Ideas for activities using the Webb mirror jigsaw pieces

Activities to help people learn about the size, design and function of the Webb telescope.
The jigsaw is sized so that, when assembled, it is the same size as one panel of the real Webb telescope mirror. The below activity suggestions assume you have already explained a bit about the telescope already, including its general structure and that the mirror is a light collecting surface.

Learning objectives:

1. The mirror is huge!
2. The multi-panel design allows the mirror to fold up to fit inside the rocket.
3. The mirror is gold because gold reflects infrared light (if you have already talked about infrared)

Common misconception 1: The pointy bit (secondary mirror) is beaming something out into space to 'see'.

Common misconception 2: The mirror is a detector.

Photo: Julia Gaudelli, Guildford Astronomical Society

Build the jigsaw

At its absolute simplest, you can just leave the pieces of the mirror out (on the floor works best for children), and let people assemble the hexagons into the right shape. They should then mix them up again for the next user. The mirror pieces are robust enough that this works fine so long as you or another sensible adult are in the general area to ensure they are not thrown about.

Be aware that a 10 year old child might be very quick to finish the jigsaw! If you need them to spend longer on this activity, you will need a plan for how to achieve this. Some ideas are given below.

The resources include a printable challenge sheet you could use to help guide them. This should print out fine in black and white. There is a picture of the telescope, but the lines between the segments have been removed to make the puzzle more challenging.

Photo: Alastair Bruce, AstroBoost 1 training day

The guide sheet includes some questions as an activity extension. If doing the activity as a round robin, you may want to discuss the answers to the questions at the end in case anyone was unsure. This could also give them the opportunity to show off their new knowledge, an act that will help them recall it again in future.

If they haven't already been given the information required to answer the questions, just delete them.

With enough adults, it can be assembled in mid-air. This gives more of a challenge, involves more people, takes longer, and you can talk about the overall shape and how individual segments move.

Paper Pentagons / Hexagons

There are printable pentagons that you could cut out and provide to help them to answer the first question. There is a sheet to store the pentagons.

There is a matching sheet of printable hexagons provided too, just in case this is useful for something!

How Big is Webb's Real Mirror?

There is an explanation sheet for this activity, but it will still probably need a leader to ensure people understand what they are meant to do. (People are not good at reading instructions!)

I suggest you let them measure the jigsaw using a string that you have provided (in which case make sure it's much longer than needed, not exactly the right length), or maybe just have them pace it out. They can then multiply this length x4 to measure out how wide the real mirror is. If it's too big to fit in the room, that is not necessarily a bad thing, as it will show just how huge it really is.

I would suggest avoiding using a tape measure or ruler because the maths and numbers could distract from the emotional impact. Having a feel for the size is much more useful than remembering a number without the associated meaning. You want them to be imagining it in the room, like they were stood next to it.

Photo: NASA/ NASA/Desiree Stover

Extra background information

The mirror segments are primarily made from **Beryllium** which is very strong, and a relatively lightweight material considering its strength. It also has excellent thermal stability. For these reasons, it is commonly used in spacecraft manufacture.

The gold layer is very thin. Gold is used as it is highly reflective to infrared. The gold is added to the highly-polished segments by vacuum vapour deposition, which achieves a layer just 100 nanometres thick (that's about 600 atoms thick). Altogether, the gold would make a **cube about 1.5 cm wide**, weighing just 48 grams.

Using hexagons is good because they pack nicely into a roughly circular shape, but also because in terms of **symmetry** there are only three types of segment position that need to be calculated for.

Find lots of nice mirror information and interesting videos at:

https://www.jwst.nasa.gov/content/observatory/ote/mirrors/index.html

Demo ideas

For more camera-related but mostly non-astronomy educational demos, see
https://www.techknow.org.uk/wiki/index.php?title=Infra_Red_Camera

AstroBoost

These resources are adapted from the Royal Astronomical Society's original AstroBoost project, which was funded by a STFC Spark Award. The project was managed and developed by Dr Jenny Shipway.