Rocket-Powered Lander Experiment

2023-24 DESIGN GUIDELINES

NASA TECHRISE STUDENT CHALLENGE

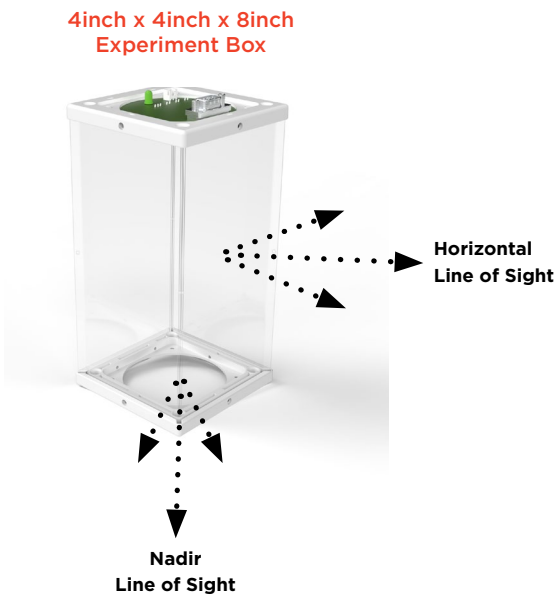
Below are guidelines to use when developing your rocket-powered lander experiment proposal. We encourage participation first and foremost. You won't be disqualified if your entry doesn't comply with every guideline, but if you do, your entry will score higher! In addition to these design guidelines, you are invited to also review the Astrobotic Tech Sheet for more information.

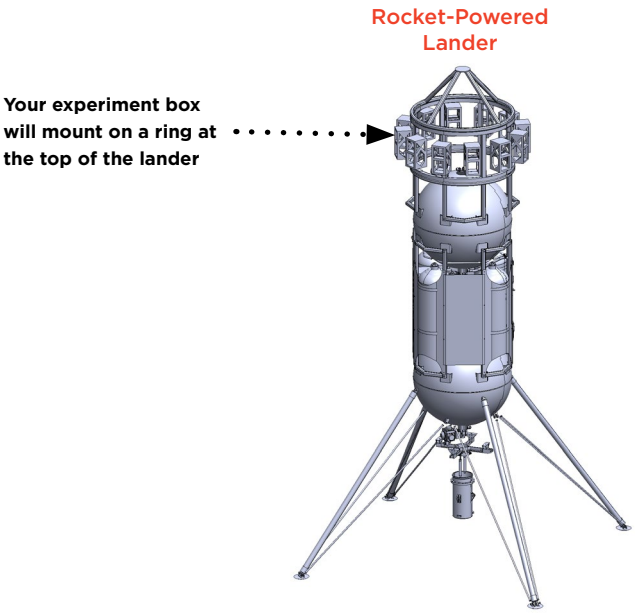
Experiment Cost

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.

How Rocket-Powered Lander Experiments Will Fly

A ring frame will mount 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) horizontal (outward). 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). 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.

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FLIGHT PROFILE

EXPERIMENT FLIGHT BOX

Winning teams will receive a flight box and a technical development guide to prepare for their rocket-powered lander flight.

Maximum Size: 4 x 4 x 8 in (10 x 10 x 20 cm)
Total Maximum Weight: 1.1 pounds (0.5 kg)

FLIGHT PROFILE DETAIL

Prepare for Launch	Flight experiments will be powered on and readied for the approximate 2-minute flight.
Launch & Ascent	Experiments will launch from a concrete pad and ascend to approximately 25 meters.
Survey the Simulated Lunar Terrain Field	After reaching the flight altitude, the experiments will fly across the 328ft x 328ft (100m x 100m) course
Termination & Descent	After 2 minutes the experiments will return to the concrete pad for landing.
Landing & Recovery	Experiments land and are mailed back to teams. Teams will also be sent a digital copy of the post-flight data to corroborate, validate, and compare with experiment results, if needed.

SAMPLE FLIGHT VIDEO

ABOUT ROCKET-POWERED LANDERS

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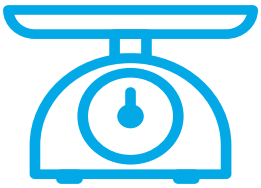
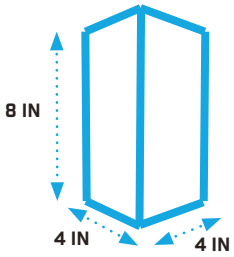


MASS

Your entire balloon experiment, including the flight box, screws, electronics, and all components inside, can weigh no more than 0.5 kilograms (1.1 pounds). The flight box provided to winners will weigh about 230 grams, leaving your team with about 270 grams left for accommodating your experiment.

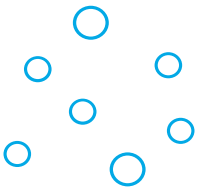


SIZE / VOLUME

Winners will be sent a flight box 4 x 4 x 8 inches in size. When brainstorming your design, it is essential for 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

Your experiment will be plugged into the lander's payload power source before and during flight. Experiments will receive 9V / 1 A power from the lander during flight. Future Engineers mentors will help advise on power if selected as a winner.



ATMOSPHERE

Your experiment will be exposed to the ambient atmospheric temperature and pressure during flight. If using sensors to measure atmospheric conditions, it is recommended to mount sensors as close to the outer face of the experiment as possible.

ACCELERATIONS

Your experiment should be designed to withstand 6 g in any direction. Rocket-powered landers are generally known for their gentle, smooth rides, but there are a few things to keep in mind when thinking about accelerations (or decelerations) during flight. Take-off, landing, and changing directions.

TEMPERATURE

Temperatures during the rocket-powered lander flight will be the same as ambient temperatures in Mojave, CA on a summer day, which could range between 16 - 40 degrees Celsius.

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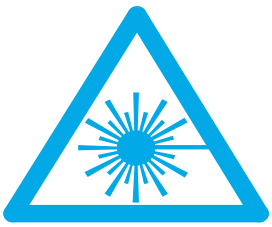
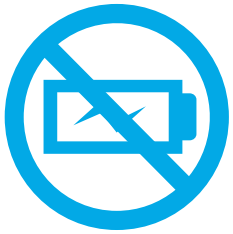


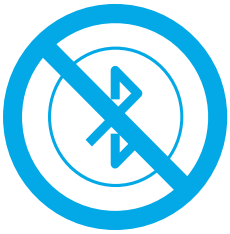
LASER SAFETY

LIDAR, LADAR, and laser range finding is acceptable, so long as the lasers are Class-1 lasers that are safe for student use; Sensors that use internal lasers to detect particles or gather other data (e.g., air quality sensors) are also allowed; All lasers will be subject to approval from the TechRise advisory team prior to purchase and use.



NO BATTERIES

Your experiment will be plugged into the lander for power. Please design your experiment to operate solely using the lander's power. By relying on lander power, a battery is less likely to lose its charge before or during flight. If you want to use a typically battery-powered component in your experiment, we recommend hard-wiring if possible.

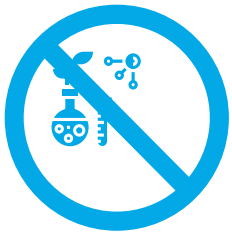


NO BLUETOOTH / WIFI / RF

Radiofrequency (RF) transmissions are NOT allowed on NASA TechRise experiments. This means no Bluetooth, Wi-Fi, cellular phone, or RF communications. You can, however, receive signals like GPS coordinates if needed.

LIQUIDS

Liquids are not allowed. Please do not include liquids in your experiment.



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.

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.