**ACTIVITY: Satellite web hunt**

**Activity idea**

In this activity, students use the internet to answer questions about various satellite missions and orbits and to explore some of the stunning imagery obtained by satellites.

By the end of this activity, students should be able to:

* identify the mission (purpose) of some of the satellites featured on the Science Learning Hub
* identify the types of orbits some of these satellites occupy
* discuss why some of these satellites occupy the orbits they do.

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**Introduction/background**

There are over 5,000 active satellites orbiting the Earth. They monitor our weather, help us navigate and communicate, observe the Earth and space and aid with national security.

In this activity, students use articles from the Science Learning Hub and the internet to answer questions and find images associated with some of the satellites mentioned in Hub resources. They are also encouraged to explore images obtained via satellites.

**What you need**

* Copies of the student handout [Satellite web hunt](#handout)
* Access to the internet
* Access to the articles [Satellites measure sea ice thickness](https://www.sciencelearn.org.nz/resources/261-satellites-measure-sea-ice-thickness), [MethaneSAT – turning data into action](https://www.sciencelearn.org.nz/resources/3130-methanesat-turning-data-into-action), [Artificial satellites](https://www.sciencelearn.org.nz/resources/269-artificial-satellites), [How are satellites helping albatross?](https://www.sciencelearn.org.nz/resources/3107-how-are-satellites-helping-albatross) and [Satellite communications](https://www.sciencelearn.org.nz/resources/270-satellite-communications).

**What to do**

1. Provide students with a digital copy of the student handout [Satellite web hunt](#handout).
2. Students work through the handout using information from the Science Learning Hub and the internet to answer the questions and source the images.
3. Discuss information from the worksheet once completed. If time allows, share some of the students’ images with the class.

**Discussion questions**

* Why do the satellites occupy the orbits they do? (Communications and weather satellites are usually placed in a geostationary orbit. They orbit above the Earth’s equator and have a period and direction that matches the rotation of the Earth. This allows the satellite to stay above the same point on the Earth’s surface. Earth observation satellites have low Earth orbits to obtain detailed images.)
* Why do the satellites have different sizes and shapes? (The size and design of a satellite depends on its purpose. Most satellites carry basic parts – power sources like solar arrays and batteries, communication and computer systems. In addition, satellites carry the equipment needed for their specific missions.)

**Extension ideas**

Satellite technology and the information it provides is an accepted part of students’ lives. Ask students to research the satellites they depend upon for:

* cell phone coverage
* navigation – either while driving or handheld units for hunting, tramping or boating
* emergency locator beacons.

**Student handout: Satellite web hunt**

Read each question to discover the type of information you need to find. Sometimes you will need to answer a question. Other times you will need to find an image and then copy and paste it onto this page.

1. Read the article [Satellite Communications](https://www.sciencelearn.org.nz/resources/270-satellite-communications) and use the internet to answer the following:
* Why is the Optus D1 satellite mission important to many New Zealanders?
* What is the coverage footprint of this satellite?
* What type of orbit does the Optus D1 occupy?
* How does rain fade affect the Optus D1 transmission?

Find an image of the Optus D1 satellite.

1. Read the article [Satellites measure sea ice thickness](https://www.sciencelearn.org.nz/resources/261-satellites-measure-sea-ice-thickness) and use the internet to answer the following:
* Which space agency launched the CryoSat-2?
* What is the CryoSat-2 mission?
* What type of orbit does it occupy?

Find an image of the CryoSat-2 satellite.

1. Read the article [MethaneSAT – turning data into action](https://www.sciencelearn.org.nz/resources/3130-methanesat-turning-data-into-action) and use the internet to answer the following:
* Which space agency is responsible for launching MethaneSAT?
* What is MethaneSAT’s mission?
* What type of orbit does it occupy?

Find an image of MethaneSAT – different from the image used in the article.

1. Read the article [Artificial satellites](https://www.sciencelearn.org.nz/resources/269-artificial-satellites) and use the internet to answer the following:
* What size are the smallest artificial satellites?
* What is the largest artificial satellite?

Find images of both of these satellites.

1. How many satellites are in the global positioning system (GPS) constellation?

What type of orbit do they occupy?

Find an image showing the GPS satellite constellation.

1. Read the article [How are satellites helping albatross?](https://www.sciencelearn.org.nz/resources/3107-how-are-satellites-helping-albatross)
* What is the name of the satellite used to monitor albatross populations?
* What is the type of payload (monitoring device) used by this satellite?
* What other type of satellite monitoring has been used to track albatross movements and feeding behaviours?

Find an image taken by this satellite.

1. Find a satellite image that appeals to you. If possible, print a colour copy of the image or save it to a device as a reminder that, without satellites, our modern world would be severely disadvantaged.

**Satellite web hunt – answers**

1. Read the article [Satellite Communications](https://www.sciencelearn.org.nz/resources/270-satellite-communications) and use the internet to answer the following:
* Why is the Optus D1 satellite mission important to many New Zealanders?

*It transmits television signals.*

* What is the coverage footprint of this satellite?

*It provides signals for the whole of New Zealand and Australia.*

* What type of orbit does the Optus D1 occupy?

*The Optus D1 is in a geostationary orbit above the equator. The time for one orbit is 24 hours. This is to match the rotation of the Earth so that the satellite appears to stay at the same point above the Earth’s surface.*

* How does rain fade affect the Optus D1 transmission?

*Rain fade is a lower-quality television signal that occurs when signals from a satellite pass through a region of rain. This happens for two reasons. Firstly, some of the signal is absorbed or reflected by the rain, so the strength of the carrier signal becomes weaker. Secondly, the rain itself produces more signal noise.*

Find an image of the Optus D1 satellite.

1. Read the article [Satellites measure sea ice thickness](https://www.sciencelearn.org.nz/resources/261-satellites-measure-sea-ice-thickness) and use the internet to answer the following:
* Which space agency launched the CryoSat-2?

*European Space Agency.*

* What is the CryoSat-2 mission?

*The CryoSat mission is for precise monitoring of the changes in the ice thickness and coverage in the polar regions.*

* What type of orbit does it occupy?

*The CryoSat-2 is in a low Earth polar orbit.*

Find an image of the CryoSat-2 satellite.

1. Read the article [MethaneSAT – turning data into action](https://www.sciencelearn.org.nz/resources/3130-methanesat-turning-data-into-action) and use the internet to answer the following:
* Which space agency is responsible for launching MethaneSAT?

*Designed and built by the Environmental Defense Fund and launched into orbit by a SpaceX Falcon 9 rocket.*

* What is MethaneSAT’s mission?

*Use data from satellite observations to locate and measure methane emissions with a key focus on ‘fugitive’ leaks from oil and gas operations.*

* What type of orbit does it occupy?

*A Sun-synchronous polar orbit about 600 km above the Earth.*

Find an image of MethaneSAT – different from the image used in the article.

1. Read the article [Artificial satellites](https://www.sciencelearn.org.nz/resources/269-artificial-satellites) and use the internet to answer the following:
* What size are the smallest artificial satellites?

*CubeSats are as small as 10 cm.*

* What is the largest artificial satellite?

*The International Space Station – the main part of the ISS is as big as a large five-bedroom house. If the solar panels are included, it is the size of a rugby field.*

Find images of both of these satellites.

1. How many satellites are in the global positioning system (GPS) constellation?

*A minimum of24 satellites plus a number of spares in case one of the satellites fails – allowing up to 32.*

What type of orbit do they occupy?

*Medium Earth orbit – an altitude of 20,000 km, orbiting every 12 hours.*

Find an image showing the GPS satellite constellation.

1. Read the article [How are satellites helping albatross?](https://www.sciencelearn.org.nz/resources/3107-how-are-satellites-helping-albatross)
* What is the name of the satellite used to monitor albatross populations?

*WorldView-3* satellite.

* What is the type of payload (monitoring device) used by this satellite?

*Multi-payload – including a high-resolution camera and has the ability to capture full-colour imagery at 31 cm resolution.*

* What other type of satellite monitoring has been used to track albatross movements and feeding behaviours?

*GPS*.

Find an image taken by this satellite.

1. Find a satellite image that appeals to you. If possible, print a colour copy of the image or save it to a device as a reminder that, without satellites, our modern world would be severely disadvantaged.