ACTIVITY 12

LANDING CONTEST

Level:	Preparation:	Number of students:	Length:	Place:	Type of activity:
Grades 3-6	**intermediate**	**groups of 2-4**	**60 min.**	**classroom, gym, outdoors**	**do-it-yourself, competitive, creative activity**

BRIEF DESCRIPTION

Students build a lander that allows an egg to fall from a minimum height of 2 metres without breaking.

MATERIALS

- materials for decorating the lander: pencils, glue, glitter...
- scissors
- adhesive tape
- fresh eggs, 1 per team
- plastic tablecloth or large garbage bag to protect the floor
- hoop or tape to mark out landing area

Note: you may want to boil the eggs to avoid making a mess, but sometimes messes are fun!

Eco-friendly tip: To build the lander, use materials that often end up in the recycling bin or garbage. Don't hesitate to ask parents to provide you with certain items in advance. Here are a few ideas:

- small plastic containers (yogurt, etc.)
- egg cartons
- straws
- wooden skewers
- string
- rubber bands
- balloons
- scrap paper or cardboard
- cotton or other stuffing material
  (ask the school secretary for stuffing material from delivered parcels) —limit quantities per team!

PREAMBLE

Imagine you need to send a probe to the planet Mars. After travelling hundreds of millions of kilometres, the probe must slow down to avoid crashing into the planet's surface. The probe can start to slow down using a parachute. However, this method can't be used on its own, as Mars' atmosphere is thinner than Earth's. The probe would still be travelling too fast on the ground! What other braking system could you use? How would you protect the probe from damage on landing?

Students will build a lander and then explore the influence of gravity and atmosphere in a safe landing, getting the students thinking about the technological challenges of such missions. The aim is to land an egg from a predetermined height without breaking it. This means slowing its fall and protecting it on impact with the ground.

PREPARATION

Make sure you have enough equipment for each group. You can allow groups to take what they want from the materials, or limit the quantities available to each. You can also provide each group with a bag or box containing all the materials they can use.

For the test, you can use different methods depending on your situation. The starting height can be two metres or more if you have access to a stepladder, the top of a staircase, or a 2nd-floor window. Make sure the whole thing is safe, and that any mess can be cleaned up easily if the eggs break.

STEPS

To broach the subject with students, share these videos demonstrating the challenges of landing on Mars.

- Challenges of Getting to Mars: Curiosity's Seven Minutes of Terror: *https://science.nasa.gov/resource/challenges-of-getting-to-mars-curiositys-seven-minutes-of-terror/*
- Landing of the Spirit and Opportunity probes in 2004: *https://www.youtube.com/watch?v=KyktvC7w7Js*

Discuss the challenges these missions represent, what they remember from the videos...

Explain to the students that today they'll be engineers, and that they'll also face a big challenge: building a system to land a fragile object without breaking it. Instead of landing a robot like on Mars, the students will have to land an egg! The challenge will be to see which groups can keep the egg intact, while landing as close as possible to the target.

Distribute the materials and set a time limit for building the lander (between 15 and 30 minutes). Groups can run tests without the egg during this period to optimize their landing systems.

For the test, **use a hoop or ribbon to mark out a landing zone.** Have the teams go one after the other, and check if the egg is broken once the lander is back on the ground. A cracked egg is considered a broken egg. Also note whether the lander has fallen inside the

target. If you're looking for a competition and several groups successfully complete the challenge in the first round, you can repeat the challenge in a second round, with modifications such as starting higher or reducing the size of the target.

INFORMATION

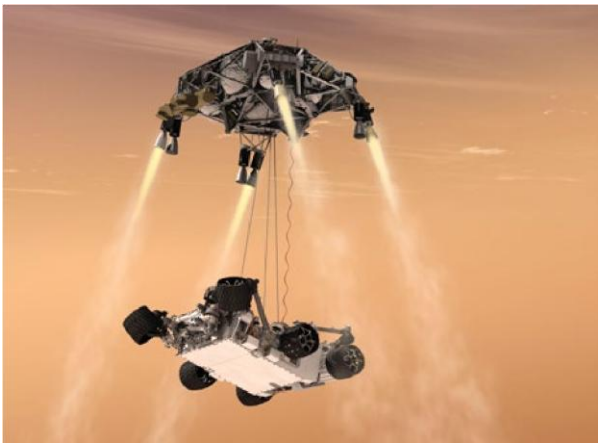
The first missions to Mars took place in the 1960s. The first probes simply flew over the planet without stopping. Engineers then increased the level of difficulty by having probes orbit the planet to better study it. The most difficult challenge is when the probe has to land on the surface. Various types of landers have been tested over the years, including the famous inflatable balloons of the *Pathfinder*, *Spirit*, and *Opportunity* missions. **The Pathfinder mission, with its small robotic vehicle, took place in 1997 and was a huge success.** The same landing method was used for *Spirit* and *Opportunity* in 2004. Once again, these missions exceeded expectations. *Opportunity* was still moving around on the surface of Mars in 2018, fourteen years after its landing!

Inflatable balloons for the Mars *Pathfinder* mission. Image Credit: *NASA.*

Did you know that billions of years ago, there were lakes on the surface of Mars?

DID YOU KNOW...?

In 2011, *NASA* sent another rover to Mars: *Curiosity*. This was bigger than all the previous rovers, roughly the size of a small car. This size posed a problem for the inflatable balloon method, so instead, it was decided to use a crane to lower the rover gently to the surface. It was a challenge of engineering and creativity, and fortunately, it all worked out perfectly! *Curiosity* is still studying the surface of Mars today.



The *Curiosity* rover landing. Image Credit: *NASA.*

Unfortunately, not all missions have been so successful... Of all the missions sent to Mars by the USA, Russia, and Europe, around 65% have failed. A number of problems can arise during lift-off from Earth, during the journey, and especially on arrival to Mars. Occasionally, even human error during manufacturing or navigation of the probe can also cause a mission to fail.

Missions to other planets pose enormous technological challenges, and teams of engineers and scientists are constantly working to develop new methods. If your students don't manage to land an egg without breaking it, tell them to persevere, just like the engineers working on these space missions do!

SOURCE

This activity was inspired by the European Space Agency's activity *L'œuf-tronaute* and the *Club des Débrouillards* experiment.

TO LEARN MORE

- *Exploration of Mars*, *Wikipedia* page.