

Hot Sun

6 Week STEM Clubs



Aim

To introduce the challenges facing spacecraft engineers regarding the need to keep instruments cool whilst orbiting the sun by designing and making a space probe that will protect its content from the sun

Introduction

Out of the billions of stars that exist in our galaxy the sun is closest, and in order to unravel its mysteries, engineers have designed the Solar Orbiter space probe. Its mission: to take unprecedented close-up observations of the sun from closer than any spacecraft has ever been before.

Solar Orbiter will need to keep all its electronic scientific instruments working whilst being subjected to extreme temperatures of up to 500 degrees Celsius – this will be over 13 times hotter than any of our satellites in Earth's orbit.

Equipment

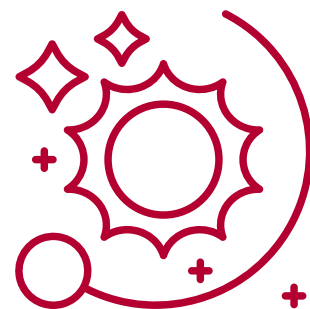
- Chocolate
- Stiff card
- Tin foil
- Cotton wool
- Hair dryer
- Polystyrene beads

Instructions to make and test your space probe

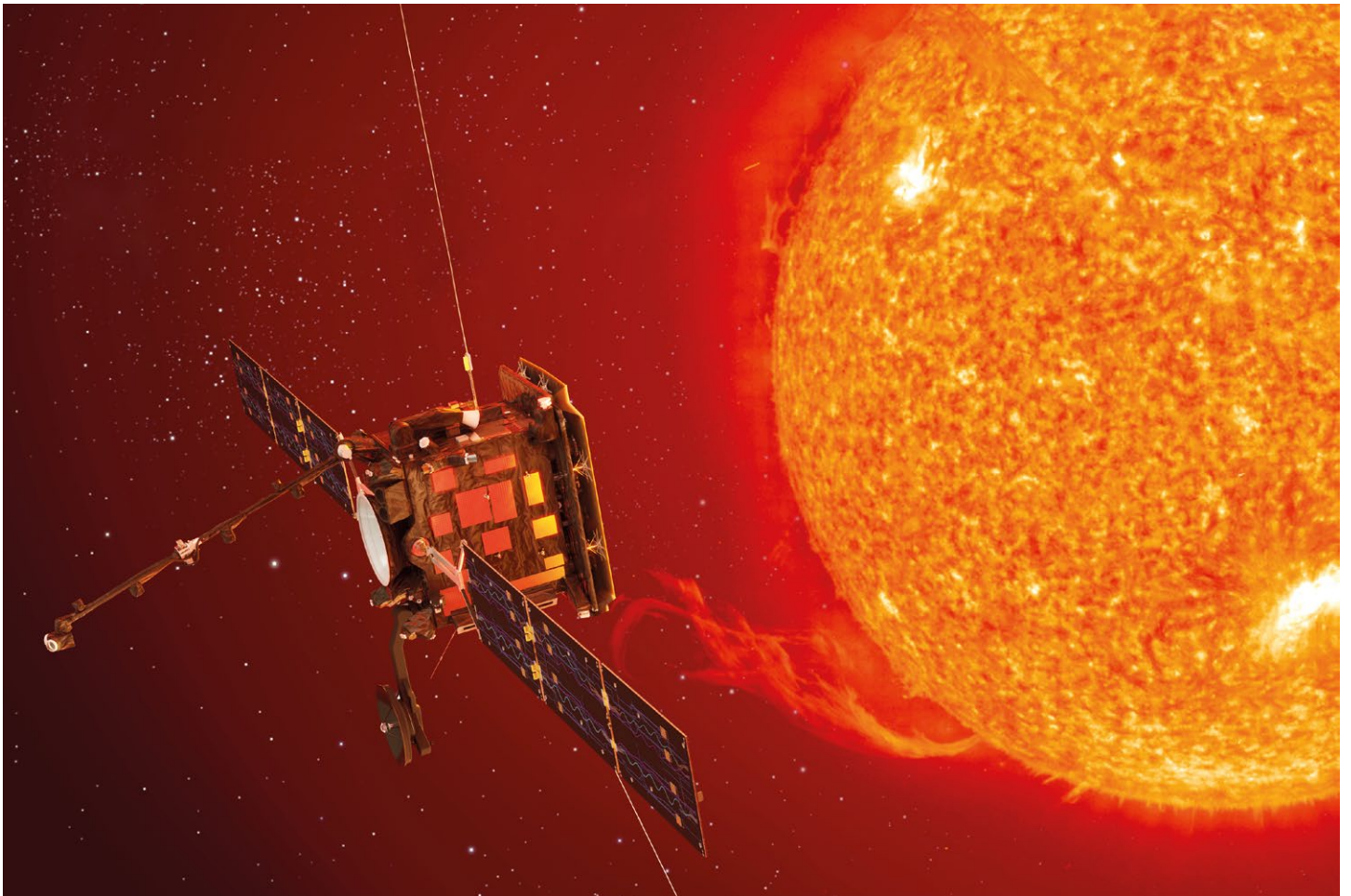
- 1** In your teams make a small box from stiff card to be your model space probe
- 2** Put a small piece of chocolate in the box. The chocolate represents the electronic scientific instruments on the space probe which need protecting from the heat of the sun (or in this case the hairdryer)
- 3** Sketch several designs in which you use the cotton wool, tin foil and polystyrene beads as heat protection. Think about whether your chosen materials should be good conductors or good insulators and whether to use several types. Remember that some materials are better at reflecting heat away
- 4** Build your designs and test each one by blasting it with the heat from the hairdryer
 - a) From a set distance
 - b) For a set length of time

Which design best protected the chocolate from melting?
- 5** Using what you have learnt from your tests, improve your design and retest by
 - a) Decreasing the distance between the hairdryer and your probe
 - b) Increasing the heat of the hairdryer
 - c) Increasing the length of time, you blast the probe with the heat

Activity



In association with



Useful links

- ◉ Solar Orbiter Mission <https://tinyurl.com/52ekjgjl>
- ◉ Thermal Straps <https://tinyurl.com/1ewv8ohk>
- ◉ Multi-Layer Insulation <https://tinyurl.com/1hra794f>



Next steps

- ◉ Make a presentation explaining your designs, highlighting what worked well and what didn't
- ◉ Conduction, radiation, and convection are the 3 ways that heat energy gets transferred. Do your own independent research into how they differ
- ◉ Research multi-layer insulation and thermal straps