SNS COLLEGE OF TECHNOLOGY

AN AUTONOMOUS INSTITUITION

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COIMBATORE

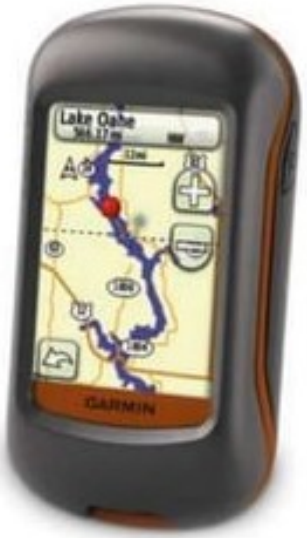
DEPARTMENT OF CIVIL ENGINEERING

19CEB205 -SURVEYING

II YEAR / III SEMESTER

UNIT 5 : GPS SURVEYING

GLOBAL POSITIONING SYSTEM



GLOBAL POSITIONING SYSTEM

- World wide radio navigation system
- Formed from a constellation of 24 satellites and their ground stations.
- GPS uses satellites as reference point to calculate positions in meters and also CM
- GPS plays a vital in cars, boats, planes, construction equipments, movie making gears, farm machinery, even laptop computers, phones etc.....

GLOBAL POSITIONING SYSTEM

BASIC CONCEPTS OF GPS

- Trilateration from satellites.
- Relative positions of objects using the geometry of triangles.
- GPS receiver measure distance using the travel time of radio signals.
- Used atomic clock to achieve Accurate timing.
- Along with distance the exact location of the satellites in space must be known.

DIFFERENT SEGMENTS OF GPS

- Space segments
- Control segments
- User segments

Space segment

Deal with GPS satellites system

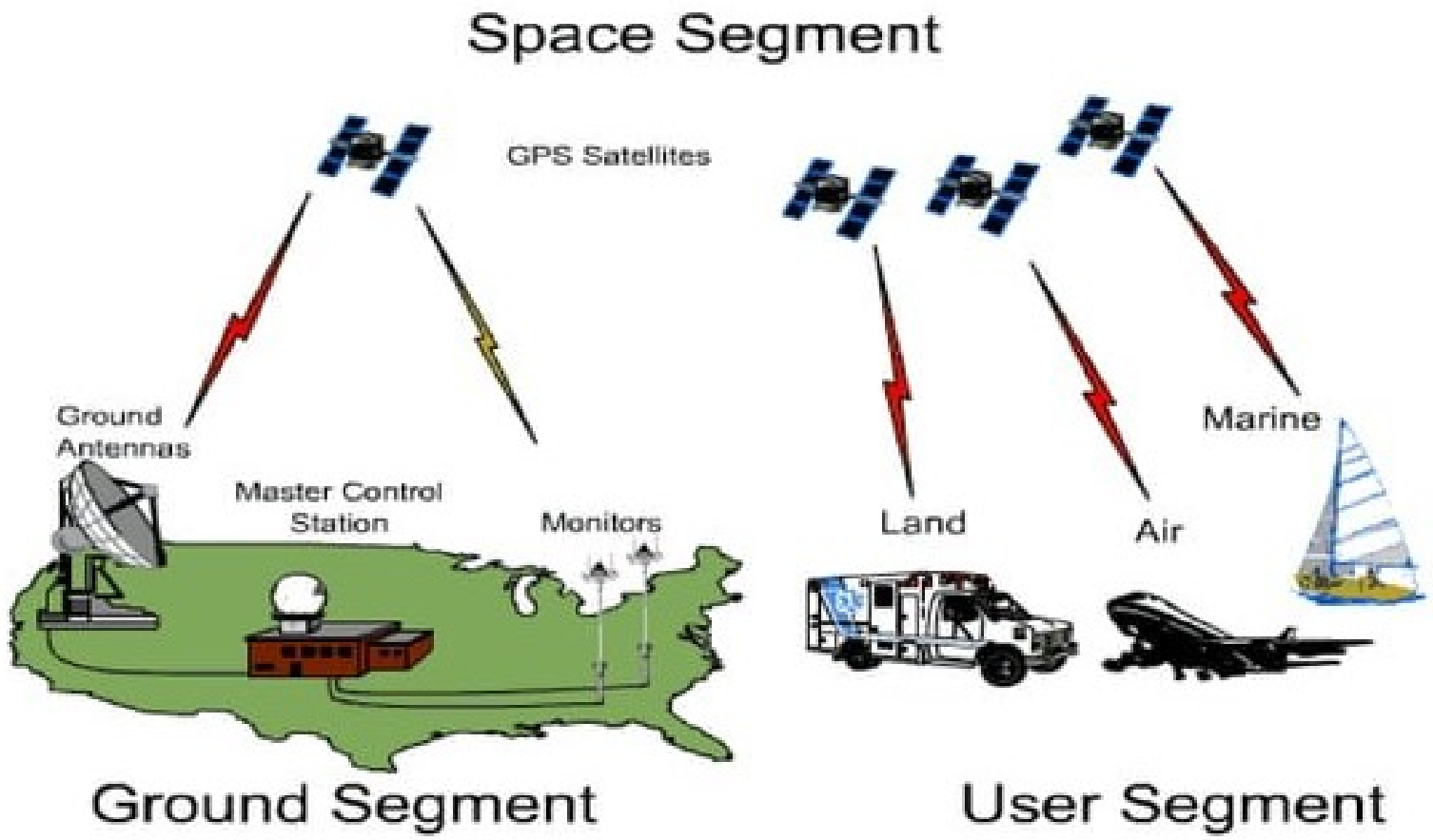
Control segment

Ground based time & orbit control predication

User segments

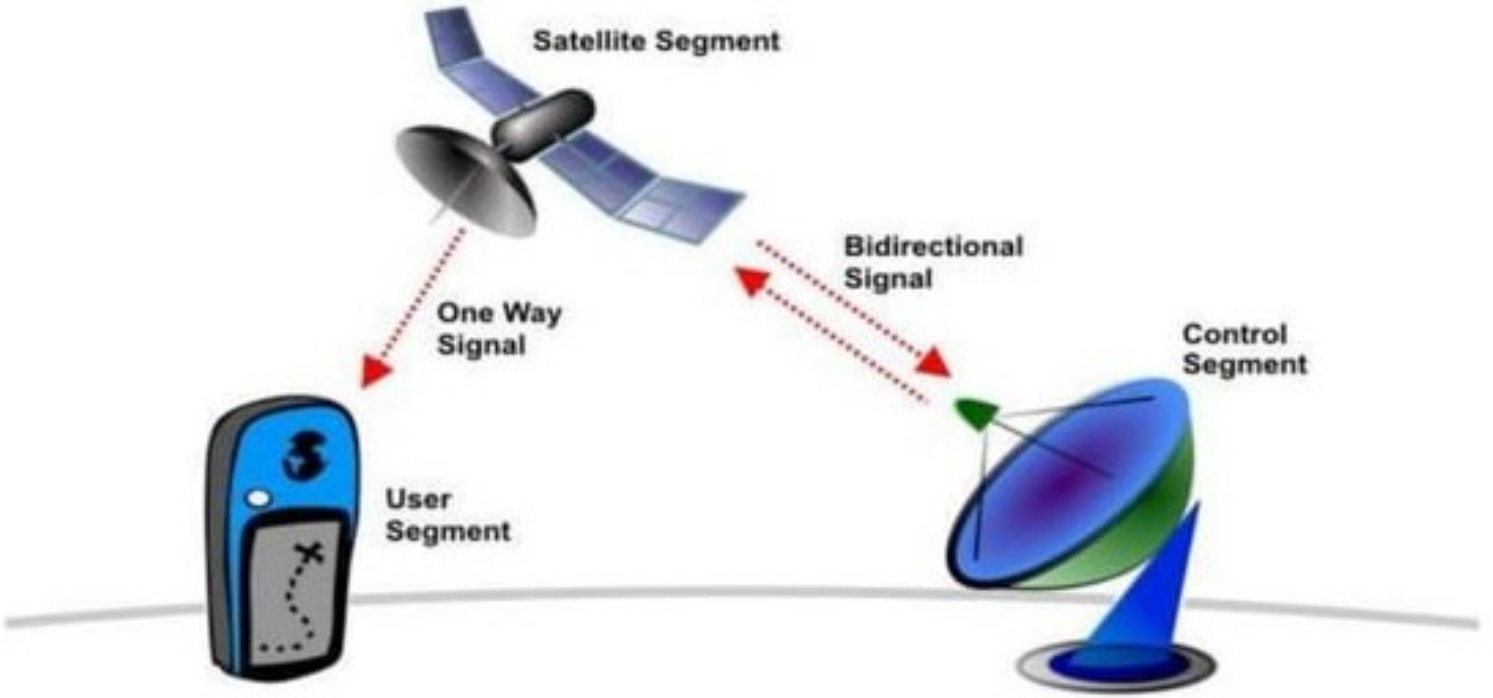
Types of existing GPS receiver and its applications

DIFFERENT SEGMENTS OF GPS

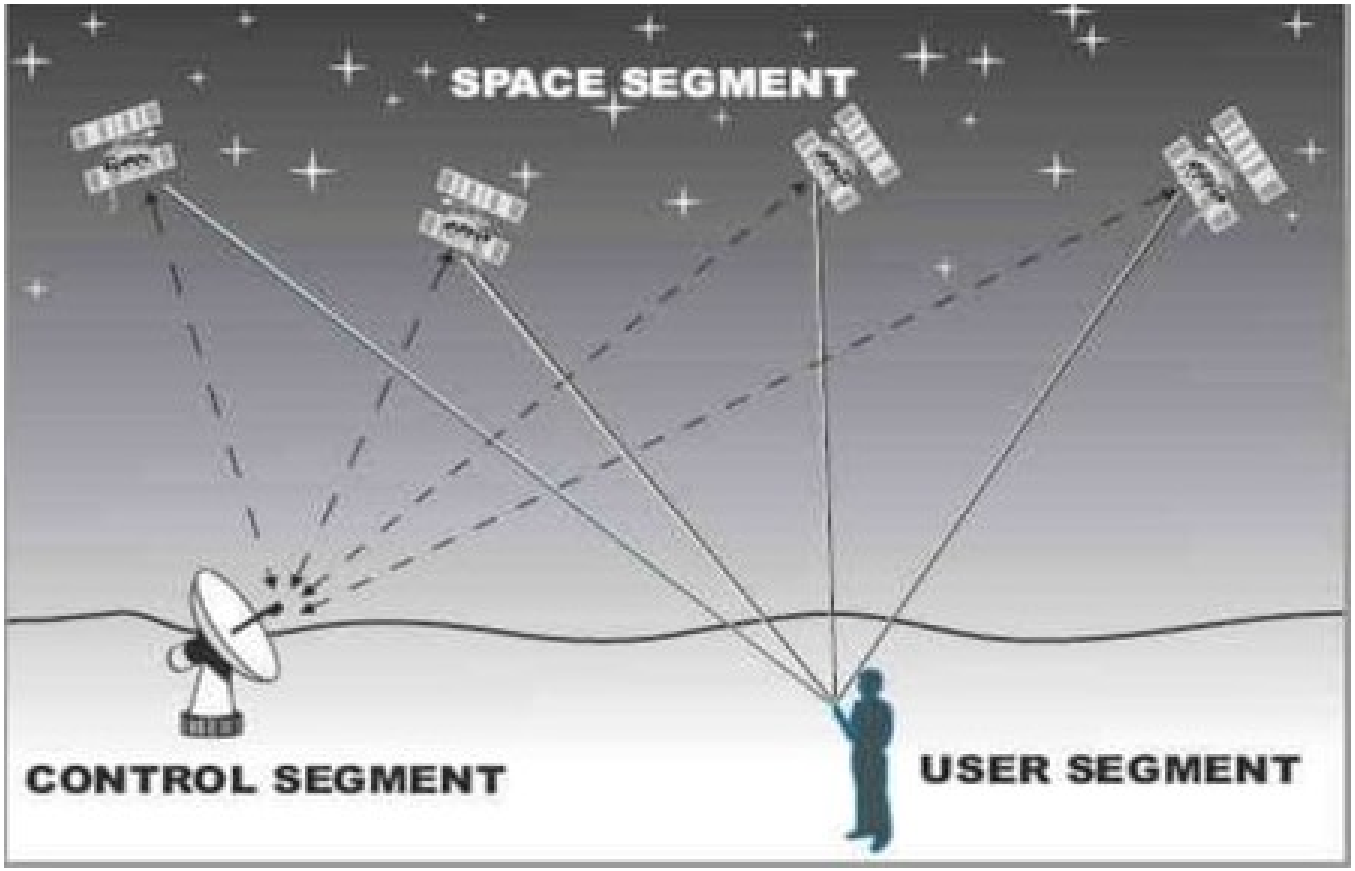


DIFFERENT SEGMENTS OF GPS

- Different segments



DIFFERENT SEGMENTS OF GPS



DIFFERENT SEGMENTS OF GPS

SEGMENT	INPUT	FUNCTION	OUTPUT
Space	Navigation message	Generate Transmit code Carrier phase Navigation message	P-Code C/A-Code L1,L2 Carrier Navigation message
Control	P-Code operation time	Produce GPS time predict Ephemer is manage space vehicles	Navigation message
User	Code operation carrier phase operation navigation message	Navigation solution surveying solution	Position velocity time

SPACE SEGMENT

- Consists of 21 GPS Satellites with an addition of 3 active spares
- Placed in almost 6 circular orbits with an inclination of 55 degree
- Orbit height 20200km corresponding to about 26600km from the semi major axis.
- Normal orbit period is 12Hrs.

SPACE SEGMENT

- 24 hours global navigation and time determination capacity
- Each satellite send a full description of its own orbit and an approximate guide to orbits of other satellites
- Location of a satellites are established by their own orbit data
- Transmitted also health of satellites, parameter for propagation, error correction Etc....

SPACE SEGMENT

GPS satellites divided into 3 types

1. Block 1-1 to 11-1978 to 1985 - 5 years - development purpose
2. Block 11-28-1989-5 to 7 years - production satellite
3. Block 11R - 20 satellites-Spare

CONTROL SEGMENT

- Vital link in GPS technology.
- Monitoring and controlling the satellite system continuously
- Determine GPS system time
- Predict the satellite ephemeris and behaviour of each satellite clock
- Update periodically the navigation message for each particular satellite

CONTROL SEGMENT

Its consists of

1. Master Control Station (MCS)
2. Several Monitor Station (MS)
3. Ground Antennas (GA) (All our world)
4. Operation Control Segments (OCS)

CONTROL SEGMENT

- MCA located in Colorado (USA)
- 3 MS and GA- Kwajalein, Ascension and Diego Garcia
- 2 MS in Colorado and Hawaii
- Monitor station receives all visible satellite signals by using antennas.
- Antennas are contacted to satellite at least 3times per day automatically.

USER SEGMENT

- Ground station equipments consists of an antenna and a receiver for surveying purpose.
- In small unit(work) using poles and large unit using tripod over a control station.
- Transmitted signals are received by the antenna, processed electronically and passed by the cable to the receiver where microprocessor reduces the data.

USER SEGMENT

Method of establish the distance b/n the satellite and receiver

1. Pseudo-range
2. Carrier phase measurement method.

PSUEDO-RANGE METHOD

- Distance measurement is depends upon accurate time measurement and precise synchronization of clock in both satellite and receivers.
- Its almost impossible to achieve the technique is known as Psuedo-range.
- Satellite continuously transmits its code at every milliseconds.

PSUEDO-RANGE METHOD

- Due to the travel of signal the receiver received the code delay and its converted into a distance by multiplying by the speed of lights
- Due to the atmosphere the error will be occurred in speed of light

CARRIER PHASE MEASUREMENT METHOD

- Similar to the operational of EDM
- Problem creating by two clock
- To prevent this problem by taking two reading satellite by simultaneously and operation by single satellite by two station.

TYPES OF GPS

1. **Absolute positioning**

   Single receiver station -50 to 100m accuracy

2. **Differential or Relative positioning (DGPS)**

   Two receiver station - 0.5 to 5m accuracy

3. **Real-time kinetic float (RTK float)**

   More precise-Dual receiver-20cm to 1m accuracy

4. **Real-time kinematic fixed (RTK fixed)**

   Dual receiver- 7 to 5cm - very accurate

SIGNAL STRUCTURE

- One way ranging system
- Distance is calculated through the knowledge of signal propagation velocity
- Clock readings at transmitted and receiver antennas are compared
- Two clocks are not strictly synchronized
- The observed signal travel time is biased with systematic synchronization error

SIGNAL STRUCTURE

- Biased ranges are known as pseudoranges
- Need four pseudoranges are necessary to determine X,Y and Z coordinates of user antenna and clock bias.
- Used two different codes p and C/A
- P means Precision C/A means Clear/Acquisition
- Satellite have highly precise oscillators with a fundamental
- frequency of 10.23 MHz. It consists of 3 components.

THREE COMPONENTS

1. Two micro wave L-band (carrier) waves

LI carrier: 1574.42 MHz

L2 carrier: 1227.60 MHz

2. Ranging codes modulated on the carrier waves

C/A code modulated at 1.023MHz

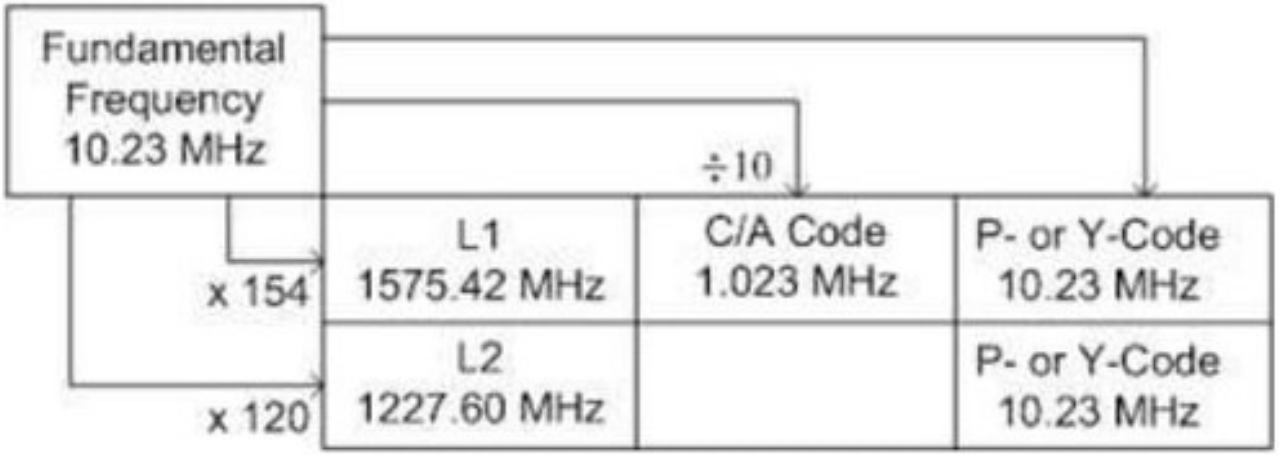
Degraded code for civilian users modulated on L1

P(Y) code modulated at 10.23 MHz

Authorized military users used both L1 and L2

3. Navigation message

Modulated on both L1 and L2 and contains satellite positions and constants.



SIGNAL STRUCTURE