

Air Traffic Control

Task A: Question sheet

The number of edges, faces and vertices on a Goldberg Polyhedron can be calculated using formulae.

If

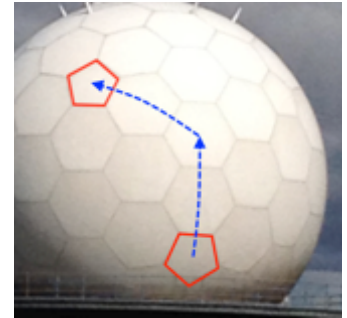
$$T = m^2 + mn + n^2$$

Then:

$$\text{Number of edges} = 30T$$

$$\text{Number of faces} = 10T + 2$$

$$\text{Number of vertices} = 20T$$



- 1) Find the number of edges, faces and vertices on the Titterstone Clee Hill NATS radar dome.
- 2) Find the number of edges, faces and vertices on the Titterstone Clee Hill Met Office radar dome.
- 3) Another NATS radar dome, on Great Dun Fell in Cumbria, is a $G(4,0)$ Polyhedron. Find the number of edges, faces and vertices on this shape.
- 4) The formula $T = m^2 + mn + n^2$ can also be written as $T = (m + n)^2 - mn$. Verify your results in (1), (2) and (3) by using this version of the formula to check in each case.
- 5) Show, algebraically, that $m^2 + mn + n^2 = (m + n)^2 - mn$.

Optional task

Set up a spreadsheet to calculate the number of edges, faces and vertices for a given Goldberg Polyhedron.

Remember

- The NATS radar dome is an example of a $G(2,2)$ Polyhedron;
- The Met Office radar dome is an example of a $G(2,0)$ Polyhedron;
- NATS stands for National Air Traffic Services.

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Task B: BBC News extract

Take-off for new radar system

The first phase of a £127m scheme to replace the UK's air traffic control radar network has gone live.

The new system at Burrington in north Devon is the first of the National Air Traffic Services' 19 radar stations to be replaced as part of a nine-year upgrade programme.

The new radars provide a higher standard of information, greater reliability, and more advanced technology, a spokesman for the National Air Traffic Services (NATS) said.

The north Devon radar surveys the skies over South Wales, the West Country and the Western Approaches.

It supplies information to air traffic controllers at the London Area Control Centre at Swanwick in Hampshire, and also RAF controllers at the Military Air Services Operations Room, near Heathrow.

Radar display

Dr Rob Witty, NATS chief technology officer, said: "The new radar network is a critical element of the systems supporting UK air traffic control."

The new equipment at Burrington uses a primary radar to show an aircraft's position which is tracked as a "blip" on the air traffic controller's radar display.

It also has a secondary radar which can electronically request more information about an aircraft's flight level, route or destination.

Radar installations at 18 other sites across the UK are to be replaced by 2012.

NATS plans to replace two radar installations each year, with Sumburgh in the Shetland Isles and Cromer in Norfolk scheduled for 2004.

Future sites earmarked for the new radars are Alanshill in Aberdeenshire; Belfast; Claxby in Lincolnshire; Clee Hill near Ludlow; Debden in Essex; Gatwick; Glasgow; Great Dun Fell in Cumbria; Heathrow; Lowther Hill in Lanarkshire; Pease Pottage near Crawley; Perwinnes Hill near Aberdeen; Sandwick on Stornoway; St Anne's near Blackpool; Stansted, and Tiree.

Source: BBC website, 19th December 2003
<http://news.bbc.co.uk/1/hi/england/3335743.stm>

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Task B: Question sheet

19 NATS radar sites are listed in the news article. None are in Wales.

The Titterstone Clee Hill NATS radar monitors all aircraft within a radius of 100 miles.

Assume that all NATS radars monitor aircraft within the same radius.

1) Plot the 19 locations on a map of the UK. Create a diagram showing the region monitored by each radar.

Do these 19 sites provide full coverage of UK airspace?

2) Some of these sites are at major airports:

- Heathrow
- Gatwick
- Stansted
- Glasgow
- Perwinnes Hill, Aberdeen
- Belfast

Is there full coverage of UK airspace if these radar installations are ignored?

Task B: Map 1



Task B: Map 2

