Landers & Rovers

Spacecraft designed to explore the surface of a planet.

Humans are naturally curious…

No robot will ever have the flexibility of a human explorer, so someday we will want to travel to Mars ourselves to study the planet and its history directly.

Because of the difficulty and the number of challenges, robotic spacecraft must pave the way for humans to follow.

One important task is to study new techniques for entering the Martian atmosphere and landing on the surface.

Cooperative Engineering...

Watch the following video clip and list the challenges NASA had to address to successfully land the Mars Rover.

Seven Minutes of Terror

Your Challenge

You are a space engineer and your team must build a Mars Lander. Your lander must land on Mars without injuring your astronaut (a golf ball) or damaging the lander itself.

Using Newton's Third Law, design a solution to this problem so the effects of the collision between the lander and the surface of Mars are minimized and the astronaut is unharmed.

As you test, you'll find ways to make it work better. Improving a design based on testing is called the engineering design process.

Instructions...

Supplies

(Per Team)

8 straws

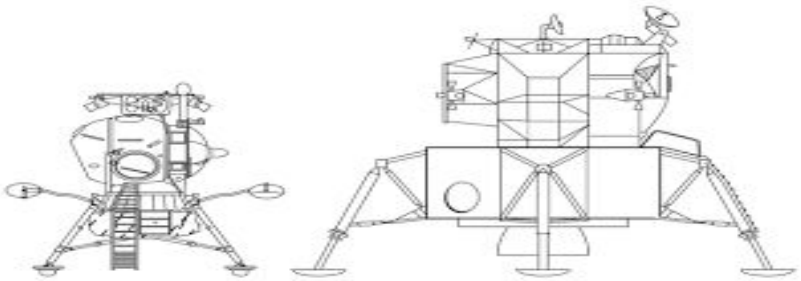
3 index cards (4x6)

1 3oz cup

3 rubber bands

1 golf ball

Your “astronaut” *(golf ball)* is placed in its "cabin" *(3oz cup)*. Use the other provided supplies to cushion their landing and cause the astronaut to remain in the cabin when dropped.



Bottom line: Engineering constraints often force you to make trade-offs. These constraints may keep you from being able to achieve all of your science goals.

Constraints:

- ★ No other items maybe inside the cabin with the astronaut.
- ★ The cabin may not have any type of lid, covering, or roof that intersects the vertical plane of the cup rim.
- ★ The astronaut may not be stuck to the cabin.

During the design process, *you may drop and test your lander making any changes for improvement. No design changes will be allowed once official testing begins. Strive for a design in which the astronaut stays in the cup from the highest distance possible.*

When it is time to test designs,
each team will drop their lander from a height of 4 feet and increase the height by units determined by your teacher. The drop height will be increased to determine the best design.

Things you need to consider as you start planning

- Where are the collisions between two objects in this system? (Think about the astronaut as well as the lander.)
- What are the action/reaction forces going to do during this collision?
- Will these action/reaction forces allow your “astronaut” to land safely inside an undamaged “lander”?
    - If you answered no, how can you design a solution to minimize the effects of the collision?
    - How did NASA reduce the impact of the collision between the lander and Mars?