What is the Global Positioning System (GPS)?

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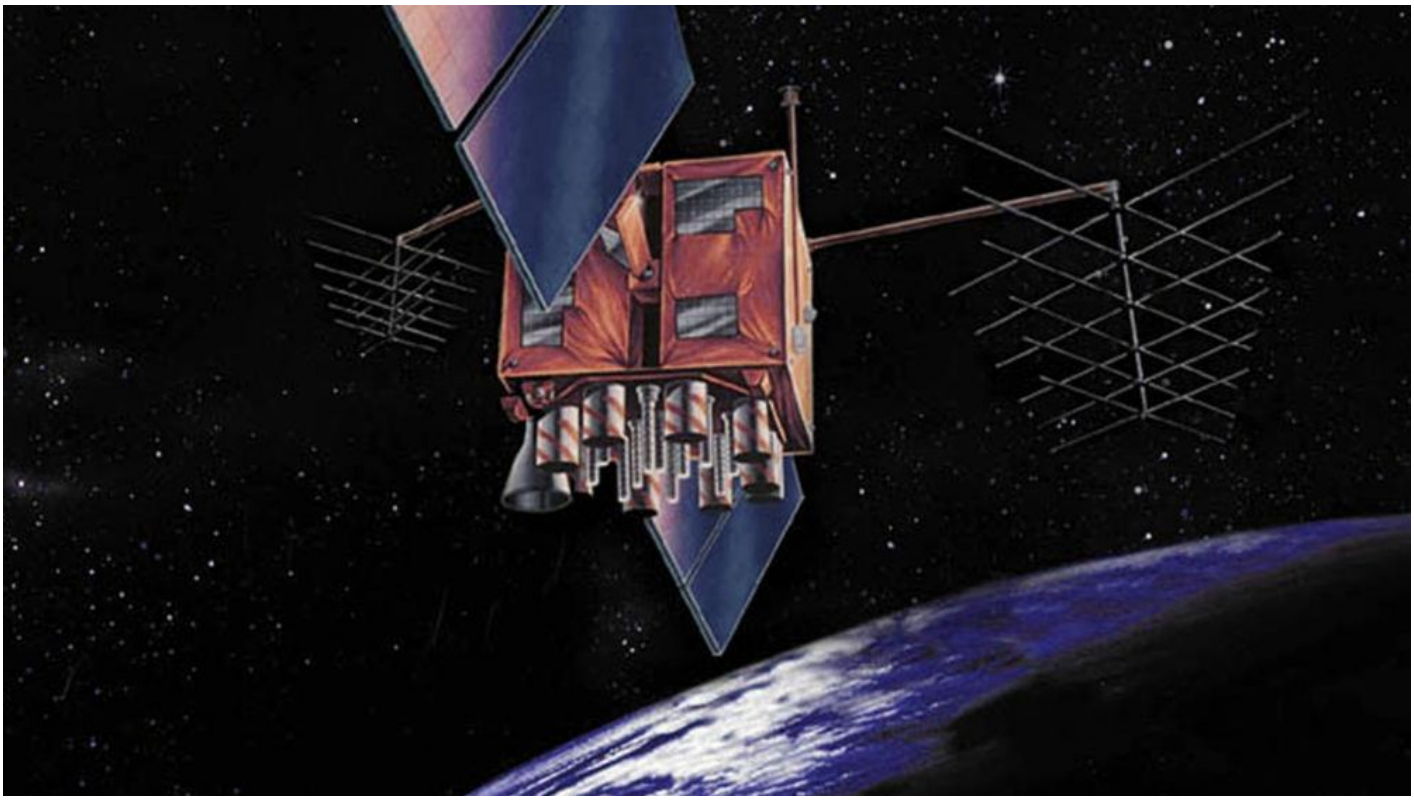

About Global Positioning System (GPS)

- The U.S. Department of Defence started the GPS programme in 1973 and launched the first satellite in 1978.
- The modern GPS satellite constellation consists of 24 satellites moving around the earth in six orbits.
- Each satellite completes two orbits in a single day.
- The overall programme has three main components:
    - Space segment: It consists of 24 satellites. The six orbits they occupy are all 20,200 km above the earth, and each orbit has four satellites at all times. In this configuration, anyone on the earth will be able to ‘see’ at least four satellites at a time.
    - Control segment: It consists of a global network of ground-brd control stations and antennae that track the 24 satellites, make sure their performance is as expected at all times, and transmit commands.
    - User segment: It pertains to the use of GPS in various sectors and applications. The major sectors include agriculture, construction, surveying, logistics, telecommunications, power transmission, search and rescue, air travel, meteorology, seismology, and military operations.

How does GPS work?

- Each GPS satellite continuously broadcasts a radio signal containing information about its location in orbit, operational status, and the time at which the signal is emitted.
- The signals are transmitted at the L1 (1,575.42 MHz) and the L2 (1,227.6 MHz) frequencies at 50 bits/second.
- The signals are encoded with code-division multiple access.
- This allows multiple signals to be transmitted in the same channel and for a receiver to be able to disentangle them.
- There are two encoding types: the coarse/acquisition mode, which civilians can use to access coarse GPS data, and the precise mode, which is encrypted and is for military use.
- Being an electromagnetic signal, the radio waves travel at the speed of light.
- If the receiver has access to signals from four satellites, it will have the information required to calculate its location in four dimensions (three of space plus one of time relative to the satellite clock) – and can thus accurately triangulate its location on the ground.
- This informs the need for every point on the earth being able to ‘see’ four satellites at a time.

Q1) What is Radio wave?

These are waves from the portion of the electromagnetic spectrum at lower frequencies than microwaves. The wavelengths of radio waves range from thousands of metres to 30 cm. These correspond to frequencies as low as 3 Hz and as high as 1 gigahertz (109 Hz). Radio-wave communications signals travel through the air in a straight line, reflect off of clouds or layers of the ionosphere, or are relayed by satellites in space.

Source: How does GPS work? | Explained