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WELCOME TO THE COMMUNITY OF PRACTICE WEBINAR SERIES

▶ **Keep your mics muted and cameras off**

- Helps ensure a clean recording

▶ **The recording will be posted online**

- nasa.gov/flightopportunities
- Resources menu
- Community of Practice webinars

▶ **Please engage!**

- Post your questions in the chat

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ABOUT THE COMMUNITY OF PRACTICE WEBINAR SERIES



An opportunity to hear from subject matter experts on best practices for preparing for suborbital flight tests



Researchers, program staff, and flight providers



Connecting and sharing information and lessons learned to:

- Increase the impact of suborbital flight tests
- Transfer best practices
- Optimize the experience of current and prospective program participants

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JOIN US FOR COMMUNITY OF PRACTICE WEBINARS

Subscribe to our newsletter for updates on future webinars!

<https://www.nasa.gov/directorates/spacetech/flightopportunities/newsletter>

Future webinars

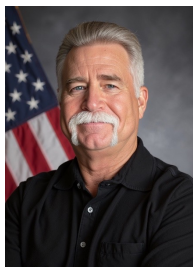
- Webinars are usually held 1st Wednesday of each month at 10 a.m. PT.
- Topics are announced in the Flight Opportunities newsletter and website.
- Session recordings are posted on the Flight Opportunities website.
- Let us know session topics you would like to see covered.

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TODAY'S SPEAKERS



Greg Peters
Program Manager
NASA Flight Opportunities



Danielle McCulloch
Program Executive
NASA Flight Opportunities



Macarena Parra, Ph.D.
Technologist
NASA Flight Opportunities

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WEBINAR AGENDA

1

Overview of the Flight Opportunities Program

2

How NASA and Other Agencies Can Leverage NASA-Contracted Flight Providers

3

Mechanisms for Engaging with the Program

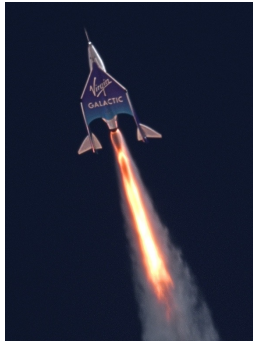
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Resources for the Flight Test Community

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NASA'S FLIGHT OPPORTUNITIES PROGRAM



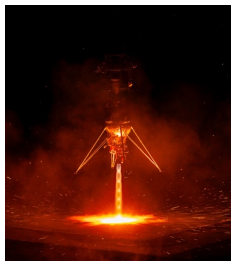
The **Flight Opportunities** program rapidly demonstrates promising technologies for space exploration, discovery, and the expansion of space commerce through suborbital and hosted orbital testing with industry flight providers.



- Subject matter expertise on flight test with commercial providers
- Access to flight tests through IDIQ contracts and astute use of funding mechanisms
- Flights for technologies, instruments, and experiments



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Credits (clockwise): Virgin Galactic, Zero Gravity Corp., Blue Origin, Zero Gravity Corp., SpaceWorks Enterprises, NASA/Matthew Kuhn, and Austin Buttar

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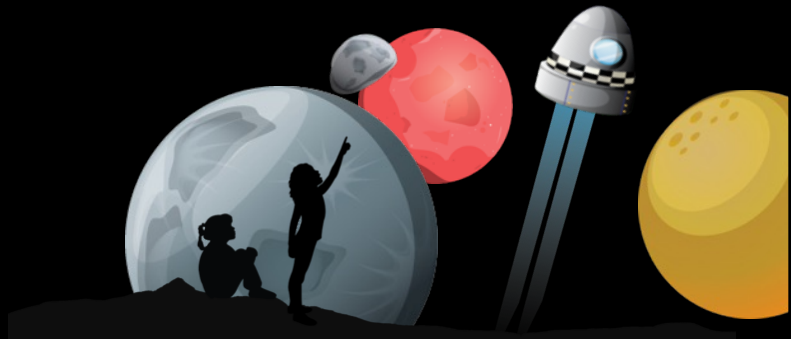
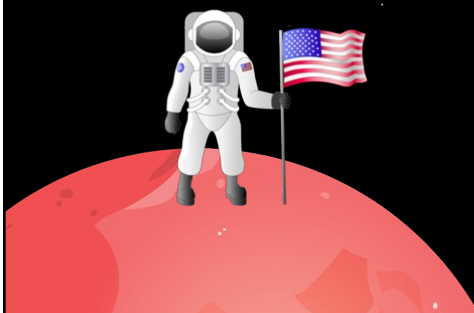
FLIGHT OPPORTUNITIES PROGRAM

Speed, flexibility, risk-tolerance, and access to a wide array of commercial capabilities provide the opportunity to rapidly address technology gaps and emerging needs, **changing the pace of space.**

WHY?

To ensure **American leadership** in space...

...and **increase the rate of scientific discoveries** within our lifetimes.



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FLIGHT OPPORTUNITIES PROGRAM

Changing the Pace of Space

HOW

will we
achieve it?

- Minimize NASA processes but leverage agency expertise
- Leverage commercial capabilities and best practices
- Embrace risk-informed decision making and risk tolerance
- Apply constraint-driven mission philosophy (cost / schedule)
- Rapidly move from benchtop to flight test to de-risk technology
- Maintain programmatic agility to ensure responsiveness to disruptive innovation and the changing geopolitical landscape

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FLIGHT OPPORTUNITIES PROGRAM COMMERCIAL TEST PLATFORMS

Rocket-Powered Vehicles

Credits: Virgin Galactic

High-Altitude Balloons

Credits: World View Enterprises

Parabolic Flights

Credits: University of California, Berkeley

Vertical Takeoff Vertical Landing (VTVL) Vehicles

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Credits: Lauren Hughes/NASA

Orbital Platforms Hosting Payloads

Credits: Varda

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BLUE ORIGIN LUNAR GRAVITY FLIGHT



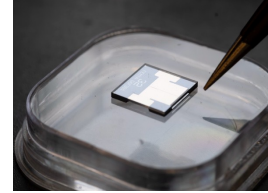
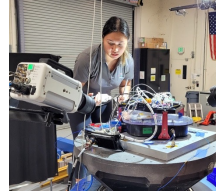
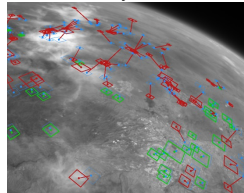
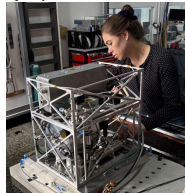
Credits: Blue Origin

- **A Unique Flight Environment:** Payloads experienced ~2 minutes of simulated lunar gravity during February 4, 2025, suborbital rocket flight
- **Value to Researchers:** Lunar gravity simulation enables test/de-risk innovations critical for the Artemis program, lunar surface exploration, and Moon-bound commercial applications:
 - In-Situ Resource Utilization
 - Dust Mitigation
 - Advanced Habitation Systems
 - Sensors and Instrumentation
 - Small Spacecraft Technologies
 - Entry, Descent, and Landing

17 NASA-supported technologies, instruments, and experiments included payloads from (left to right) NASA's Glenn Research Center, Honeybee Robotics, Draper, NASA's Kennedy Space Center, and Purdue University.



Credits (left to right): ZIN Technologies/Voyager Technologies, Honeybee Robotics, Draper, NASA, and Purdue University



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WORLD VIEW ENTERPRISES LONG-DURATION BALLOON FLIGHT

- **A 4-week flight test:** August 31–September 27, 2024
- **ARMAS Dual Monitor** (Space Environment Technologies)
 - Identifies possible radiation sources that may lead to higher rates of melanoma and basal cell carcinoma in air crew members
 - Builds on findings from six predecessor ARMAS experiments since 2011
- **CubeSounder** (Arizona State University)
 - Low SWaP-C (size, weight, and power-cost) microwave sounding technology to improve weather forecasting
 - Technology will collect 3D images of atmospheric temperature and humidity to validate performance at high-altitudes and ultimately address limitations of current mixer sensors



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PARABOLIC FLIGHTS: BRIEF PERIODS OF MICROGRAVITY YIELD BIG RETURNS FOR PIs AND NASA

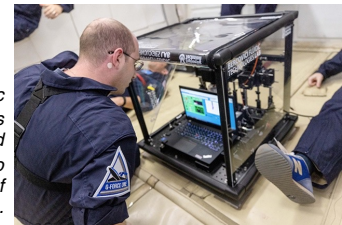
FY2024 with Zero Gravity Corporation:

- 56 payload tests of 26 technologies aboard 20 flights during 4 flight campaigns
- Lunar, Martian, and microgravity profiles
- Payloads address several technology shortfall areas:
 - Advanced manufacturing
 - Cryogenic fluid management
 - In-situ resource utilization
 - Thermal management systems
 - Lunar/Mars global access
 - Advanced habitation
- Outcomes:
 - Prepared payloads for orbital (e.g., ISS) and/or further suborbital testing/demonstrations
 - Shared data with scientific and technology communities

Case Study

FLUTE: Fluidic Telescope Experiment (NASA Ames)

- Creating giant optics from liquids in space to reduce cost, construction time, and failure risk for space-based astronomy.
- Flight testing in 2022 helped PI secure NIAC funding analyze options for 50-m observatory, develop mission concept, and plan for subscale demo in LEO.
- Additional flight testing in Aug. 2024 enabled further advancement.



Multiple rounds of parabolic flights enabled testing of various liquids, geometries, and deployment mechanisms to optimize future development of the fluidic telescope.

Credits: Zero Gravity Corporation/Steve Bosall

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TESTING LUNAR LANDING TECHNOLOGIES

- **Winners of the NASA TechLeap Prize Nighttime Precision Landing Challenge**
 - Low SWaP-C sensing systems to detect terrain hazards to help spacecraft land safely in low light conditions, particularly on the lunar surface
- **Draper Multi-Environment Navigator (DMEN) Hazard Detection**
 - Vision navigation system to advance entry, descent, and landing
 - Flight testing to advance DMEN to higher altitudes and faster velocity
- **Astrobotic Lidar Hazard Detection for Safe and Precise Lunar Landing**
 - System designed to detect hazards as small as 15 cm
 - Successfully captured high-precision data to enhance hazard detection during flight test
 - Lessons from test being directly applied to Astrobotic's CLPS missions



Credits: Astrobotic

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COMMERCIAL LUNAR PAYLOAD SERVICES (CLPS) TRANSITIONS

<p>Supporting Commercial Lunar Landers and Demonstrating Technologies on the Lunar Surface</p>  <p><small>Credit: Devin Bolt</small></p>	<p>Honeybee Robotics: PlanetVac regolith sample collection <i>Firefly Aerospace Blue Ghost</i> Tested on Xodiac lander (Astrobotic).</p>  <p><small>Credit: Honeybee Robotics</small></p>	<p>Montana State University: RadPC rad-hard computer <i>Firefly Aerospace Blue Ghost</i> Matured through testing with UP Aerospace and Aerostar.</p>  <p><small>Credit: Montana State University</small></p>
<p>NASA Glenn: Radio Frequency Mass Gauge <i>Intuitive Machines 1</i> Matured through parabolic flight testing.</p>  <p><small>Credit: NASA</small></p>	<p>NASA and the Italian Space Agency: LuGRE (Lunar GNSS Receiver Experiment) <i>Firefly Aerospace Blue Ghost</i> Tested with UP Aerospace.</p>  <p><small>Credit: NASA</small></p>	<p>MIT: AstroAnt mini robot <i>Intuitive Machines 2</i> Matured through parabolic flight testing with Zero Gravity Corp.</p>  <p><small>Credit: MIT Media Lab Space Exploration Initiative</small></p>
<p>NASA Langley: Navigation Doppler Lidar <i>Astrobotic 1 and Intuitive Machines 1</i> Tested on Xodiac lander (Astrobotic).</p>  <p><small>Credit: NASA</small></p>	<p>SET: ARMAS radiation monitor <i>Intuitive Machines 2</i> Matured via flight tests with World View (balloon) and Blue Origin (suborbital rocket).</p>  <p><small>Credit: Space Environment Technologies</small></p>	<p>Orbital Platforms Hosting Payloads</p>  <p><small>Credit: Varda</small></p>

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EXPANDING ACCESS TO COMMERCIAL CAPABILITIES VIA FLIGHT OPPORTUNITIES CONTRACTS

<p>Suborbital Rocket-Powered Vehicles</p>  <p><small>Credit: Virgin Galactic</small></p> <ul style="list-style-type: none"> • Astrobotic • Blue Origin • Rocket Lab USA Inc. • Virgin Galactic 	<p>High-Altitude Balloons</p>  <p><small>Credit: World View Enterprises</small></p> <ul style="list-style-type: none"> • Aerostar International LLC (acquired Near Space Corporation) • Angstrom Designs • World View Enterprises 	<p>Parabolic Flights</p>  <p><small>Credit: University of California, Berkeley</small></p> <ul style="list-style-type: none"> • Zero Gravity Corp. 	<p>Orbital Platforms Hosting Payloads</p>  <p><small>Credit: Varda</small></p> <ul style="list-style-type: none"> • Astro Digital • Loft Federal • Momentus Space • Rocket Lab USA Inc. • Space Exploration Technologies (SpaceX) • Spire Global • Tyvak Nano-Satellite Systems (Terran Orbital) • Varda Space Industries
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Links to payload users guides (PUGs) available on Flight Opportunities website

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HOSTED ORBITAL SERVICES VIA FLIGHT OPPORTUNITIES IDIQ4

Hosted Orbital Payload Definition	<ul style="list-style-type: none"> • Payload is integrated on to provider's vehicle and remains attached throughout mission • Integration, launch and mission management included in hosting service • Researchers can focus on technology, instrument, or experiment development rather than spacecraft development or mission planning
Provider Qualifications	<ul style="list-style-type: none"> • Successful flight of a 2U, 2kg payload with one orbit of Earth • Opportunity for on-ramps of new capabilities
Structure of Proposed Services	<ul style="list-style-type: none"> • Each provider proposed their own standard services • Non-standard rates cover unique requirements or evolving capabilities
Wide Variety of Commercial Services	<ul style="list-style-type: none"> • Slots on small spacecraft (e.g., ESPA buses) designed for multi-payload / multi-customer hosting • Hosting on a CubeSats designed for a specific payload • Space-available options on vehicles conducting other commercial missions • "Virtual" hosting of software payloads leveraging provider assets • Space in or on capsules that return to Earth • Test articles attached to rocket upper stages

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UTILIZING FLIGHT OPPORTUNITIES CONTRACTS

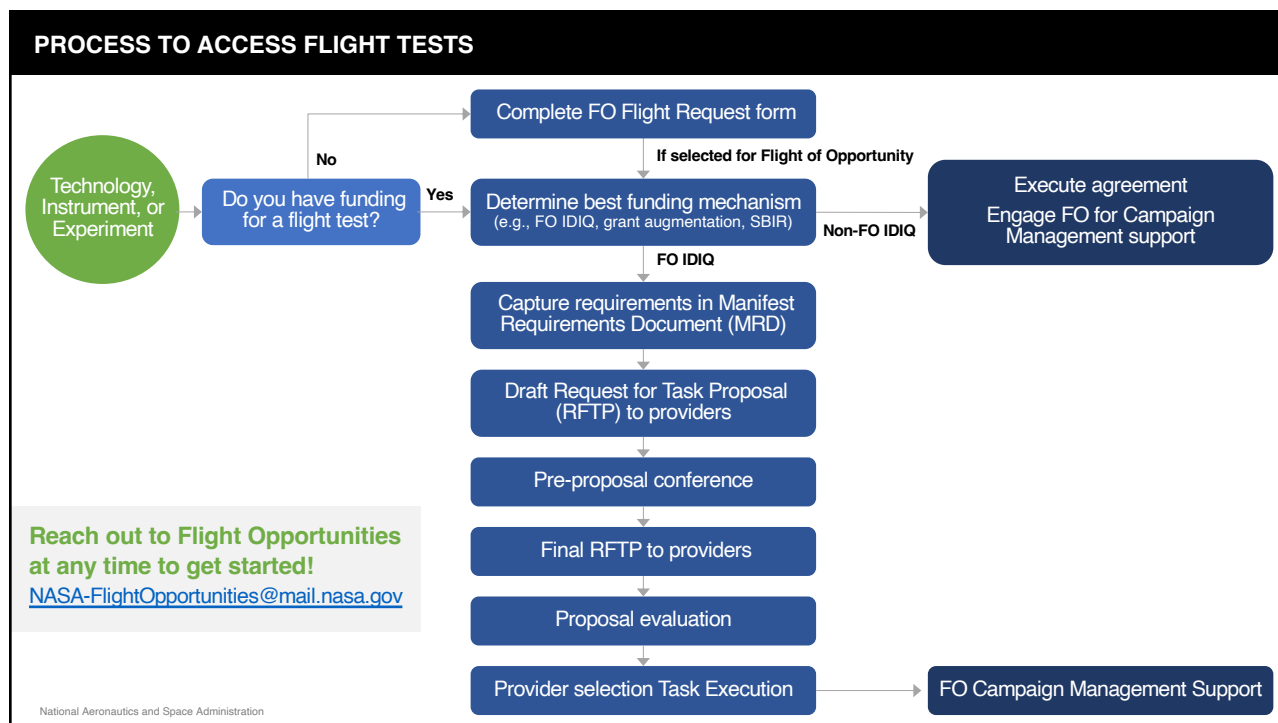
	Contracts available for use by all of NASA or on behalf of any NASA-supported researcher.
	Funding is not limited to Flight Opportunities budget – any program or project can purchase a flight.
	Each Request for Task Proposal will be presented to the cohort of qualified providers for bid.
	Flight Opportunities offers campaign management and flight test subject matter expertise to all teams.
	Contracts can be used by any other U.S. government agency .
	Interested parties can contact Flight Opportunities about available services available and task order process.

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PROVIDING RESEARCHERS WITH ACCESS TO FLIGHT TESTS		
Flight Opportunities creatively uses a variety of funding mechanisms to mature innovative solutions for the nation's technology needs, engaging academia, non-profit research institutes, industry, and entrepreneurs to address technology shortfalls.		
Challenges	Solicitations	Other Mechanisms
 <ul style="list-style-type: none"> Open to: <ul style="list-style-type: none"> Commercial businesses Academic or non-profit research institutions Entrepreneurs Independent innovators Funding + flight test opportunity 	    Announcements of Collaboration Opportunity  Tipping Points	Flights of Opportunity <ul style="list-style-type: none"> Open to: <ul style="list-style-type: none"> NASA personnel Competitively selected NASA-funded projects Other government agencies Request Flight Opportunities support for flight testing with NASA-contracted U.S. commercial flight providers Flight Opportunities helps you: <ul style="list-style-type: none"> Identify test environment Establish mechanism/agreement Prepare for flight
STEM Initiative (6-12 grades)  <small>National Aeronautics and Space Administration</small>		






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PROVIDING RESEARCHERS WITH ACCESS TO FLIGHT TESTS		
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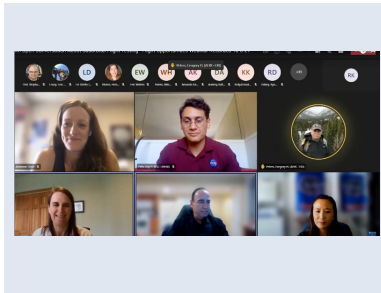
NASA TECHLEAP OVERVIEW	
Rapidly identify and develop technologies of significant interest to NASA through a series of challenges <ul style="list-style-type: none"> Cash prize and opportunity for a flight test Open to qualified businesses, universities, entrepreneurs, and other innovators 	
	
1 Autonomous Observation Challenge Autonomously detect, locate, track, and collect data on transient terrestrial events 	3 Universal Payload Interface Challenge Optimized interface system that enables rapid and seamless integration of diverse payloads onto various flight vehicles 
2 Nighttime Precision Landing Challenge Detect hazards from an altitude of $\geq 250\text{m}$ and process the data in real time to generate a terrain map 	4 Space Technology Payload Challenge Advance transformative solutions and develop a flight-ready payload to address NASA's technology shortfalls 
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A WEALTH OF RESOURCES FOR ENGAGING THE FLIGHT TEST COMMUNITY

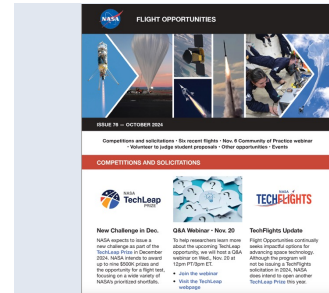
Community of Practice Webinars

Sharing important insights from suborbital researchers and flight providers



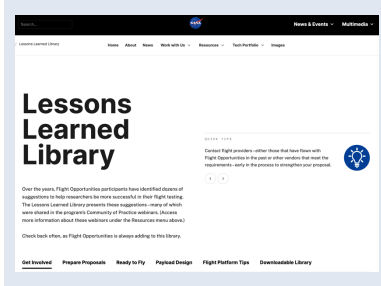
Newsletter

Providing timely information about funding opportunities, recent flights, upcoming events, new resources, and other news



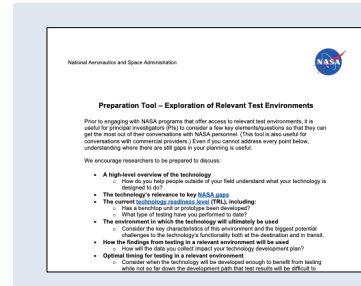
Lessons Learned Library

Promoting best practices and suggestions to help researchers optimize flight test outcomes



Researcher Prep Tool

Key considerations to prepare for conversations with the Flight Opportunities team.



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RESEARCHER PREPARATION TOOL – ELEMENTS TO CONSIDER FOR FLIGHT TEST

High-level overview

Relevance to key NASA STMD shortfalls

Current technology readiness level (TRL)

Environment in which it will ultimately be used

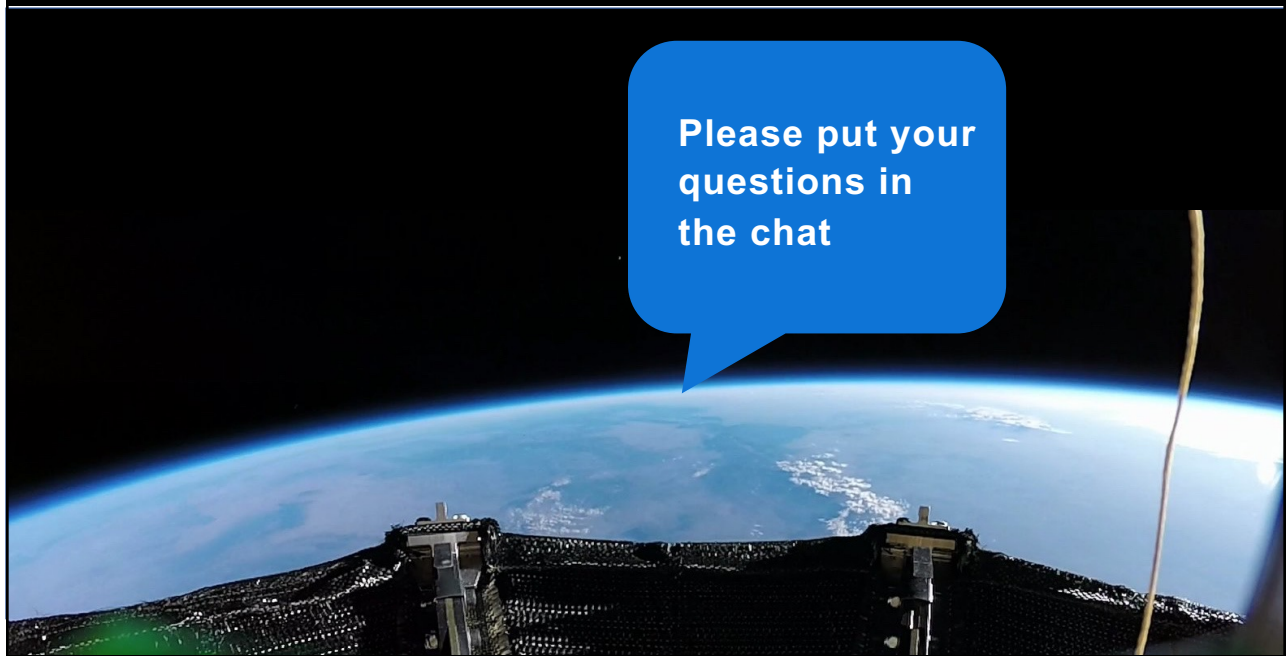
How the findings from testing will be used

Optimal timing for testing

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WHAT QUESTIONS DO YOU HAVE?



Please put your
questions in
the chat

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[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:

NASA-FlightOpportunities@mail.nasa.gov



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NASA TECHRISE STUDENT CHALLENGE

The NASA TechRise Student Challenge leverages suborbital flight platforms to offer students in **sixth through 12th grades** hands-on insight into the design and test process used by NASA-supported researchers.

DESIGN



Credit: John F. Kennedy High School

BUILD



Credit: Washington Liberty

LAUNCH



Credit: World View

Visit the challenge website for information and resources:

www.futureengineers.org/nasatechrise

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