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.

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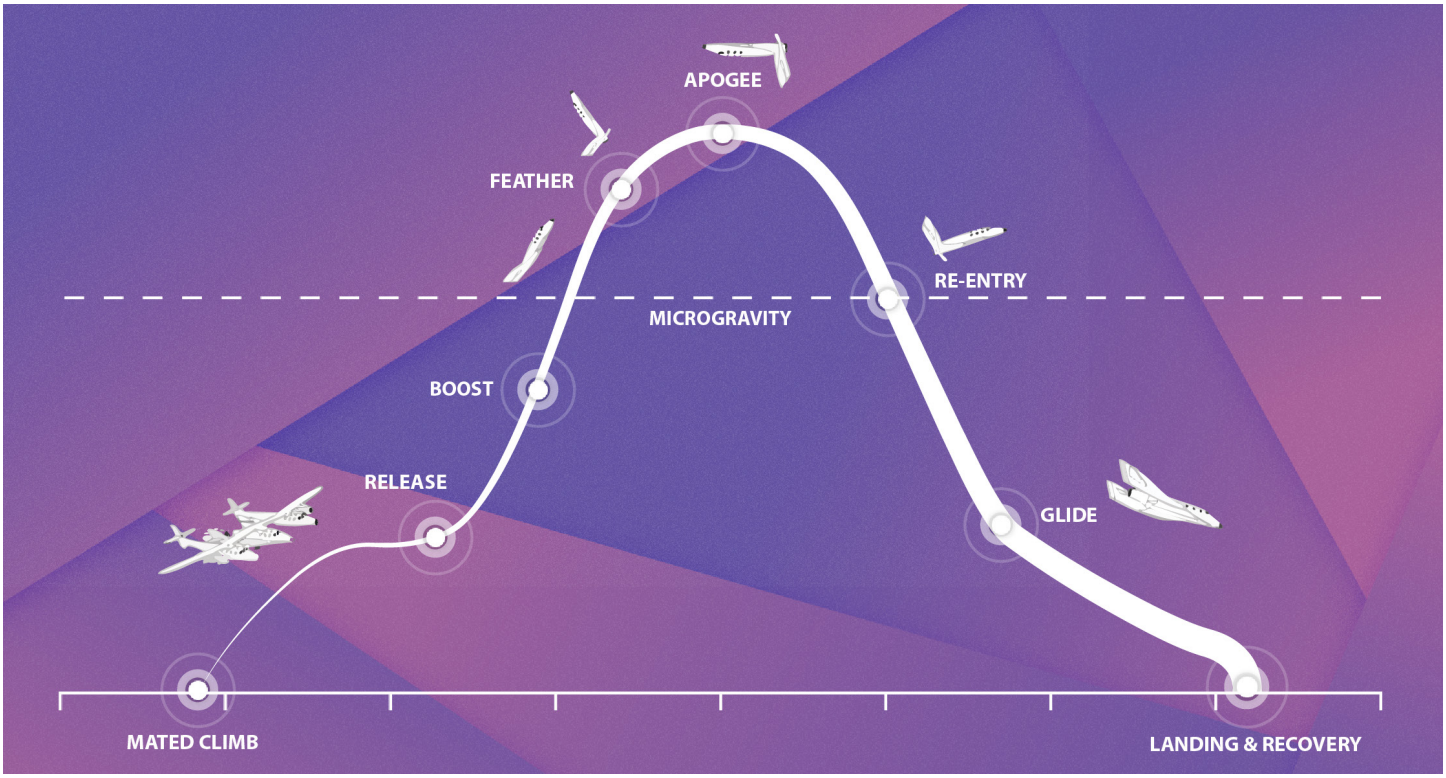
FLIGHT PROFILE



SAMPLE FLIGHT VIDEO

EXPERIMENT FLIGHT BOX

Winning teams will receive a flight box to prepare their payload for suborbital-spaceship flight.

Maximum Size: 4 x 4 x 8 in (10 x 10 x 20 cm)
Total Maximum Weight: 2.2 pounds (1 kg)

FLIGHT PROFILE DETAIL

FLIGHT EVENT	EVENT DETAILS
Pre-Launch	Flight experiments will be powered on and readied for flight. Target launch time is in the morning (minimal cloud cover, no rain).
Payload Power On	Payloads are powered on approximately 1 hour prior to launch.
Launch	The connected pair of the launch vehicle and the suborbital-spaceship take off and ascend for 1 hour.
Release	The suborbital-spaceship releases from the launch vehicle at approximately 45,000 feet.
Boost	After a few seconds of free-fall, the suborbital-spaceship ignites its rocket motor and the vehicle climbs vertically for ~60 seconds.
Microgravity Start	The suborbital-spaceship has entered microgravity (< 0.05 G).
Feather	The suborbital-spaceship has begun "feathering" (movement of wings) maneuvers to increase the total time within microgravity.
Apogee	Upon reaching 262,467 feet (80 kilometers) or more, the suborbital-spaceship has achieved apogee (the highest point).
Microgravity End	After approximately 3 minutes of weightlessness, the suborbital-spaceship has exited microgravity and begun re-entry.
Glide	The suborbital-spaceship executes gliding maneuvers to descend safely.
Landing	After 15 minutes of gliding, the suborbital-spaceship safely lands.
Payload Power Off	Payloads are powered off shortly after landing.
Payload Return	Experiments are de-integrated and best efforts will be made to recover the experiments and mail them back to teams.

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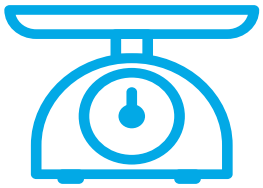
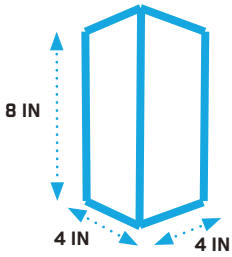


MASS

Your entire experiment, including the flight box, screws, electronics, and all components inside, can weigh no more than 2.2 pounds (1 kilogram). The flight box provided to winners will weigh about 0.5 pounds (230 grams), leaving your team with about 1.7 pounds (770 grams) left for accommodating your experiment.

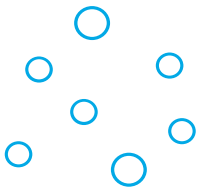


SIZE / VOLUME

Winners will be sent a flight box 4 x 4 x 8 inches (10 x 10 x 20 centimeters) in size. When brainstorming your design, it is essential for the components of your experiment idea to fit within this volume. The flight box will also have mounting points available on each side, which can be used to attach different experiment components.

POWER & DATA

Your experiment will be plugged into the suborbital-spaceship for power and data. Experiments will receive 9 volts / 1.0 amps power from the vehicle during flight. Batteries are not permitted as part of your experiment. Please rely solely on the vehicle to power your payload. Flight data will be sent in a serial format that can easily be received by a microcontroller and interpreted as text and numeric data. Future Engineers mentors will help advise on power and data if selected as a winner.



ATMOSPHERIC SENSING

Your experiment will not be exposed to the outside environment; however, it will experience 11.8 psi to 12.2 psi (81.2 kPa to 84.5 kPa) of pressure (similar to airplane cabin pressure). You may still use environmental sensors to learn more about the environment inside the suborbital-spaceship.

ACCELERATIONS

Your experiment should be designed to withstand 4 *g*-forces in any direction. The suborbital-spaceship is designed for a smooth ride, but some parts of flight such as the ignition of the rocket motors or re-entry may cause your payload to experience rapid accelerations or decelerations. Future Engineers will help advise on how to make your payload as robust as possible to survive these accelerations.

TEMPERATURE

Temperatures during the suborbital-spaceship flight could range between 32°F and 113°F (0°C and 45°C). Payloads will be kept in a climate-controlled cabin, so you do not need to design for extreme temperatures.

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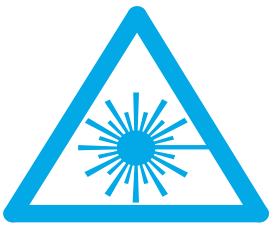
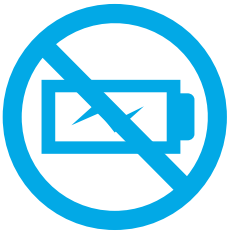


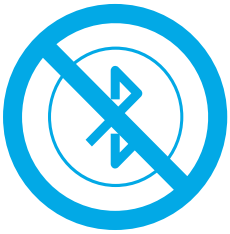
LASER SAFETY

For safety, lasers will not be allowed, including laser-transmitting technologies, such as lidar (light detection and ranging). However, exceptions will be made for commercial sensors that use internal lasers to detect particles or gather other data (e.g., air quality sensors), so long as students are not directly interacting with a laser and a laser does not transmit outside of the experiment.



NO BATTERIES

Your experiment will be plugged into the suborbital-spaceship for power. Please design your experiment to operate solely using the suborbital-spaceship's power.

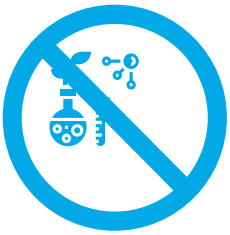


NO BLUETOOTH / WIFI / RF

Radiofrequency (RF) transmissions are NOT allowed.

LIQUIDS

Liquids are NOT allowed.



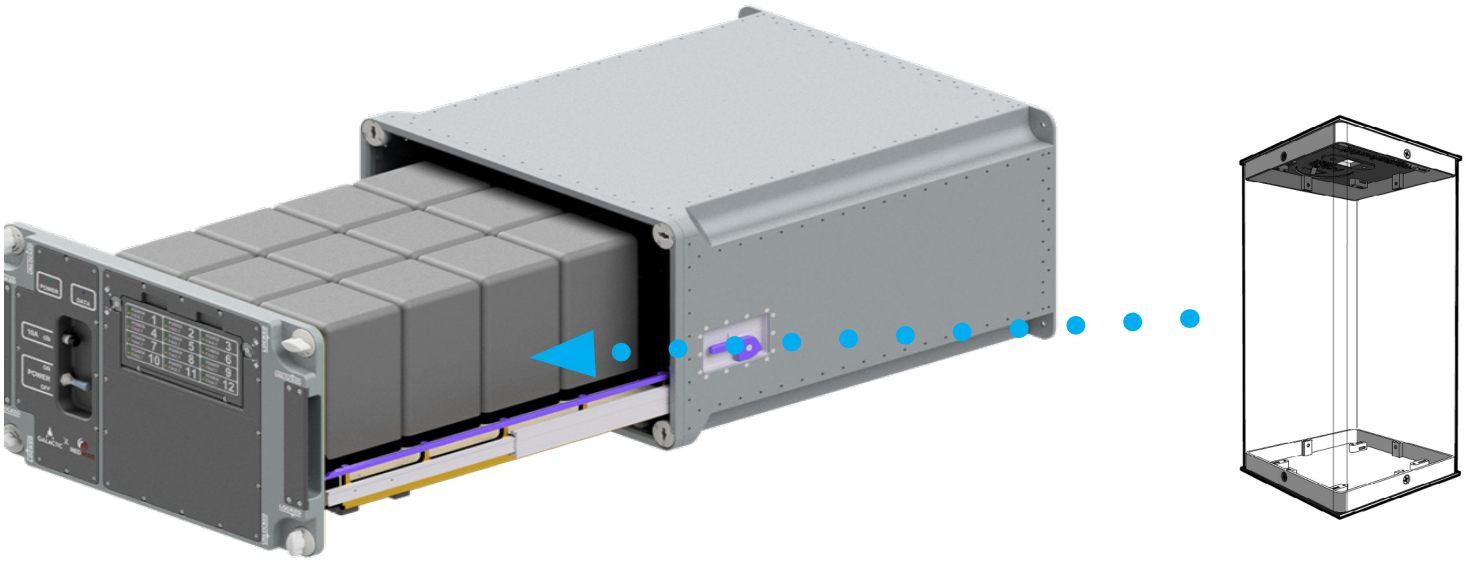
NO BIOLOGICAL MATERIALS

Experiments that grow or monitor LIVE organisms, including plant, animal, or cellular-focused experiments are not allowed. (Unintentional bacteria/ germs are fine.) Exceptions are seeds on their own, soils, or artificial soils for space farming-related experiments, and substances such as yeast that remain dormant until activated. Dormant microorganisms such as tardigrades are allowed.

MAGNETS

Experiments that propose magnets are allowed, but the magnets cannot adversely impact, affect or alter the neighboring experiments around it. You should assume that another experiment will be directly adjacent to your experiment. If selected, Future Engineers will help advise whether the magnets you have described in your proposal are appropriate for flight.

LOCKER MOUNTING CONFIGURATION FOR EXPERIMENTS



VIRGIN GALACTIC SPACEFLIGHT SYSTEM