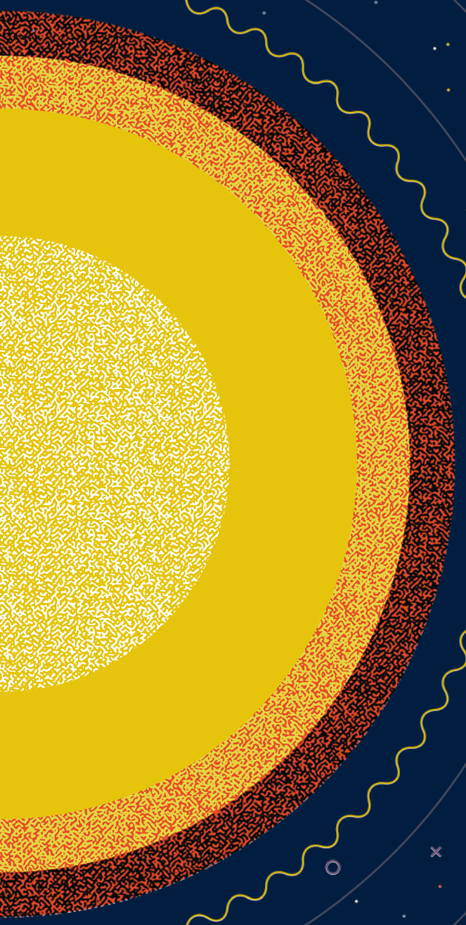
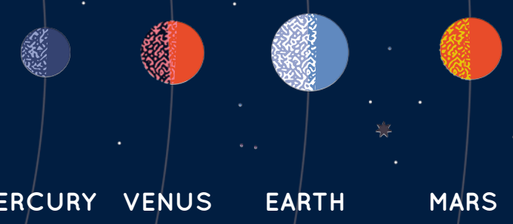
WHAT IS SPACE?

Space is massive! Space is bigger than anyone can imagine! Space goes on further than the eye can see! But what actually is it?



Space starts **100 kilometres above Earth** – that's **ten times** the height that **most aeroplanes fly at.** It is very dark and quiet up there, with no air to breathe. But that doesn't mean it is empty. There are **loads of cool things in space,** like planets and stars, comets and asteroids, gas and dust.

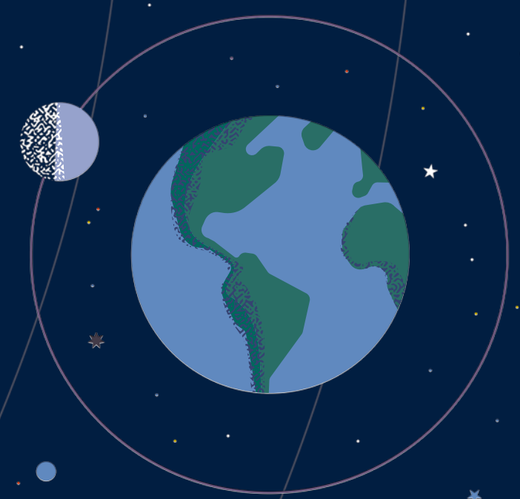


Stars are enormous balls of burning-hot gas. **The Sun is a star.** Because it is so hot it gives off energy, which almost all living things on Earth need to live. Plants use energy from the Sun to grow, and animals (including humans) need these plants to eat, and the warmth and light from the Sun to survive.

DID YOU KNOW?
There are more stars in space than there are grains of sand on the whole Earth!

Planets are huge rounded objects made of **rock, gas,** or **ice**, or **a mixture of all three.** Earth, where we live, is a planet, and it **'orbits'**, or goes around, the Sun. Things that orbit the Sun are part of our **'solar system'.**

The other planets in our solar system are **Mercury, Venus, Mars, Jupiter, Saturn, Uranus** and **Neptune**. Each one is very different, and the only planet where we have found any life at all is Earth.



Moons are **smaller objects** that go around some planets. Earth has one moon, Mars has two, Saturn has more than 50, and Jupiter has more than 60!

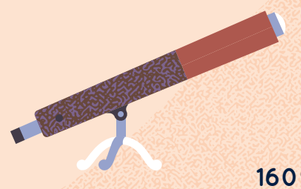
THE HISTORY OF

SPACE EXPLORATION

For thousands of years, humans have been fascinated by the question of what is 'up there'. This is because no matter where you are in the world, you can see the Sun, Moon and some planets and stars, just with your eyes.

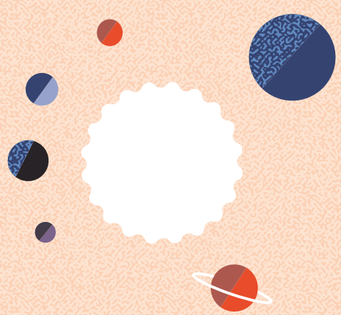
Aglaonike was the first known female astronomer in ancient Greece. She could predict lunar eclipses and was sometimes called a witch!

The first telescope was made by the German-Dutch astronomer Hans Lippershey.



100 BC | 476 AD | 499 AD | 1608 | 1630 | 1949 | 1957 | 1959 | 1961 | 1963 | 1969

The ancient Romans named seven bright objects in the sky: Mercury, Venus, Mars, Jupiter, Saturn, as well as the Sun and Moon, which they called Apollo and Diana!



The Indian mathematician and astronomer Aryabhata came up with the idea of the force of gravity to explain why objects do not fall off the Earth.

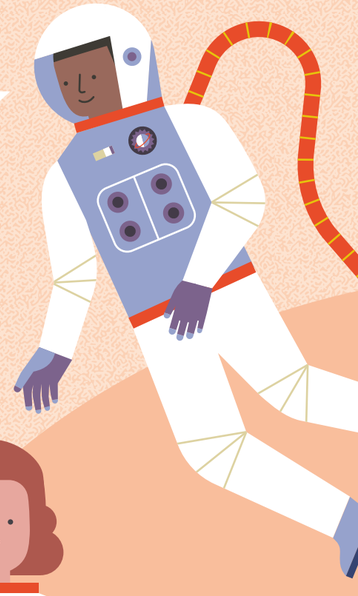
Other astronomers, such as Galileo, started using more and more powerful telescopes to discover planets, moons and stars.

The Russian *Sputnik 1* satellite became the first ever human-made object to orbit the Earth! This started the Space Race – a battle between the Russians and the Americans to land on the moon first.

A dog named Laika was sent by the Russians into space inside the *Sputnik 2* satellite.

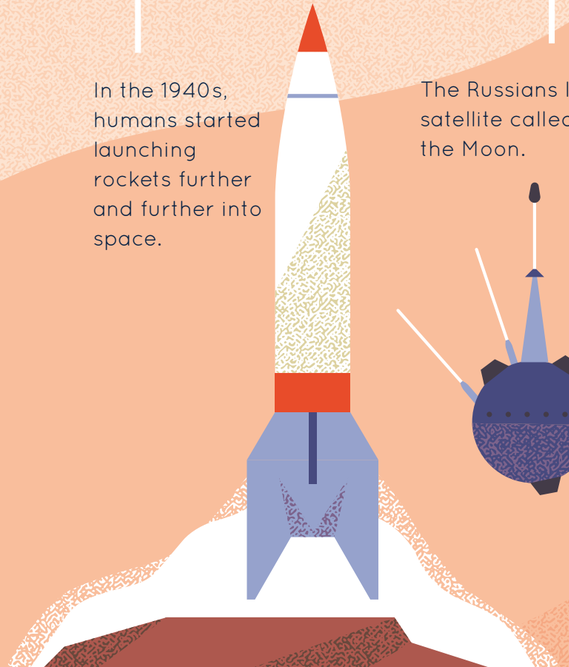
DID YOU KNOW?
Russian astronauts are sometimes called 'cosmonauts'.

A Russian astronaut called Yuri Gagarin orbited Earth once. He had to use a parachute to land. A few weeks later, the Americans sent Alan Shepard into space.

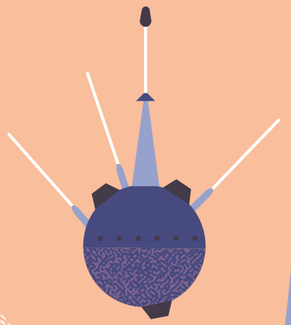


A Russian astronaut called Valentina Tereshkova became the first woman in space.

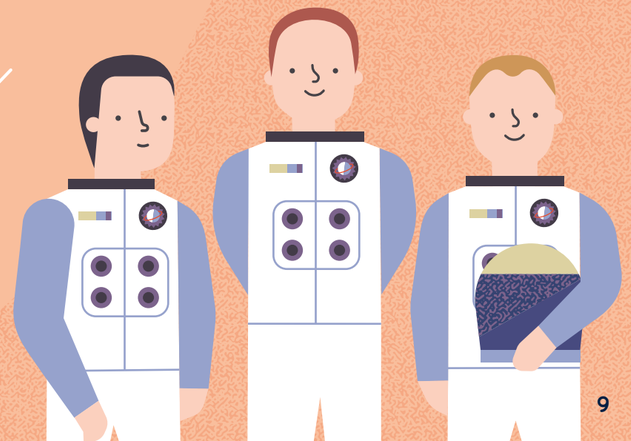
In the 1940s, humans started launching rockets further and further into space.



The Russians landed a satellite called *Luna 2* on the Moon.



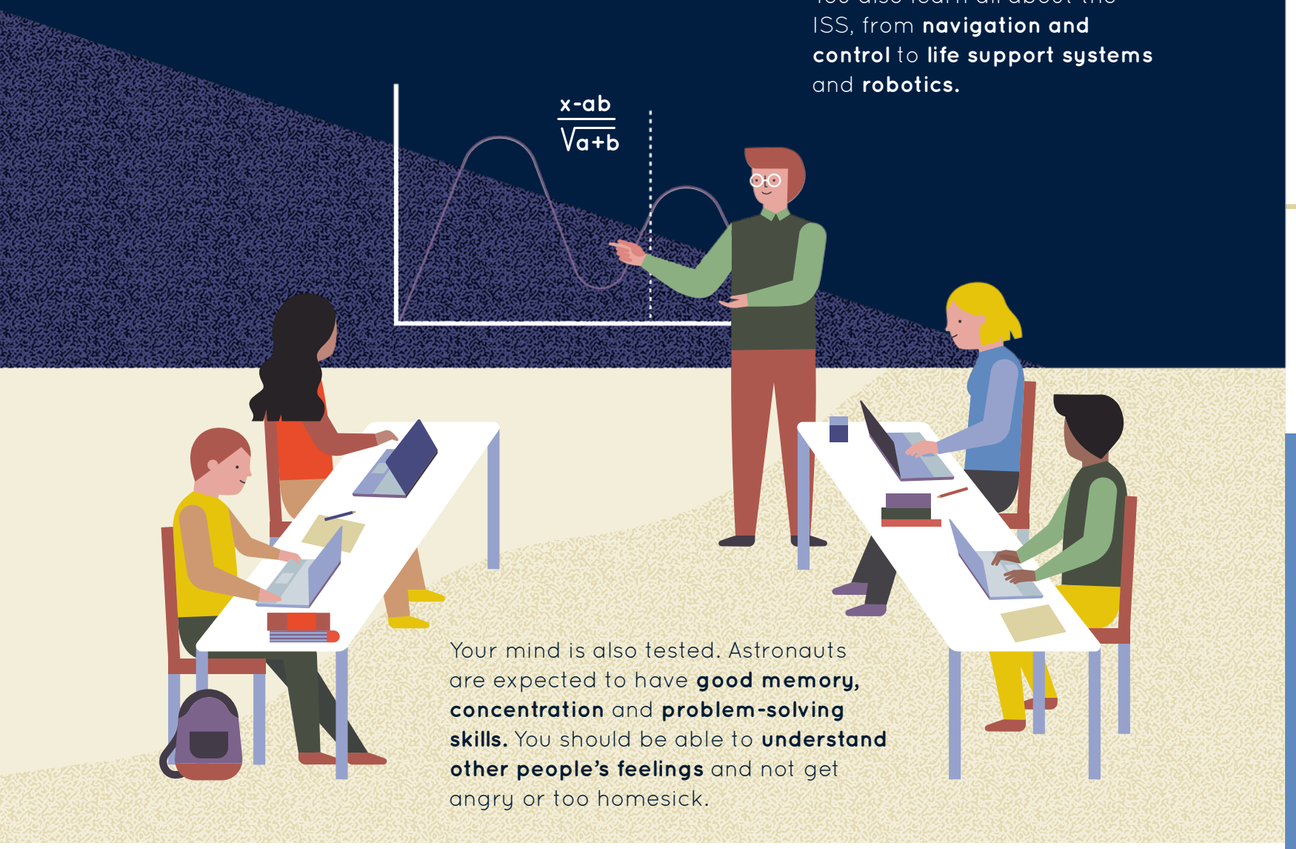
America won the Space Race when they sent Neil Armstrong, Buzz Aldrin and Michael Collins to the moon on the *Apollo 11* spacecraft.



WHAT KIND OF TRAINING DO ASTRONAUTS HAVE TO DO?

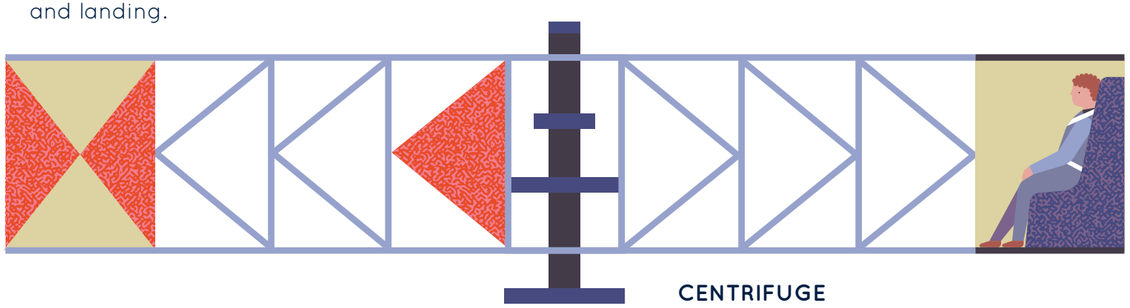
Basic training is a bit like going to school. You **learn everything** from the history of spaceflight and electrical engineering, to Russian language and first aid.

You also learn all about the ISS, from **navigation and control** to **life support systems** and **robotics.**



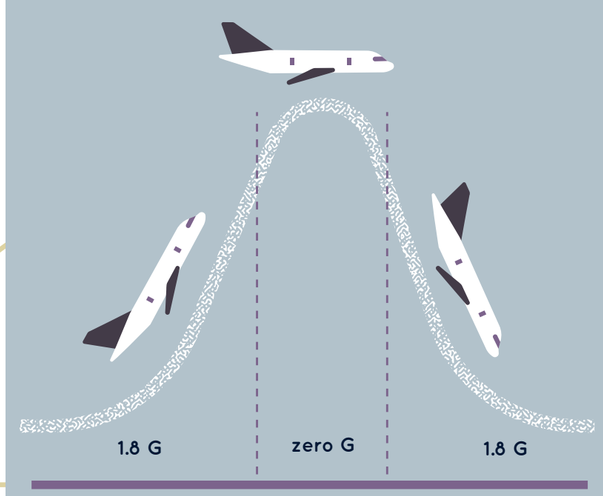
Your mind is also tested. Astronauts are expected to have **good memory, concentration** and **problem-solving skills.** You should be able to **understand other people's feelings** and not get angry or too homesick.

Astronauts have to be **fit and healthy.** To test their bodies, they do **unusual exercises** like sitting in a **centrifuge.** You sit inside a small pod and a metal arm spins you around, which can make you feel very sick. This tests how a person might feel in a rocket during take-off and landing.



CENTRIFUGE

Astronauts also have to get used to **'microgravity'.** Gravity is the force that attracts you to the Earth and stops you floating away. In space, there is **very little gravity**, which feels strange.



Astronauts practise by going on a special plane (known as the **'vomit comet'**), which flies up and down **like a rollercoaster** and makes you feel like you're floating.

Finally, astronauts are given a mission to train for. They go through every experiment they will do up in space and get to know the other two astronauts in their team. They also **learn what to do in an emergency** (including how to fix the space toilet!).

DID YOU KNOW?
Swimming deep underwater feels a bit like space, so astronauts learn how to scuba dive in a giant swimming pool with parts of the ISS.

After many years of training, it's time to go up into space . . .

WHAT OTHER KINDS OF SPACE JOBS ARE THERE?

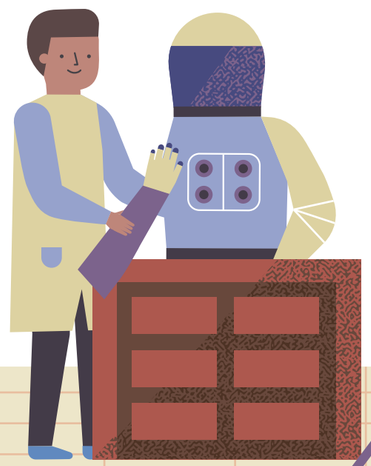
For every astronaut that goes to the International Space Station, there are hundreds of people working hard to get them there. But what do these people actually do?

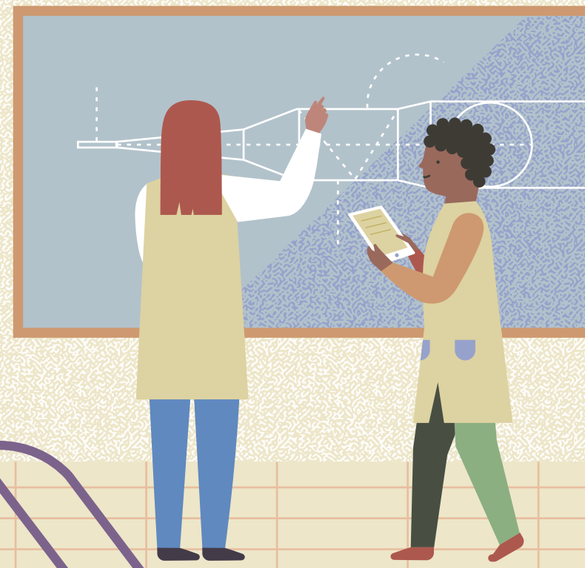
DID YOU KNOW?
Spacewalks can last for hours, so spacesuits have to be able to absorb a lot of sweat!

Spacesuit designers look at each astronaut and mission, then they design spacesuits to **fit that astronaut exactly.** Spacesuits need to keep astronauts comfortable, at the right temperature and with air to breathe.

Satellite designers and **engineers** build satellites, which are used to study other planets, as well as to help us do everyday things on Earth like **using the internet and maps** on our mobile phones.

Spacecraft designers and **engineers** are in charge of planning and building the spacecraft, from shuttles to space stations. They need to make sure that everything will work in the **extreme environment of space** and will survive **take-off and landing.**





Computer engineers create robots that can drive around planets, drill holes, take photos and decode information.

Computer engineers also write the programmes needed to **make the technology work.**

Technicians work closely with the engineers and designers by testing and carrying out checks on the spacecraft and technology created, so everything is perfect by the time it is ready to launch into space.

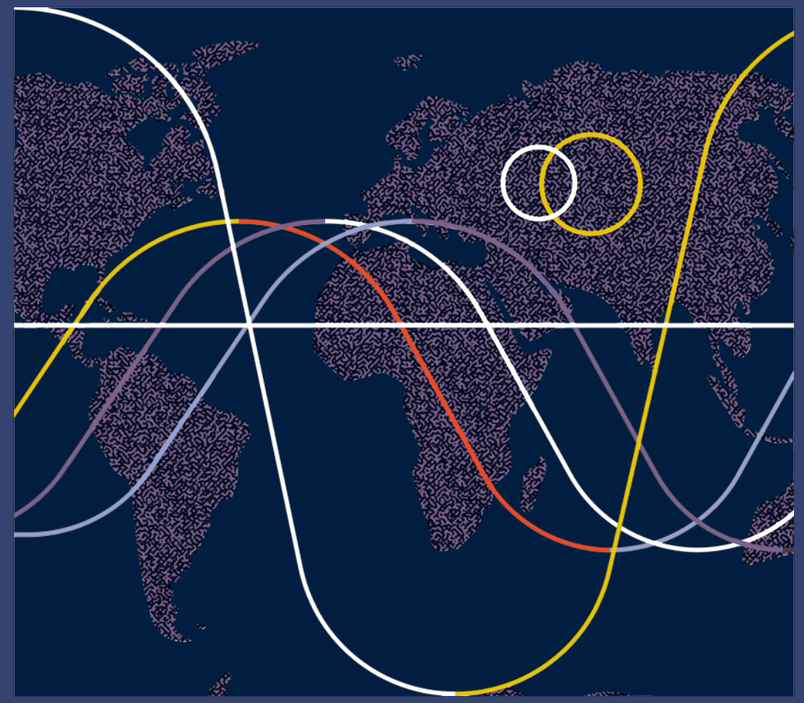
ARE YOU GOOD AT PROBLEM-SOLVING? THEN A JOB IN

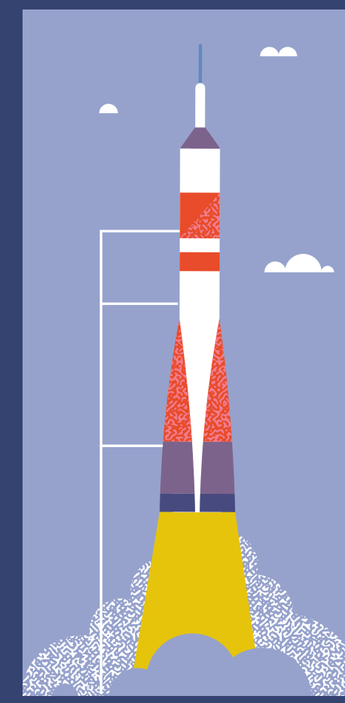
MISSION CONTROL

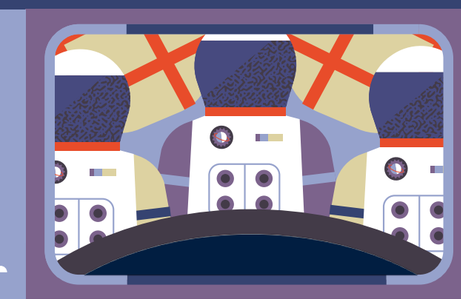
MIGHT BE FOR YOU.

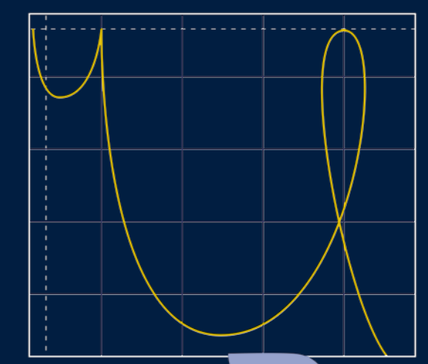
Many experts, from **communicators** to **mathematicians,** work in Mission Control. These people check that the astronauts are safe and well, track where the spacecraft is travelling to and make sure that the rockets launch successfully.

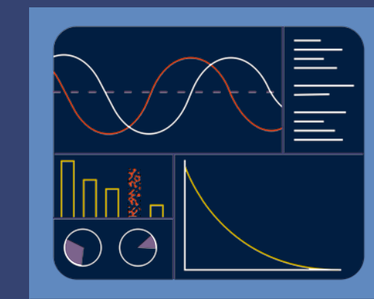
Flight directors are in charge of the whole team. They sometimes have to make quick, important decisions to keep the astronauts safe.











Spacecraft communicators, also known as **CAPCOM,** are the people who talk directly to the astronauts. Sometimes there is more than one CAPCOM because they have to work for long hours, and often the CAPCOM are astronauts themselves who are currently based on Earth.

The **flight activities officer** is in charge of planning the astronauts' schedules, experiments and daily lives.

Space doctors check on the astronaut crew during missions and make sure they are fit and well.