Exomars Challenge Pack

Introduction

As our closest planetary neighbour, Mars is the focus of many scientific research fields and space missions. Analysis of Martian features can tell us about the formation of our Solar System, long term effects of exposure to radiation and even how life might have come to form on Earth! The ESA ExoMars rover comprises of two missions: the first – the Trace Gas Orbiter – launched in 2016 while the second, carrying the Rosalind Franklin rover, will target launch in 2028. Together they will address the question of whether life has ever existed on Mars. RAL Space has been involved with field trials for the ExoMars rover and development of some of the scientific instruments.

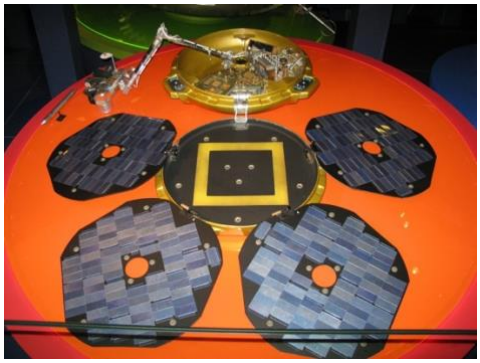

Figure 1: Beagle 2 reached Mars in 2003 but suffered an immediate communications failure.

Figure 2: Schiaparelli EDM reached Mars in 2016

Other missions to Mars have looked at testing technology for soft landings on the Martian Surface (Schiaparelli EDM), but have had varying levels of success. Beagle 2 landed in 2003 but suffered a communication blackout immediately after landing. It was only discovered 12 years later that two of the four solar panels failed to deploy which blocked the antenna which was vital to establish communication.

Activity Brief

Build a structure to protect "ExoMars" on landing. We want you to land our ExoMars (Egg) payload safely. A diagram of how NASA's Curiosity managed it is in Figure 3, but we're sure you'll have some great ideas!

You'll have five minutes to discuss in your teams how best to protect ExoMars, using the resources you've been provided (a list of suggestions can be found below). Then there's 20 minutes for building your prototype, at the end of which each team will give a 60 second pitch – why yours is going to work. This is a really vital part of all space missions. Finally, you'll test your designs by deploying them from a height of 2 metres! (If you want an additional challenge you can increase the height)

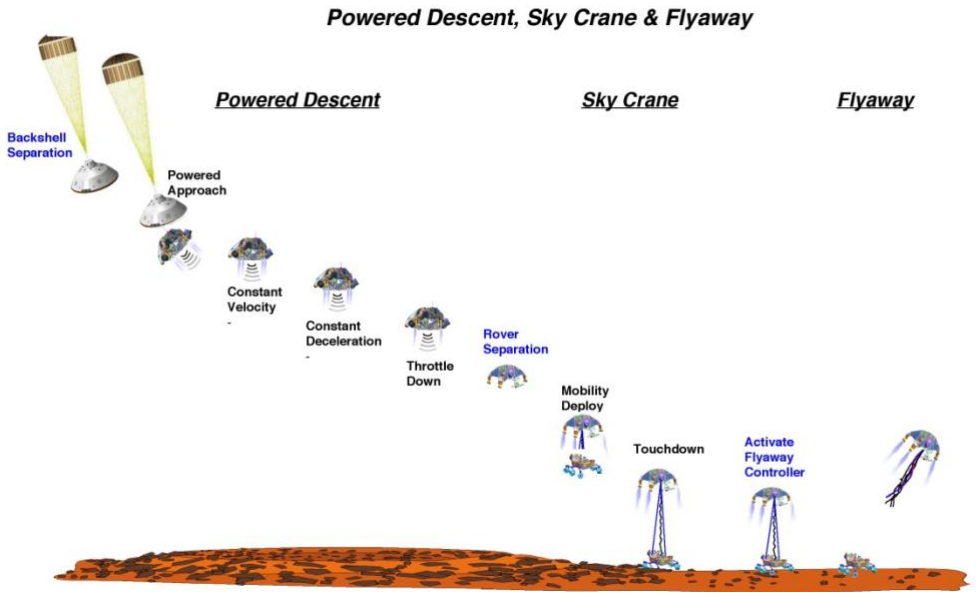

Figure 3: NASA Curiosity landing mechanism, using parachutes and a flyaway controller to drop the rover off on the surface.

Resources

- Scales
- Finance tracking sheet
- Teacakes: one per team plus one box per winning team
- Scissors (two pairs per team)
- Sellotape (one roll per team)
- Budget sheet (one per team)
- Tupperware container (one per team)
- Plastic food bags
- String
- Packing peanuts/Cotton wool/Bubble wrap
- Card
- Paper
- Balloons

Scoring

- 1 point for every pound you save from your budget
- Lose 1 point for every 0.1g
- Up to 50 points awarded for your pitch
- Up to 50 points awarded for your prototype's performance

Team	Budget	Weight penalty	Pitch	Performance	Overall Design	Cracked?
	1 point for every £ saved from budget	Minus 1 point for every 0.5g	Up to 50 points awarded	How well did it float/fly? Max 50 points	Did it look nice? Max 50 points	Did the payload break?
Team 1						
Team 2						
Team 3						
Team 4						
Team 5						
Team 6						
Team 7						