

Satellites!

See the world through the eyes in the sky

This teachers' supplement should be used in conjunction with **Project Pull-out #19: Satellites**, which is found in *DMAG's* issue **72, March 2008**. The pull-out will inspire students to learn about how communication methods have changed over time, and to consider the Earth from a different perspective – space!



These activities encourage students to:

- Appreciate that technology has a major role in modern-day communication methods
- Consider how satellites affect their daily lives
- Apply simple geometrical principles to understand how satellites locate things
- Think about the environment beyond Earth
- Consider weather systems as seen from space

Maths

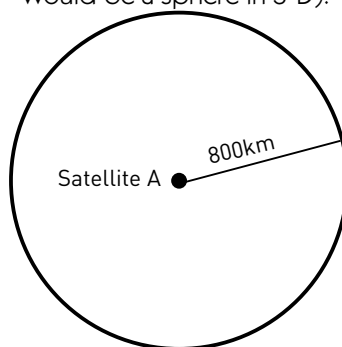
Where in the world?

Read pages 50-51 paying particular attention to the breakout on Global Positioning Systems. Discuss GPS systems in cars, boats, planes etc. Explain to the class that they're now going to work out how satellites locate things using a process called triangulation.

Thought process for class:

1) Draw on the board a dot, and label this satellite A.

Say to the class, "if David is 800 kilometres away from satellite A, where could David be standing?"
 Answer: Anywhere on a circle around satellite A. The circle will have a radius 800 kilometres. (Note: this is for a 2-dimensional board illustration. It would be a sphere in 3-D).



1) With only one satellite, David could be anywhere on this circle.

2) Draw a second dot to the right of the first dot, as shown in the diagram over the page.
 Say to the class, "David is standing still. He now finds out he is also 500 kilometres from satellite B. Where

could David be standing?"
 Answer: Anywhere on a circle of radius 500 kilometres around satellite B. But we also know that David is 800 kilometres from satellite A, which means he can be at either of the two places the circles intersect.

3) Draw a third dot, as shown on the diagram over the page, and label this satellite C. Say, "if David now finds he is also 300 kilometres from satellite C, can we work out where he is?"
 Answer: Yes. Draw a circle around point C (make sure you draw it so that it intersects the lower intersection point of the two previous circles). Label the circle as having a radius of 300 kilometres.
 Explain that they've all just found David's location by triangulating it. This is the same method used to locate cars with GPS receivers.

Satellites!

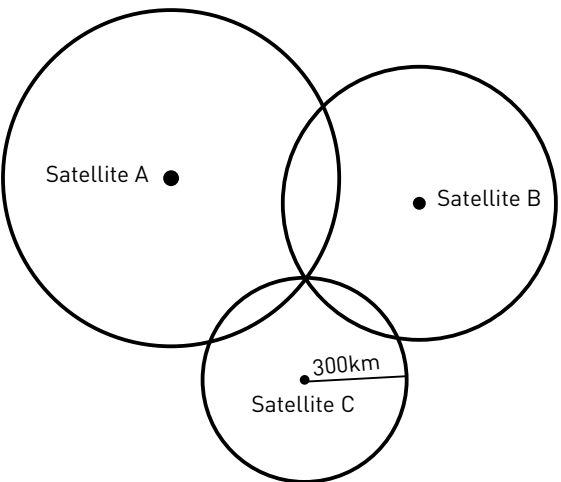
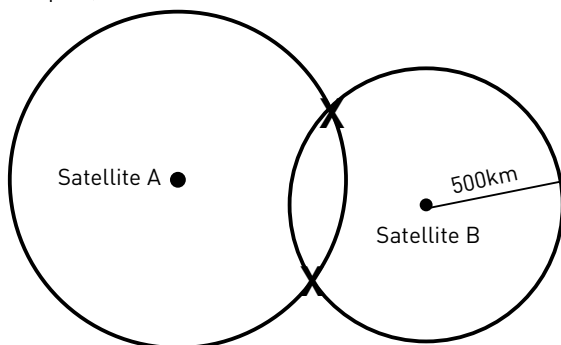
See the world through the eyes in the sky

4) Ask the students to do the first activity on the student sheets (note: the answers are D5 and H1 provided that the sheets are printed on A4).

Distance = speed x time
You can only work out accurate distances if you've accurately measured the time. So the fourth satellite is used to synchronise the atomic clocks on all the satellites.

Visit the website: earthobservatory.nasa.gov. Use the site to find some examples of the weather types discussed. Split the class into pairs and ask each pair to research a weather pattern and/or occurrence.

2) With two satellites, David could be at one of two spots, as marked with the X.



3) With three satellites, David can only be at the intersection of the three circles.

Science and Technology: Way out Communication

Discuss the different forms of technology that are used in communications. Ask students to complete the exercise *Communicate with Me* on the Student Activity Sheets.

Tell the class they are each to choose one of the technologies and find out who invented it. Each student is to do a brief presentation about the inventor. When preparing their presentations, they should consider: Was the inventor in a race to invent their device? When and where did they live?

English: Warning, warning!

Tell the class to pretend that they work for the government and their job is to monitor satellite pictures of the Earth for any unusual occurrences. They've just spotted something major, which could affect the lives of hundreds of people. What is it that they've spotted? (e.g. a tsunami, cyclone, avalanche, mudslide etc). What does it look like? What should people do to save themselves/prepare? When and where will it hit?

Ask each person to write a short news bulletin of a few hundred words. This bulletin should contain all the above information and have an attention-grabbing heading.

Science and Technology: Out in Space

Read the section on satellites on page 48-49. Break the class into groups. Each group is to create a scale drawing of Earth and draw in the three different types of man-made satellites above it (LEO, MEO and GEO). Each drawing is also to include the Moon.

As a first step, students will need to find out from research the diameter of the Earth, the diameter of the Moon, and the distance of the Earth from the Moon.

Extension discussion: Why is the fourth satellite needed to locate something via GPS?

To find out how far the satellites are away from David, we need to measure the time taken for the radio signals sent from where David is, to travel to the satellite. The speed of the radio signal is always the same. If we know the time and the speed, we can work out the distance,

Science and Technology: What's the Weather?

Read the articles in *DMAG* entitled *Where Am I?* and *Earth from Space* and look at the pictures.

Ask the class to brainstorm different weather patterns and natural occurrences that they might see from the satellites. Write the list on the board. E.g. cyclones, clouds, snow, tsunamis, flooded areas etc.