

# NASA TECHTCHALLENGE

Step 3: Plan Your Experiment Brainstorm Possible **Rocket** Flight Experiments





### **About Suborbital Rockets Video**







#### **Brainstorm Possible Flight Experiments**

Let's start planning your experiment and come up with an idea.

First, we will take a look at some brainstorming buckets for **Suborbital Rockets**.

Then, we will break out into groups and brainstorm experiment ideas.





## Suborbital Rockets Brainstorm Buckets

- Living in Microgravity
- Organization in Microgravity
- Medical In Microgravity
- Spacecraft Structures
- Lunar Dust
- Small Propulsion Systems
- Acceleration Exploration
- Liquids
- Farming Tech
- Your Choice!







# Living in Microgravity

Imagine a full day living in microgravity on the International Space Station. Or on <u>Gateway</u> on your way to the Moon. Or in a spacecraft traveling to Mars. From waking up in the morning to going to bed at night, what things would you do and how would they be different? Astronauts eat meals, exercise at least 2 hours a day, and brush teeth in microgravity, but it's not *quite* the same since everything floats! They also work hard and play hard – from conducting important scientific research to knitting or playing a guitar in space. What microgravity experiment can you conduct to understand the differences of living in microgravity? What invention or technology can you innovate (and test!) to help astronauts living in microgravity?







# Organization in Microgravity

Can you imagine living in an environment where EVERYTHING you try to put down floats away, whether it's a tiny screw or a big camera? It's important to keep things organized and tidy while living in microgravity. Velcro is very common on the space station to help things stay put, but maybe you can brainstorm new and innovative ways to keep things where they need to be in microgravity!

# Medical in Microgravity

It's of the utmost importance that astronauts stay healthy while living in microgravity. What can you test or invent to help with medical studies in microgravity? From taking blood samples to administering first aid, astronauts need to be equipped with supplies for routine health monitoring, diagnostic testing, and urgent care scenarios such as surgeries or tooth extractions. What medical devices can you develop for microgravity? Or what experiment can you conduct to understand how the human body might behave differently in microgravity?





#### **Spacecraft Structures**

Great things come in small packages in spaceflight, but scientists and engineers work hard to make that happen. Solar arrays deploy, space structures unfold like origami, habitats inflate, and modules are assembled in space. Within a 4 x 4 x 8 inch volume how can you prototype and test an innovative space structure?







#### **Lunar Dust**

NASA's Artemis Program is going back to the Moon - and this time will be different. NASA is developing sustainable technologies to explore more of the Moon than ever before. While the Moon does have gravity, it is considerably less than we have here on Farth. The Moon has about 1/6<sup>th</sup> the amount of gravity we experience on the surface of Earth. Microgravity experiments are a great place to start in understanding the differences of designing for the Moon. And one of the biggest challenges is lunar dust!

The Moon is covered is lunar regolith that kicks up very easily. It's harmful for humans and difficult to deal with. Can you imagine the cloud of regolith that will happen when a rocket takes off from the Moon? Lunar dust can reduce visibility and cover important technical equipment like robots, solar panels, or space suits. What's worse is that it is very harmful to breathe! What can you design and test that helps tackle to problems of lunar dust?





## Small Propulsion Systems

It only takes a little force to move a lot in microgravity. NASA has invented small-scale propulsion methods to move things around on the International Space Station, like the <u>Astrobees</u>, which are autonomous floating robots that use small electric fans. What kind of propulsion systems could you invent and/or test? Can you setup a mini obstacle course in your 4 x 4 x 8 inch box to see if it works?







## **Acceleration Exploration**

Understanding the physics at play on a suborbital rocket is an experiment unto itself! What sensors can you use to measure the accelerations inside your experiment over the course of the rocket's flight? What acceleration values do you expect during the approximately 3 minutes of weightlessness? What other data can you collect during flight to better understand the incredible forces of a rocket flight? Is the flight suitable for humans? Why or why not? What about other physics explorations – for example, is it possible to simulate gravity in a microgravity environment? Or is it possible to despin an object in microgravity?

# Liquids

While you are limited to 150 ml, NASA TechRise experiments can incorporate liquids and there is a whole world of fluids research that awaits! Can you think of an experiment that tests surface tension in microgravity? What about sloshing? Or conservation of momentum? Or flow through small pipes? And what about mixing fluids? How might two different kinds of liquids mix in space? There are many technologies to invent as well – from fluid capture and cleanup in microgravity to newly shaped cups or straws for staying hydrated in space.





# **Farming Tech**

What's better than bringing a six-month supply of food on a space mission? Bringing a farm that can grow a six-month supply of food for that mission AND the next one! To be 100% clear – **you cannot fly a living plant or animal in your experiment**. But there are still so many farming technologies and experiments to explore – from irrigation systems that work in microgravity to soil containers or to synthetic soil substrates that can be used with hydroponics .. and more. Without bringing a plant, how can you innovate the future of space farming?







# **Your Choice!**

Understanding microgravity is imperative to innovating and preparing for space exploration. And it goes way beyond the International Space Station. The spacecraft that travel to asteroids to collect important samples or to Jupiter to take eye-opening pictures are all designed for microgravity. What other types of microgravity experiments can you dream up? What microgravity experiments have you researched? How can you use 3 minutes in microgravity to expand on NASA's mission to further explore and understand the universe?





## **Brainstorm Activity**

- 1) Breakout into groups of 4
- 2) Assign 1-2 brainstorm categories to each group
- Use the worksheet below to help brainstorm suborbital rocket experiment ideas

Brainstorm Rocket Experiment Ideas Activity Worksheet





# **Share Your Ideas**

Share your ideas with your class.

