## ROBOT HAND ACTIVITY

## Briefing

In this activity you will be an engineer with the job of creating a simple model of the human hand that could become a robotic hand for use on the International Space Station.

## Background

The international Space Station (ISS) is a permanently manned laboratory in space, orbiting (going around the Earth) at a speed of $28000 \mathrm{~km} / \mathrm{hr}$.

Tim Peake, the UK's first European Space Agency Astronaut spent 6 years training for his mission to the ISS. Part of his training involved learning how to use the CANADARM 2, a robotic arm that he can control from inside the ISS. This allows Tim to make repairs or fit equipment remotely - without having to go outside the ISS himself and allowing him to move objects much heavier and bulkier than he could himself.

The CANADARM has many joints - much like the human arm and a specialised unit at the end that allows it to fix on to objects. You can even use it to move astronauts around outside the ISS!


## Robot Hand



Often, when designing a robot, scientists and engineers will try to copy what has been proven to work well at moving and working with objects - the human hand!

Most hands have four fingers and a thumb. The fingers have three bones and the thumb has 2 bones (the finger bones are called phalanges). These are connected to bones in the palm which connect to bones in the wrist and so on.

To open and close the hand you need stretchy material that is connected to the bones and can pull on them in different directions. These are called MUSCLES and TENDONS. FLEXOR muscles and tendons cause the fingers to bend, while EXTENSORS cause them to straighten out.

## You are going to build a simple model robot hand with FLEXORS which will allow the fingers to close and let you pick up objects with the hand.

Think about how you could improve the design:
Would other materials be better?
Could you alter the design to move each finger independently?

国 ROBOT HAND ACTIVITY

## You will need:

- Corrugated cardboard at least as big as your hand
- Craft knife/scissors
- A straw
- String
- Sellotape


## Instructions:

| 1) Place your hand on the cardboard and draw around your four fingers. | 2) Add your thumb so that it is pointing in the opposite directions to your fingers. Add a bit of arm to the hand. | 3) Mark onto the hand the position of the folds in your fingers. | 4) With a craft knife or scissors, carefully cut out around the hand. |
| :---: | :---: | :---: | :---: |
| 5) Using the scissors or a craft knife, score along these lines and carefully bent the fingers in towards the palm. BE CAREFUL NOT TO GO ALL THE WAY THROUGH THE CARDBOARD! | 6) Cut pieces of straw slightly shorter than the finger segments and carefully tape them between the folds so that they are pointing up along the fingers. | 7) Feed a piece of string along all the straws on one finger and tape it to the top of the finger. Repeat this with the other fingers and the thumb. | 8) Use a craft knife or scissors to carefully poke a hole through the middle of the hand. |
| 9) Feed the strings through the hole and tie a knot in the strings on the back of the hand. | 10) Test your hand! Go to pick up an object. To lose the fingers and thumb around it, pull on the knot of string. |  |  |

