

Design Challenges

Educator Guide Mission: Mars

Prompt

Can you build a large habitat for the surface of Mars that can collapse to fit inside a lander and self-deploy while remaining fully enclosed?

Primary Goal

Build a collapsible and deployable structure, test it, and improve your design.

Secondary Goal

Maximize the volume of your structure.

Materials

- Lander testing station
- Tabletop test landers
- Base hubs with rubber tubes
- 2", 4" nylon rods
- 2", 4", 6" rubber tubes
- 2" rubber cross pieces

Set-Up

STATION 1 INTRODUCTION

Designate a space where a facilitator can introduce the activity to participants. The base hubs, nylon rods, and rubber tubes and cross pieces should be available at this station.

STATION 2 CONSTRUCTION

Tables should be set up for participants to construct their habitats. Set tabletop test landers on tables for participants to use for pre-testing while building.

STATION 3 TESTING

The lander testing station should be facilitated to assist visitors with testing their habitats and to encourage iteration. The testing station should be oriented so that a distinct queue may form for participants waiting to test. Electrical cords should be tucked away where they do not present a tripping hazard.

Talking Points for Facilitators

- What could you change about your design to affect its height and/or width?
- How might adjusting the shape of your design affect its height and/or width?
- Imagine what you might need in order to live on Mars for an extended period of time. How could you maximize the volume of your design to accommodate everything you might need?
- Think creatively about how to get your habitat to Mars efficiently. How might changing how you use the materials affect how your design collapses and deploys from the lander?
- Why is it important for a habitat to be an enclosed structure?
- Are there any elements of a real-life habitat that you can incorporate into your own design?
- Why is it important to only make one modification to your habitat at a time?



Facilitating the Activity

INTRODUCTION

To begin, introduce the activity to participants by stating the challenge, the goals, and the available materials. Indicate where participants can build and test their designs in the tabletop test landers before they test in the lander testing station.

PREPARE FOR TESTING

To test a design in the lander testing station, first make sure the lander is lowered down to the platform by pressing the reset button, marked with the image of a circular arrow. Ask participants to collapse or fold up their designs to fit into the lander. Open the front door of the lander and allow visitors to lower their designs to the platform, ensuring that the base hub lies flat against the platform. Close the front door and use the latch to lock it.

CONDUCT TEST

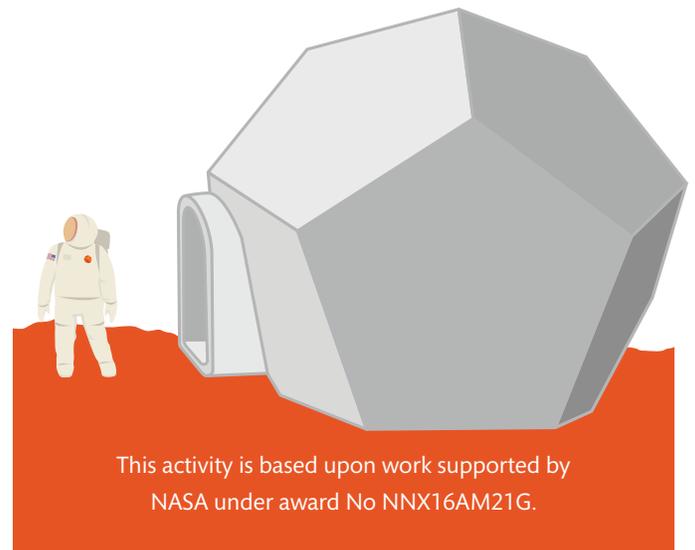
Participants can press the launch button, marked with the image of a rocket, to launch the lander off of the platform. After the lander has lifted off, the platform will rotate to measure the height of their habitat design in centimeters and determine which of the four zones (indicated by the concentric circles on the platform) their design has reached. The height measurement and the zone reached will appear on the small screen below the buttons. Participants should keep their hands away from the testing station while the test is underway so their results can be measured. Once their measurements appear onscreen, ask participants to remove their design from the platform.

RESET THE LANDER TESTING STATION

To bring the lander back down, press the reset button. Make sure that participants have removed their designs from the platform before pressing the reset button.

TROUBLESHOOTING

If a design gets stuck at the top of the test station or if the lander comes down while there is an object on the platform underneath it, the lander will stop moving. To reset the lander testing station, cycle through the commands by first pressing the launch button and then the reset button.



Facilitation Tips

- All habitats must utilize one (and only one) base hub, onto which participants can connect the nylon rods, rubber tubes, and rubber cross pieces to construct their designs.
- Participants' habitats must be fully enclosed, meaning any material attached to the base hub must be connected back to the base hub with another rod or tube making a full enclosure so that no added material is protruding from the base hub.
- The rods and rubber tubes can sometimes be hard to separate. It can be helpful to use a hard edge as leverage, or twist the materials when separating them from each other rather than pulling from the ends.
- When testing, allow only one habitat in the lander testing station at a time. After a participant tests their design, encourage them to improve their design and allow the people behind them in line to test before the participant tests again.
- Participants are encouraged to redesign and retest their habitats multiple times, but they must disassemble their designs and return all materials when they are all done.
- Facilitators can keep a leaderboard to document the tallest designs within each zone. When a participant sets a record, have them name their design to put on the leaderboard. Using a name other than their own name is recommended in order to celebrate the success of the design itself.