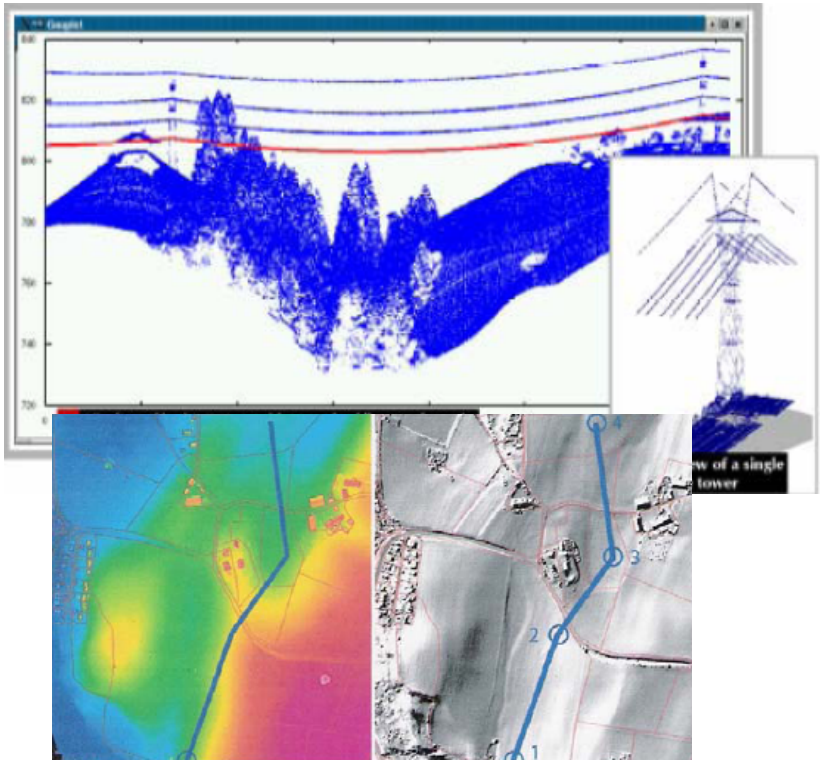
Special Services (LIDAR in Powerline Industry)

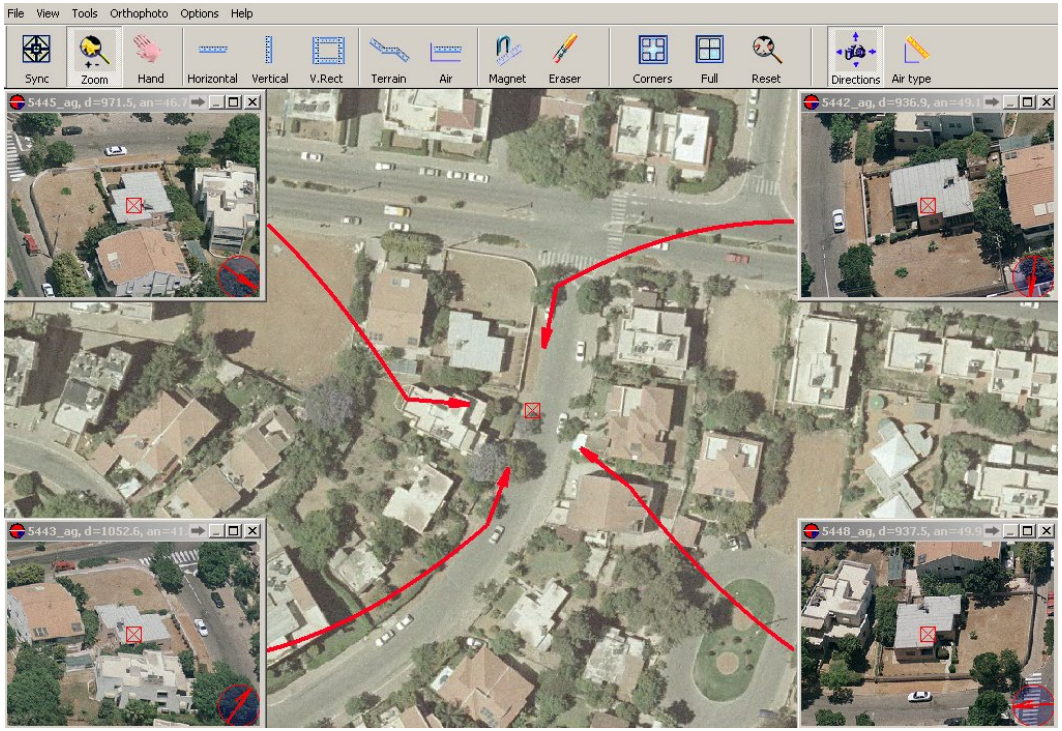


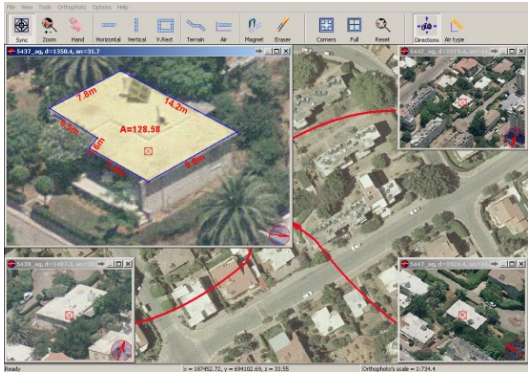
1. **Acquisition** of terrain elevation in the power line corridor
2. **Mapping** of vegetation, land use and infrastructure
3. **Creation** of power line information and maintenance systems
4. **2D and 3D** presentation of power line pylons
5. **Determination** of pylons centers and suspensions points
6. **Vectorisation** of power lines
7. **Determination** of the clearance between vegetation and power line
8. **Creation** of vegetation maintenance and management plans
9. **Overlaying** with additional geoinformation

Oblique Photogrammetric Solution

Oblique Photogrammetric Solution (OPS) is a software program that provides a dynamic lateral viewing with the added features of measurement.

In contrast to a map or an Orthophoto where viewing is limited from above and measuring is limited on the horizontal surface of the ground, OPS enables the display and measurement of objects on the ground, from various angles and directions. The horizontal viewing which OPS solves is the convenient angle to which we are all accustomed.

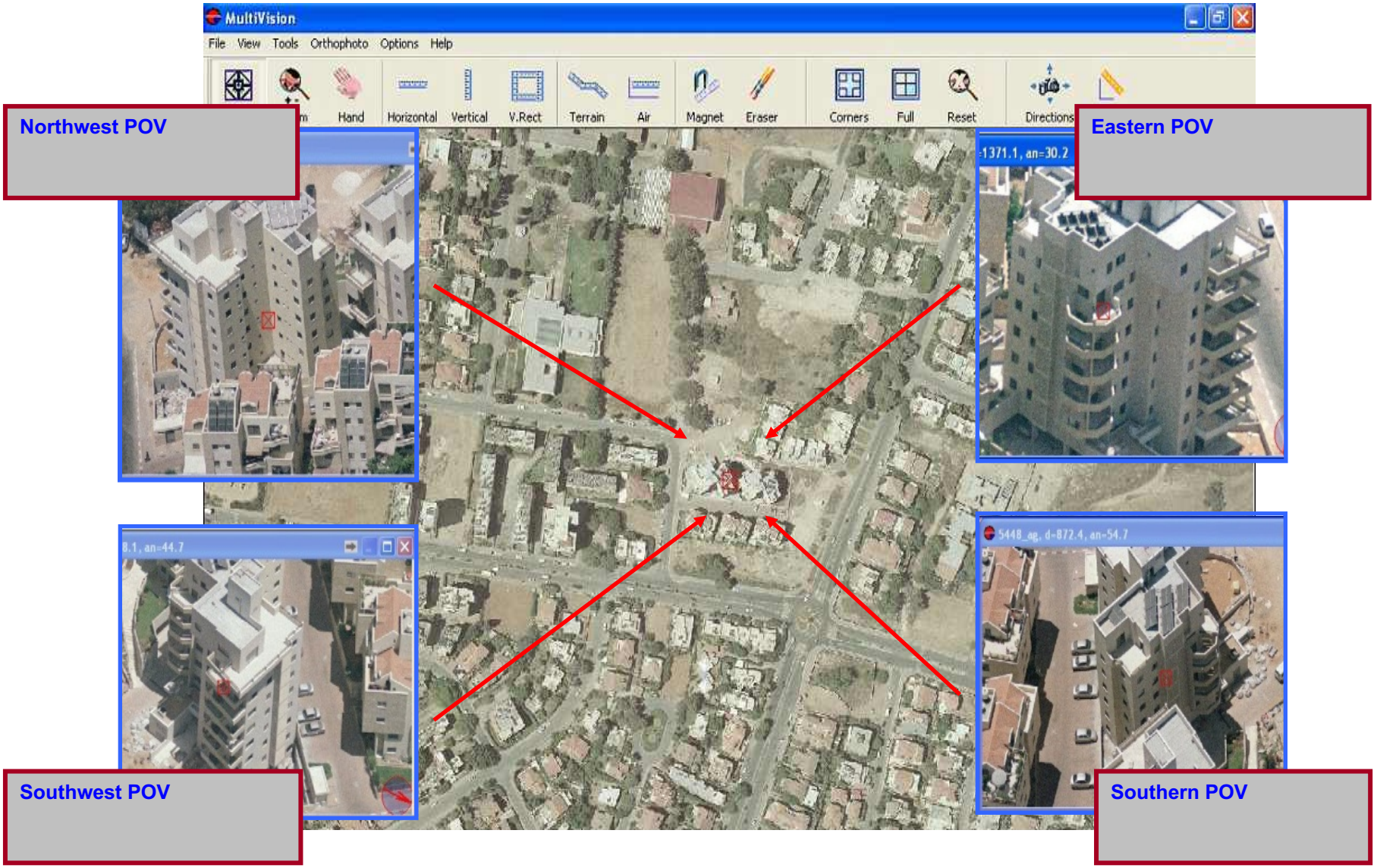




Measurement

GIS Integration

Special Services involving Aerial Survey



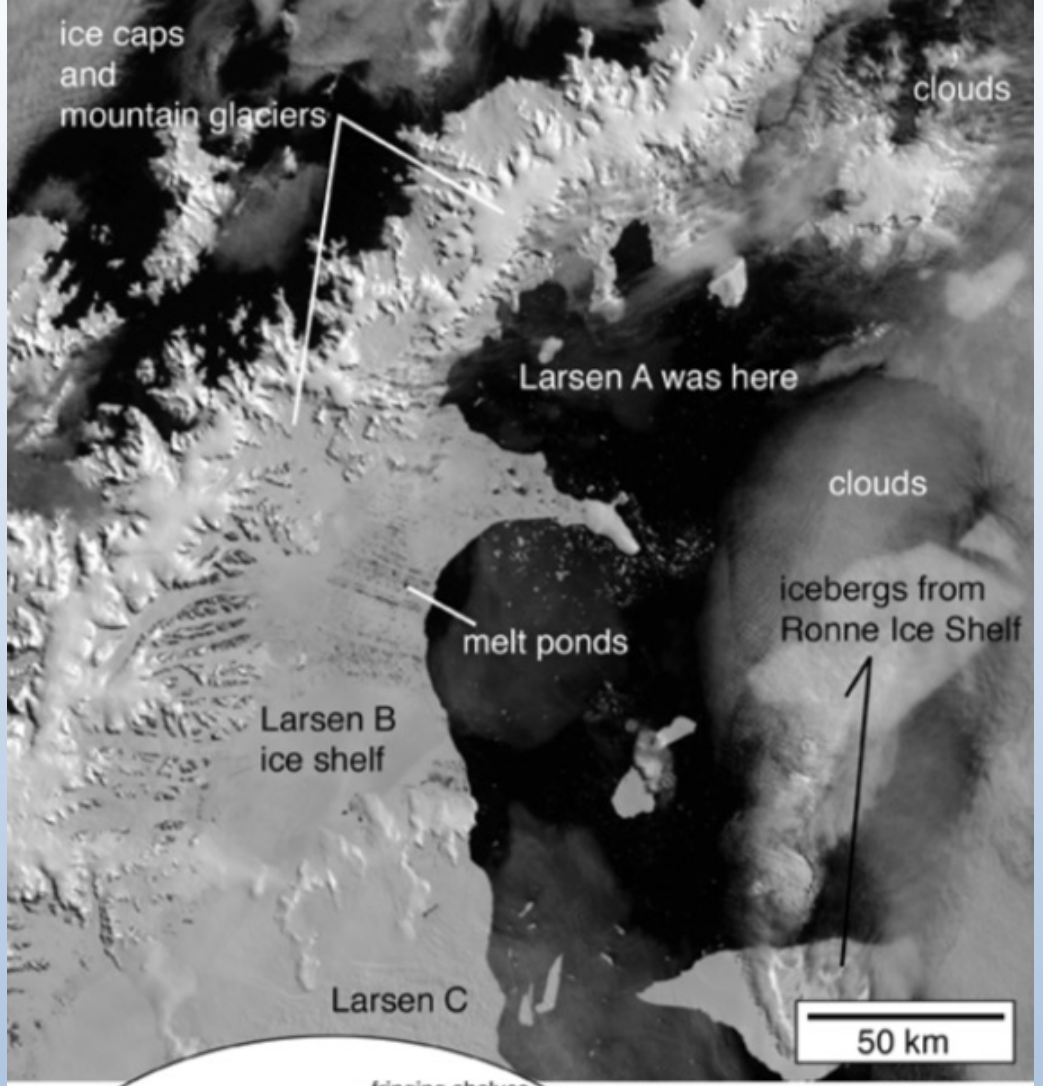
Oblique Photogrammetric Solution (OPS)

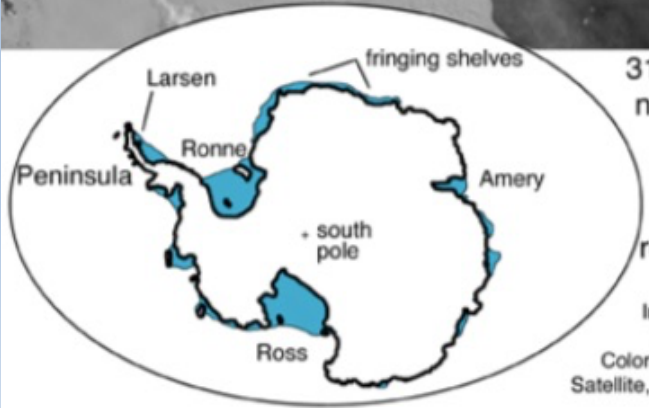
Drones – UAV (Unmanned Aerial Vehicle)

Value of aerial/space photography in disaster assessment

- Data often needed in a very timely fashion to aid in relief efforts – airplanes can be deployed very quickly and precisely
- High resolution spaceborne data can provide information in very remote regions
- Scale of damage requires high resolution imaging capability provided by camera systems

Antartic ice sheet disintegration

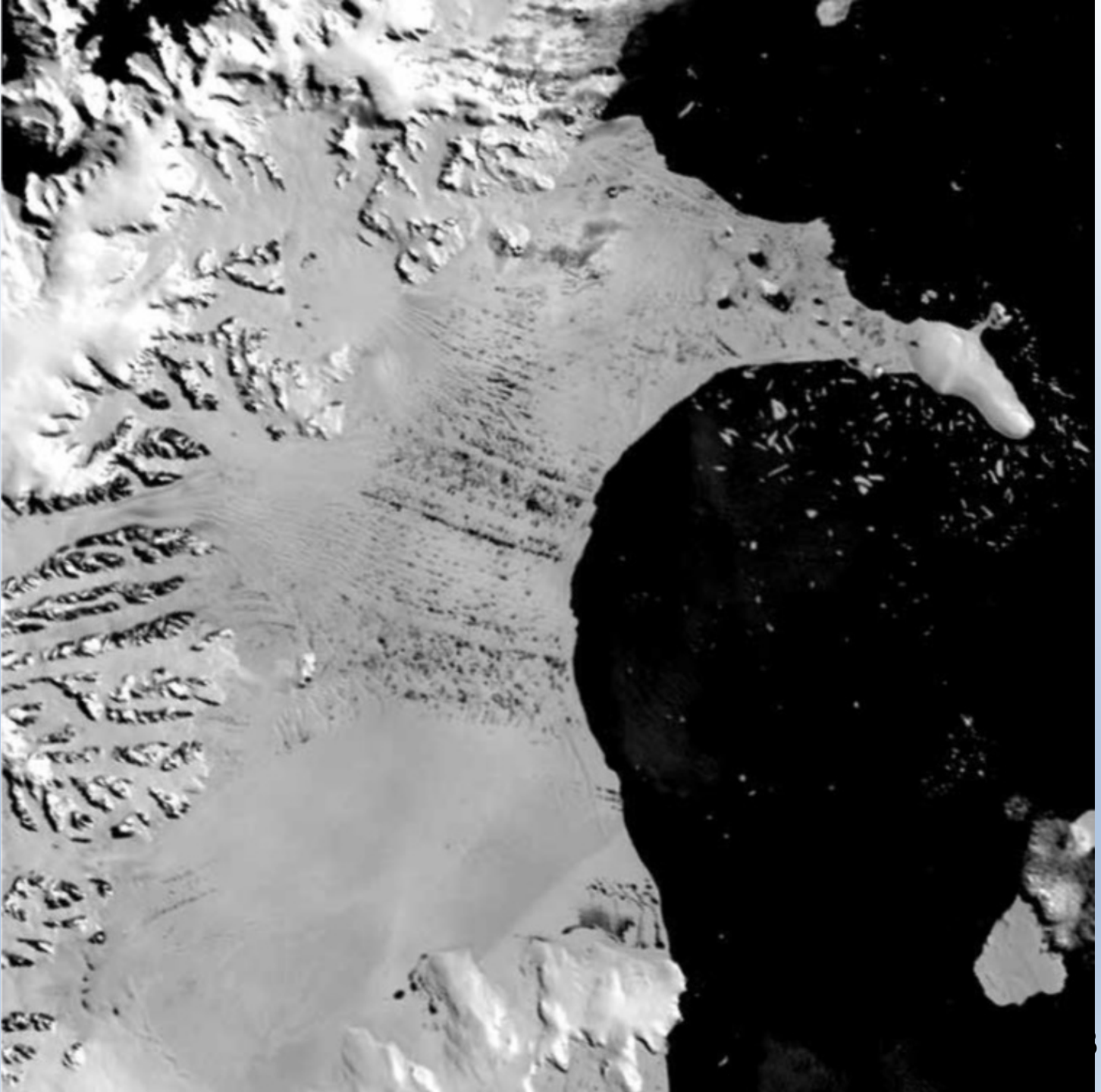




31 January 2002 image of the northeast Antarctic Peninsula

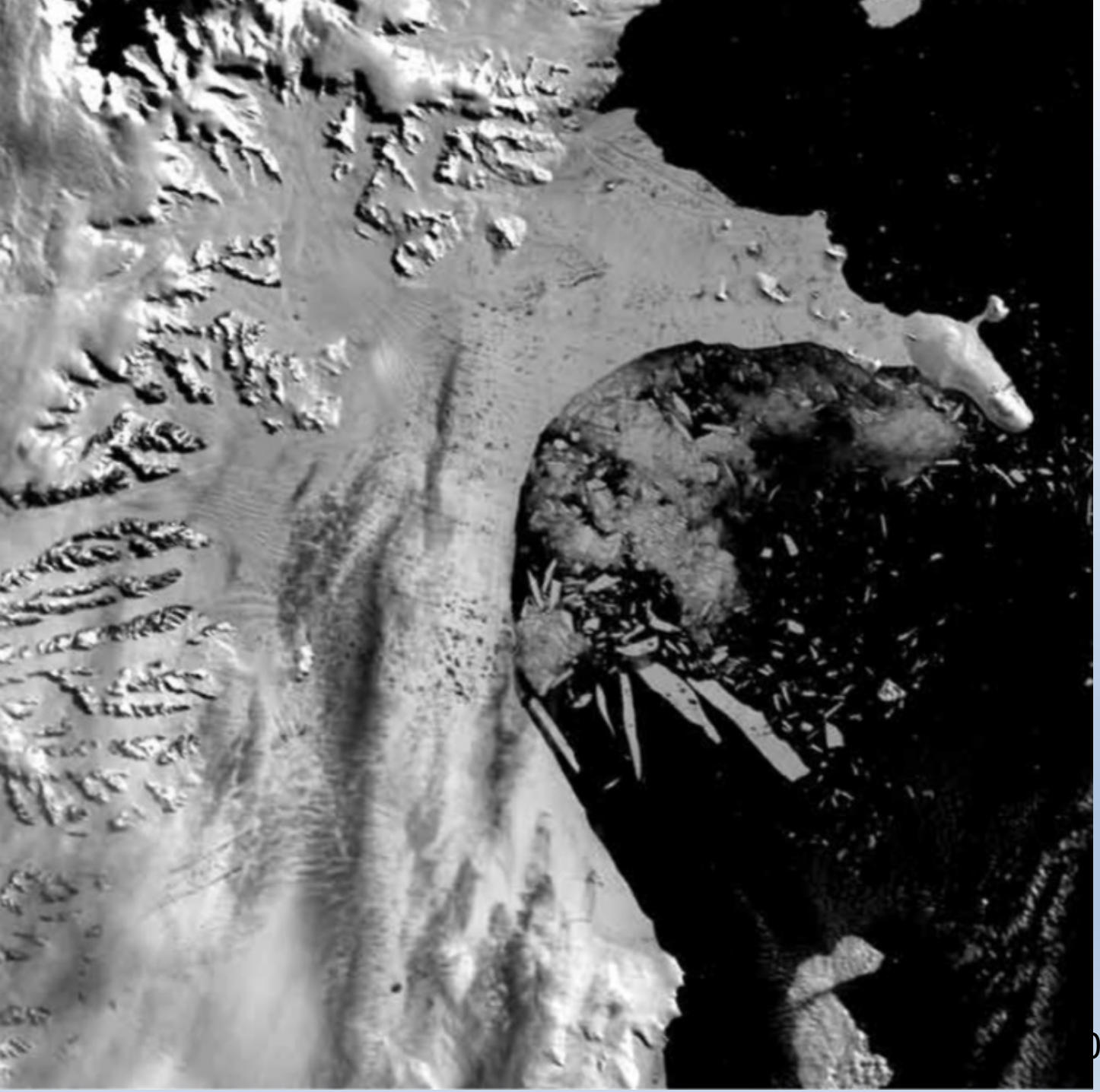
The Peninsula's fringing ice shelves are retreating, in response to recent warming.

Image courtesy of Ted Scambos, National Snow and Ice Data Center, University of Colorado. Data from MODIS, on NASA's Terra Satellite, via the Distributed Active Archive Center

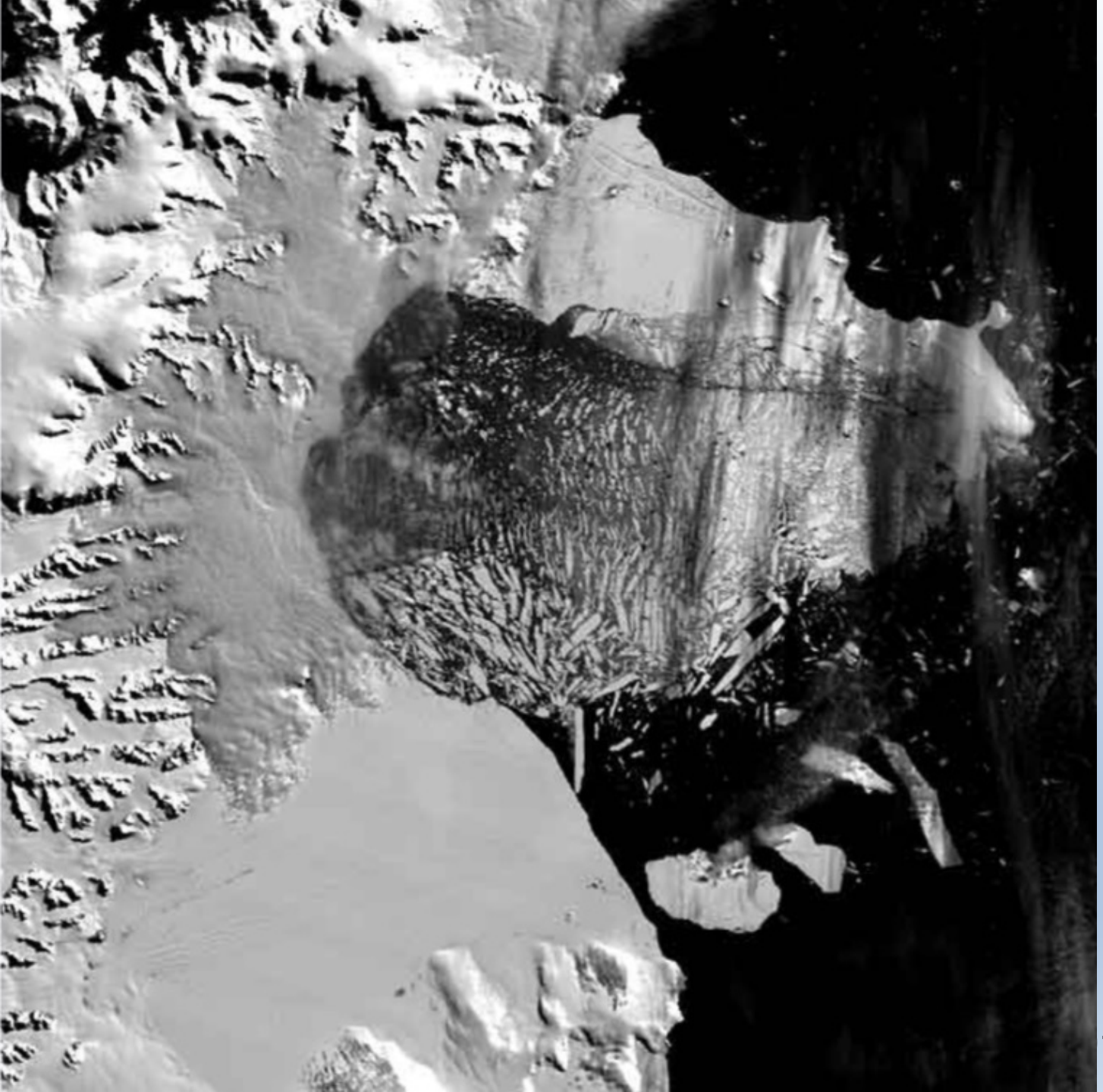


31 Jan 2002

17 Feb 2002



23 Feb 2002



5 Mar 2002

1

GNSS

(European GSA Agency 2017)

Global Navigation Satellite System (GNSS) refers to a constellation of satellites providing signals from space that transmit positioning and timing data to GNSS receivers. The receivers then use this data to determine location.

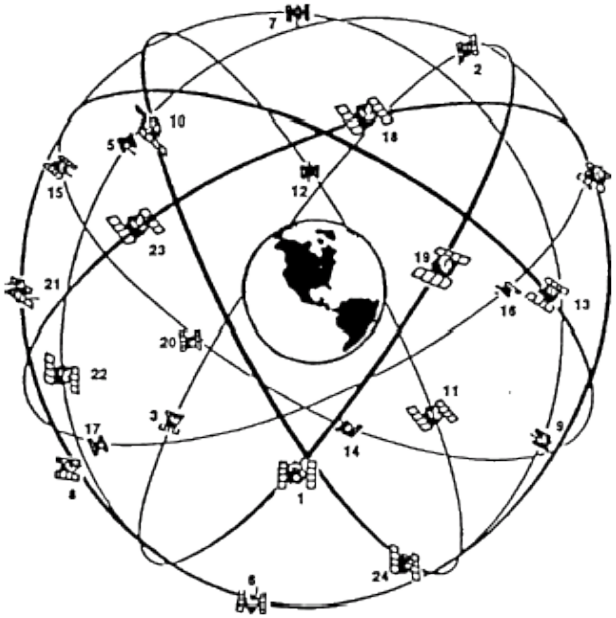
GNSS

(European GSA Agency 2017)

By definition, GNSS provides global coverage. Examples of GNSS include Europe's Galileo, the USA's NAVSTAR Global Positioning System (GPS), Russia's Global'naya Navigatsionnaya Sputnikovaya Sistema (GLONASS) and China's BeiDou Navigation Satellite System.

GPS

GLONASS



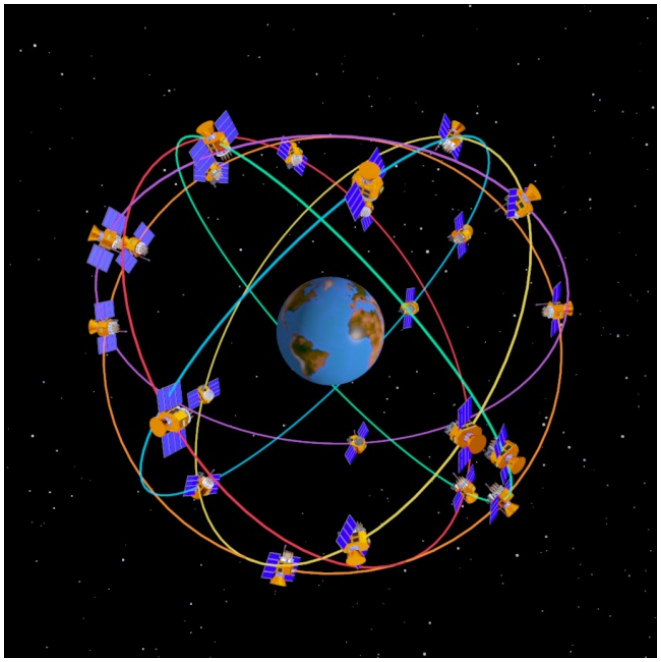
GALILEO

BEIDOU

The Global Positioning System (GPS) is

a Constellation of Earth-Orbiting Satellites Maintained by the United States Government for the Purpose of Defining Geographic Positions On and Above the Surface of the Earth.

It consists of Three Segments:



User Segment

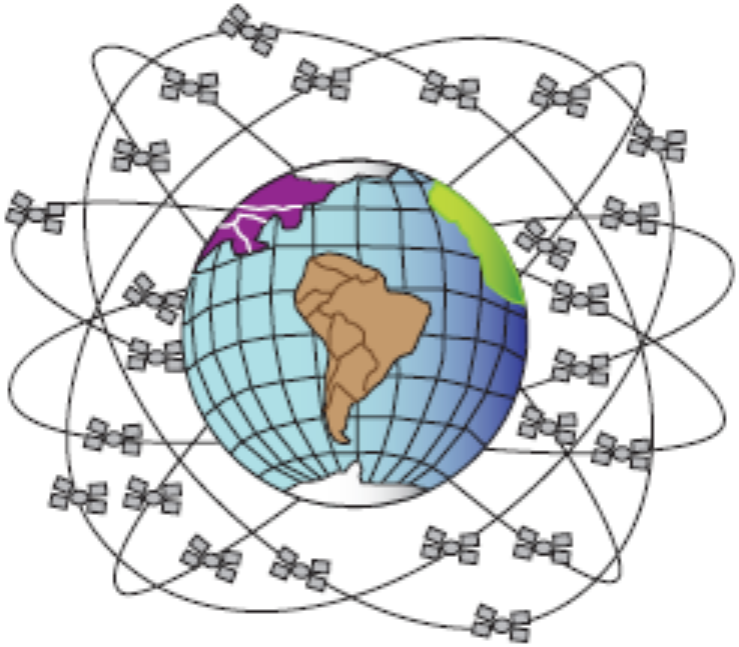
Control Segment

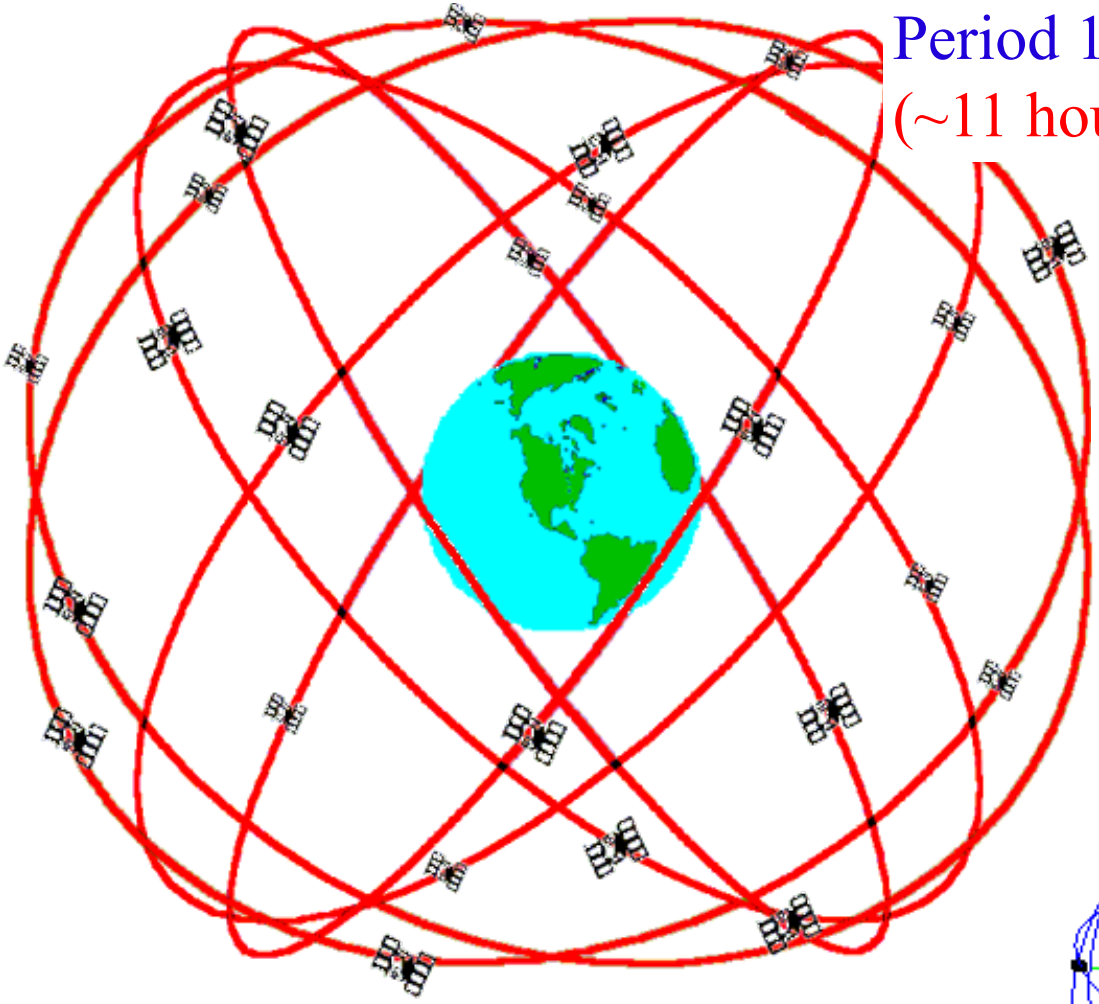
Space Segment

106

Space Segment

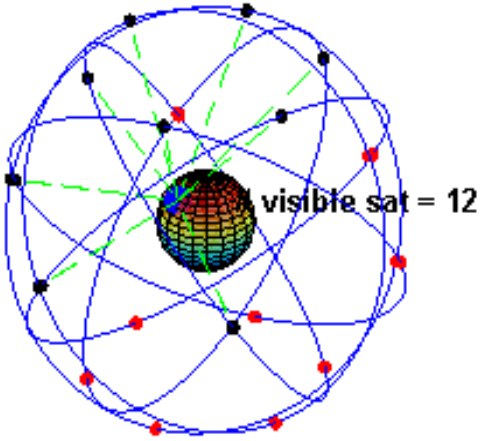
- Consists of GNSS satellites, orbiting about 20,000 km above the earth. Each GNSS has its own constellation of satellites





Period 12 sidereal hours
(~11 hours 58 minutes)

nearly circular orbit with a semi-major axis of 26 578 km



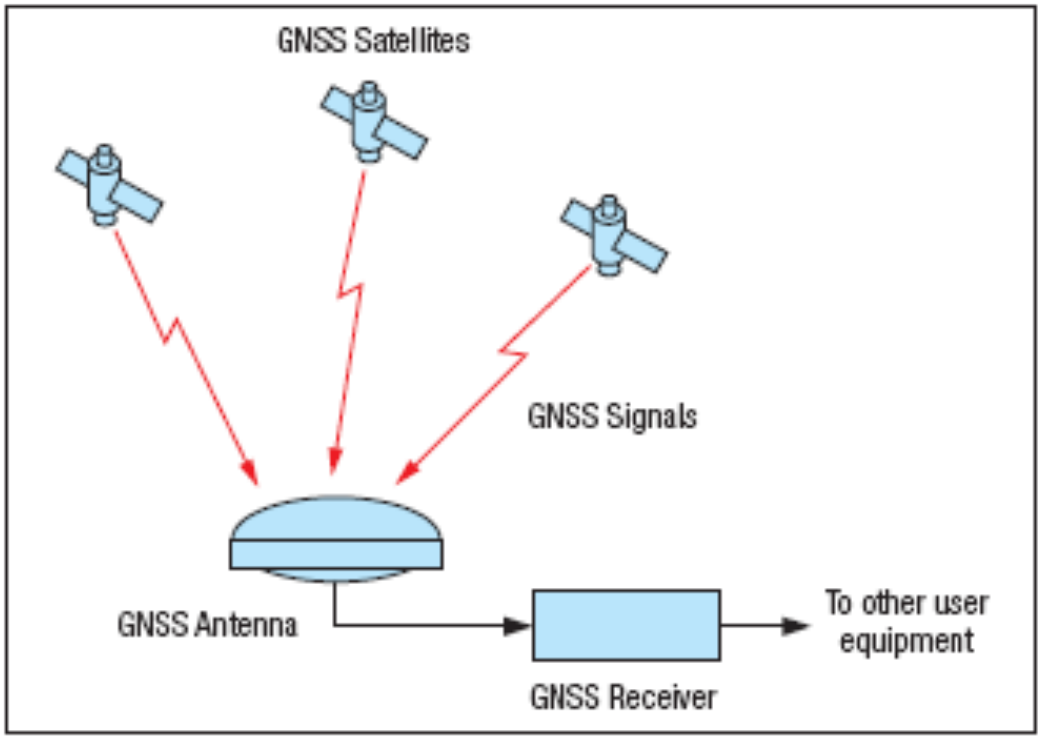
GPS Nominal Constellation
24 Satellites in 6 Orbital Planes
4 Satellites in each Plane
20,200 km Altitudes, 55 Degree Inclination

Control Segment

- The control segment comprises of a ground-based network of master control stations, data uploading stations, and monitor stations.
- Master control stations adjust the satellites' orbit parameters and on-board high-precision clocks when necessary to maintain accuracy
- Monitor stations monitor the satellites' signal and status, and relay this information to the master control station
- Uploading stations uploads any change in satellite status back to the satellites

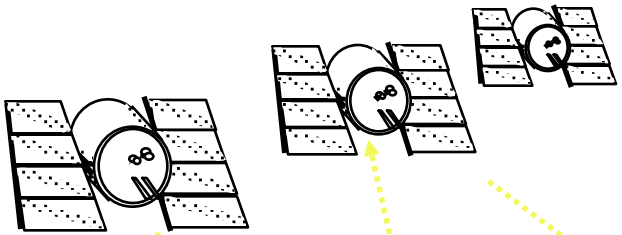
User Segment

- User segment consists of GNSS antennas and receivers used to determine information such as position, velocity, and time



How the system works

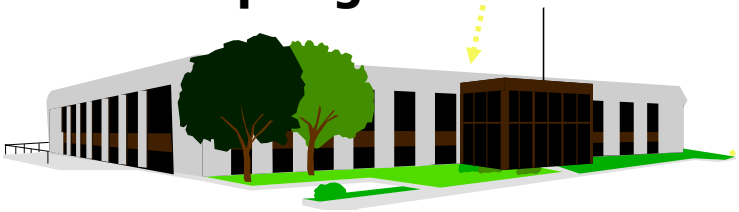
Space Segment
24+ Satellites

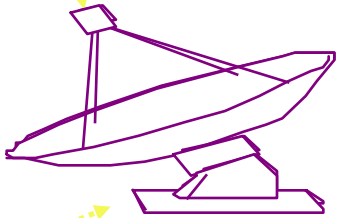


The Current Ephemeris is Transmitted to Users

Monitor Stations

- Diego Garcia
- Ascension Island
- Kwajalein
- Hawaii
- Colorado Springs





GPS Control
Colorado Springs

End User

111

T0

Total Time: T = T1 – T0

V = Speed (of radio signal)

Distance = T * V

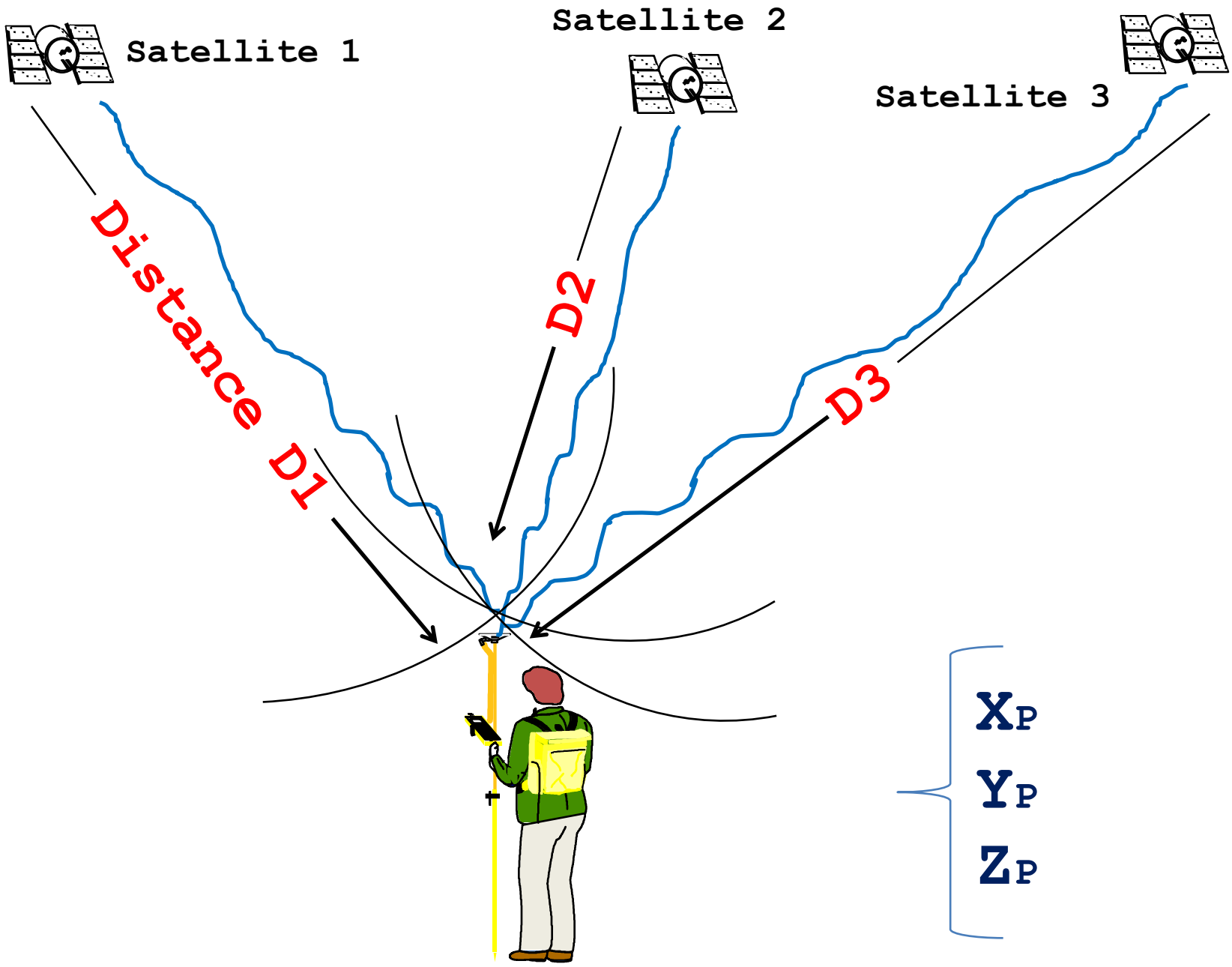
Satellite message

- Satellite id
- Ephemerides
- Time of signal start
- Ancillary data:
  - Conditions of health
  - etc

T1

End User

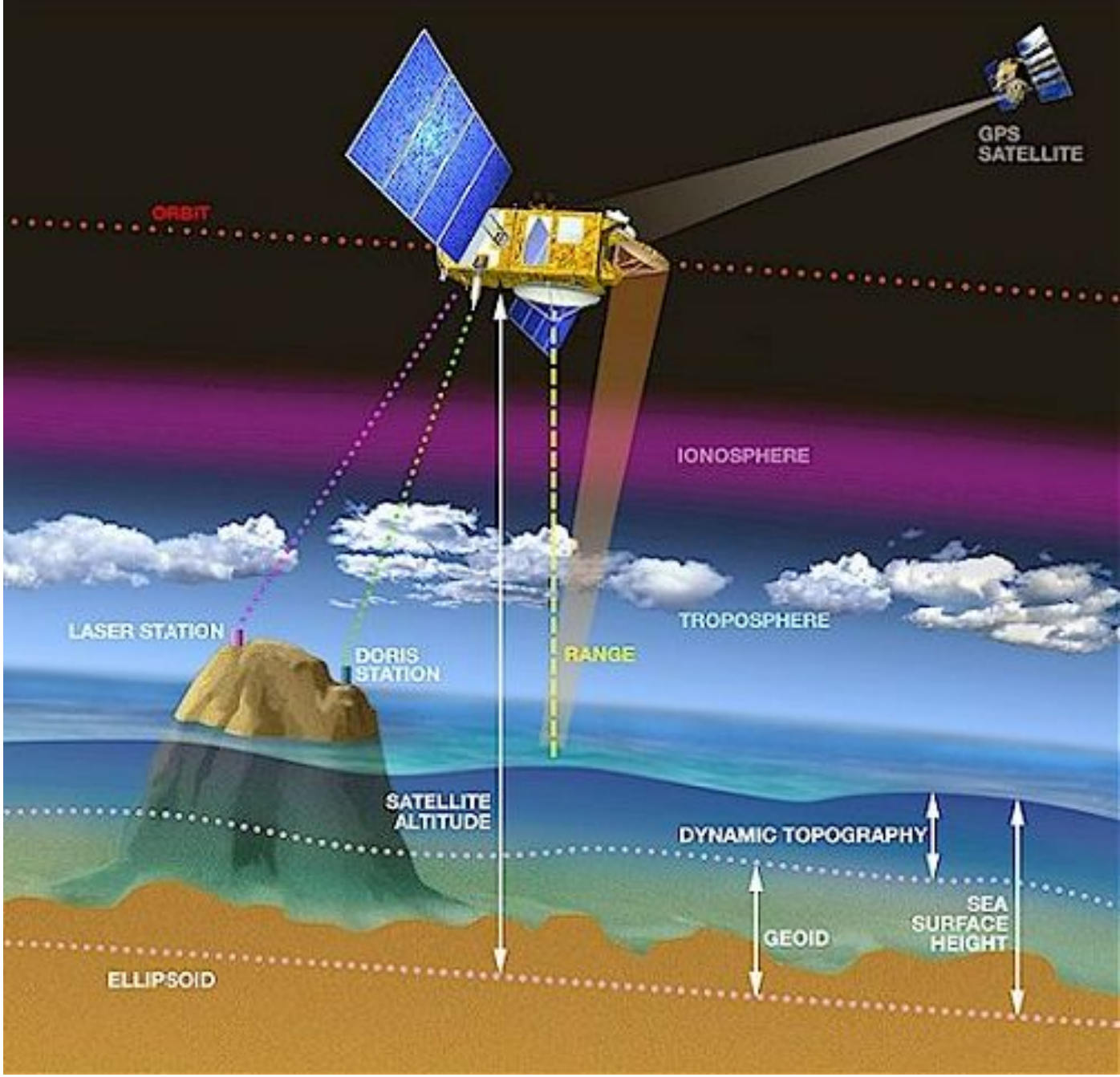
112


Satellite 1
Satellite 2
Satellite 3
Distance D1
D2
D3
Point P
XP
YP
ZP

113

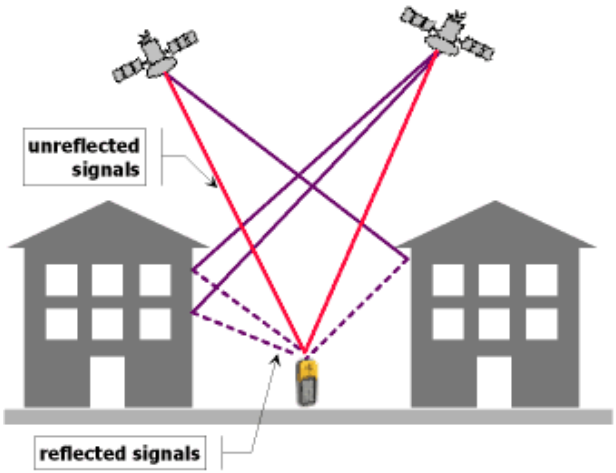
Ionosphere Delays

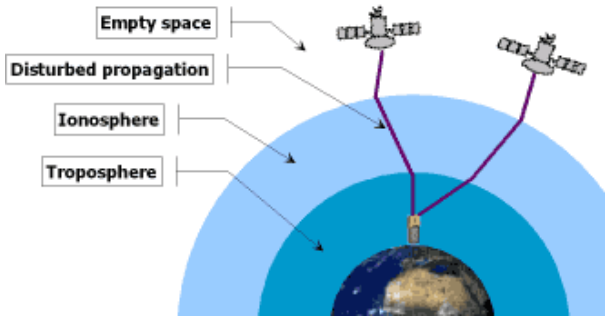
Delay of GPS signals as they pass through the layer of charged ions and free electrons known as the ionosphere.



114

GNSS Errors

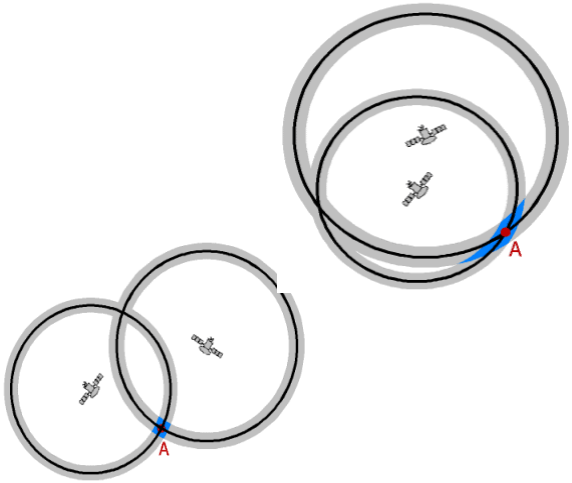


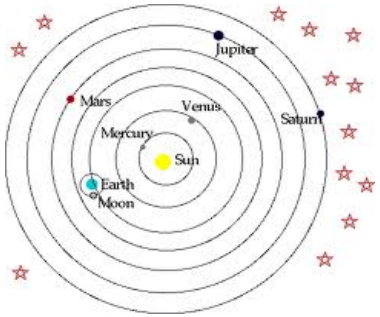


Canyon Effect – 1 metre

Ionospheric & Tropospheric diffraction 10 + 1 metres

Part copied from http://www.kowoma.de/en/gps/errors.htm





Geometry up to 100m

Timimg errors 4m – Rounding errors

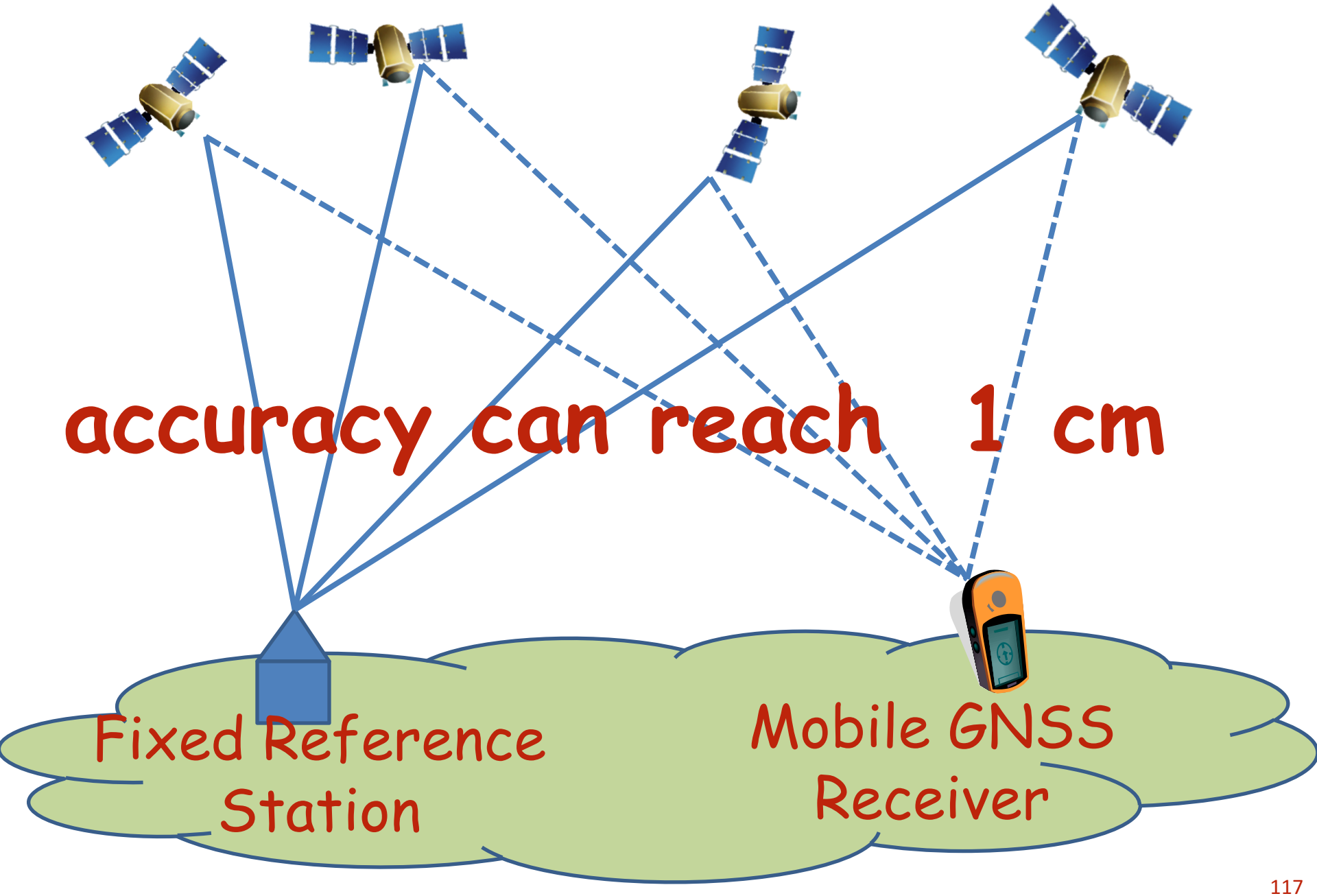
Orbits up to 5m

Ionospheric effects ± 5 metres
Shifts in the satellite orbits ± 2.5 metres
Clock errors of the satellites' clocks ± 2 metres
Multipath effect ± 1 metre
Tropospheric effects ± 0.5 metre
Calculation & rounding errors ± 1 metre

All adds up to +- 15m – 10m typically stated

With EGNOS still +-3 to 5m according to this source
However +- 1m considered realistic

GNSS – Global Navigation Satellite System



SUMMARY OF PUBLIC SOURCES FOR DGPS CORRECTIONS				
System	**Name**	**Areas Covered**	**Frequencies**	**Status**
Public Beacon Services				
NDGPS	Nationwide DGPS Service	Continental U.S., plus parts of Hawaii, Alaska, Puerto Rico	285–325 MHz	Operational
MDGPS	Maritime DGPS Service	Continental U.S. coastal areas, inland rivers, plus parts of Hawaii, Alaska, Puerto Rico	285–325 MHz	Operational
Satellite-Based Augmentation Systems				
WAAS	Wide Area Augmentation System	Continental U.S.	GPS L1	Operational
EGNOS	European Geo-Stationary Navigation Overlay Service	Europe	GPS L1	Partially Operational
MSAS	MTSAT Satellite-Based Augmentation System	Japan	GPS L1	Operational
QZSS	Quazi-Zenith Satellite System	Japan	GPS L1, L2, and L5	R&D
GAGAN	GPS-Aided Geo-Augmented Navigation	India	GPS L1	R&D
Local Area Augmentation Systems				
LAAS	Local Area Augmentation System	Local area around various airports in continental U.S.	108–117.975 KHz	R&D
Public Internet-Based Service				
CORS	National Continuously Operating Reference Station System	Continental U.S.	Internet Access	Operational
IGS	International GNSS Service	Worldwide	Internet Access	Operational

GIS

Geographic Information System

GIS

GIS is an acronym for a Geographic Information System. The classic textbook definition for GIS is "an integrated collection of computer hardware, software, data procedures and people working together to analyse spatial relationships and model spatial processes."