2025 Brainstorm Activity Worksheet (Suborbital-Spaceship)

Brainstorm possible suborbital-spaceship flight experiment ideas for the TechRise challenge.

Brainstorm Activity Procedure

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

Questions

1. What is special about the suborbital-spaceship's flight environment?

2. What brainstorming topic most interests your group? Read the brainstorming topic out loud and discuss what experiment ideas come to mind. Expand on your experiment ideas.

3. What science experiment would you like to conduct on a suborbital-spaceship?
    a. What do you want to study in the environment that the suborbital-spaceship provides?
    b. What kind of data would you like to collect?
    c. What is your hypothesis?
    d. Why is it important? How does it relate to NASA?

4. What technologies would you like to test on a suborbital-spaceship?
    a. What types of technologies do you find interesting?
    b. How do you think those technologies will function on the suborbital-spaceship flight, and why?

Write your ideas below:

SUBORBITAL-SPACESHIP 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 from life on Earth? 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?

Air Quality on a Spacecraft
Air quality is a vital part of living in space. Small particles of dust or metal cannot settle in microgravity and can become irritants for astronaut's lungs and eyes. The recirculated air astronauts breathe in a spacecraft cabin is carefully monitored to make sure there are no pollutants that could potentially put them at risk. Think about ways you can monitor or improve air quality in a closed space. Can you utilize an existing air-quality technology or will you invent your own?

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 4x4x8 inch volume, how can you prototype and test an innovative space structure?

Lunar Dust Mitigation
Dust mitigation has been an issue for NASA since Apollo. Lunar regolith is easily disturbed and can coat everything with a fine layer of dust that sticks to surfaces like static cling. When astronauts were entering and exiting the lunar module, dust got everywhere – it clogged mechanisms, interfered with instruments, caused radiators to overheat and even tore up their spacesuits. Can you come up with a solution to deal with the dust on the Moon? If so, what will it be, and how can you use the microgravity flight to test it?

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 Astrobees, which are autonomous floating robots that use small electric fans. What kind of propulsion systems could you invent and/or test? Can you set up a mini obstacle course in your 4x4x8 inch box to see if it works?

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?

Acceleration Exploration
Understanding the physics at play on a suborbital-spaceship is an experiment unto itself! What sensors can you use to measure the accelerations inside your experiment over the course of the suborbital-spaceship's flight? What acceleration values do you expect during the approximately 3 minutes of microgravity? What other data can you collect during flight to better understand the incredible forces of a suborbital-spaceship flight? 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?

Radiation
As humans explore further and stay longer in space and near-space, or even high in our atmosphere on planes, NASA needs to understand ionizing radiation and its effects on living things. Just like NASA plans to fly a Moonikin around the Moon, how can you test the radiation levels a living thing or person may experience the closer they get to space? Or what kind of radiation shield can you invent and test during your flight?

Materials Experiments
Materials react differently the farther away they get from Earth's surface – from rubber to plastics to organic substrates, like soil and seeds. Radiation can affect how much materials degrade. Some materials may not handle the high velocities of flight as well as others. What materials could you fly, test, and compare to objects here on Earth to study the effects of flight?

Earth's Magnetic Field Measurements
Magnetometers aboard suborbital flights can measure the Earth's magnetic field. Do you think you can map magnetic field fluctuations? Why do magnetic field fluctuations matter? What can they tell us about our planet?

You Choose!
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?