NASA

TECHRISE STUDENT CHALLENGE

Step 3 Learn About Rocket-Powered Landers

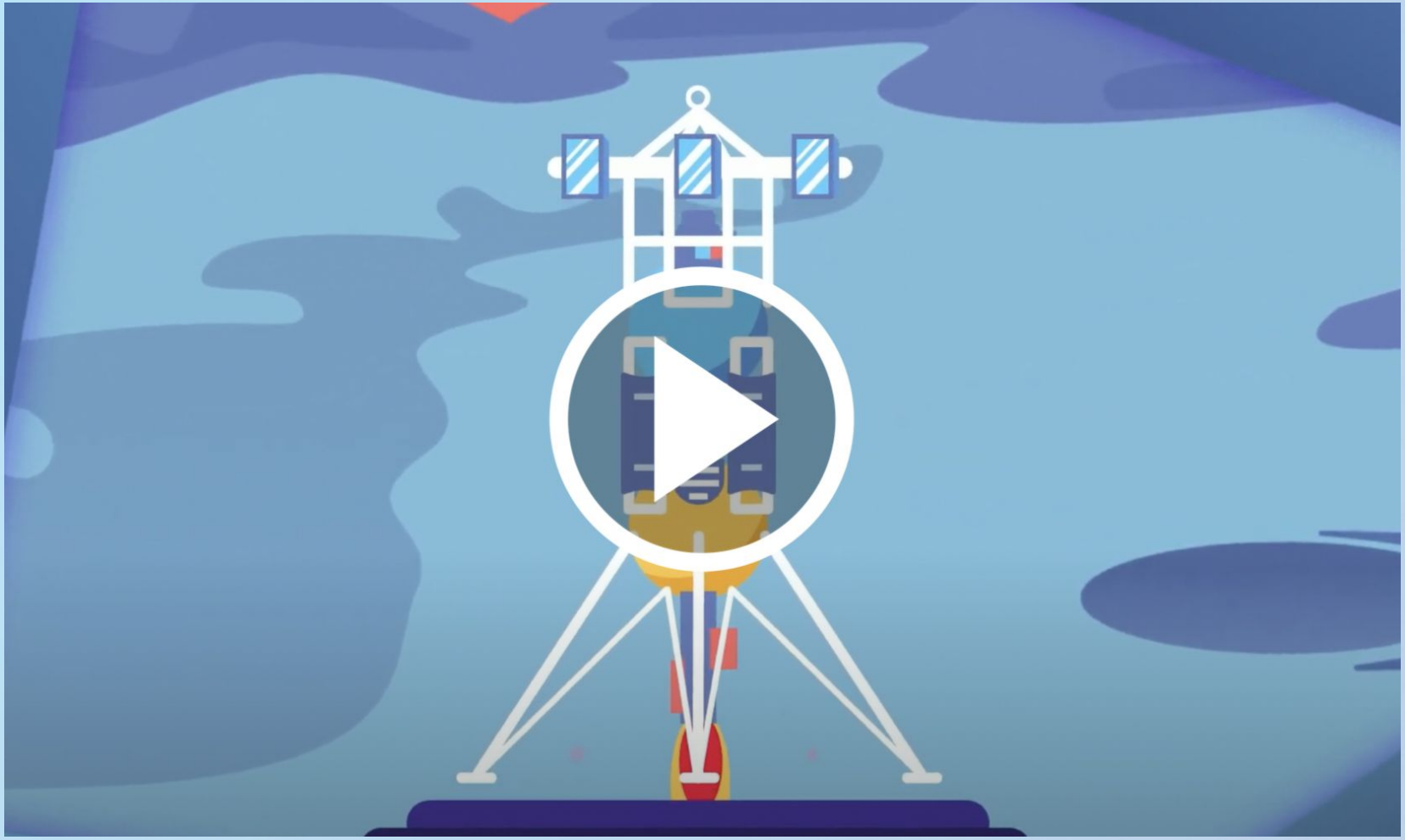
Step 3: Learn About Rocket-Powered Landers

Learn all about Rocket-Powered Landers.

Think about the following questions when learning about the lander:

- What environment does the lander provide? How long will your experiment/payload be in that environment?
- What types of experiments can you conduct on the lander?
- What kind of data can you collect during the lander flight? (e.g., can you take pictures, collect temperature, or measure altitude, etc…?)

About Rocket-Powered Lander Video



Rocket-Powered Landers

A rocket-powered lander is a test vehicle that can be used by researchers and engineers used here on Earth to simulate exploring and landing on another planetary surface. Like the Moon.

For NASA TechRise, Astrobotic's Xodiac lander will remain relatively low to the ground. The flight will simulate exploring the surface of the Moon from an altitude of approximately 80 feet (~25 meters).

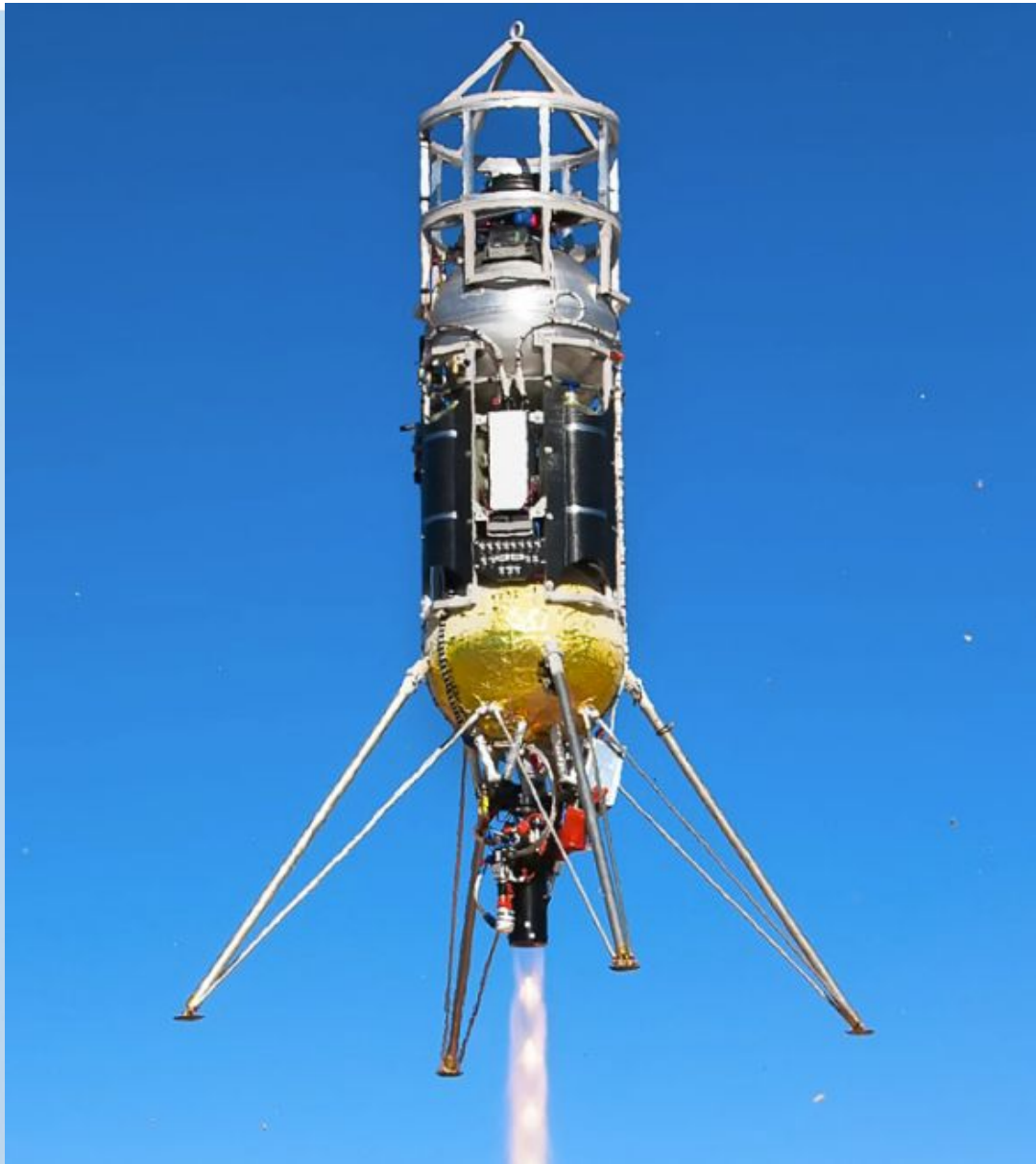
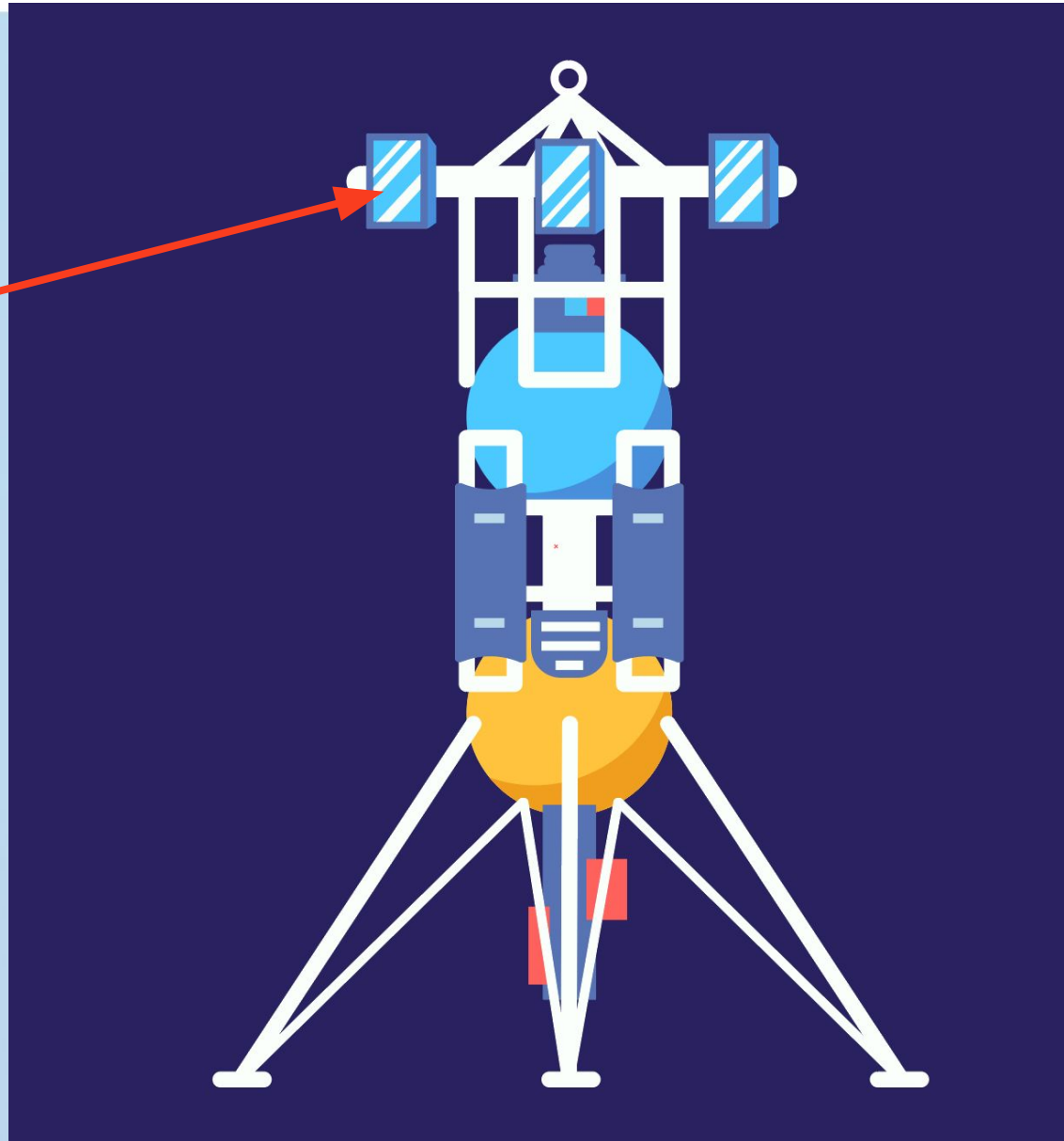


Photo Credit: Astrobotic

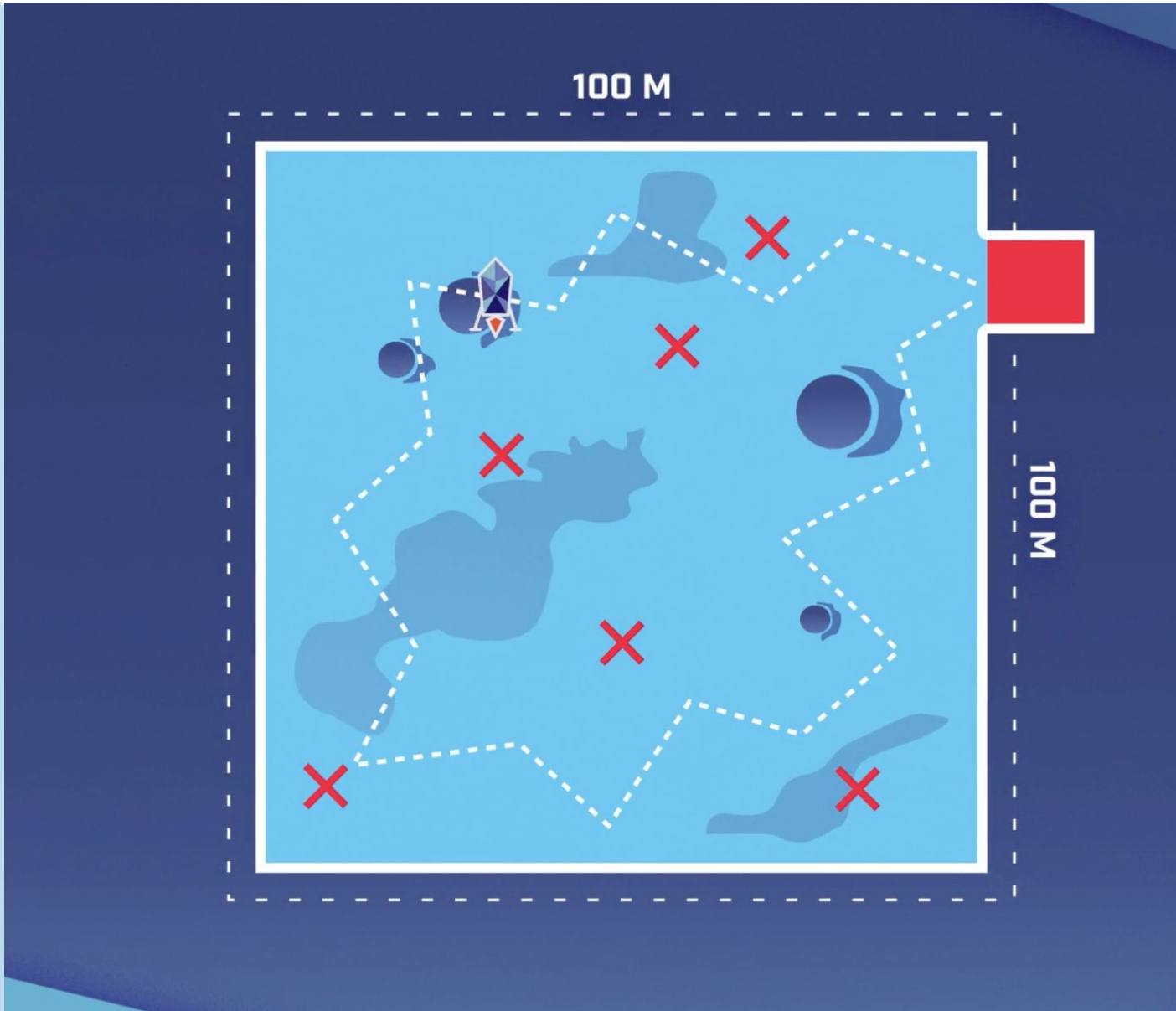
Power

Before flight, all NASA TechRise experiments will be hooked up to the lander's power and mounted to a circular frame at the top of the lander. If it is daytime, not raining, and with little/no cloud cover, then we are GO for launch.



The Flight

For NASA TechRise, the Xodiac lander will perform a 2-minute flight test in Mojave, California. The lander will start on a concrete launchpad next to a 100m x 100m lunar surface test field (LSTF) from where it will take off and reach an altitude of approximately 80 feet (~ 25 meters) and hover for 4 seconds. Then, the lander will enter the test field and fly over the simulated lunar terrain. At the end of the 2-minute flight, the vehicle will return back to its starting position and gently land on the concrete launch pad.



Collecting Data

Once the vehicle is powered on, the experiments can start using their onboard sensors and cameras to collect data. The experiments will have exposure to the air around them and views down down to the lunar surface test field (LSTF) during the entire flight. To be clear – your experiment CAN NOT control the lander. But it will definitely be an exciting scientific ride!

Vehicle data will not be sent to payloads during flight. However, a copy of the general flight data, including timestamp, latitude, longitude, altitude, and 3-axis velocity, will be provided to teams after flight.

Photo Credit: Astrobotic

The Terrain

The lander will traverse over a hardscaped surface that resembles the surface of the moon including craters, rilles, and troughs. While dust is a big concern on the Moon, the lander will NOT be exposed to significant amounts of dust during the NASA TechRise flight test.

Photo Credit: Astrobotic

Land and Mail Experiments Back

And once the lander is safely back on the ground, your experiment will be mailed back to you, so that you can analyze the data, and see how your experiment worked.

Photo Credit: Astrobotic

Key Points: Rocket-Powered Lander

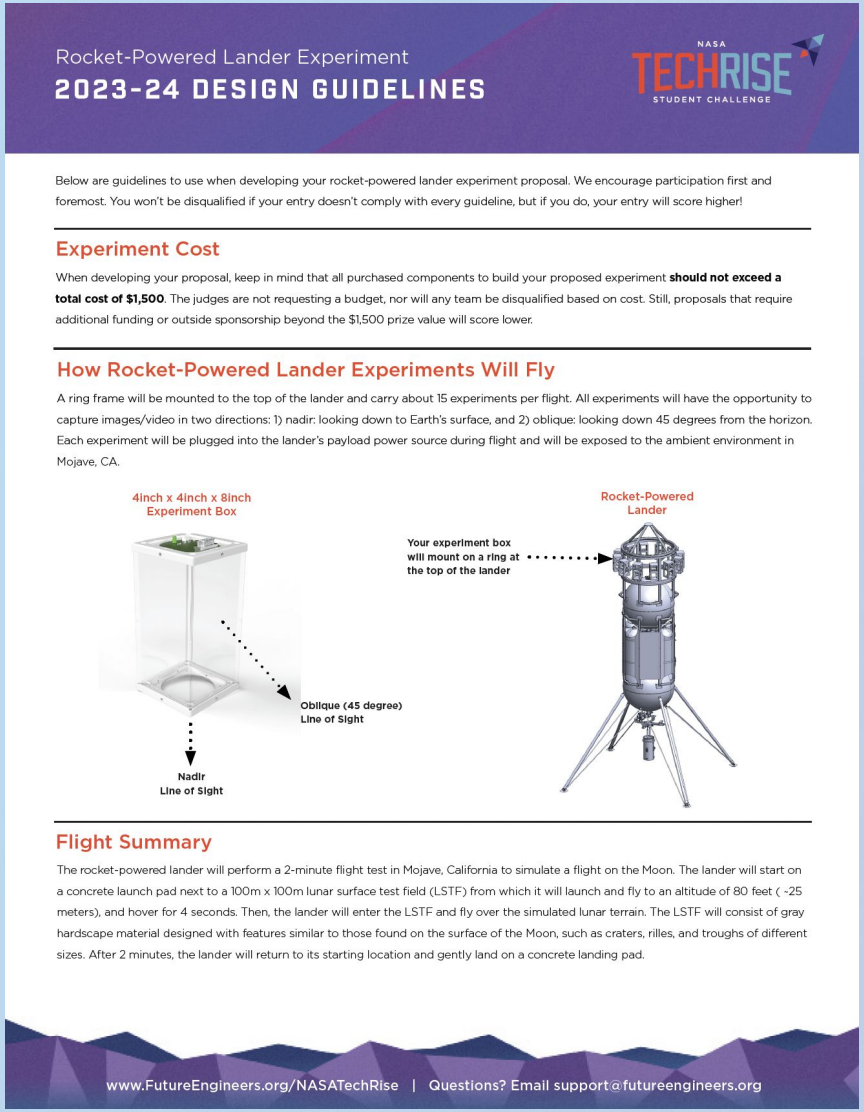
- Flight Time: approximately 2 minutes at 80 feet (~25 meters)
- Experiment will have two lines of sight down to the Lunar Surface Test Field (Nadir-pointing directly down to Earth and a horizontal/oblique 45 degree view)
- Lunar Surface Test Field will have features similar to those found on the surface of the moon such as craters, rilles, and troughs
- Flight Location is Mojave, CA
- Exposed to ambient atmospheric temperature and pressure
- Power is provided to each experiment. No additional batteries permitted
- Vehicle data is not streamed during the flight, instead it will be provided after the flight

Possible Experiments Topics
Rocket- Powered Landers

- Imaging/Mapping the Lunar Surface Test Field
- Object Detection on the NASA TechRise Test Field
- Studying the Physics of Rocket Flight
- Measuring the Rocket Flight Environment
- Mitigating the Effects of the Vehicle
- Your Choice!

Design Guidelines

The NASA TechRise Student Challenge website has the Rocket-Powered Lander Design Guidelines with more information.



Rocket-Powered Lander Experiment

2023-24 DESIGN GUIDELINES

NASA TECHRISE STUDENT CHALLENGE

Below are guidelines to use when developing your rocket-powered lander experiment proposal. We encourage participation first and foremost. 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

When developing 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.

How Rocket-Powered Lander Experiments Will Fly

A ring frame will be mounted to the top of the lander and carry about 15 experiments per flight. All experiments will have the opportunity to capture images/video in two directions: 1) nadir: looking down to Earth's surface, and 2) oblique: looking down 45 degrees from the horizon. Each experiment will be plugged into the lander's payload power source during flight and will be exposed to the ambient environment in Mojave, CA.

Flight Summary

The rocket-powered lander will perform a 2-minute flight test in Mojave, California to simulate a flight on the Moon. The lander will start on a concrete launch pad next to a 100m x 100m lunar surface test field (LSTF) from which it will launch and fly to an altitude of 80 feet (~25 meters), and hover for 4 seconds. Then, the lander will enter the LSTF and fly over the simulated lunar terrain. The LSTF will consist of gray hardscape material designed with features similar to those found on the surface of the Moon, such as craters, rilles, and troughs of different sizes. After 2 minutes, the lander will return to its starting location and gently land on a concrete landing pad.

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