

FUNcube-1 satellite speed - how long does it take?

There are so many satellites orbiting the Earth, we often see them in the night sky. How long do they take to go round the Earth?

We will focus on the FUNcube-1 educational satellite and from its telemetry data we can determine its period of orbit. You can receive this data with a simple antenna and free software to show the data. You can calculate the time taken for it to orbit by analysing the temperature variations.



About One Hour



Kit List

- A Yagi antenna
- A FUNcube-1 radio receiver dongle
- A laptop, running the Dashboard software

Your local amateur radio club should be able to supply you with the necessary equipment which you can use without the need for a licence. Search for your local club at: <https://rsgb.org/club-finder>

You can also carry out this activity using the data from the satellite warehouse (<http://warehouse.funcube.org.uk/ui/fc1-fm>).

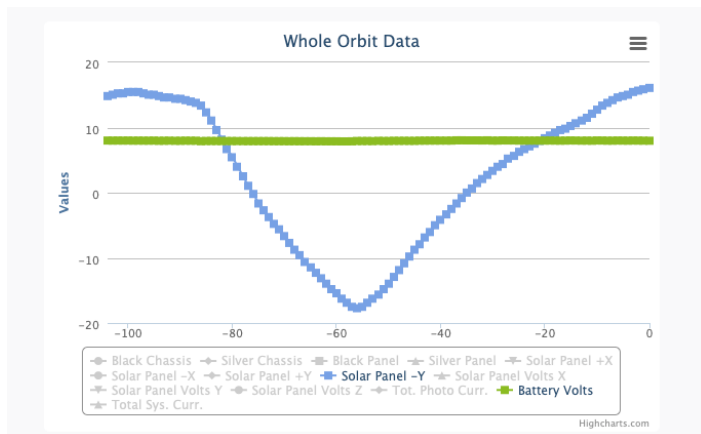


Instructions

1. The Heavens Above website (<https://www.heavens-above.com>) will give the times of the pass of the FUNcube-1 satellite, which has the designation AO-73. It also gives the height of the satellite.
2. Use a compass to find out where the Yagi antenna should be pointed to receive the satellite's radio signal.



3. Run the Dashboard program and download the telemetry data, which will last for about 8 minutes as the satellite moves across the sky.
4. Once indoors, open the file and plot the temperature graph of any of the panels, for a whole Earth orbit.



5. The temperature will rise and fall during the orbit as it goes into the sunlight and into the shadow of the Earth. The period can be found where the temperature repeats on the graph.
6. To calculate the speed we need to find the circumference of the orbit, assuming it is circular. The height of the orbit is added to the radius of the Earth.
7. The speed is found from the formula: $\text{speed} = \text{distance} / \text{time}$
8. You can keep the distance in km and the time in hours, to give a final answer in km/h.

Next Steps

Change the speed to miles/h and compare it to the ISS, which travels at 17,500 miles/h.

Why is FUNcube-1 going slower than the ISS?

Were there any fitter messages in the telemetry? They can also be found here:
<http://warehouse.funcube.org.uk/ui/fc1-fm>.

A jet plane seems to take the same time to cross the sky as a satellite. Is the ratio (distance/speed) roughly the same in each case? How high do planes fly and at what speed?

Calculate the speed of the Moon which takes 27.3 days to orbit the Earth.

Over 400 years ago, Johannes Kepler discovered the mathematical pattern that satellites follow when they orbit a planet. Find out what is Kepler's third law. Incredibly, we can use our results for the FUNcube-1 satellite to determine the mass of the Earth!