Teaching Notes

Building on Mars
Instruction Sheet and Guidance

These notes accompany the section titled 'Building on Mars' to support teachers in carrying out the three activities. They provide background information, tips for advance preparation, opportunities for cross curricular links and a suggested reading list and useful website links for enrichment.

Background information

Conditions on the surface of Mars are more similar than on any other planet to the conditions on Earth in terms of sunlight and temperature. However, due to a very thin atmosphere with only 0.1% oxygen, reduced air pressure and very high levels of radiation, the surface is not conducive to human or, as far as we know, any other forms of known life.

We don't yet have the technology to send a manned mission to Mars, but space agencies will use robotic missions to find out more about the planet. The European Space Agency's (ESA) Rosalind Franklin rover is going to find out more about Mars, collecting data, images and samples; these will better inform the scientists and engineers at ESA, helping them to plan for possible future missions to Mars. If humans are to live on Mars one day, to survive its harsh conditions they will need shelter to protect themselves from radiation and the lack of atmospheric pressure; they will also need a supply of water, oxygen, food and energy.

NASA and ESA have plans for using the Moon as a stepping-off point for Mars missions. Refuelling might take place here and materials could be stored. ESA has plans to build a village on the Moon, whilst NASA has plans to 3D print houses on Mars! Some suggest that the Martian soil, called regolith, or perhaps recycled waste materials, could be used. NASA has suggested using an inflatable inner structure encased in ice providing protection from radiation.

Dome shaped structures are stronger and use less material to construct; they are more energy efficient than rectangular structures because they have up to 40% less surface area and thus less heat is lost.

Habitation Systems Project's Deep Space Habitat (DSH) is a one storey, 4-port habitat unit for deep space missions

Activity for 4 to 5 year olds

Children in Early years foundation stage (EYFS) listen to the story of 'Q Pootle' and are introduced to the types of houses encountered in the story. They learn about robotic rover Rosalind and they go on to construct Martian shelters for the robot, describing the 2D and 3D shapes they have used.

Advanced preparation

Prepare a selection of 2D coloured shapes to be used for decorating the model homes. Collect a variety of containers of various shapes and sizes. Follow this link to upload images of Mars to help the children imagine what life on Mars might be like:

exploration.esa.int/mars/44969-images-videos-archive

www.nasa.gov/mission_pages/mars/images/index.html

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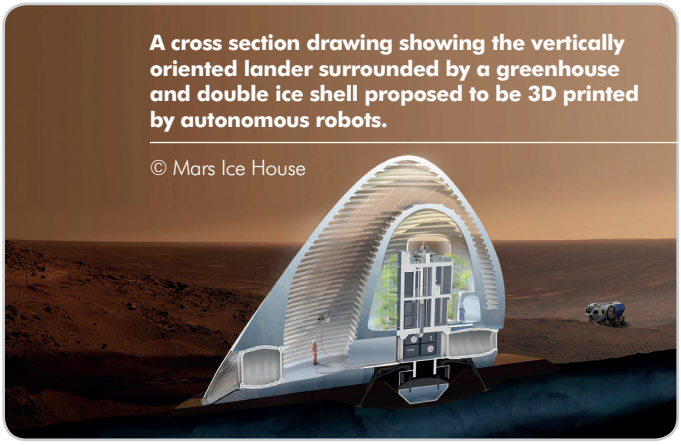

A cross section drawing showing the vertically oriented lander surrounded by a greenhouse and double ice shell proposed to be 3D printed by autonomous robots.

© Mars Ice House

Cross curricular links

Communication and language:
- Role play building homes and living on Mars
- Creating a class story
- Sequencing events in 'Q Pootle'

Maths:
- Identifying 2D and 3D shapes
- Making patterns using shapes
- Measuring and comparing models built eg smaller, taller, bigger, wider, longer

Music:
- Making space music and rhythms to accompany the story

Physical development:
- Living on Mars creative dance

Computing:
- Use paint software to design homes for Mars

Activity for 5 to 7 year olds

In this maths-linked activity, the children use a variety of boxes and recycled materials to design and build homes on Mars in the future. They discuss shape, appropriate materials and size. They generate mathematical questions related to shape based on their designs. Finally they present their ideas to ESA, justifying their choices.

Advanced preparation

Collect examples of 2D and 3D shapes. Include spherical items. Pipe cleaners cut into approximately 5cm lengths provide flexible joints for joining straws together, threaded into the ends of two straws. They can also be twisted around corners of 2D straw shapes to make 3D shapes. Full length and half-length straws will be required for constructing cuboids.

Cross curricular links

English:
- Sequence the story
- Write a story about what happens next
- Imagine landing on Mars and write about your adventures
- Write a class poem about Mars

Maths:
- Go on a walk around school looking for 2D and 3D shapes
- Keep a tally

Computing:
- Make an animation based on the Iron Giant or another robot story

Science:
- If humans were ever to go to Mars, they would need a food source. Investigate germinating seeds and growing plants under different conditions eg cold versus warm, covered or uncovered, in presence of light/darkness, in soil, compost and sand

Plans for growing food on future space missions

© NASA

Further activities

Investigate simple computer drawing programs that the children could use for further design work for buildings on Mars.

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Activity for 7 to 11 year olds

In this maths-linked activity, the children investigate 2D nets to make 3D shapes; they design and build a Martian village using the 3D shapes. They discuss shape, appropriate materials and size. They generate mathematical questions related to shape based on their designs. Finally they present their ideas to ESA, justifying their choices.

Advanced preparation

Enlarge the nets on Activity sheet 1 and print multiple copies on thin card or quality paper. Alternatively, this link to a variety of printable nets is useful:

file:///C:/Users/Compaq%20User/Downloads/Geometric-Nets-Printable-Pack.pdf

Supermarket moulded fruit trays can be cut to produce individual dome shapes in case the children decide to use them.

Download images of the surface of Mars to help the children to imagine conditions on the red planet.

Cross curricular links

English:

- If you could interview scientists working with Rosalind Franklin, the new rover that is going to explore Mars, what would you want to know?

Science:

- Rocks, dusty soil and even ice may be used to build houses on Mars. If you made ice cubes with water and sand, would they freeze? Would they melt at the same rate as cubes made from water alone? Set up an investigation to find out

Computing:

- Use computer software to design and build with 3D shapes

Further activities

The children can do further research about Mars using books and internet. They could prepare reports for the UK Space Agency or ESA, describing their reasons for the house designs and what materials they would use.

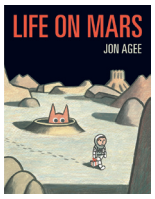
Plenary

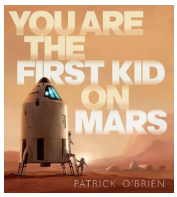
During the plenary, compare the children's designs with some of the many designs available to view on the internet. Searching 'Mars building designs' produces a wide variety of examples.

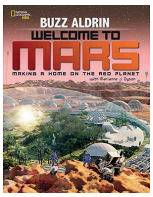
STEM clubs

A 'design and build a Mars settlement project' could be used in after-school clubs or as a homework project.

Books (Amazon)







Useful links

Clips showing building moon village:
www.youtube.com/watch?v=EqsJGzdcPP0
www.youtube.com/watch?v=6_yIsLwl0H4

Free printable nets:
www.pinterest.co.uk/pin/439030663647415773

STEM e-library has a host of resources on shape. Try:
www.stem.org.uk/rx33so
www.stem.org.uk/rx353h

ESA ran a competition to design an item to be 3D printed on Moon: www.esa.int/spaceinvideos/Videos/2018/07/What_s_your_idea_to_3D_print_on_the_Moon_to_make_it_feel_like_home

Posters advertising ESA's competition: www.esa.int/Education/Teach_with_the_Moon/Living_in_Space

Mars habitat:
en.wikipedia.org/wiki/Mars_habitat#Biodomes