



### Aim

*Children are introduced to the challenges facing spacecraft engineers regarding the need to develop protective landing systems*

## Introduction

Touchdown, the final phase of a planetary landing, is a very critical moment and a huge challenge.

The landing system needs to absorb the impact so that the spacecraft remains intact. When landing on the moon, spacecraft need to decrease from 6000 km/h in a lunar orbit to a few km/h for a soft touchdown. Engineers need to design spacecraft that weigh as little as possible as heavier craft cost more to launch, manoeuvre in space and have greater impact forces on landing. Spacecraft engineers often build a model to allow experimental testing and, if it doesn't land successfully, the model is improved until it gets closer to success.

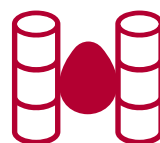
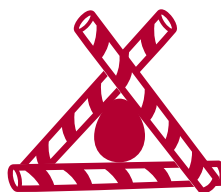
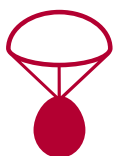
### Equipment

- ⊙ One egg
- ⊙ Stiff card
- ⊙ Paper cups
- ⊙ Paper plates
- ⊙ Marshmallows
- ⊙ Cotton wool
- ⊙ Bubble wrap
- ⊙ Tissue Paper
- ⊙ Balloons
- ⊙ Corks
- ⊙ Elastic bands
- ⊙ Stiff wire
- ⊙ Straws
- ⊙ Foil
- ⊙ Tape
- ⊙ Stapler
- ⊙ Scissors

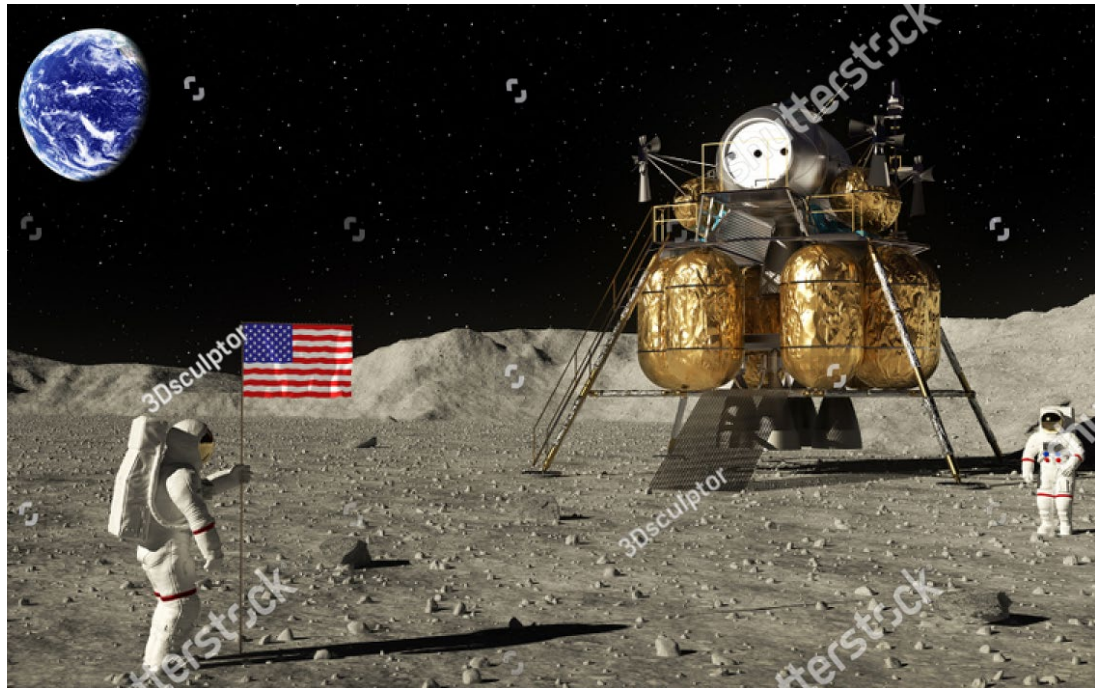
### Instructions

- 1** Working in teams you are to design and build a spacecraft that can survive a descent onto a solid surface, from a specific height. The sensitive payload will be an egg which must not be damaged
- 2** Your design constraints are that your space craft must not exceed 450 grams, must survive a decent from 2 metres, and must fit within a space of 25cm x 25cm x 25cm
- 3** To build your craft, you can use an assortment of items commonly found at home or in the classroom
- 4** In your teams, discuss your ideas, sketch out several designs, then test them out
- 5** Remember the need to experiment: (ie) test, fail, evaluate and redesign – this is part of engineering
- 6** Remember that increasing the amount of time the spacecraft spends slowing down before coming to rest increases the chances of survival so think about shock-absorbing systems like springs, airbags, cushions or maybe parachutes to reduce descent speeds
- 7** Also, during testing, consider dropping your spacecraft from progressively greater heights, until you successfully achieve touch down from the target height

Activity



In association with



## Useful links

- ◉ Artemis Mission: Returning to the Moon <https://tinyurl.com/37x5x1g2>
- ◉ Delivering cargo to the Moon <https://tinyurl.com/thn7zyp6>
- ◉ 3-2-1 Drop !!! <https://tinyurl.com/rdwxt5np>
- ◉ Perseverance Rover's Descent and Touchdown on Mars <https://tinyurl.com/b1grygb1>



## Next steps

- ◉ Make a presentation explaining your designs that you tried. Focus on what didn't work and what you learned from it.
- ◉ Think about the engineering process: **test**, **fail**, **evaluate** and **redesign**. What personal attributes would engineers benefit from in order to keep going? List at least three