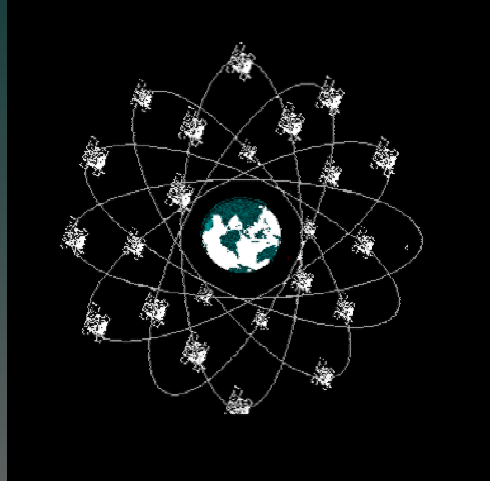
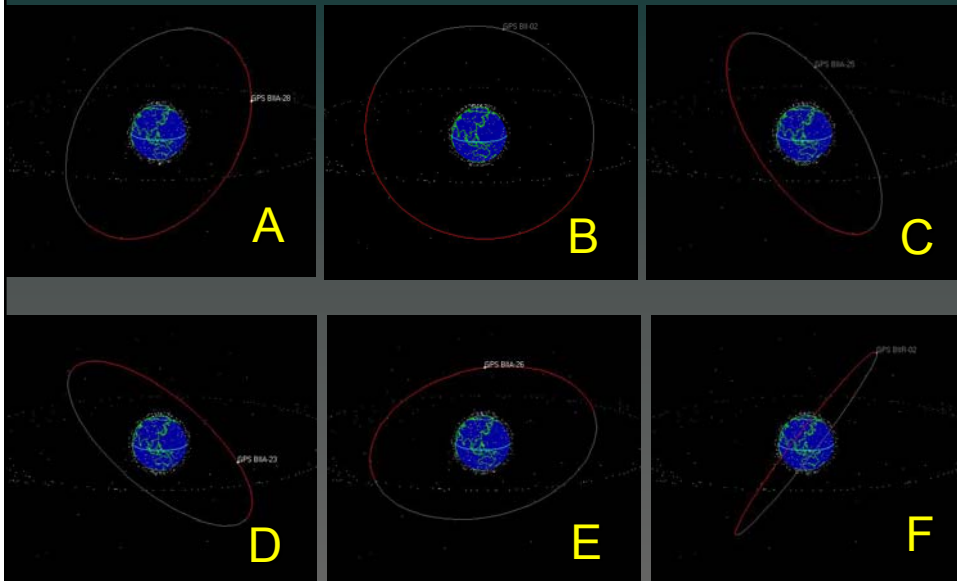


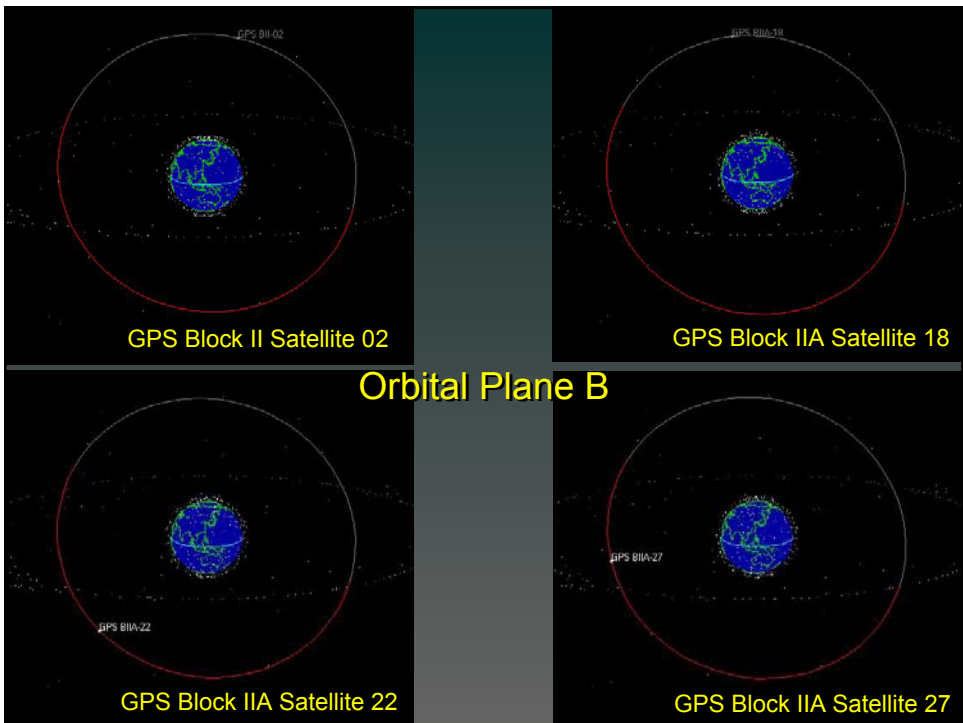
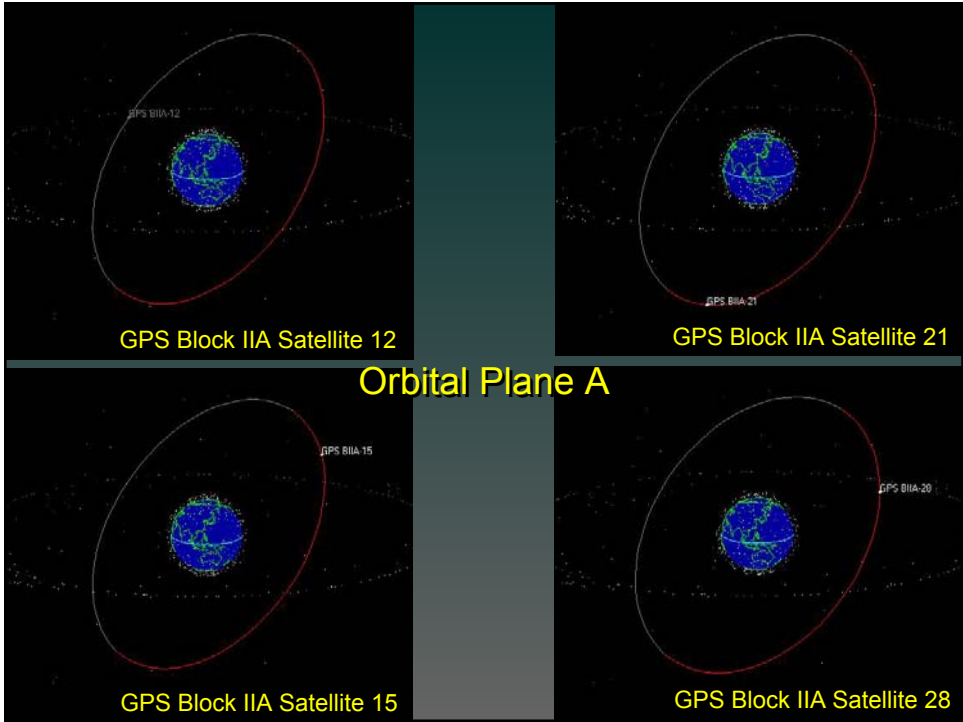
Space Segment

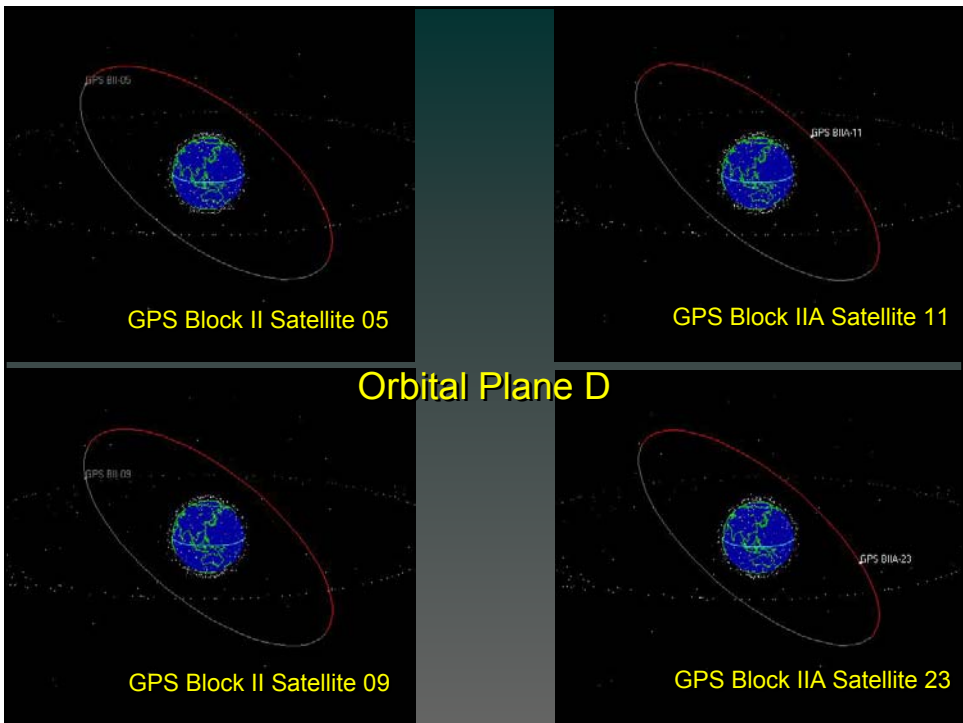
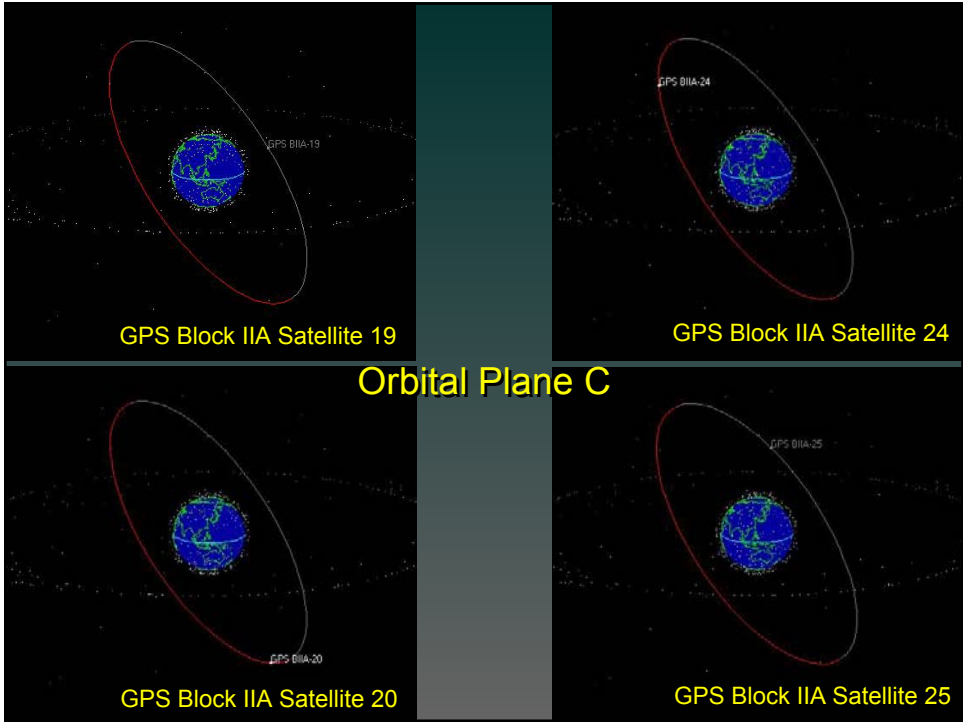
- Satellite orbits:
 - GPS satellites are in one of 6 orbital planes
 - 4 satellites are in each plane

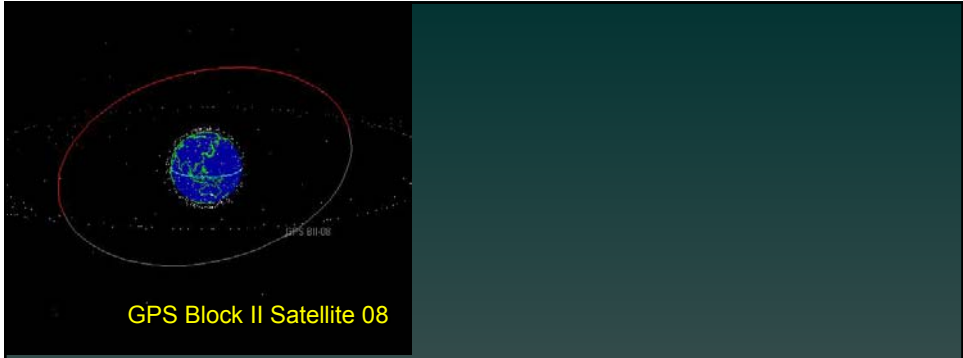


Orbital Planes

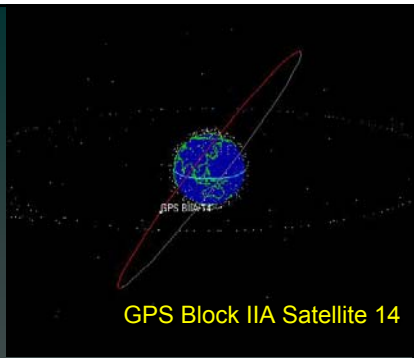
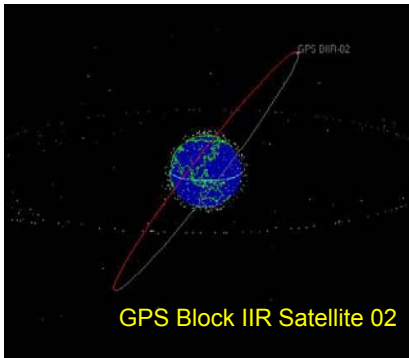
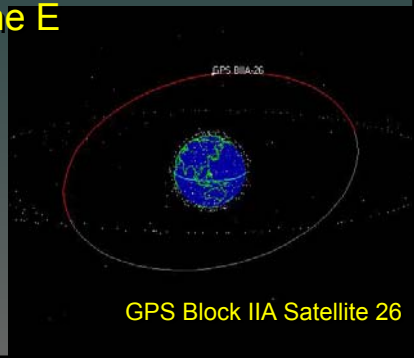
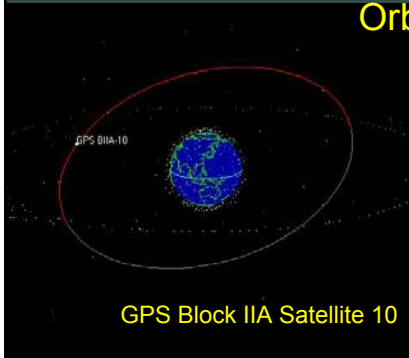




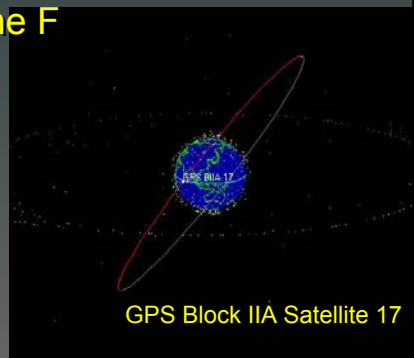
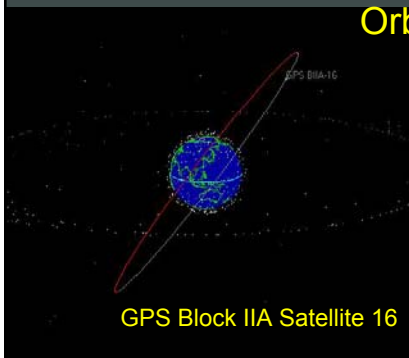




Orbital Plane E

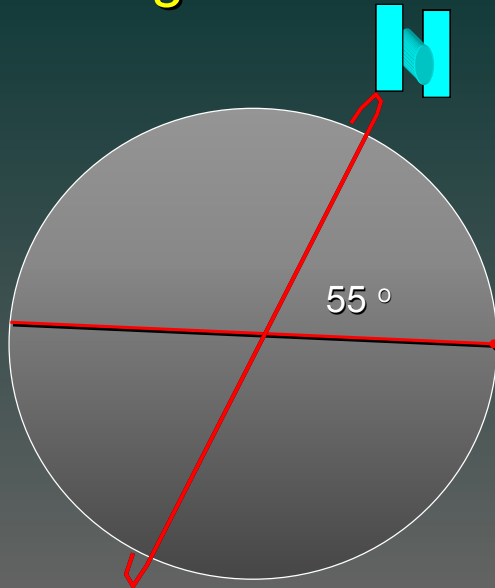


Orbital Plane F



Space Segment

- Satellite orbits:
 - Each orbital plane is inclined 55 degrees with respect to the equator



Space Segment

- NOTE about identifying satellites:
 - satellite signals are broadcast in pseudorandom noise codes
 - individual satellites are identified by their Pseudo Random Number or PRN

<http://www.schriever.af.mil/GPS/>

UNCLASSIFIED
GPS OPERATIONAL ADVISORY 015.OA1
SUBJ: GPS STATUS 15 Jan 2002

1. SATELLITES, PLANES, AND CLOCKS (CS=CESIUM RB=RUBIDIUM):

A. BLOCK I : NONE

B. BLOCK II: PRNS 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15
PLANE : SLOT F4, B3, C2, D4, B4, C1, C4, A3, A1, E3, D2, F3, F1, D5
CLOCK : CS, CS, CS, RB, CS, CS, RB, RB, CS, CS, RB, RB, RB, CS

BLOCK II: PRNS 17, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31
PLANE : SLOT D3, E4 E1, E2, B1, E5, D1, A2, F2, A4, B5, F5, B2, C3
CLOCK : RB, RB, RB, CS, RB, CS, CS, CS, RB, CS, RB, RB, RB, CS

<http://www.schriever.af.mil/GPS/>

UNCLASSIFIED
GPS OPERATIONAL ADVISORY 015.OA1
SUBJ: GPS STATUS 15 Jan 2002

2. CURRENT ADVISORIES AND FORECASTS :

A. FORECASTS: FOR SEVEN DAYS AFTER EVENT CONCLUDES.
NANU MSG DATE/TIME PRN TYPE SUMMARY (JDAY/ZULU TIME START - STOP)

| | | | | | |
|---------|---------|----------|----|-----------|-------------------|
| 2001154 | 110026Z | DEC 2001 | 17 | FCSTMX | 352/0030-352/1230 |
| 2001158 | 131458Z | DEC 2001 | 29 | FCSTDV | 354/0500-354/1700 |
| 2001159 | 131743Z | DEC 2001 | 29 | FCSTRESCD | 354/0500-355/0500 |
| 2001160 | 180510Z | DEC 2001 | 17 | FCSTSUMM | 352/0037-352/0458 |
| 2001161 | 201223Z | DEC 2001 | 29 | FCSTSUMM | 354/0511-354/1213 |
| 2001164 | 271524Z | DEC 2001 | 04 | FCSTMX | 004/2045-005/0845 |
| 2002001 | 032038Z | JAN 2002 | 04 | FCSTCANC | 004/2045-/ |
| 2002002 | 032049Z | JAN 2002 | 21 | FCSTMX | 010/0600-010/1800 |
| 2002005 | 032115Z | JAN 2002 | 11 | FCSTMX | 008/0430-008/1630 |
| 2002008 | 080754Z | JAN 2002 | 11 | FCSTSUMM | 007/0521-007/0749 |
| 2002010 | 082200Z | JAN 2002 | 26 | FCSTDV | 015/0515-015/1715 |
| 2002011 | 101219Z | JAN 2002 | 21 | FCSTSUMM | 010/0615-010/1218 |
| 2002012 | 101357Z | JAN 2002 | 08 | FCSTMX | 016/1445-017/0245 |
| 2002014 | 151242Z | JAN 2002 | 26 | FCSTSUMM | 015/0539-015/1226 |

B. ADVISORIES:

NANU MSG DATE/TIME PRN TYPE SUMMARY (JDAY/ZULU TIME START - STOP)

| | | | | | |
|---------|---------|----------|----|----------|-------------------|
| 2001155 | 111600Z | DEC 2001 | 13 | UNUSUFN | 345/1538-/ |
| 2001156 | 112303Z | DEC 2001 | 13 | UNUSABLE | 345/1538-345/2302 |
| 2001162 | 221951Z | DEC 2001 | 28 | UNUSUFN | 356/1921-/ |
| 2001163 | 230054Z | DEC 2001 | 28 | UNUSABLE | 356/1921-357/0040 |
| 2001165 | 311811Z | DEC 2001 | 24 | UNUSUFN | 365/1803-/ |
| 2002003 | 032052Z | JAN 2002 | 23 | UNUSUFN | 007/1900-/ |
| 2002006 | 071527Z | JAN 2002 | 24 | UNUSABLE | 365/1803-007/1519 |
| 2002013 | 142217Z | JAN 2002 | 23 | UNUSABLE | 007/1900-014/2206 |

C. GENERAL:

NANU MSG DATE/TIME PRN TYPE SUMMARY (JDAY/ZULU TIME START - STOP)

To ""Nanu@nislist.navcen.uscg.mil"" <Nanu@nislist.navcen.uscg.mil>

NOTICE ADVISORY TO NAVSTAR USERS (NANU) 2002014
SUBJ SVN26 (PRN26) FORECAST OUTAGE SUMMARY JDAY 015/0539 - JDAY 015/1226

1. NANU TYPE FCSTSUMM
NANU NUMBER 2002014
NANU DTG 151242Z Jan 2002
REFERENCE NANU 2002010
REF NANU DTG 082200Z JAN 2002
SVN 26
PRN 26
START JDAY 015
START TIME ZULU 0539
START CALENDAR DATE 15 JAN 2002
STOP JDAY 015
STOP TIME ZULU 1226
STOP CALENDAR DATE 15 JAN 2002
2. CONDITION GPS SATELLITE SVN26 (PRN26) WAS UNUSABLE ON JDAY 015
(15 JAN 2002) BEGINNING 0539 ZULU UNTIL JDAY 015 (15 JAN 2002)
ENDING 1226 ZULU.
3. POC CIVILIAN - NAVCEN AT (703)313-5900, [HTTP://WWW.NAVCEN.USCG.GOV](http://www.navcen.uscg.gov)
MILITARY - CAPT HERB KNIERIM, 2 SOPS NAVIGATION ANALYST, DSN 560-6614,
COMM 719-567-6614, GPS@SCHRIEVER.AF.MIL, [HTTP://WWW.SCHRIEVER.AF.MIL/GPS](http://www.schriever.af.mil/gps)

Space Segment

- Satellites:
 - the key to GPS is precise timing
 - 4 atomic clocks are onboard the Block II/IIA satellites
 - 2 Cesium, 2 Rubidium
 - 3 atomic clocks are onboard the Block IIR satellites
 - 3 Rubidium

Space Segment

- Satellites:
 - contain computers, transmitters, receivers
 - powered by solar panels and batteries
 - contain attitude control systems
 - contain additional sensors
 - contain fuel for stationkeeping maneuvers

Space Segment

- Satellite Signals:
 - satellites broadcast their position and timing signals on two radio frequencies
 - L1 - 1575.42 MHz
 - L2 - 1227.60 MHz
 - signals (traveling at speed of light) take about 0.06 seconds to reach earth

Space Segment

- Satellite Signals:
 - satellite signals are broadcast in pseudorandom noise codes
 - the codes are a repeating sequence of data
 - codes contain timing and position information
 - C/A or Coarse / Acquisition Code
 - Standard Positioning Service
 - 1.023 Mbits/sec, period = 1 msec
 - unclassified - for civilian use

Space Segment

- Satellite Signals:
 - P code
 - Precise Positioning Service
 - 10.23 Mbits/sec
 - period = 267 days
 - unclassified
 - Y code
 - military encrypts the P code to form the Y code

Space Segment

- Satellite Signals:
 - L1 frequency carries two codes:
 - Standard Positioning Service - C/A Code
 - Precise Positioning Service - P code
 - L2 frequency only carries P code

Space Segment

- Planned Satellite Signals:
 - L2 frequency will be upgraded beginning in 2003
 - the L2C frequency - L2 Civilian
 - will give civilians more accuracy in harsher environments
 - indoors (E911), in forested areas, etc.
 - L5 frequency will also begin use in future
 - for military and aerospace navigation applications

Space Segment

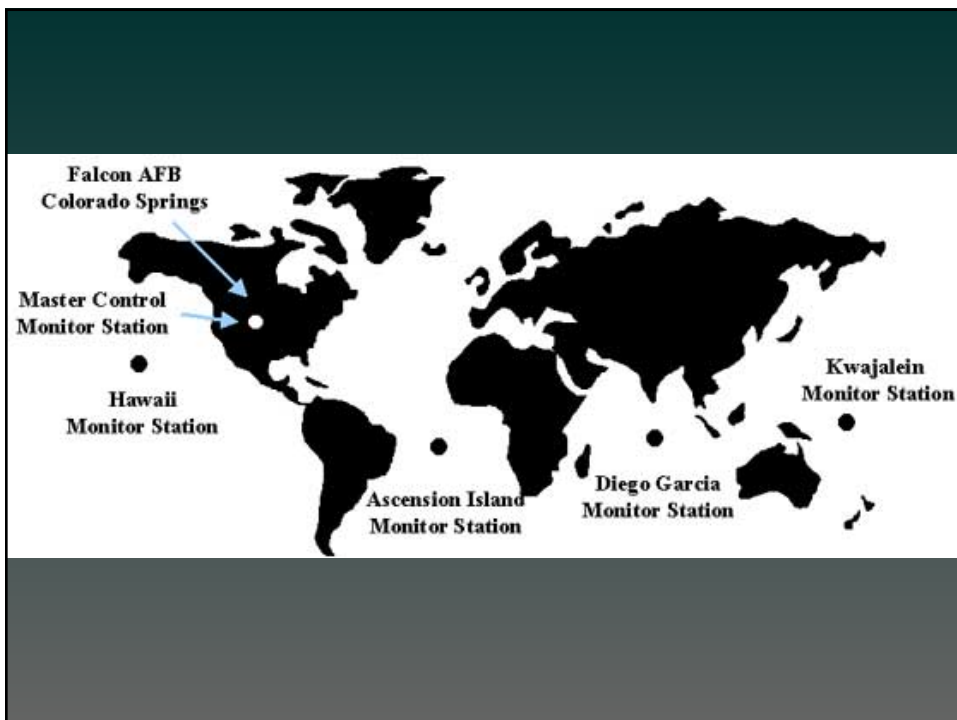
- Satellite Signals:
 - satellite signals must have a direct line of travel to the GPS receiver
 - signals cannot penetrate water, soil, structure walls, etc.
 - heavy forest canopy affects GPS performance
 - water, structures, etc. also deflects signals

GLONASS

- Russian positioning system:
 - consists of 24 satellites
 - 3 orbital planes
 - orbits are inclined at 64.8 degree angle
 - uses same codes for each satellite
 - uses many frequencies

Control Segment

- Control segment consists of ground control and monitoring stations:
 - 1 Master control is at Falcon Air Force Base in Colorado Springs, CO
 - calculates satellite paths and clock correction coefficients
 - 4 Monitoring stations (Hawaii, Ascension Island, Diego Garcia, Kwajalein)
 - track satellites continuously and provide data to master control station
 - 3 Upload stations transmit satellite path and clock correction data to satellites 2 times each day



Control Segment

- Control segment responsible for:
 - monitoring health of satellites
 - fuel, power, etc.
 - monitor orbits of satellites
 - determine when and where Delta-V maneuvers are required to trim the orbits
 - upload navigation messages for broadcast
 - satellite almanac, clock corrections