

Global Positioning System

GPS

Let's Discuss IT
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John W Ware III

What is GPS ?

The Global Positioning System (GPS) is a U.S.-owned utility that provides users with positioning, navigation, and timing (PNT) services.

This system consists of three segments:

- Space Segment
- Control Segment
- User Segment

The U.S. Air Force develops, maintains, and operates the space and control segments.

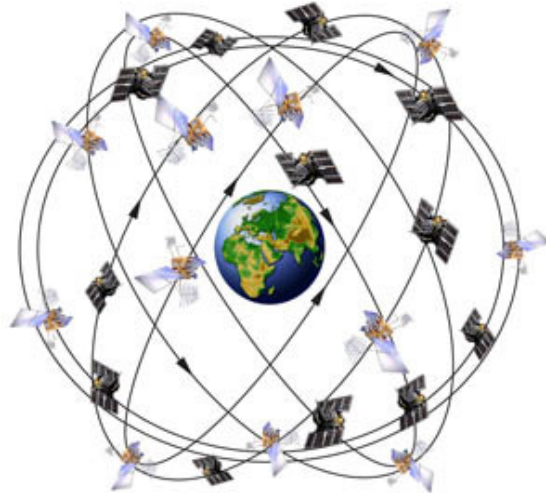
Space Segment

- The GPS space segment consists of a constellation of satellites transmitting radio signals to users.
- The United States is committed to maintaining the availability of at least 24 operational GPS satellites, 95% of the time.
- To ensure this commitment, the Air Force has been flying 31 operational GPS satellites for the past few years.

Constellation Arrangement

- GPS satellites fly in medium Earth orbit (MEO) at an altitude of approximately 20,200 km (12,550 miles). Each satellite circles the Earth twice a day.
- The satellites in the GPS constellation are arranged into six equally-spaced orbital planes surrounding the Earth. Each plane contains four "slots" occupied by baseline satellites. This 24-slot arrangement ensures users can view at least four satellites from virtually any point on the planet
- In June 2011, the Air Force expanded the configuration. So that three extra satellites became constellation.

Constellation Arrangement



Control Segment

- The GPS control segment consists of a global network of ground facilities that track the GPS satellites, monitor their transmissions, perform analyses, and send commands and data to the constellation.
- The current Operational Control Segment (OCS) includes a master control station, an alternate master control station, 11 command and control antennas, and 16 monitoring sites.
- U.S. Air Force's 2nd Space Operations Squadron (2SOPS) and the Air Force Reserve's 19th Space Operations Squadron (19SOPS) at Schriever Air Force Base, Colorado.

Control Segment – Monitoring Stations

- Track GPS satellites as they pass overhead
- Collect navigation signals, range/carrier measurements, and atmospheric data
- Feed observations to the master control station
- Utilize sophisticated GPS receivers
- Provide global coverage via 16 sites: 6 from the Air Force

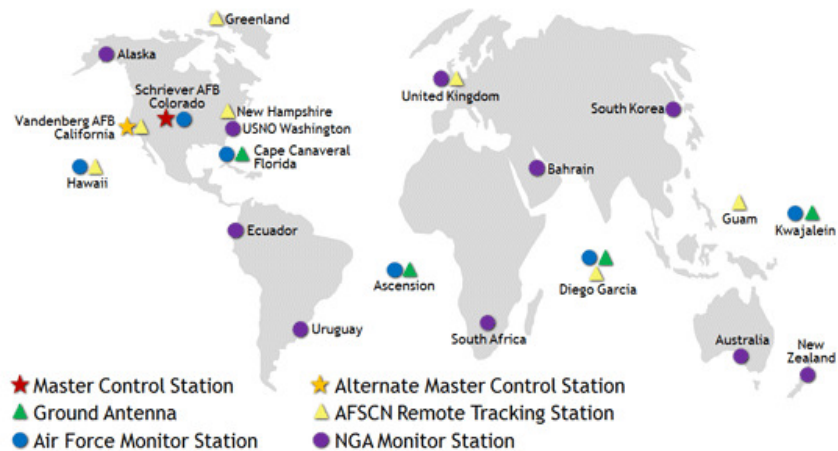
Control Segment – Master Control Station

- Provides command and control of the GPS constellation
- Uses global monitor station data to compute the precise locations of the satellites
- Generates navigation messages for upload to the satellites
- Monitors satellite broadcasts and system integrity to ensure constellation health and accuracy
- Performs satellite maintenance and anomaly resolution, including repositioning satellites to maintain optimal constellation
- Currently uses separate systems ([AEP](#) & [LADO](#)) to control operational and non-operational satellites
- Backed up by a fully operational alternate master control station

Control Segment – Ground Antennas

- Send commands, navigation data uploads, and processor program loads to the satellites
- Collect telemetry
- Communicate via S-band and perform S-band ranging to provide anomaly resolution and early orbit support
- Consist of 4 dedicated GPS ground antennas plus 7 Air Force Satellite Control Network (AFSCN) remote tracking stations

Control Segment

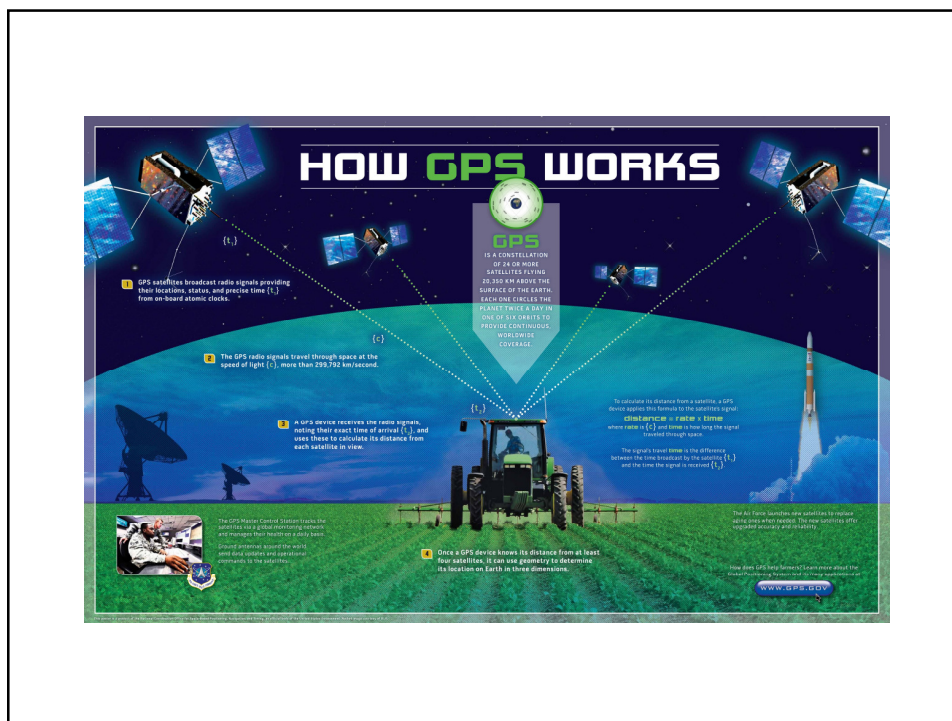


User Segment

- Like the Internet, GPS is an essential element of the global information infrastructure.
- The free, open, and dependable nature of GPS has led to the development of hundreds of applications affecting every aspect of modern life.
- GPS technology is now in everything from cell phones and wristwatches to bulldozers, shipping containers, and ATM's.

User Segment - Applications

- Agriculture
- Aviation
- Environment
- Marine
- Public Safety & Disaster Relief
- Rail
- Recreation
- Roads & Highways
- Space
- Surveying & Mapping
- Timing



GPS – FAQ's

- How accurate is GPS ?
- Address, Route & Map Problems ?
- How do we use it for Genealogical Research?
 - Cemetery & Headstone location
 - Logging longitude & latitude for locations where our ancestors had significant events
 - Land grant or deed interpretation / documentation
 - Geomapping migrations and events

