GPS (Global Positioning system)

In early 1970's (1974), Department of defence, USA launches its first GPS satellite. In early 90's when there is war between Kuwait and Iraq and American army entered in that war from Kuwait side and the war area is desert where the Landforms are hard to find (operation Desert storm, 1993) where GPS is used for Army purpose. In 1995, full operation capability announced on March 1996, President of USA decided to make GPS free of cost available to civilians.

Definition –

GPS is a network of orbiting satellites that send precise details of their position back to earth received by GPS receivers and are used to calculate exact position, speed and time at the particular location.

What does a GPS receiver calculate?

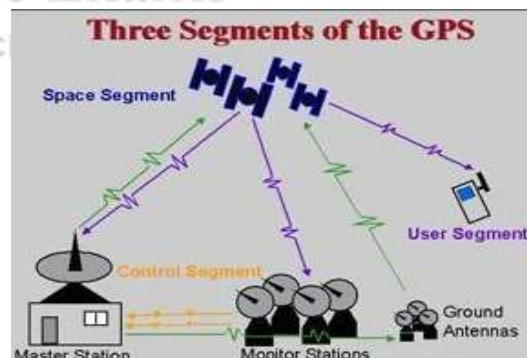Using GPS, the following values can be determined on earth.

- Location (longitude and Latitude) to within a range of 20m to 1mm approx.

- Altitude (Height)
- The Precise time accurate to within a range of 10-10 seconds.

Components of GPS (segments) –

- Space segment
- Control segment
- User segment

a) Space Segment –

- GPS satellites or space vehicles sends radio signals from space.
- Nominal GPS operational constellation consist of 24 satellites that orbit the earth in 12 hrs. (Total 31 satellites)
- 6 orbital planes (4 satellites in each plane) which are equally spaced 60° apart and at 55° inclination to the equatorial plane
- This constellation provides the user with between eight satellites visible from any point on earth.
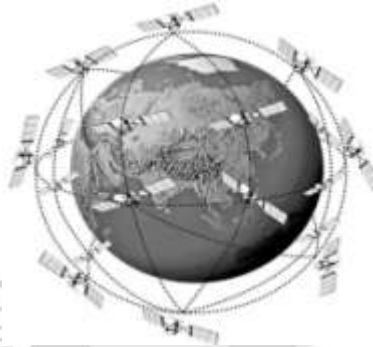
- These satellites operate at a height of 20,200 km (approx.)
- At any given time at any point an observer can receive signals from at least 4 satellites.

b) Control Segment –

- Master control facility is located at Schriever Air force Base. (formerly falcon AFB) in colarado springs.

Global Positioning System (GPS) Master Controll and Monitor Station Network

- There are ground stations which measures the signals from satellite and process the tracking data for computation of satellite co-ordinates and satellite clock parameter.

c) User segment –

- It consist of GPS receivers and user community,
- GPS receivers converts satellite signals into position, velocity and time estimates.
- 4 satellites are required to compute the 4 dimensions of x, y, z (positions) and time.

IRNSS – (Navic)

- The Indian Regional Navigation satellite system (IRNSS) with an operational name of NAVIC [Navigation with Indian constellation] is an autonomous regional satellite navigation system.
- It will be an independent and autonomous regional navigation system aiming a service area of about 1500 km around India.
- IRNSS is being developed by Isro which would be under total control of Indian government
- The requirement of such navigation is driven by the fact that access to global Navigation satellite system, GPS is not guaranteed in hostile situation.
  > In during Kargil war in 1999, where Pakistani troops took the position in high mountains, one of the first things Indian military was trying to get their hands on was GPS data of the region.
 > GPS could have provided viral information but the US denied access to India.
- The experience at Kargil made nation realize the importance of indigenous navigation system and hence the idea of IRNSS began to take shape.
  > With help of IRNSS, India will become self reliant to keep a close watch on its boundaries and much more.

IRNSS:Navic

- Presently IRNSS constellation consist of 7 satellites
  (total 9 Launches, 1 failed in fairing stage, 1 during operational)
- Out of 7 satellites
  - 3 satellites in Geostationary orbit.
  - 4 satellites in Geosynchronous orbit with required inclination and equatorial crossing in two different planes
- All satellites (IRNSS 1A – 1G) of constellation are configured identically.
  - First satellite Launch – 2013
  - Lifetime of each satellite – 112 years
  - Precision – 20m for civilians
    10m for military

Comparison of IRNSS with other aps system					
Parameter	GPS	GLONASS	GALILEO	COMPASS/BEIDOU	IRNSS
1. COUNTRY	US	RUSSIA	EU	CHINA	INDIA
2. COVERAGE	GLOBAL	GLOBAL	GLOBAL	GLOBAL	REGIONAL
3. FIRST LAUNCH	1978	1982	2011	2000	2013
4. LIFE O SAT.	10 YEARS	10 YEARS	12 YEARS	12 YEARS	12 YEARS
5. PRECISION	5M	5-10 M	1M PUBLIC 1CM MILITARY	10 M PUBLIC 10 CM MILITARY	20 M PUBLIC 10 M MILITARY
6. NO. OF SAT.	31	24	40	35	07
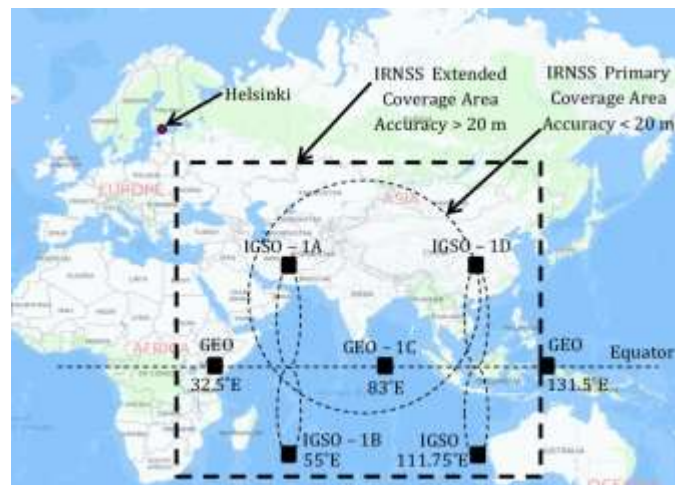
- Navic will provide accurate real-time positioning timing and services.
- It will cover India and a region extending 1500km around it with plans for further extension.
- The System at Present consists of a constellation of 7 satellites with 2 additional satellites on ground as stand by.
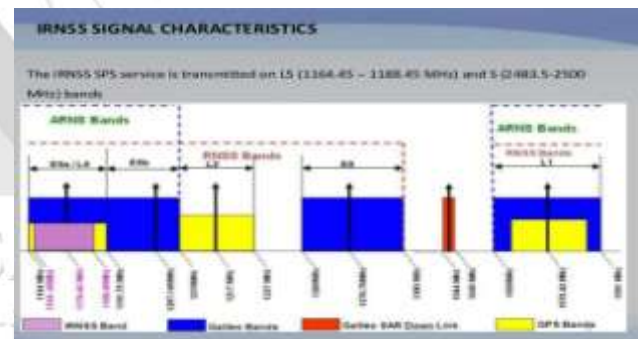
IRNSS will provide two types of services

- Standard positioning service (SPS) – Provided to all users.
- Restricted Services (Rs) – Encrypted service provided only to authorized users.

IRNSS Frequency bands –

IRNSS (sps) – LS (1164.45 – 1188.45 MHZ)

S (2483.5 – 2500 MHz)