Understanding GPS

1. Explain how radio signals broadcast by Global Positioning System satellites are used to calculate positions on the surface of the Earth **(Sections 13 - 17)**

Radio signals are used in satellite transmitters as well as the GPS receivers on the ground to calculate distances and one’s position on the surface of the Earth.

There are two distinct radio frequencies broadcast by NAVSTAR Block II satellites which are…

1. 1575.42 MHz (L1) -> civilian use
2. 1227.6 MHz (L2) -> encrypted and designated for military use

Satellite ranging uses those radio signals and the time it takes the signals to reach the surface of the Earth to determine the distance and location of the receiver.

However, multiple satellites and their radio signals (4 to be exact) are required from the receiver for the results to be accurate enough for the end user in terms of time and space (10-20 feet).

1. Describe the functions of the space, control, and user segments of the Global Positioning System. **(Sections 13 - 17)**
2. Space Segment

This segment consists of 31 satellites that are always orbiting the Earth once every 12 hours along one of six orbital “planes” at an altitude of 20,200 km or 12,500 miles.

A diagram of gps orbital planes

AI-generated content may be incorrect.

1. Control Segment

The control segment is a network of ground stations that monitors the shape and velocity of each satellite and their corresponding orbits.

There are Monitor Stations and the Master Control Station.

Monitor Stations record discrepancies between known and calculated positions caused by slight variations in satellite orbits while the Master Control Station is where the data describing the orbits are produced, uploaded, and broadcast as part of the GPS positioning signal.

1. User Segment

The last segment known as the user segment is made up of GPS receivers which today can include cell phones as well as traditional receivers.

Traditional receivers consist of a radio receiver, internal antenna, digital clock, user interface, computer chip, memory, I/O jacks, and batteries for power.

In 2006, there was an estimated 500,000 GPS receivers in use.

In 2025, it is estimated that there are 900 million GPS receivers in use.