

SPACE TECHNOLOGY MISSION DIRECTORATE



A Guide to Commercial Suborbital Flight Providers for

Flight Opportunities



About Flight Opportunities

light Opportunities facilitates rapid demonstration of promising technologies for space exploration, discovery, and the expansion of space commerce through suborbital testing with industry flight providers, thereby maturing capabilities needed for NASA missions and commercial applications while strategically investing in the growth of the U.S. commercial spaceflight industry.

About this Document

In this document you will find information about commercial flight providers who have conducted successful flights for research payloads supported by Flight Opportunities. Some of these companies are contracted by NASA to provide commercial suborbital flight testing for NASA-developed technologies. Others have been chosen by academic, research, and industry organizations using funds awarded through NASA's Space Technology Research, Development, Demonstration and Infusion (SpaceTech-REDDI) Tech Flights solicitation or previous solicitations. Awardees receive a grant or enter into a collaborative agreement that allows them to purchase flights directly from a U.S. commercial flight vendor that best meets their needs for flight testing a promising space technology.

While the flight providers highlighted in this document have been selected by Tech Flights grantees in recent years, other commercial flight providers not covered herein may also be eligible under the criteria set forth in the Tech Flights solicitation. Interested organizations and principal investigators should read the full eligibility criteria for flight providers in the Tech Flights solicitation available on NASA's NSPIRES website.

More information about the flight profiles featured in this document can be found in the respective Payload User Guides, which are available from individual flight providers.



Types of Suborbital Flight Providers



Rocket-Powered Vehicles

This category includes both suborbital reusable launch vehicles (sRLVs) that reach high altitudes and may include periods of microgravity, as well as lander vehicles that specialize in entry, descent, and landing (EDL) technologies. Both of these classes of vehicles are typically recoverable and reusable after launch. They can be used for testing:

- EDL and navigation systems
- Atmospheric and surface sampling
- Biological experiments
- Robotic systems
- In-space manufacturing methods
- Electronics and information technology systems



High-Altitude Balloons

Large balloon systems reach a nominal altitude of 30 km and can also typically sustain the longest duration of the suborbital vehicles hours, days, or even weeks at a time. This makes them ideal for payloads that benefit from extended periods of data collection. These systems are ideal for testing:

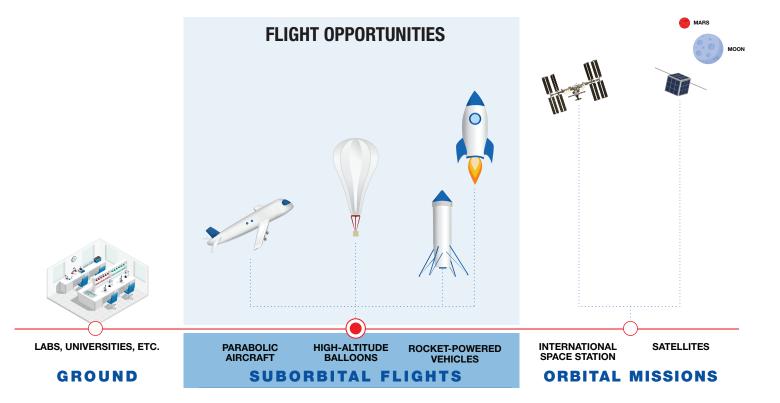
- Sun-sensitive and solar instruments
- Earth-observation instruments
- Other instruments and technologies that may benefit from high-altitude observations (both to ground and into space) and drop tests



Parabolic Aircraft

These airplanes achieve brief periods of reduced gravity through a series of maneuvers called parabolas. These aircraft can be used for testing technologies that need to operate in the absence of gravity, such as:

- Space-based medical experiments
- Biological experiments
- Robotic systems
- In-space manufacturing methods
- Electronics and information technology systems



Blue Origin

www.blueorigin.com



New Shepard is prepared for flight on the Blue Origin launch platform in West Texas. Credit: Blue Origin

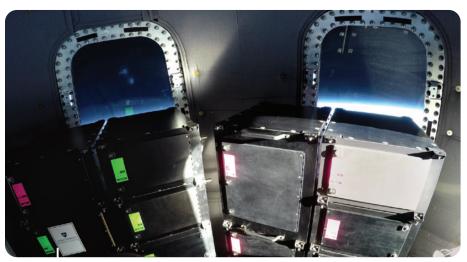
New Shepard

This fully reusable, high-fidelity space vehicle offers fast turnaround times from launch to payload recovery and the next flight.

- Target duration: 15 minutes
- Target altitude: 100+ km
- Target microgravity duration: 3 minutes
- Payload capacity: 11.3 kg for a single locker (custom solutions may be available for larger payloads, including 22.7 kg-capacity double lockers and custom solutions for payloads of up to 100.5 kg)
- Payload mounting: Internal or external



New Shepard's crew capsule (with payloads inside) separates from the propulsion module and is recovered by parachute. Credit: Blue Origin



Payload lockers are located inside the New Shepard crew capsule. Credit: Blue Origin

Masten Space Systems

www.masten.aero



Payloads can be attached to the lander's legs for performance evaluation, as shown here. Credit: Honeybee Robotics

Xodiac

This low-altitude testbed is ideal for testing precision entry, descent, and landing methods as well as evaluating planetary surface exploration payloads.

- Target duration: 180 seconds
- Target altitude: 2 km
- Target microgravity duration: N/A
- Divert range: 800 m
- Payload capacity: 50 kg
- Payload mounting: Internal or external



Payloads can also be mounted to the side of Xodiac, as shown here, to the top of the vehicle, or internally. Credit: NASA



Tether tests are performed prior to free flight. Credit: Honeybee Robotics



Xodiac is prepared for a demonstration in Mojave, California. Credit: Honeybee Robotics

Near Space Corporation

www.nsc.aero

Small Balloon System

The Small Balloon System (SBS) is ideal for payloads needing additional mission services, including real-time command and control, and payload telemetry.

- Target duration: 2+ hours
- Target altitude: 30+ km
- Target microgravity duration: N/A
- **Payload capacity:** Nominal 10 kg (custom options available for larger payloads)
- Payload mounting: Internal or external



A payload is prepared for integration on the SBS in Madras, Oregon. Credit: Near Space Corporation



NSC's SBS carries a payload near the company's headquarters in Tillamook, Oregon. Credit: Near Space Corporation



A payload hangs below the SBS, with Earth seen below. Credit: Near Space Corporation

Nano Balloon System

The Nano Balloon System (NBS) is an option for small payloads with minimal integration requirements.

- Target duration: 2+ hours
- Target altitude: 30+ km
- Target microgravity duration: N/A
- Payload capacity: Nominal
 1 kg for standard services
- Payload mounting: Internal or external

High-Altitude Shuttle System

This balloon-borne, autonomously piloted shuttle aircraft enables rapid payload recovery.

- **Target duration:** 2+ hours (based on mission requirements)
- Target altitude: 30 km
- Target microgravity duration: N/A
- Payload capacity: 10 kg
- Payload mounting: Internal

Raven Aerostar

www.ravenaerostar.com

Zero-Pressure Balloon System

Several classes of balloons are available for long-duration and navigational missions, stratospheric missions for scientific, engineering, and communication advances, gathering meteorological data, and more.

- Target duration: 1–8 hours
- Target altitude: 30+ km (33 km for payloads less than 5 kg)
- Target microgravity duration: N/A
- **Payload capacity:** Nominal 45 kg (heavier payloads can be accommodated as a non-standard service)
- Payload mounting: Internal/ external (the payload envelope is open to the external environment)



A payload is released from a balloon flight with parachute assistance. Credit: NASA



A Zero-Pressure balloon from Raven Aerostar is prepared for flight in Baltic, South Dakota. Credit: NASA

Stratodynamics

www.stratodynamics.ca

HiDRON Hybrid Glider/Balloon System

This uncrewed stratospheric glider is designed to release from a sounding balloon at near-space altitude, enabling a controlled descent and landing for technology payloads aboard. The glider achieves higher velocity than a balloon flight alone and operates well in the cold temperatures of the stratosphere.

- Target duration: 5-6 hours
- Target altitude: 30+ km
- Target microgravity duration: 0-30 seconds
- Payload capacity: 1 kg
- Payload mounting: Internal or external



The HiDRON stratospheric glider from Stratodynamics is seen over New Mexico on June 6, 2021 carrying turbulence detection technologies supported by NASA's Flight Opportunities program. Credit: Stratodynamics, Inc./UAVOS



Stratodynamics CEO Gary Pundsack carries the HiDRON glider off the runway at Spaceport America after a successful controlled landing on June 6, 2021. Credit: Stratodynamics, Inc./UAVOS



The HiDRON is suspended from a sounding balloon before release on June 6, 2021. Credit: Stratodynamics, Inc./UAVOS

UP Aerospace

www.upaerospace.com

SpaceLoft XL

This rocket is suitable for both scientific and technology payload testing and includes a payload ejection option (as a non-standard service) for experiment recovery.

- Target duration: ~13 minutes
- Target altitude: 115 km
- Target microgravity duration: ~4 minutes
- Payload capacity: Nominal 36 kg
- Payload mounting: Internal/ external (Payload Transportation System modules are enclosed in aluminum but feature windows that provide direct access to the space environment)



A payload canister is prepared for integration onto the SpaceLoft rocket. Credit: UP Aerospace



A payload ejection option enables payload recovery after flight. Credit: U.S. Army



SpaceLoft XL is shown here prepared for launch. Credit: UP Aerospace

Virgin Galactic

www.virgingalactic.com



Virgin Galactic's space plane as seen from inside the cockpit. Credit: Virgin Galactic

VSS Unity

This piloted, high-fidelity suborbital space plane features high payload-carrying capacity and fast payload recovery options.

- Target duration: ~1 hour
- Target altitude: 80+ km
- Target microgravity duration: 2–3 minutes
- Payload capacity: 22.7 kg for a single locker, 45.4 kg for double, 68 kg for triple, 90.7 kg for quad (custom solutions may be available for larger payloads up to 450 kg)
- Payload mounting: Internal



The space plane comes in for a smooth landing on the runway at Mojave Air and Space Port. Credit: Virgin Galactic



A payload is loaded into the cargo bay of VSS Unity. Credit: Virgin Galactic

World View Enterprises

www.worldview.space

Stratollite

This navigable system with stationkeeping capabilities is suitable for payloads requiring data acquisition over long durations.

- Target duration: Up to weeks
- **Target altitude:** 15-23 km (to enable long-duration or long-dwell missions)
- Target microgravity duration: N/A
- **Payload capacity:** Nominal 50 kg (custom options available for larger payloads)
- Payload mounting: External

Z-Class

This fixed-altitude balloon system is designed for payloads requiring short-duration data acquisition.

- Target duration: 2+ hours
- Target altitude: 30+ km
- Target microgravity duration: N/A
- Payload capacity: < 1 to 1,000 kg
- Payload mounting: External



A World View balloon is shown prepared for flight outside the company's launch facility in Tucson, Arizona. Credit: World View Enterprises



Flights can be scheduled for different times of day and over different types of terrain, depending on payload testing requirements. Credit: Earth Science Systems

Zero Gravity Corporation





Payloads are set up in the main cabin before takeoff. Credit: Zero Gravity Corportation

G-FORCE ONE

This Boeing 727-200F three-engine aircraft is modified for reducedgravity crewed flights. The flights offer a minimum of 25 parabolas with a combination of Martian and lunar gravities as well as microgravity.

- Target duration: 2 hours
- Target altitude: 9 km
- Target microgravity duration: 30 seconds per parabola
- Payload capacity:
 ~ 3m x 3m in-flight test area (per research section)
- Payload mounting: Internal



G-FORCE ONE is shown on the runway at Orlando Sanford International Airport in Florida. Credit: Zero Gravity Corporation



Research teams are briefed on flight logistics prior to takeoff. Credit: Zero Gravity Corporation



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