

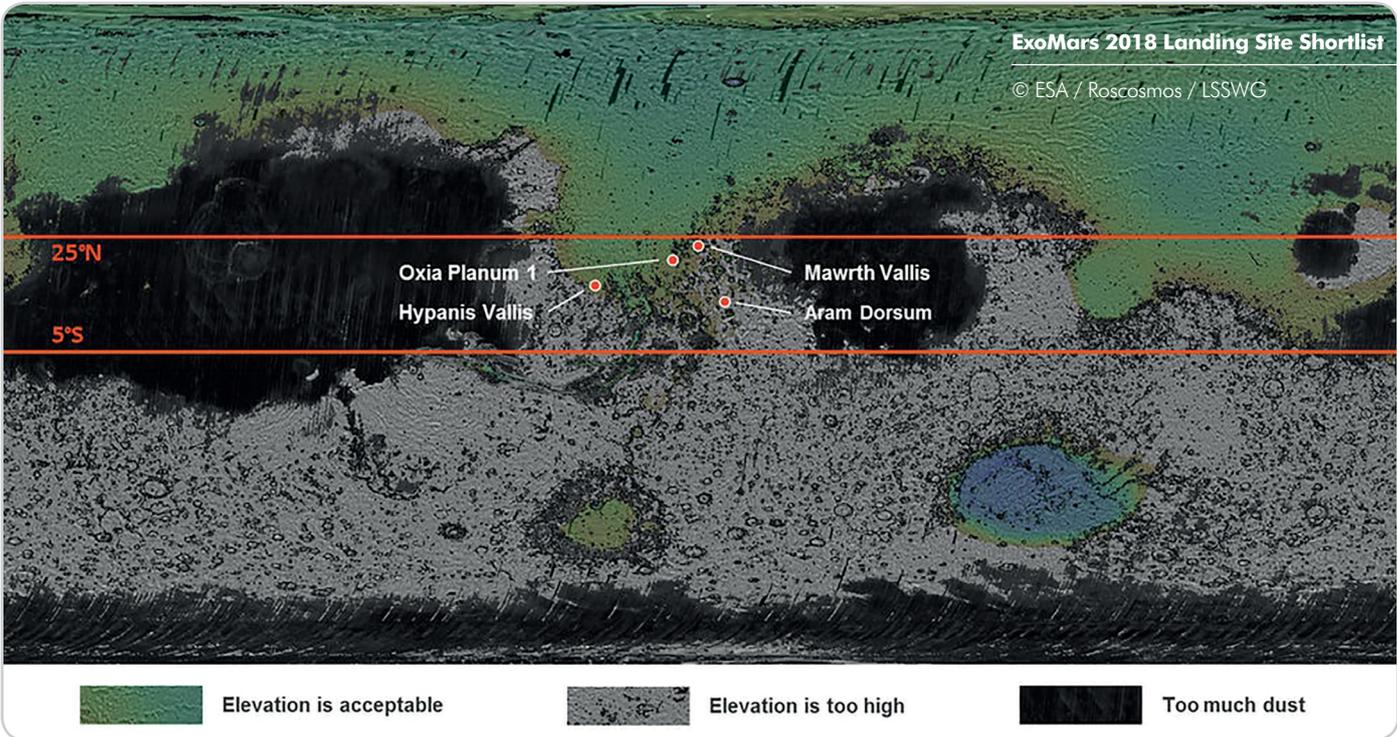
These notes accompany the section titled 'Landing and Exploring' to support teachers in carrying out the three activities. They provide background information, tips for advance preparation, opportunities for cross curricular links and a suggested reading list and useful website links for enrichment.

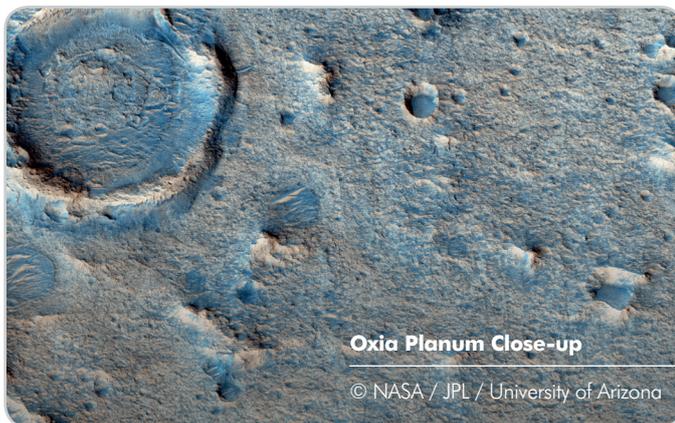
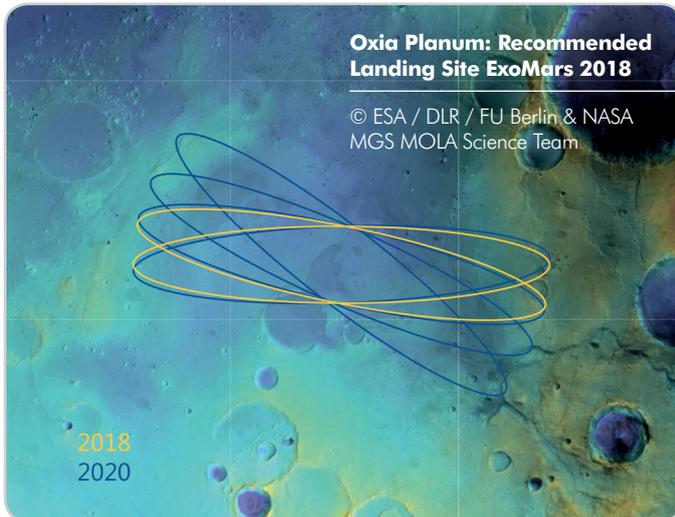
Background information

The ExoMars 2020 mission consists of two elements; a lander that will remain at the landing site and will study the Martian environment and a rover that will explore the geology and take samples by drilling underground. The rover will be looking for evidence of present or past life that could lie buried, protected from the Sun's radiation that bombards the surface of planet Mars. Scientists are looking for 'bio signatures' such as molecules preserved from once living microorganisms. Scientists are interested in areas that are very old, at least 3.6 billion years, and show signs of having been in the presence of water, so could once have been a habitat for life. Commands to the Rover will be transmitted through a spacecraft called the Trace Gas Orbiter, launched in 2016, now in orbit around Mars. The most important consideration however, is that

the landing site must be free from hazards for a safe landing to take place.

Scientists and engineers used a vast amount of information and an enormous collection of images of the Red Planet to help them in the selection of a suitable landing site. A panel of experts studied potential areas and narrowed the choice to four, just north of the equator, shown in the image above. Each of the four sites has potential for having once had conditions to support life, such as lakes or rivers. Due to the atmosphere on Mars being so thin, 150 times thinner than Earth's, it is much more difficult to slow a spacecraft using air friction. Each site must be within the right elevation; too high and the atmosphere will be too thin to slow the capsule carrying the lander and rover. Four parachutes will be deployed in sequence to slow the lander, the final parachute having a canopy of an enormous thirty five metres! In addition, the atmospheric conditions can vary from one season to another. This makes predicting the exact landing spot very difficult, usually within an area shaped like an ellipse. Eventually, Oxia Planum was chosen (shown in close up in the image below): an area of smooth lowland, a few craters but no mountainous areas, with a thicker atmosphere and near to the equator, where ExoMars's solar panels can be charged by sunlight throughout the year.





Activity for 4 to 5 year olds

In this activity, the children play a parachute game, watch a video clip animation of ExoMars, make parachutes, and try to land a toy rover on a pretend Martian surface. They may later choose to test parachutes of different sizes, designs and materials.

Advanced preparation

Set out an area outside or in the hall as the surface of Mars. Add some obstacles such as pretend rocks, mountains, craters, volcanoes using cones or buckets and hoops. Show the children some images of the Martian geography to set the scene.

This links to an image gallery with a variety of high quality images: mars.nasa.gov/mro/multimedia/images/?ImageID=7731

Cross curricular links

Communication and language:

- Role play; describing the Mars surface features

Maths:

- Language of direction and position; comparing the fall of the parachutes

Music:

- Make up sound effects for the journey of the rover and parachute, using musical instruments

Art and design:

- Paintings of Mars; experimenting with mixing shades of brown

Physical development:

- Creative dance, moving slowly through the air, gently landing

Computing:

- Computer games requiring position or direction

Activity for 5 to 7 year olds

In this activity, the children watch a video clip of the ExoMars mission, make parachutes, are introduced to some geographical features of Mars and use language of direction and position to try to land a toy rover on a Martian surface after identifying suitable landing sites. They may go on to test parachutes of different sizes, designs and materials.

Advanced preparation

As with the EYFS activity, prepare a pretend Martian surface in a suitable area indoors or in the playground but this time, mark the area into squares using chalk or tape. Set out obstacles related to key features on Mars, such as volcanoes or craters using objects and images, but in some of the squares place large 2D shapes. Try to ensure all squares have been included. When the parachutes land on a square, discuss the characteristics of the shape or feature found on that square.

Further activities

The children could try further activities at home, making and testing different sizes or materials for the parachutes or investigating the effects of putting a hole in the canopy of the parachute. (This will reduce the air resistance, so the parachute will fall more quickly.)

Cross curricular links

English:

- Class collaborative story writing; composing a poem about Mars using descriptive words matching geographical features

Maths:

- Go on a walk around school looking for shapes you can see; keep a tally

Computing:

- Use the ALEX app game, giving instructions using direction

Science:

- Making volcanoes using vinegar and sodium bicarbonate or make a chocolate volcano melting different kinds of chocolate to represent lava.



Activity

Before the children begin the activity, model the plotting and reading of coordinates for them. Remind them that when plotting or reading coordinates, you always move across before moving up or down. Three levels of challenge are provided, the final one using coordinates in all four quadrants, and involving negative numbers.

The following links would be useful:

- www.bbc.com/bitesize/articles/z96k9qt
- www.bbc.co.uk/schools/teachers/ks2_lessonplans/maths/grids.shtml

Activity for 7 to 11 year olds

In this activity, the children watch a video clip of ExoMars and are introduced to some geographical features of Mars, including the proposed landing site. They identify the coordinates to match points marked on the map. They later look for points of interest and write corresponding coordinates for others to interpret.

Advanced preparation

Print out multiple copies of the landing site images on Activity sheets 4-6. Enlarging the images prior to printing would be beneficial but not essential. The children may like to work in pairs, sharing maps. If possible, laminate the sheets so that they can be used again. Children can mark the coordinate points on the image using nonpermanent felt tips.

Plenary

The background information provides some details about requirements for landing using parachutes.

Further activities

Further images of the landing site could be prepared, with axes values extending to ten and beyond. The children can try drawing and translating shapes on the coordinate plane and reflecting them across the axes in all quadrants.

Is There Anyone Out There? This free resource has activities for primary children based on real missions to Mars that will link well to extension ideas; activities include investigating craters, making chocolate volcanoes and producing water channels in sand.

www.stem.org.uk/elibrary/resource/30199

Cross curricular links

English:

- Write and deliver a Mars news report featuring the landing of Rosalind.
- Write weekly diary entries for Rosalind's activities

Science:

- Work scientifically, planning and carrying out fair test investigations involving dropping pretend meteorites onto a sand tray to mimic the Martian surface

Computing:

- Use a variety of computer games involving coordinates, battleship games and treasure maps

STEM clubs

Further activities could be used in after school clubs or as homework projects.

Useful links

ExoMars video: launch, journey, landing, rover, drill:
www.youtube.com/watch?v=9NpkbExlNiA

Video animation of rover:

exploration.esa.int/jump.cfm?oid=58857

Teaching resource Is There Anyone Out There?, containing many activities such as making chocolate volcanoes, is freely downloadable on:

www.stem.org.uk/elibrary/resource/30199

Seven Minutes Of Terror; the landing of Curiosity Rover: www.jpl.nasa.gov/video/details.php?id=1090

Trek across the Mars interactive website:
trek.nasa.gov/mars/index.html

Mars website: nasa3d.arc.nasa.gov/detail/mar0kuu2

ESA Kids: www.esa.int/kids/en/home

ESA Education: www.esa.int/Education

Books (World of Books, Amazon)

