



Brainstorm Activity Worksheet (Suborbital Rocket)

Brainstorm possible rocket flight experiment ideas for the TechRise challenge

Brainstorm Activity Procedure

1. Use the rocket brainstorm topics and questions below as a guide to come up with possible rocket flight experiment ideas.
2. All ideas are welcome, simple or complex.

Questions

1. What is special about the rocket’s environment?
2. What brainstorm topic most interests your group? Read the topic out loud and discuss what experiment ideas come to mind. Expand on your experiment ideas.
3. Would you like to conduct a science experiment on the rocket?
 - a. What do you want to study in the environment the rocket provides?
 - b. What kind of data would you like to collect?
 - c. What is your hypothesis?
4. Would you like to use the environment to test a new technology?
 - a. What new technology would you like to test?
 - b. How do you think the new technology will react in the rocket environment?

Write your ideas below

ROCKET BRAINSTORM TOPICS

Living in Microgravity

Imagine a full day living in microgravity on the International Space Station. Or on [Gateway](#) 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?

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?

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!

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 [Astrobee](#)s, 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?

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.

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?

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?

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. The Moon has about 1/6th the amount of gravity we experience on the surface of Earth, and microgravity experiments are a great place to start in understanding the differences of designing innovations and processes for the Moon. One of the biggest challenges is lunar dust! The Moon is covered with lunar regolith that kicks up very easily. Can you imagine the cloud of regolith that will happen when a rocket takes off from the Moon? Lunar dust can reduce visibility and coat 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 the problems of lunar dust?

Other

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?