

*Sydney Girls High School Astronomy Club*  
*Martian Lander (Egg Drop)*  
*Engineering Challenge*



### Missions to Mars

There are many ways that our spacecraft have been landed on the surface of other planets in the past. The Pathfinder and Mars Exploration Rover missions all used a combination of heat shielding for re-entry, parachutes, rockets and airbags. This method has proved extremely successful and two of these rovers are still functioning on the surface of Mars after two years of operation and many exciting discoveries.

### Basic Principles

The basic idea behind these landing systems is to change the speed of the Lander gradually. This avoids shocks that could damage its delicate instruments. If the spacecraft changed speed too abruptly, as in a crash landing, the force would damage or destroy it. The spacecraft used several methods to slow itself down for landing. The last step in the slow-down sequence used airbags to reduce the abrupt change of speed on impact with the ground. When the Lander hit the ground, the air in the bags absorbed the force of impact by compressing. It did this in less than a tenth of a second. That seems like a short time, but it was long enough to "break the fall" and reduce the force of impact. The compressed air bounced back and made the Lander bounce as well, but the bounces got smaller until the Lander came to a stop.

### Design Challenge

Your challenge is to design a Lander that will protect its cargo (a raw egg) when falling from the greatest height possible. Your design team have a budget of \$100 Million for the Lander system and the available components and their cost is listed on the next page. Your engineering team may include a maximum of 4 people.

## Design and Construction

The parts that are available to your team are:

<b>String</b>	\$5 Million per metre
<b>Sticky tape</b>	\$5 Million per metre
<b>Straws</b>	\$5 Million each
<b>Newspaper</b>	\$5 Million per sheet
<b>Paper clips</b>	\$5 Million each
<b>Small plastic bag</b>	\$30 Million each

Breakage of parts is covered under warranty during the design and construction process so you can apply to the supplier for a replacement part. The broken part must be returned to the supplier for replacement. Once the final evaluation testing (competition) is underway the warranty no longer applies.

You will also need to construct an object the size of an egg to go inside your craft during the design phase. A real egg will be issued on competition day.

### Final Evaluation Testing (Competition)

Competing teams will progress up a series of increasing height drops, like limbo in reverse. At each height a broken egg will eliminate that team following a strict “no yolk policy”. All teams will be awarded with certificates of “eggscellence” and a small prize will be available for the winners.

Design Notes: