NASA

TECHRISE

STUDENT CHALLENGE

Step 3 Learn About the Suborbital-Spaceship

2025

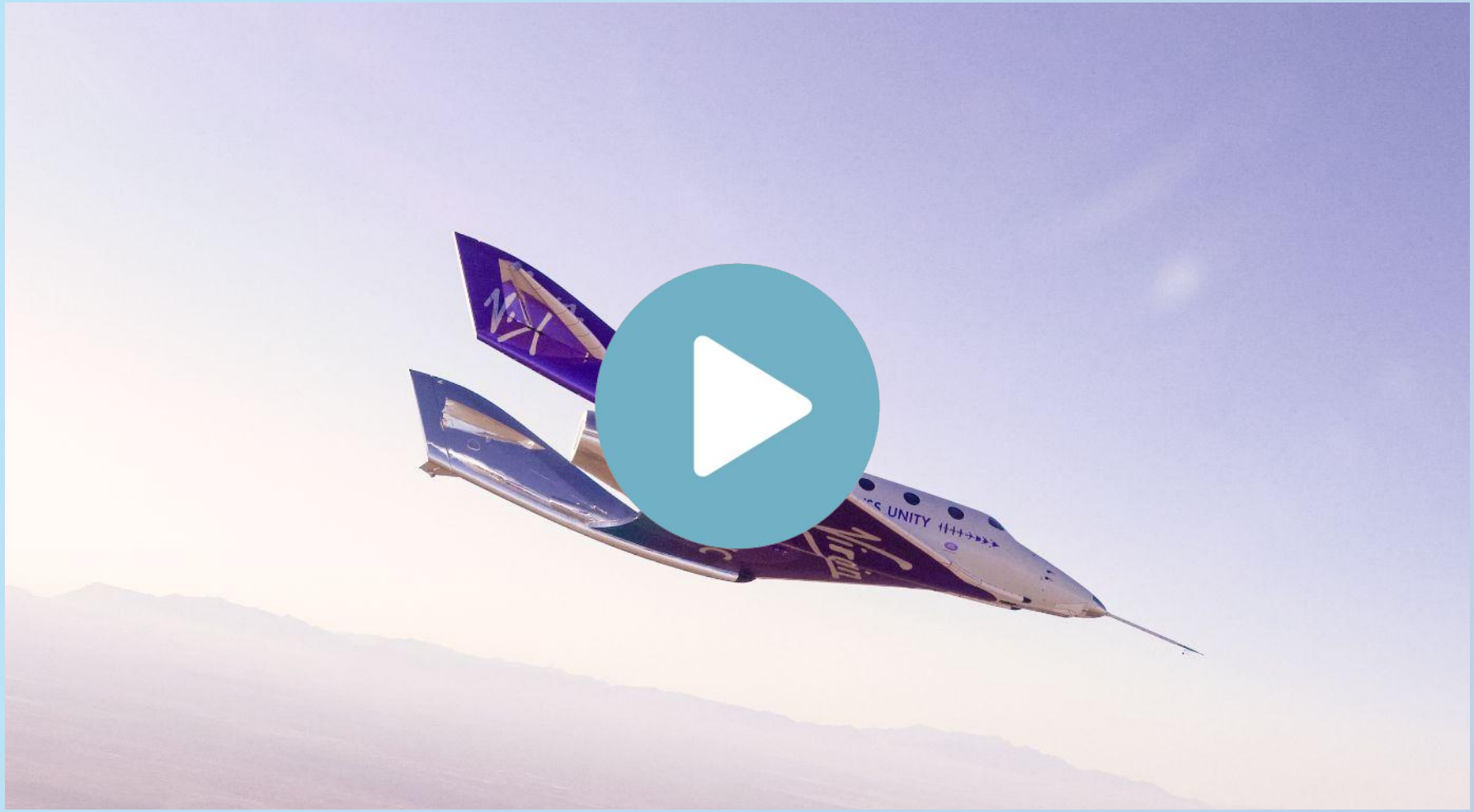
Step 3: Learn About the Suborbital-Spaceship

Learn all about the suborbital-spaceship flight.

Think about the following questions when learning about the suborbital-spaceship:

- What environment does the suborbital-spaceship provide? How long will your experiment/payload be in that environment?
- What types of experiments can you conduct on the suborbital-spaceship?
- What kind of data can you collect on the suborbital-spaceship? (e.g., can you collect acceleration, radiation, altitude, or video of your experiment?)
- Remember, your experiment must function autonomously without human interaction.

Suborbital-Spaceship Video Footage



Suborbital Microgravity Flight

NASA uses suborbital flights to test new space technologies and experiments a little closer to Earth.

When something goes around the Earth, it is in orbit. So when a flight goes up and comes back down without going around the Earth, it's called a suborbital flight.

At the peak of flight, a suborbital microgravity vehicle goes beyond the edge of space where it experiences a few minutes of microgravity – sometimes referred to as weightlessness.

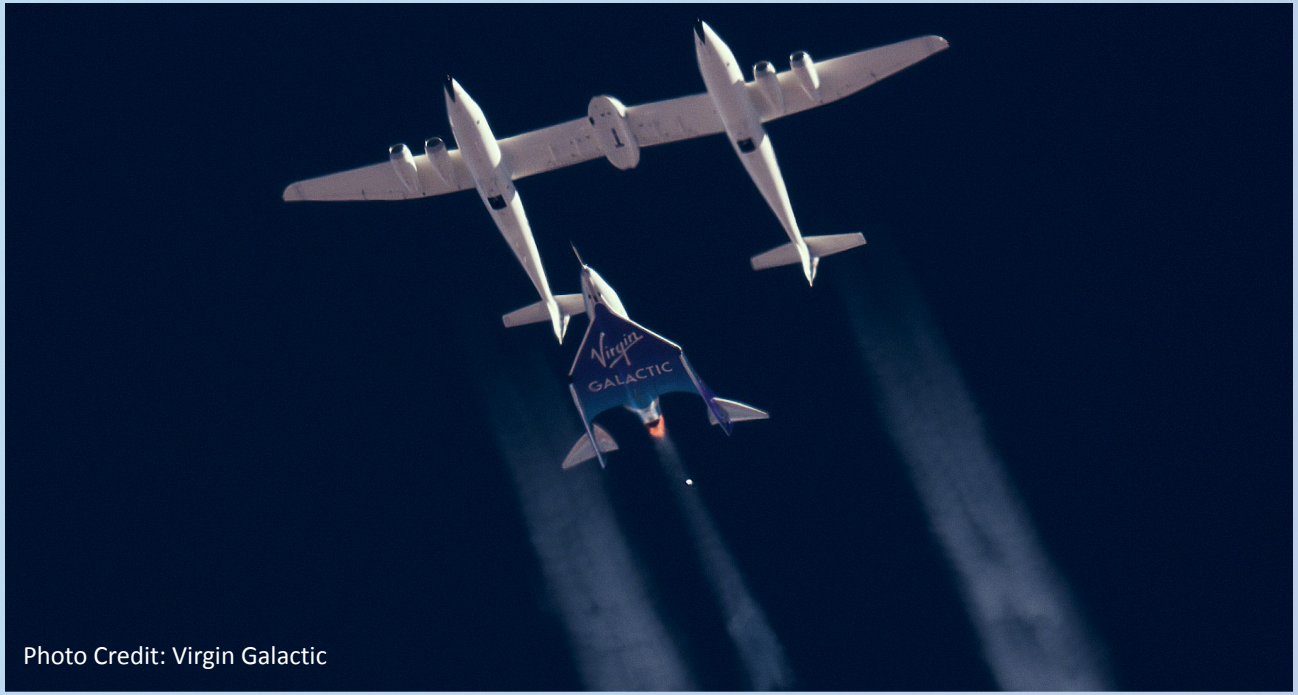


Photo Credit: Virgin Galactic

Suborbital-Spaceship

The 2025-26 NASA TechRise Student Challenge will have one microgravity flight provider: Virgin Galactic.

Components of Virgin Galactic's spaceflight system, including the launch vehicle and the suborbital-spaceship, work together to get your payload approximately 3 minutes of microgravity.

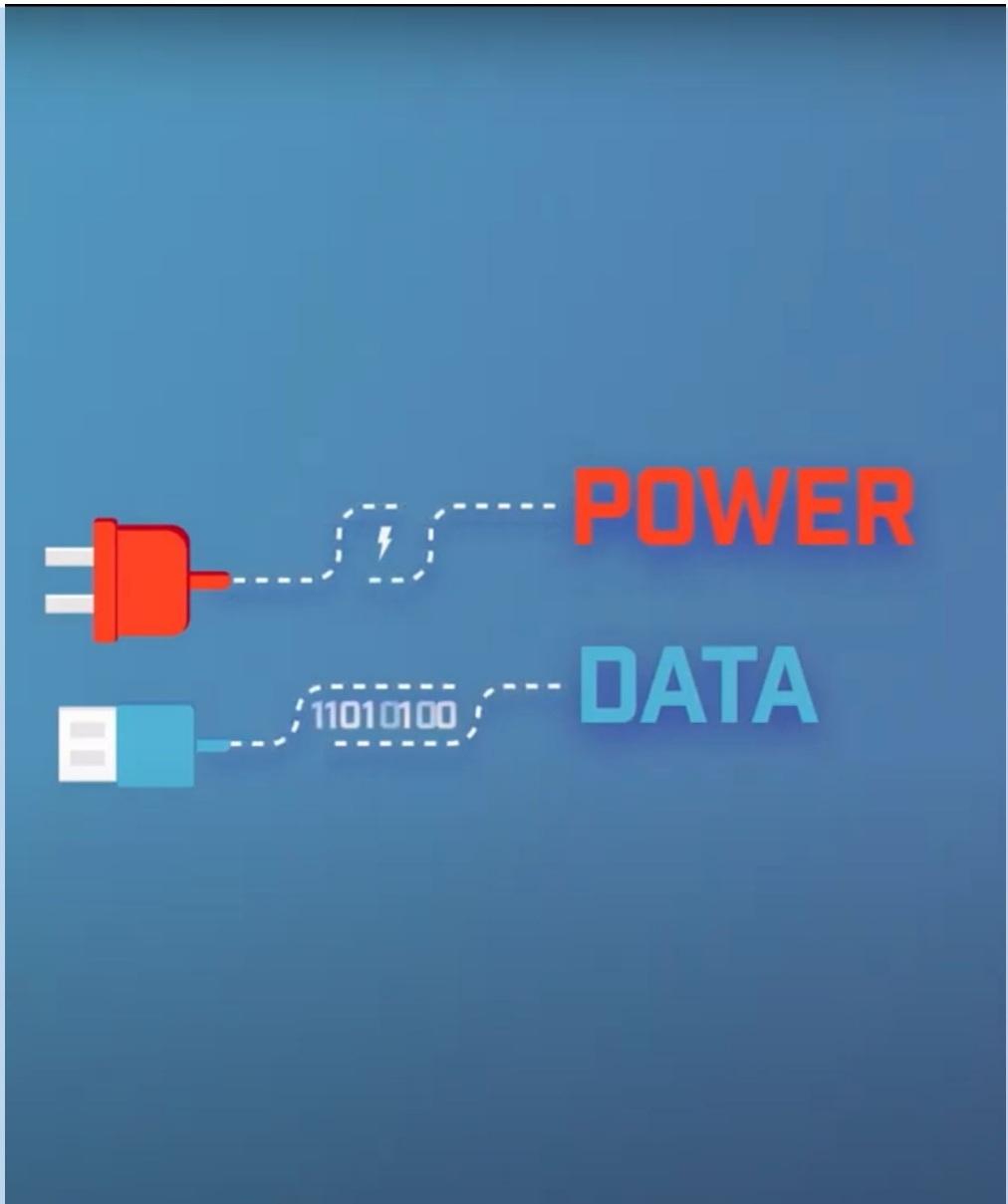
The suborbital-spaceship will begin the flight attached beneath the launch vehicle, as seen in the photo to the right. After about an hour of climbing, the suborbital-spaceship separates from the launch vehicle and boosts itself into microgravity. Then, the suborbital-spaceship coasts in microgravity for approximately 3 minutes before gliding back down to Earth and landing safely.

Photo Credit: Virgin Galactic

Power and Data

Before flight, all NASA TechRise experiments will be hooked up to the suborbital-spaceship's power and data systems and mounted to a frame called a payload locker.

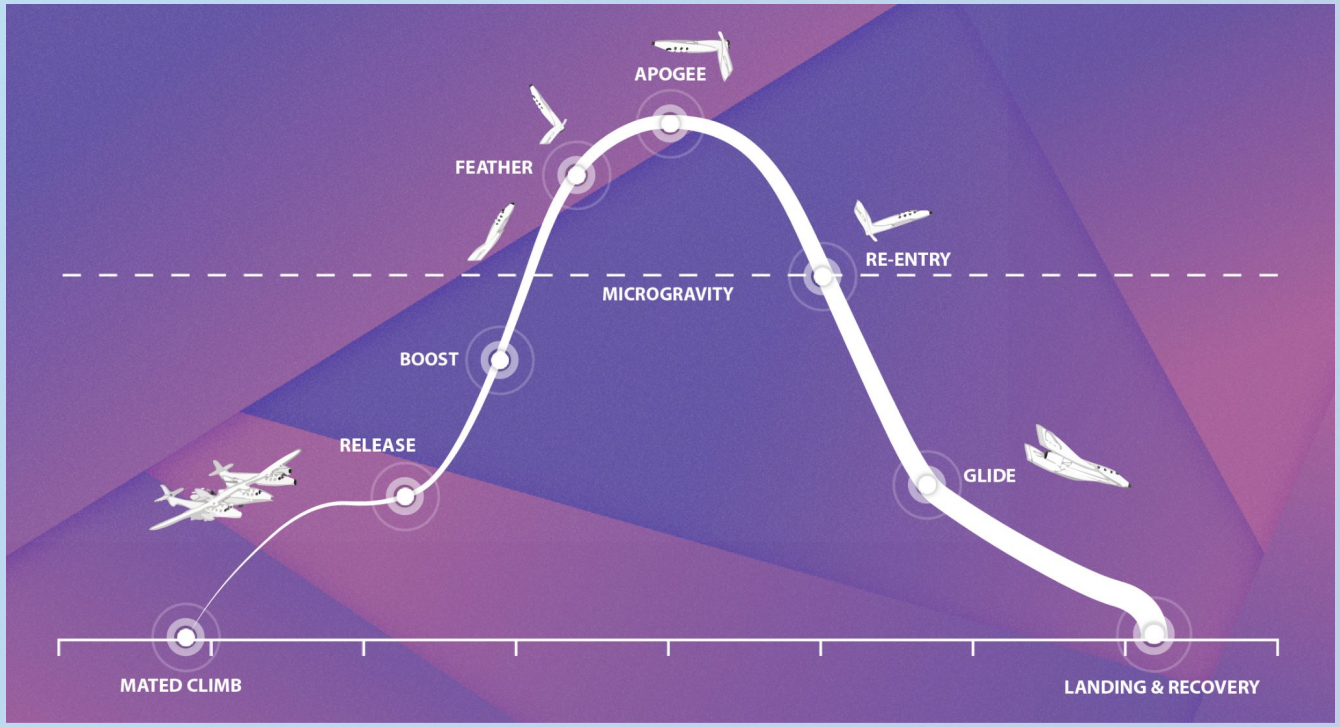
The vehicle's onboard flight computer will send messages to the experiments, including altitude or acceleration data. You can program a microcontroller to use this data stream to start or stop your experiment at a certain altitude, or to map how far your experiment traveled.



Flight

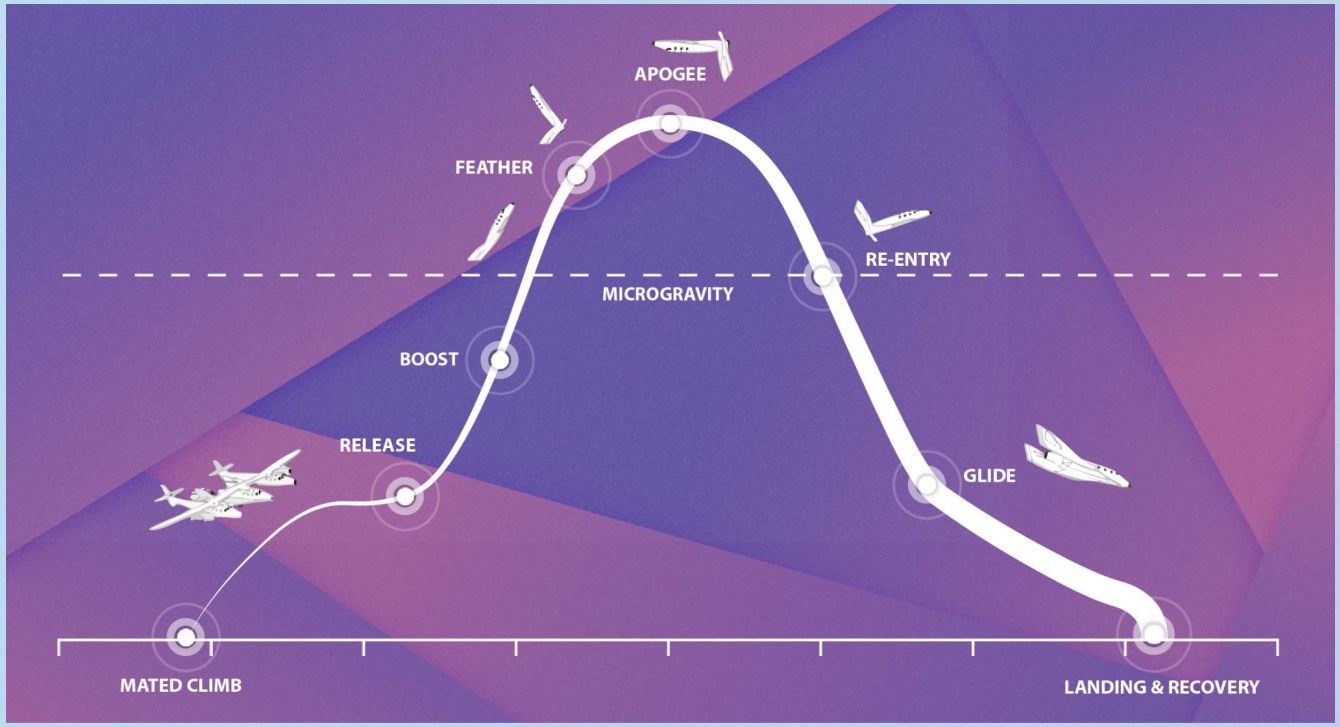
If it is morning time, not raining, low winds, and with little/no cloud cover, then we are GO for launch.

During the ride on the suborbital-spaceship, the data stream will tell your experiment about the excitement of what's going on – like how fast the vehicle is accelerating or how high up it is. Your experiment will also get messages when key events happen – like when microgravity starts.



Microgravity

And when microgravity starts, the 3 minutes of scientific fun begins! Everything inside your payload will become weightless and start to float – just like astronauts on the space station. AND – it's GO time. Not only will you want to run your microgravity experiment, you will want to take photos or video too, so that when your payload comes back down to Earth, your experiment can be mailed back to you, and you can then see what happened when it was **in** space!



Experiment Retrieval

And once the mission is complete, the experiment will be powered off after the suborbital-spaceship has safely landed back on Earth.

After the vehicle lands, a crew will unload your payload and send your experiment home.

Image Credit: Virgin Galactic

Key Points: Suborbital-Spaceship

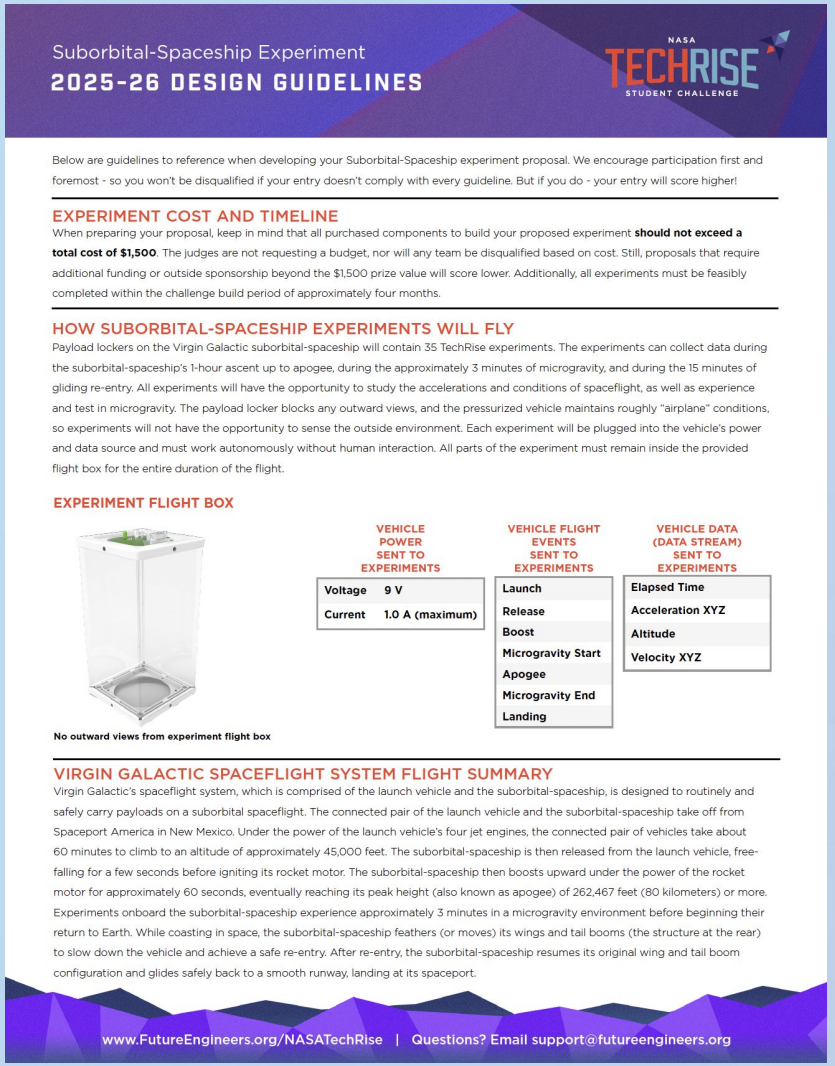
- Flight Time: 60-75 minutes
- Approximately 3 minutes of microgravity
- No line of sight to the exterior. Your experiment won't be able to see outside of the payload locker or suborbital-spaceship.
- Air Pressure: 11.8 psi to 12.2 psi
- Acceleration: 4 *g*-forces in any direction
- Power is provided to each experiment; no additional batteries are permitted
- Vehicle data is streamed to each experiment
- No liquids, plants or animals!

Possible Experiment Topics: Suborbital-Spaceship

- Living in Microgravity
- Organization in Microgravity
- Medical in Microgravity
- Air Quality on a Spacecraft
- Spacecraft Structures
- Lunar Dust Mitigation
- Small Propulsion Systems
- Farming Tech
- Acceleration Exploration
- Radiation
- Materials Experiments
- Earth's Magnetic Field Measurements
- Your Choice!

Design Guidelines

The NASA TechRise Student Challenge website has the Suborbital-Spaceship Design Guidelines with more information.



Suborbital-Spaceship Experiment

2025-26 DESIGN GUIDELINES

NASA TECHRISE STUDENT CHALLENGE

Below are guidelines to reference when developing your Suborbital-Spaceship experiment proposal. We encourage participation first and foremost - so you won't be disqualified if your entry doesn't comply with every guideline. But if you do - your entry will score higher!

EXPERIMENT COST AND TIMELINE

When preparing your proposal, keep in mind that all purchased components to build your proposed experiment **should not exceed a total cost of $1,500**. The judges are not requesting a budget, nor will any team be disqualified based on cost. Still, proposals that require additional funding or outside sponsorship beyond the $1,500 prize value will score lower. Additionally, all experiments must be feasibly completed within the challenge build period of approximately four months.

HOW SUBORBITAL-SPACESHIP EXPERIMENTS WILL FLY

Payload lockers on the Virgin Galactic suborbital-spaceship will contain 35 TechRise experiments. The experiments can collect data during the suborbital-spaceship's 1-hour ascent up to apogee, during the approximately 3 minutes of microgravity, and during the 15 minutes of gliding re-entry. All experiments will have the opportunity to study the accelerations and conditions of spaceflight, as well as experience and test in microgravity. The payload locker blocks any outward views, and the pressurized vehicle maintains roughly "airplane" conditions, so experiments will not have the opportunity to sense the outside environment. Each experiment will be plugged into the vehicle's power and data source and must work autonomously without human interaction. All parts of the experiment must remain inside the provided flight box for the entire duration of the flight.

EXPERIMENT FLIGHT BOX

No outward views from experiment flight box

VEHICLE POWER SENT TO EXPERIMENTS

Voltage	9 V
Current	1.0 A (maximum)

VEHICLE FLIGHT EVENTS SENT TO EXPERIMENTS

Launch
Release
Boost
Microgravity Start
Apogee
Microgravity End
Landing

VEHICLE DATA (DATA STREAM) SENT TO EXPERIMENTS

Elapsed Time
Acceleration XYZ
Altitude
Velocity XYZ

VIRGIN GALACTIC SPACEFLIGHT SYSTEM FLIGHT SUMMARY

Virgin Galactic's spaceflight system, which is comprised of the launch vehicle and the suborbital-spaceship, is designed to routinely and safely carry payloads on a suborbital spaceflight. The connected pair of the launch vehicle and the suborbital-spaceship take off from Spaceport America in New Mexico. Under the power of the launch vehicle's four jet engines, the connected pair of vehicles take about 60 minutes to climb to an altitude of approximately 45,000 feet. The suborbital-spaceship is then released from the launch vehicle, free-falling for a few seconds before igniting its rocket motor. The suborbital-spaceship then boosts upward under the power of the rocket motor for approximately 60 seconds, eventually reaching its peak height (also known as apogee) of 262,467 feet (80 kilometers) or more. Experiments onboard the suborbital-spaceship experience approximately 3 minutes in a microgravity environment before beginning their return to Earth. While coasting in space, the suborbital-spaceship feathers (or moves) its wings and tail booms (the structure at the rear) to slow down the vehicle and achieve a safe re-entry. After re-entry, the suborbital-spaceship resumes its original wing and tail boom configuration and glides safely back to a smooth runway, landing at its spaceport.

www.FutureEngineers.org/NASATechRise | Questions? Email support@futureengineers.org