

UNIT-8 GIS & GPS
GLOBAL NAVIGATION SATELLITE SYSTEM
(GNSS)

APARUPA BANERJEE
Dept. of Geology
Shahid Matangini Hazra Govt. College for Women

Introduction

- Satellite navigation system (Sat Nav system) is a system of satellite constellation.
- Sat Nav system is mainly used to find coordinates, altitude, time and velocity of an object presented on the ground.

What is Global navigation satellite system?

“A worldwide position and time determination system that includes one or more satellite constellations, aircraft receivers and system integrity monitoring, augmented as necessary to support the required navigation performance for the intended operation”

History of positioning system:

- In earlier time, Columbus navigated to the New World using **dead reckoning** (The technique of estimating one's current position based on a previously determined one).
 - If I head west from a known location at 10km/hr then, in two hours, I will be 20 km west of my starting point.
 - The challenge in dead reckoning was the accurate and regular estimation of speed and heading. Because Your position on Earth is of vital importance and can have an immense variety of implications and applications.
- With time satellite navigation has evolved from the level of science fiction to science fact with a dynamic and rapidly growing industry providing customers around the world with technology devoted to the rapid, reliable and readily available determination of their position.

Among the most stunning technological developments in recent years have been the immense advances in the realm of satellite navigation or Global Navigation Satellite Systems (GNSS) technologies.

Use of GNSS:

- Travellers can use handheld GNSS devices (also smart mobiles) to calculate and display their position to within few metres.
 - Farmers can automatically guide their farm machinery for more efficient ploughing, seeding, fertilizing and harvesting.
 - Now, applications are pushing the requirements of GNSS technology further than ever before.
 - In some cases it is necessary to augment GNSS technology with other systems to meet the performance requirements of a particular application.
- **Early applications of GNSS were developed for the military and later in the fields of surveying and mapping.**
Now operators of planes, trains and automobiles can know their position and heading quickly and accurately.**It started with the launch of the U.S. Department of Defence Global Positioning System (GPS) in the year 1973.**

GNSS:

- Each GNSS employs a constellation of satellites, which broadcasts signals that are then processed by GNSS receivers to determine location, speed, and time for users anywhere within range of the satellites.
 - This is normally on or just above the Earth's surface, but can be in space as well.
 - There have been a significant number of developments in the availability of new satellite navigation systems (e.g. **GPS, Galileo, GLONASS, Beidou, IRNSS, QZSS**, etc.).

GNSS systems:

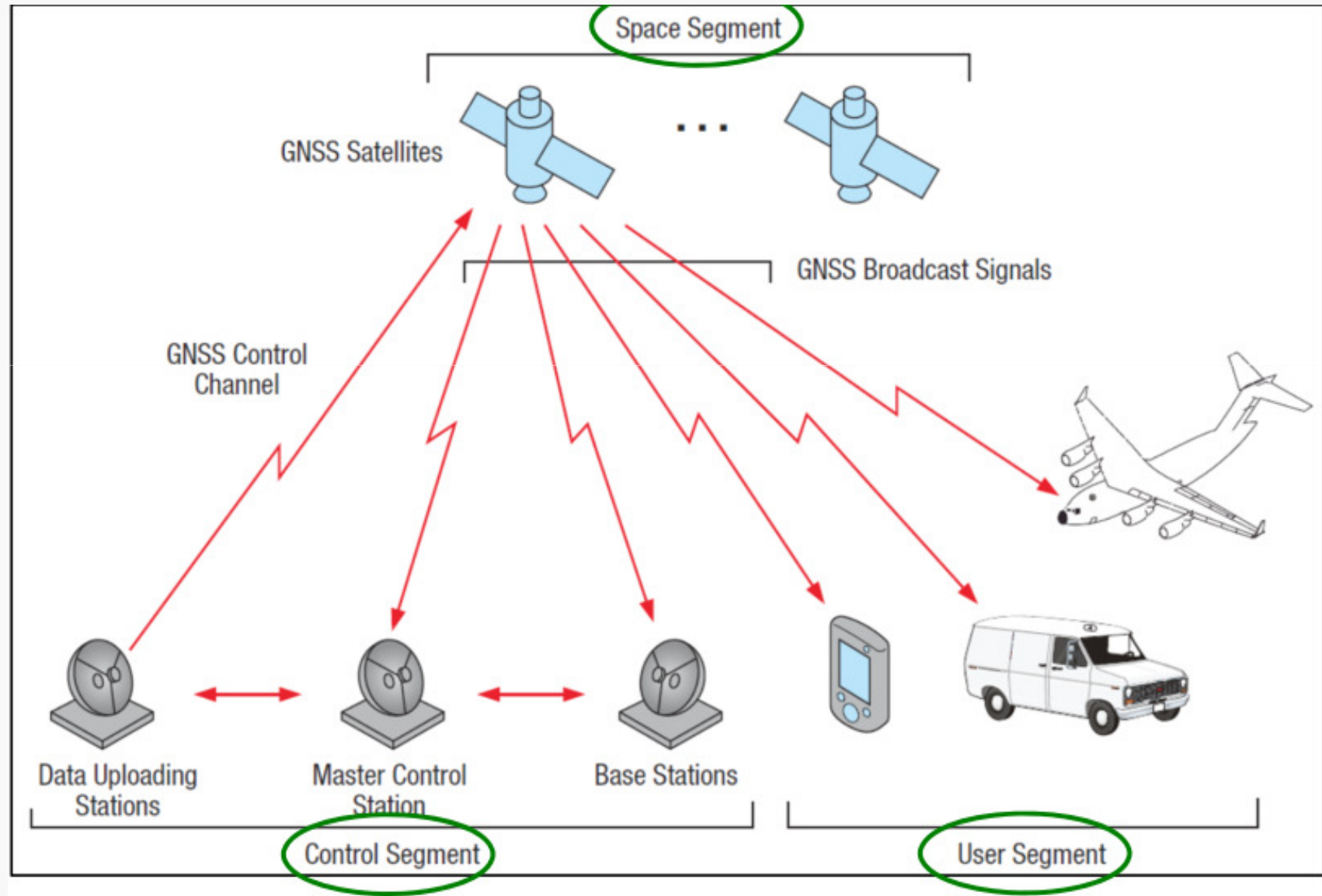
HOW MANY GNSS SATELLITES WORK ON THE EARTH'S ORBIT?



GNSS systems currently include:

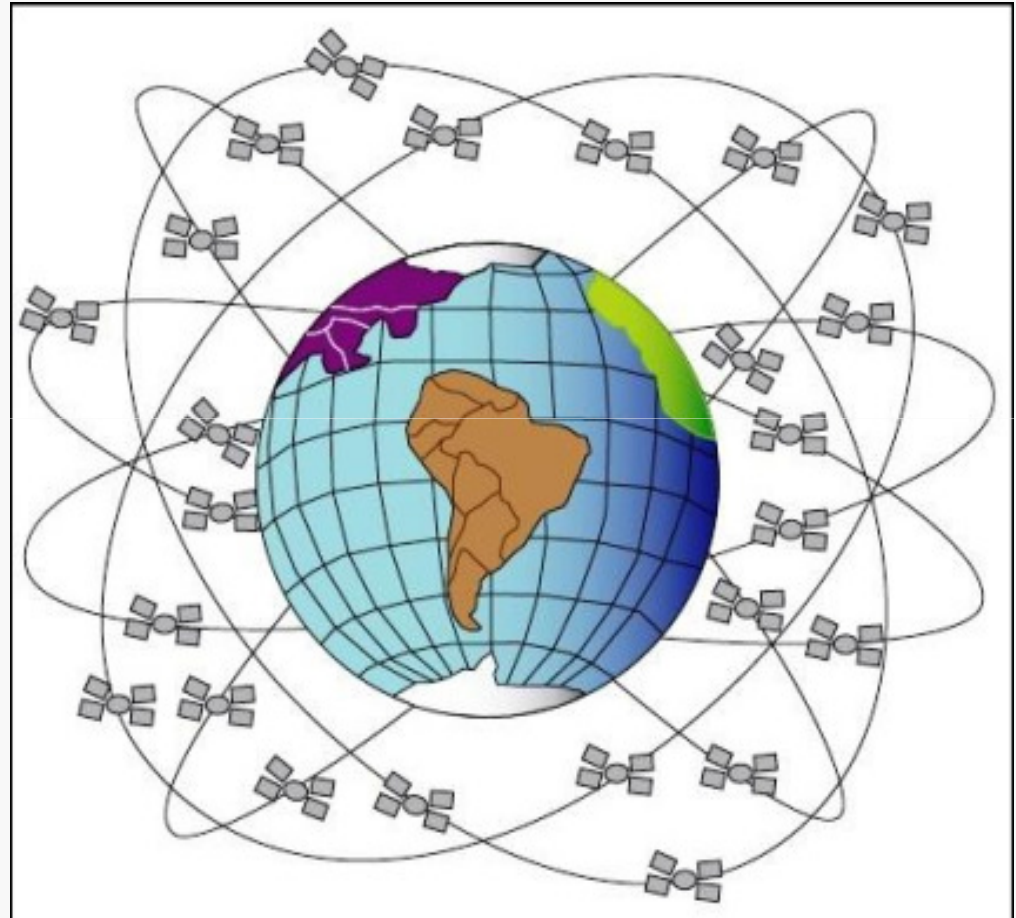
- GPS (United States) (31 satellites)
- GLONASS (Global Navigation Satellite System)(Russia) (24 satellites)
- Galileo (European Union) (30 satellites) (regional)
- BeiDou (China) (35 satellites)
- IRNSS (Indian Regional Navigation Satellite System) (regional) (7 satellites)
- QZSS (Japan) (3 satellites) (regional)
- GAGAN (GPS Aided GEO Augmented Navigation) India

Components of GNSS:

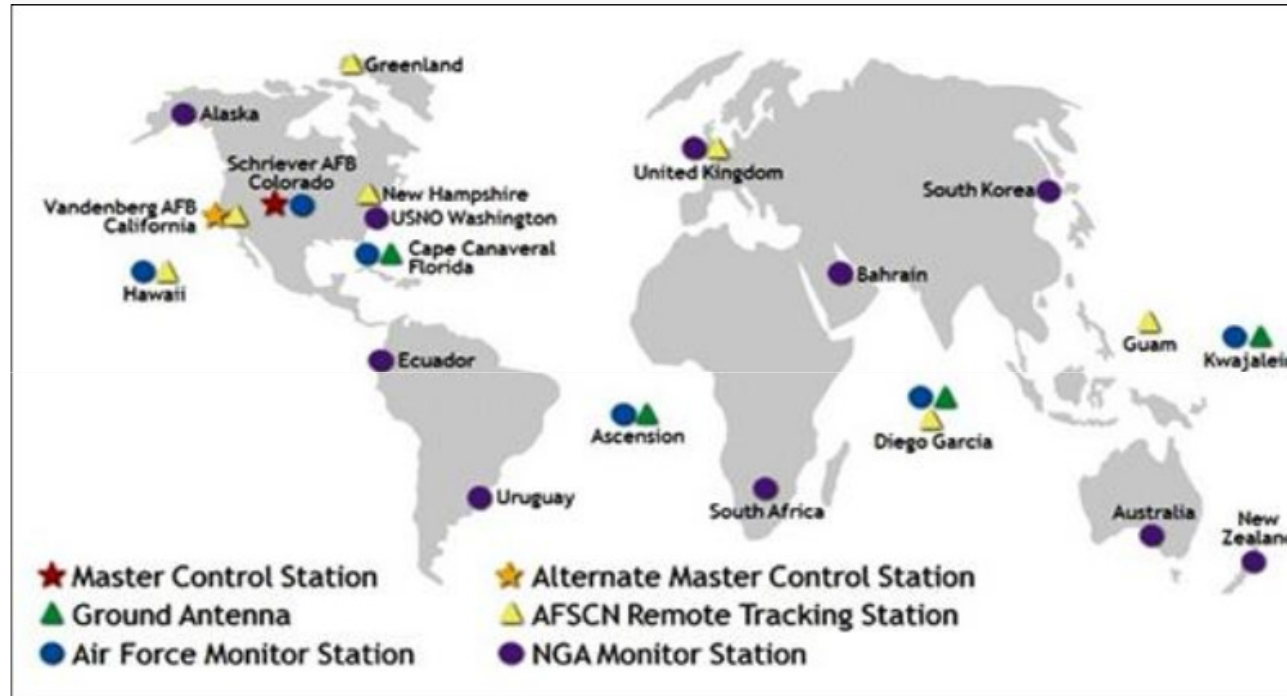


Space Segment:

- The space segment consists of GNSS satellites, orbiting about 20,200 km above the Earth.
- Each GNSS has its own constellation of the satellites, arranged in orbits to provide the desired coverage.



Control segment:



- The control segment comprises a ground-based network of master control stations, data uploading stations and monitor stations
- In each GNSS system, the master control station adjusts the satellites' orbit parameters and on-board high-precision clocks when necessary to maintain accuracy.
- Monitor stations, usually installed over a broad geographic area, monitor the satellites' signals and status, and relay this information to the master control station.
- The master control station analyses the signals then transmits orbit and time corrections to the satellites through data uploading stations.

User segment:

User Segment

- ❑ GPS receiver (parallel multi-channel)
 - ❑ Time of day
 - ❑ Location (lat and long)
 - ❑ Waypoints
 - Define: marked location
 - ❑ Routes
 - ❑ Distances
 - ❑ Tracks
 - ❑ Maps
 - ❑ PC connectivity



- The user segment consists of equipment that processes the received signals from the GNSS satellites and uses them to derive and apply location and time information.

THANK YOU