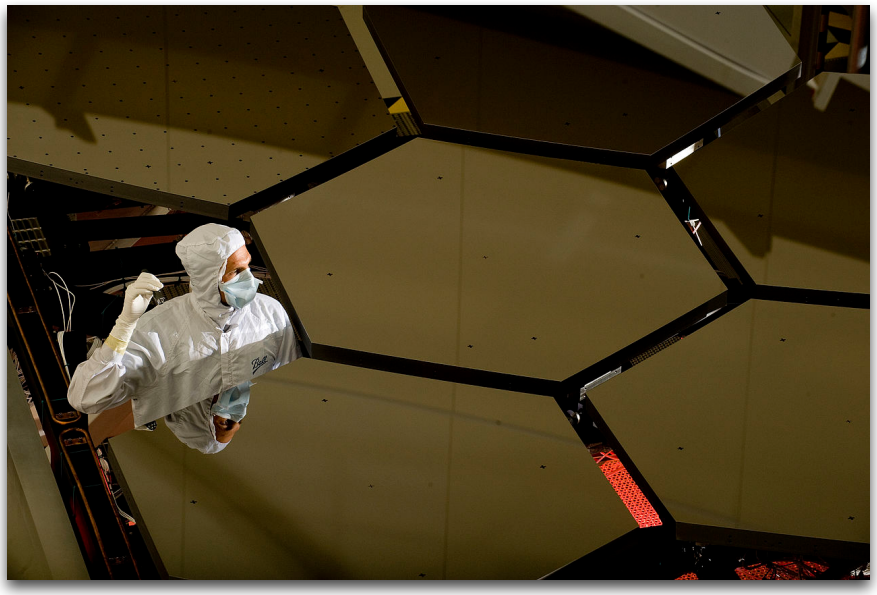
James Webb Space Telescope

DESTINATION SPACE!

The James Webb Space Telescope is the biggest and most ambitious space observatory ever built. Due to launch in Spring 2021, it will travel to its new home 1.5 million kilometres from Earth where it will use incredible technology to explore space as never before.



Some of the panels in the James Webb Space Telescope array, human for scale!
Image credit: Nasa

Webb will fundamentally alter our understanding of the universe by asking some of the biggest questions in astronomy, such as:

How did the first stars and galaxies form?
How are planets actually made?
Are there Earth-like planets out there?

Collaborative Science

Webb was funded jointly by NASA, the European Space Agency and the Canadian Space Agency. It is made up of incredibly intricate technology that has been worked on by thousands of scientists from all across the world.
Some of those scientists have been working on it right here in Edinburgh! A team at the Royal Observatory Edinburgh led the European consortium responsible for designing and building one of Webb's four scientific instruments. Royal Observatory astronomers will also be among the first to use Webb to explore the Universe.

NASA

esa European Space Agency

CSA ASC

A segment of mirror for the James Webb Space Telescope, coated in gold!
Inage credit: Drew Noel at NASA

Mirror Mirror

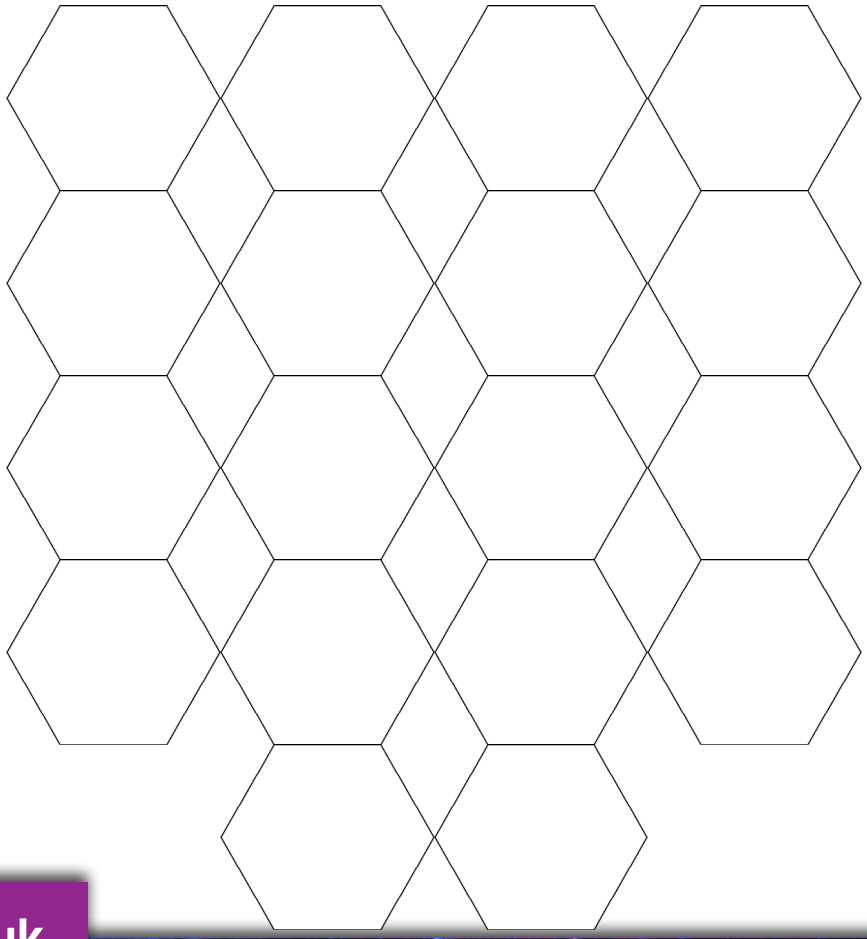
Telescopes need mirrors to gather light. Webb will be used to study things very far away so needs huge mirrors to pick up faint light coming from across the Universe. Webb is made up of 18 giant hexagonal mirrors, each 1.32m across. The more light a telescope can collect, the more it can see – so the bigger the mirrors are, the more powerful the telescope is. Together they are called the primary mirror. They are covered in gold which best reflects light up to another mirror called the secondary mirror – its job is to reflect all the light back down through the middle of the primary mirror to the telescope's instruments for analysis.

Why 18 separate mirrors? Webb is so big that at full size it can't fit in any rocket launchers. So the primary mirror has to be made of these 18 separate hexagons so that it can fold up for launch and then unfold again once the telescope is in space.

Mirror Puzzle

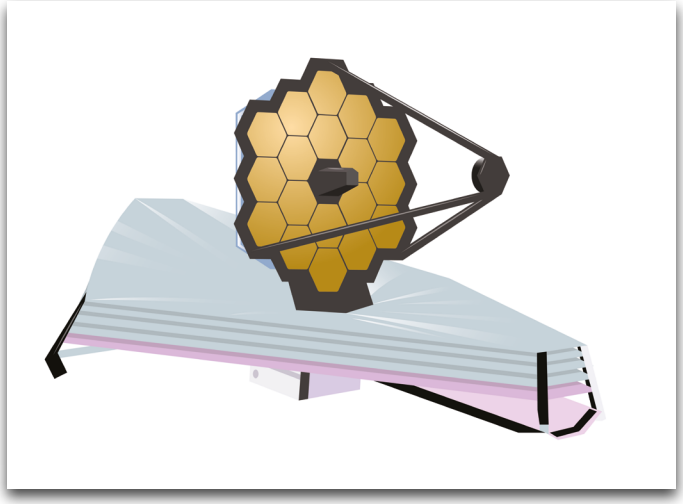
So how do you think all these mirrors are arranged? Cut out the 18 hexagons. Try to arrange them in the way you think would best help the telescope to fold up for launch but also remember that they have to be able to unfold into the best shape for gathering light once the telescope reaches space.

You could even colour them in gold like the real mirrors.



Find your mirror puzzle sheet at the end of the booklet

The 18 Webb mirrors are arranged like the pictures below.



The hexagonal shape of each mirror means that they can fit together without gaps. This is very important for gathering up all the light coming the telescope's way!
The hexagons are fitted together in a roughly circular shape. This focuses the light in the most compact way. If the mirrors were arranged with one edge longer than the other, like a rectangle or oval, then the image they collected would be stretched.

They are arranged round a gap in the middle so that there is space for the secondary mirror to reflect all the light the 18 mirrors have gathered down to the instruments below.
This arrangement also allows Webb to fold for launch – the three mirrors at each side are called the wings and will fold up for launch and then fold out again once Webb reaches space.

Learn more about Webb's launch here

For more info about Webb, click here for NASA and here for ESA!

Mirror Puzzle