



Modernization of GNSS signals and the Surveyor

May 29th 2012

Brazil

Global Navigation Satellite System

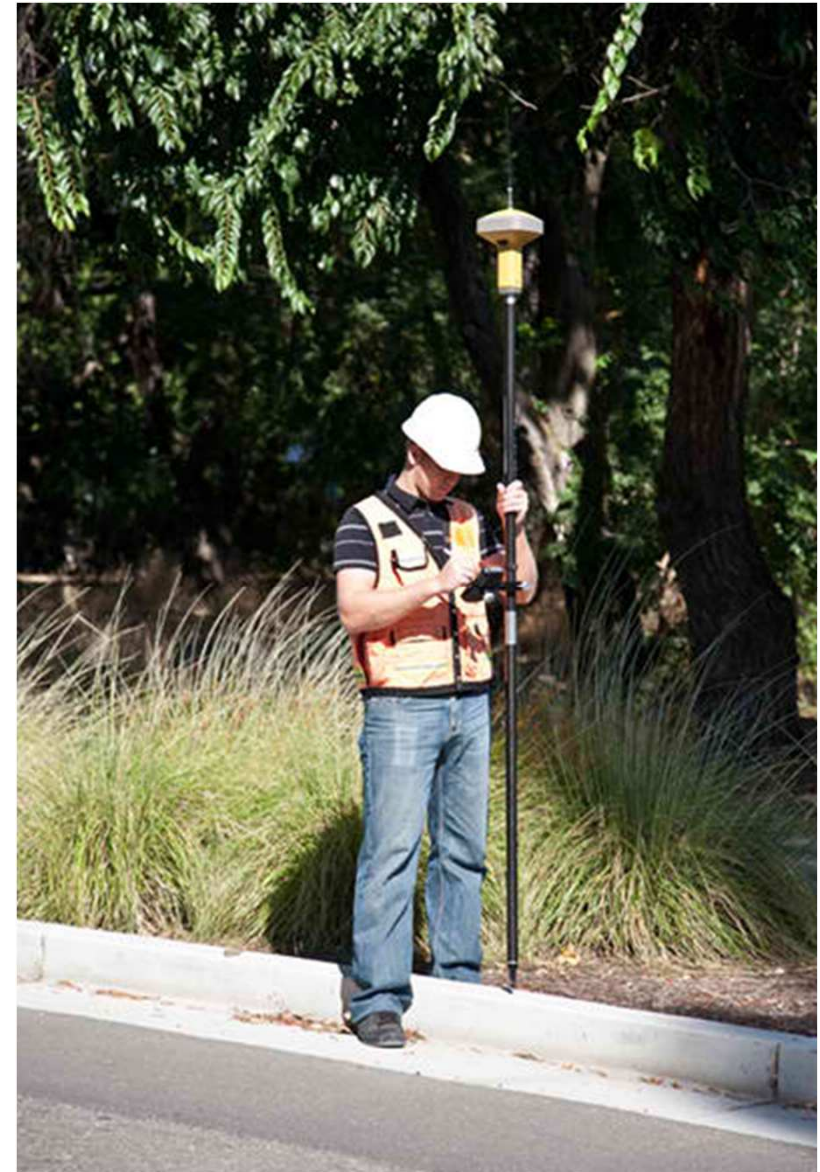
- There are different independent satellite based navigation systems
 - **GPS United States**
 - Developed primary for the military
 - **GLONASS Russia**
 - Developed to compete with the US
 - **GALILEO European Union**
 - Developed to be independent of the US and some compete in the Space industry
 - **BEIDOU2 China**
 - Beidou is regional but..
 - Compass (Global solution)



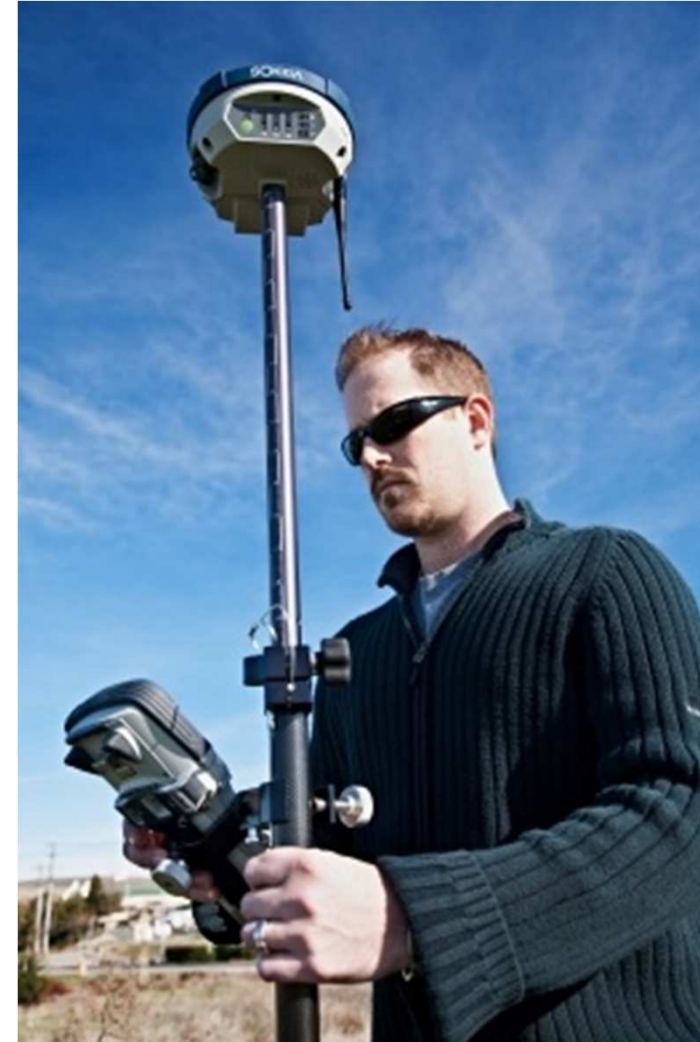
- **L2C is referred to as the 2nd Civilian Frequency**
 - **Stronger than L2P allowing for positioning inside of buildings. (Not RTK Acc)**
 - **Easier to track than encrypted P2 code**
 - **Less precise than P2 code**

- **L5 will be the 3rd Civilian Frequency**
 - **New additional code on another frequency**
 - **Allows additional combinations of frequencies to solve ambiguities**
 - **More reliable in high Ionosphere**
 - **Longer baselines**
 - **Quicker solving ambiguities**

- **Modernized L1C Civil signal**
 - Higher precision
 - It will have twice the minimum C/A signal power.
 - The longer codes will eliminate cross-satellite correlation interference and reduce effect of narrowband interference
 - Higher interference protection. The increase signal bandwidth (code clock rate) will add interference protection and have less code noise.

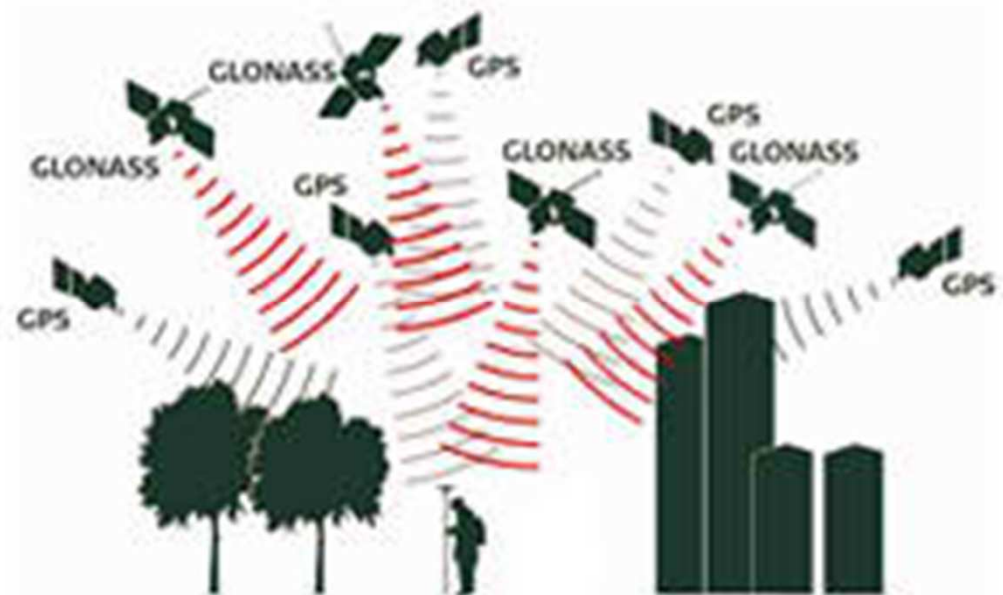
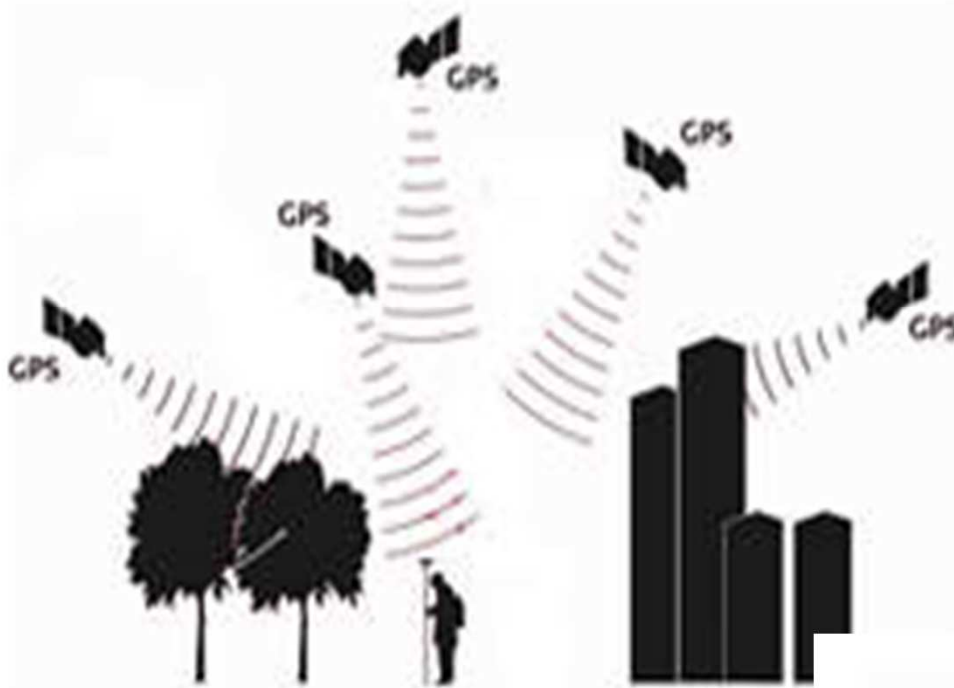


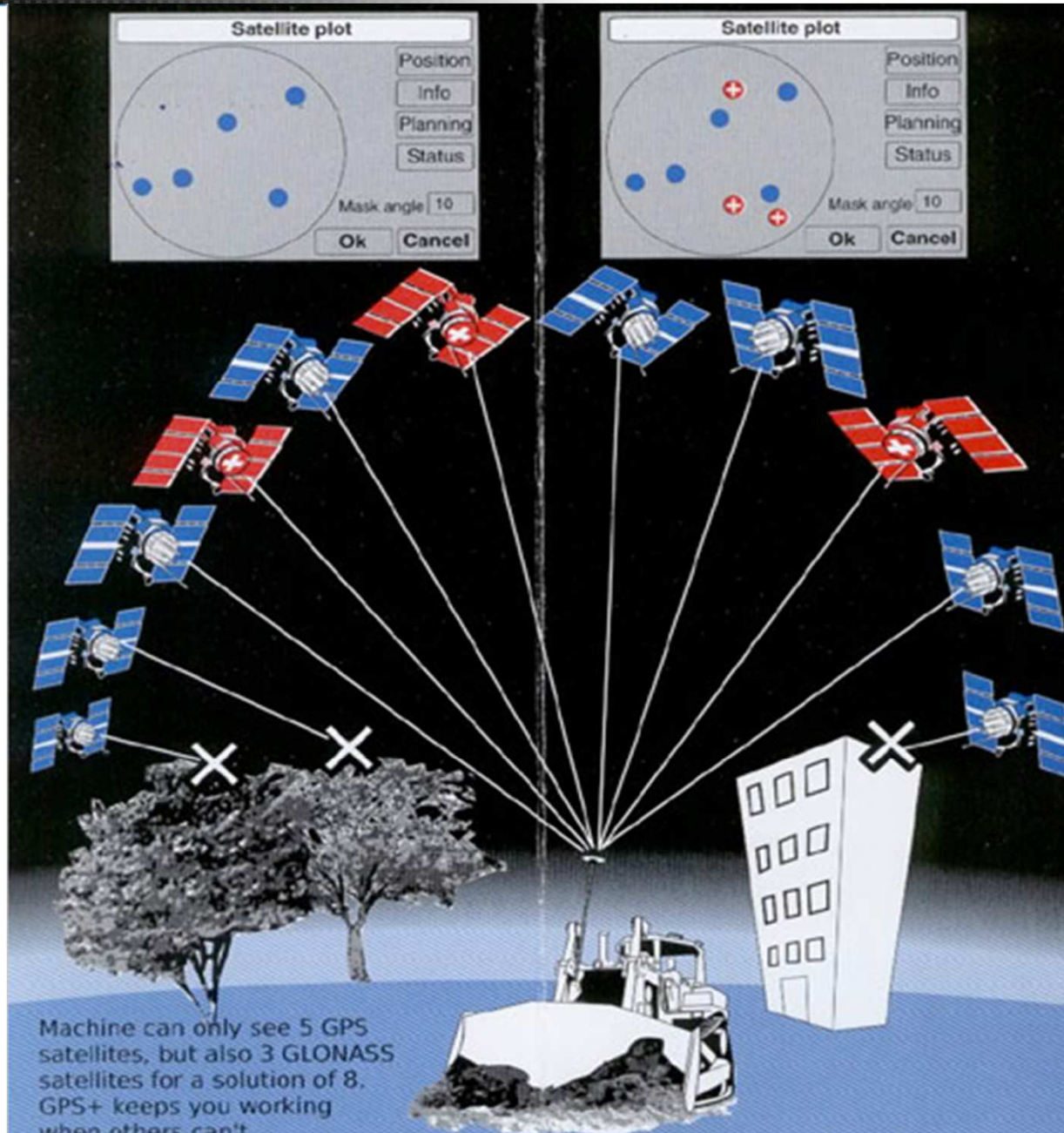
- **Benefits of L5**
 - **Improves Signal Structure for enhanced performance**
 - **Higher power (154.9 dBW)**
 - **Wider bandwidth**
 - **Begins on the IIF Sats**
 - **3rd frequency will enable better Ionosphere corrections**



- **New Signals offer several benefits**
 - **Stronger power on all signals**
 - **Better signal acquisition**
 - **Newer codes will lead to better accuracy and less multipath**
 - **More frequencies will provide wider lane combinations for ionosphere measurements and faster RTK initialization longer baselines**



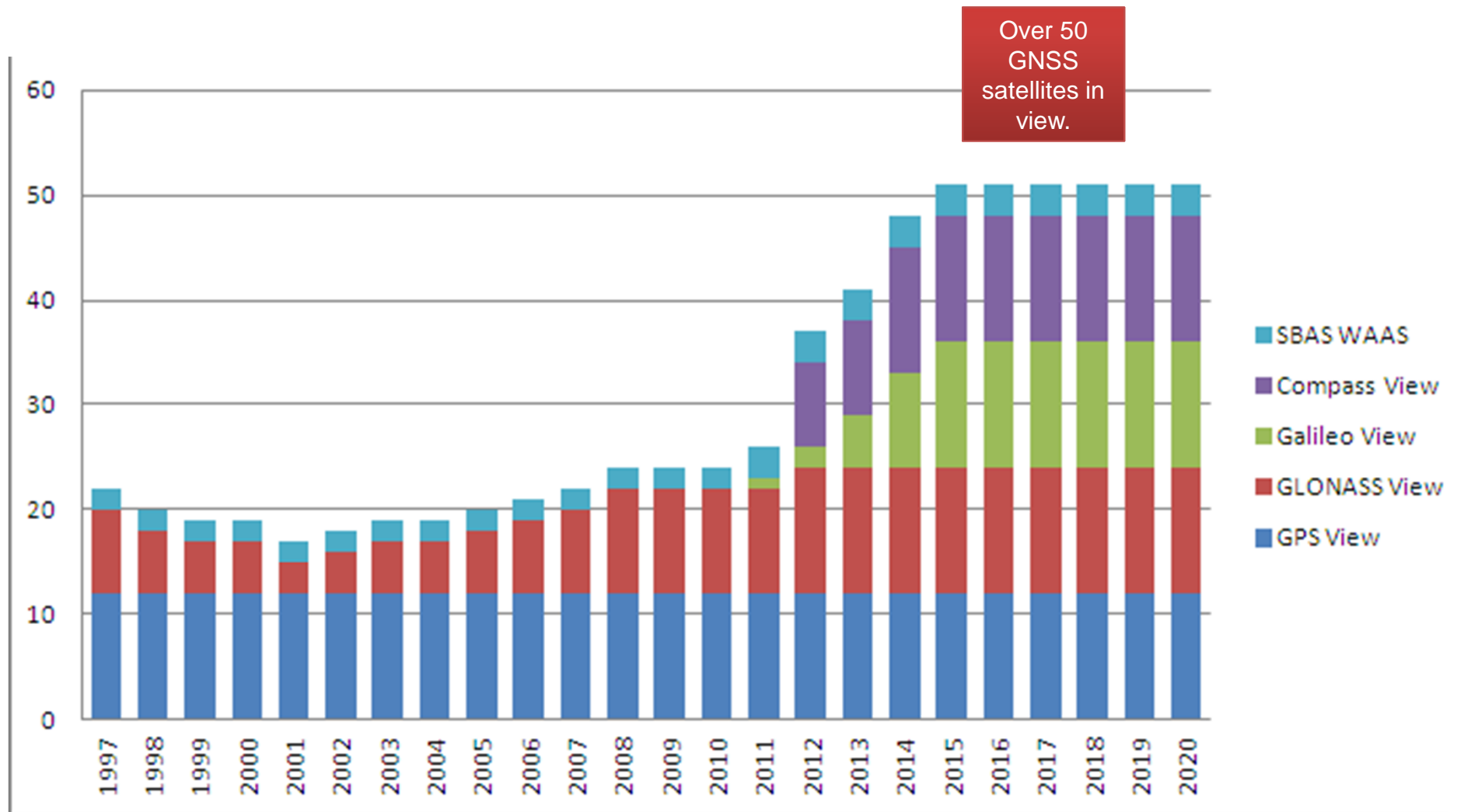




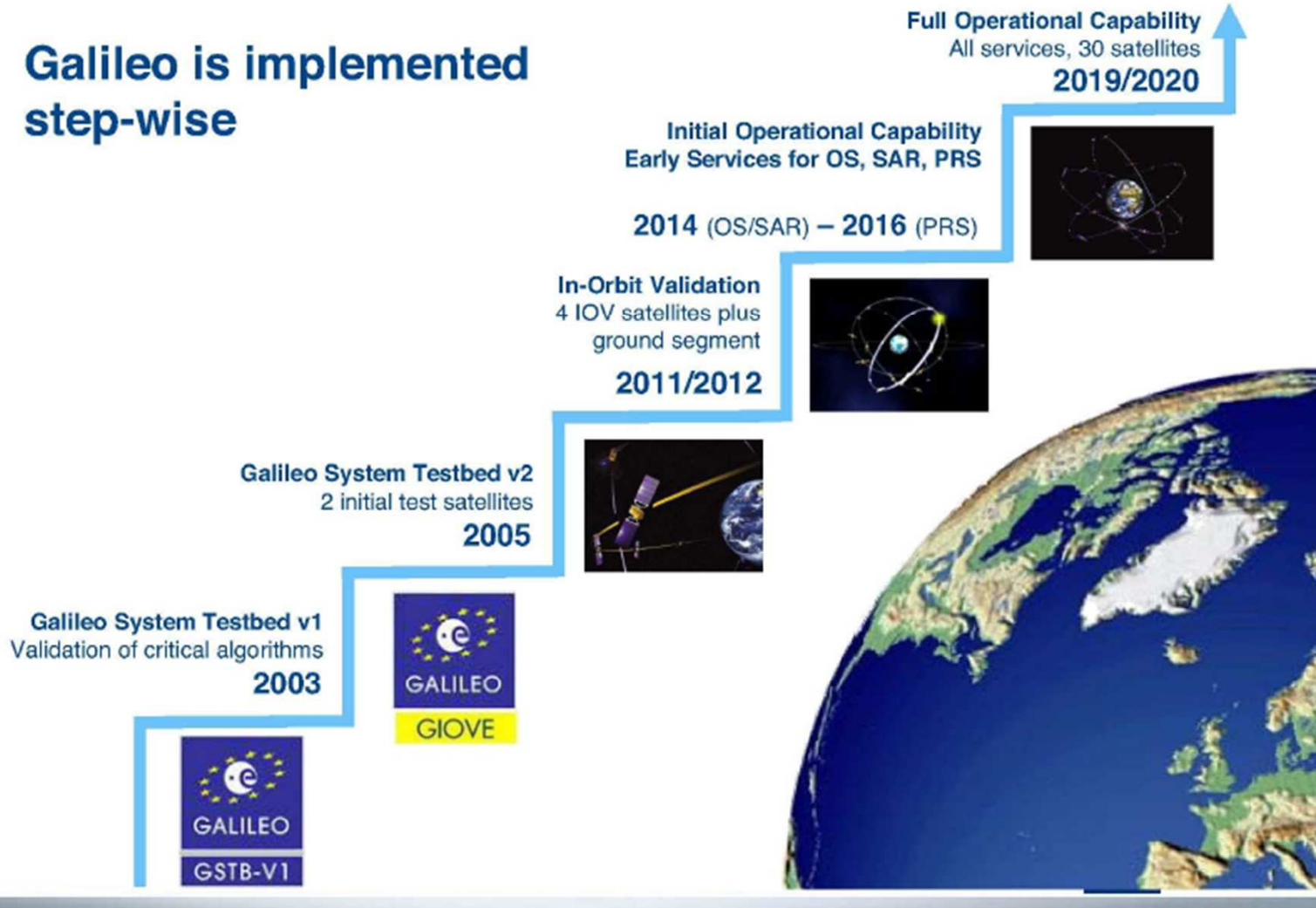
- **Improved pseudo range quality has led to much better measurement and positioning with GLONASS**
- **Longer lifetime satellites has increased availability**
- **Customer expect more availability**
 - **Currently only GPS and Glonass**
- **Sovereignty reasons**



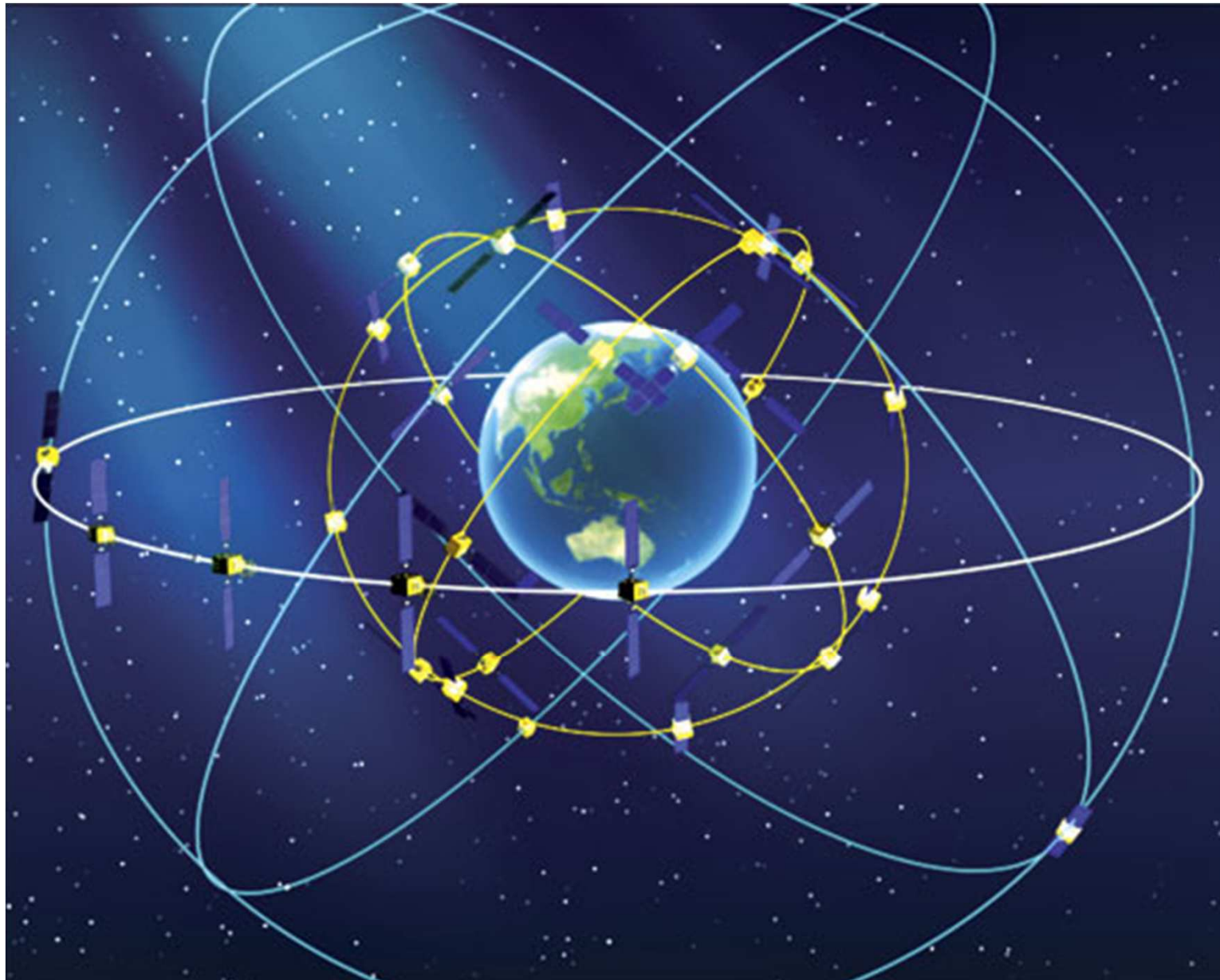
Number of GNSS Satellites In-View over Time

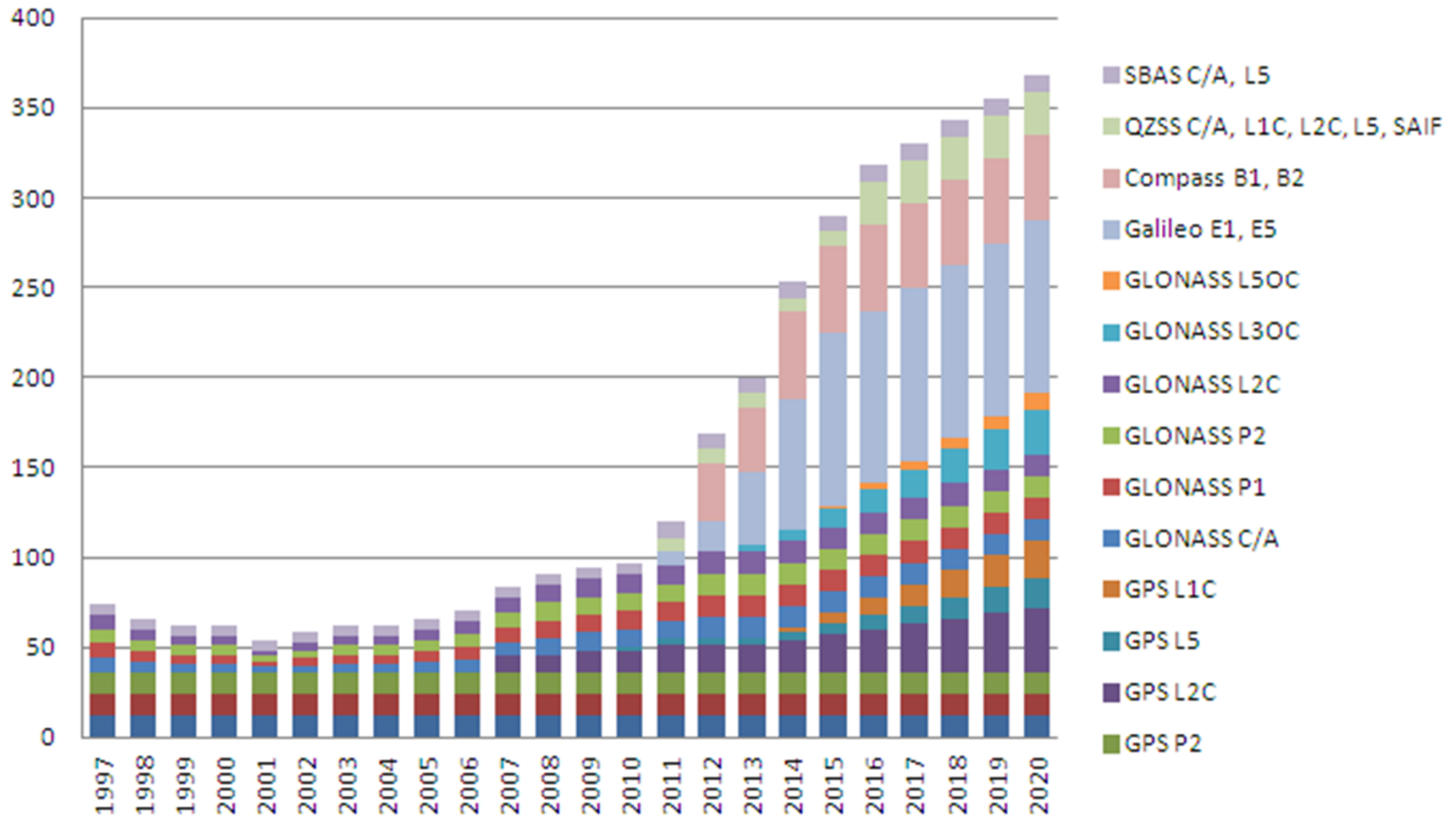


Galileo is implemented step-wise

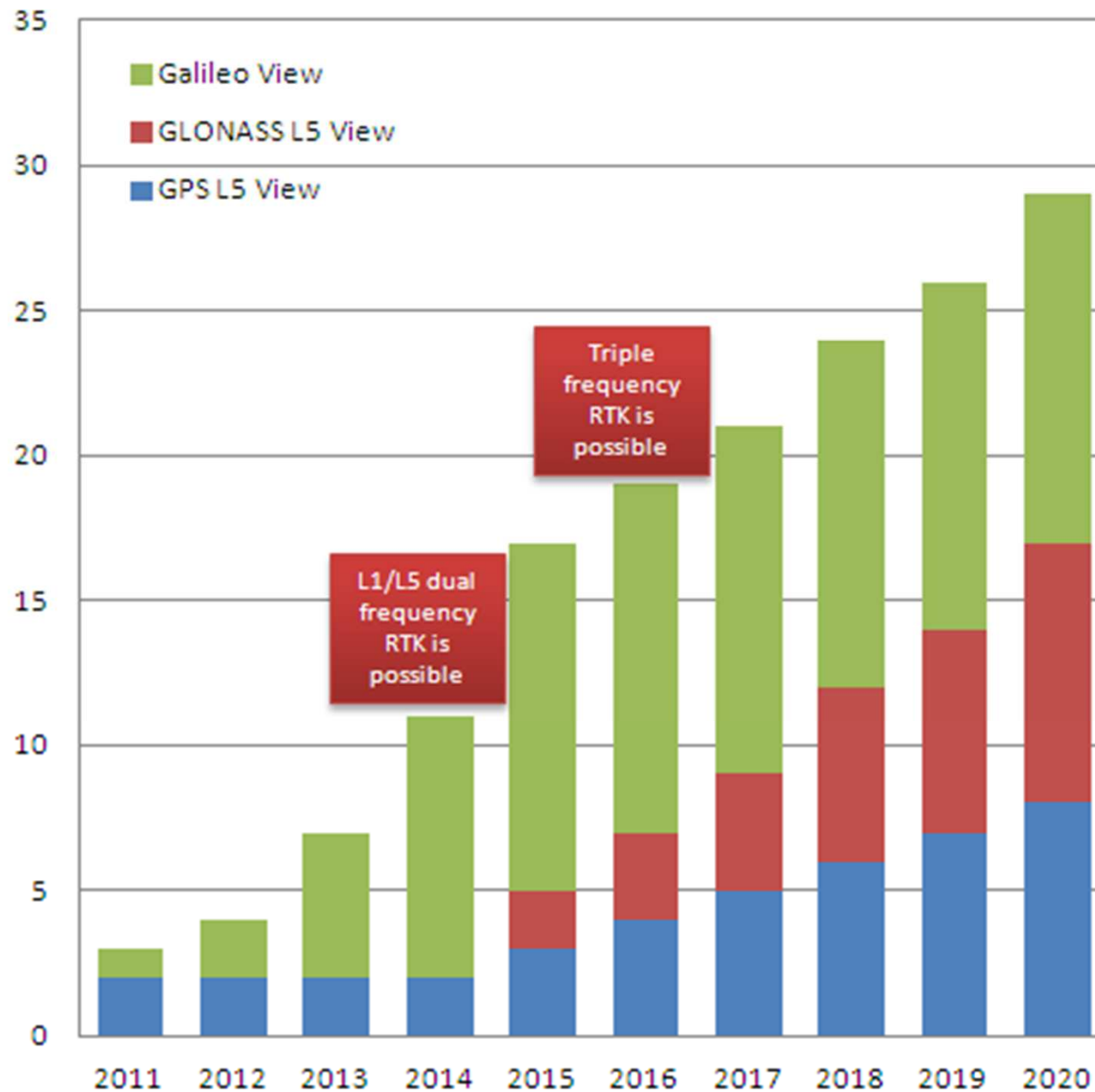


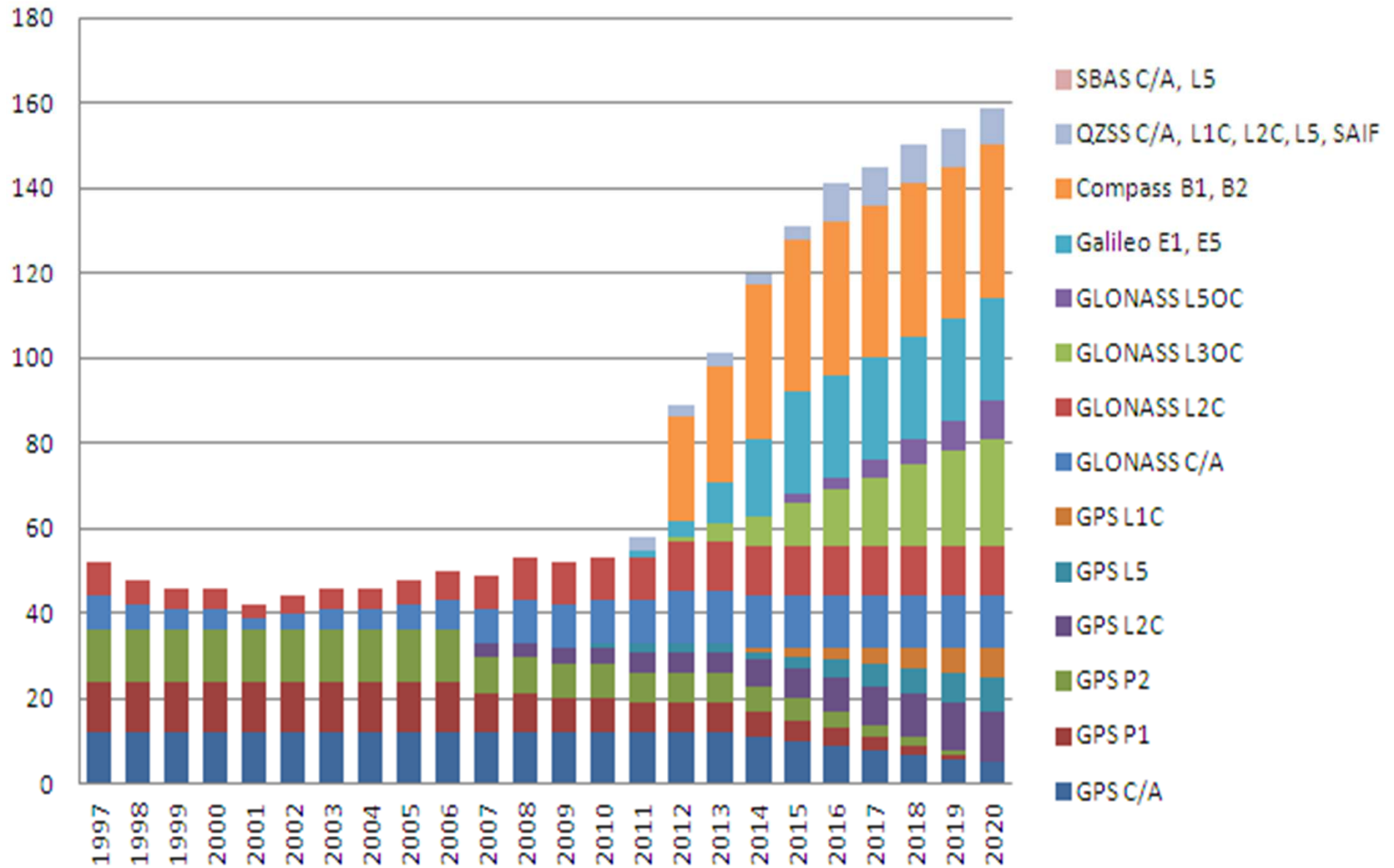
- ***Běidǒu***. The name literally means "Northern Dipper"
 - **China claims that they have over 90,000 users from emergency workers to fisherman**
 - **Beta Interface document released Dec 2011**
 - **Currently the system is regional only with**
 - **5 Compass GEO**
 - **5 Compass IGSO**
 - **3 Compass MEO**
 - **Large plans for the System with 27 MEO Sats by 2020**
 - **July Aug two MEOs**
 - **End of the year 6 total MEO**
- Regional service to start this year.**



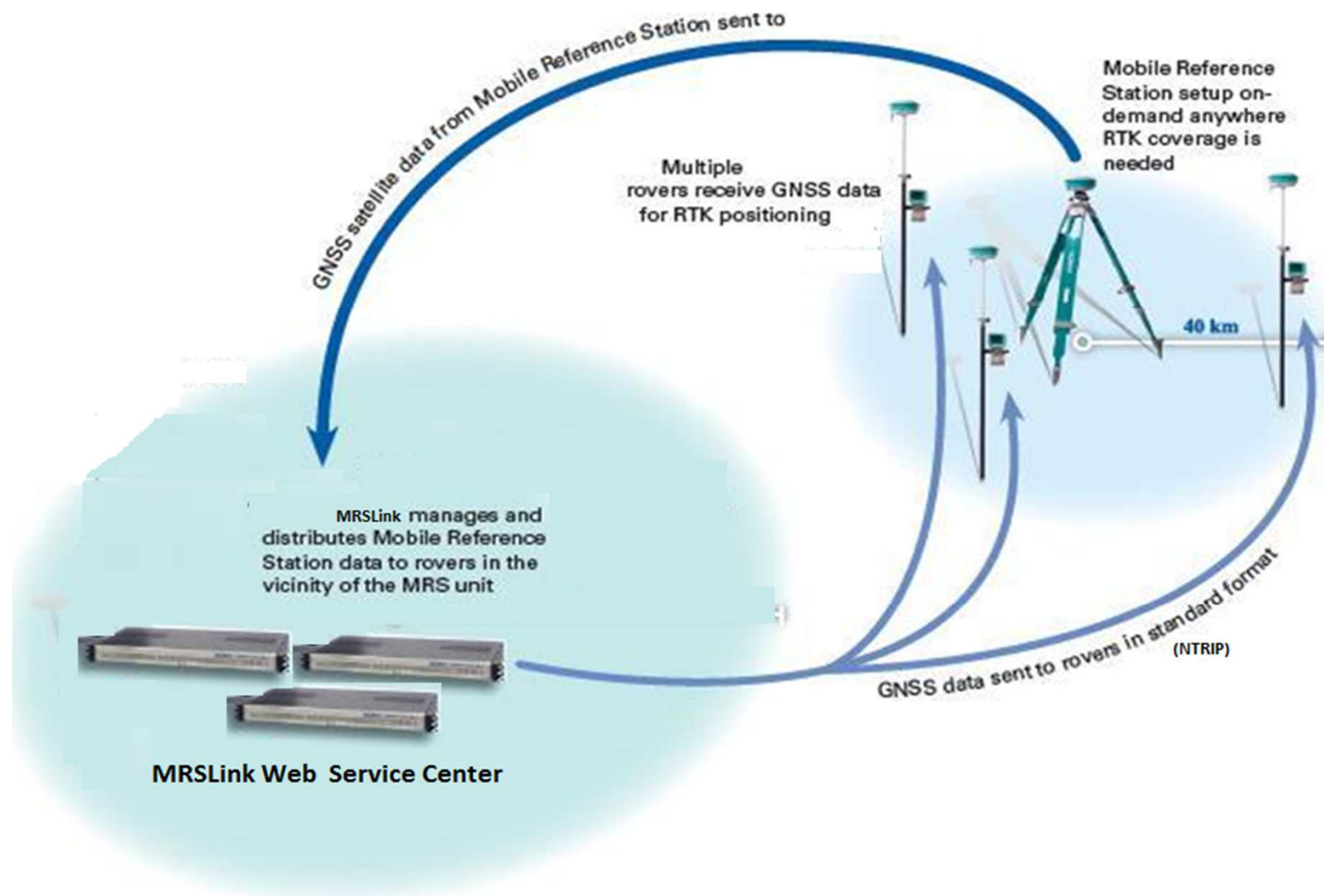


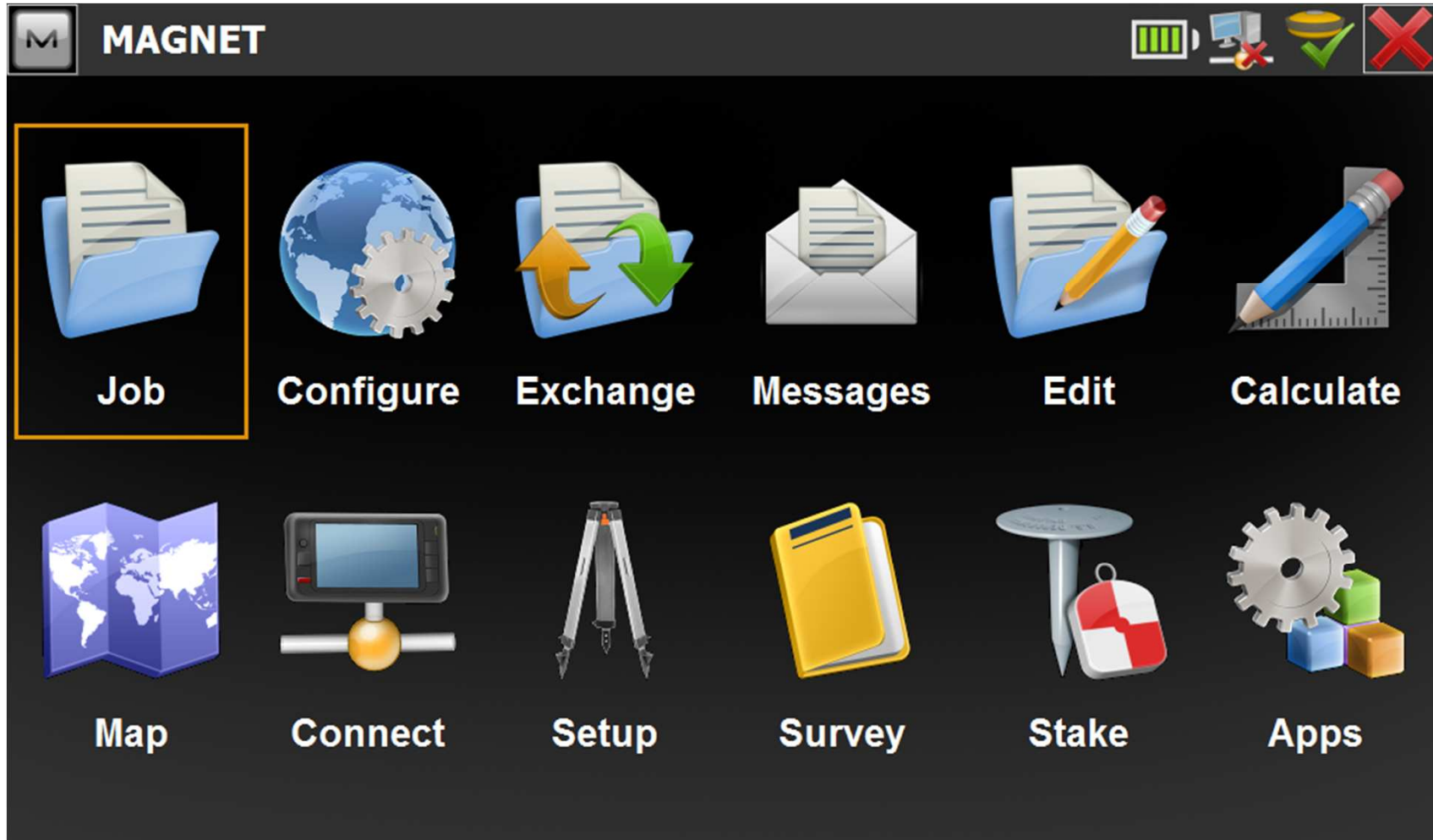
Number of L5 Satellites In View over Time











The screenshot displays the MAGNET Topo software interface. At the top left, there is a 'M' icon and the text 'Topo'. Below this is a navigation bar with four tabs: 'Meas', 'Data', 'Map', and 'Offsets', with 'Map' currently selected. The main area is an aerial photograph of a residential neighborhood with several streets labeled: 'Pebble Beach Ln', 'Cypress Point Circle', and 'Cypress Point Circle'. Overlaid on the map are blue lines representing survey paths, blue circular markers for points, and red triangles for other survey features. A scale bar in the top left of the map area indicates '50 USft'. On the right side of the map, there is a vertical toolbar with icons for zooming in (+), zooming out (-), and other navigation functions. At the bottom of the interface, there is a status bar containing a vertical scale icon with the value '6.562', an information icon, a dropdown menu showing 'EP', a '1' dropdown, a minus sign, and a save icon.



MAGNET

Username

Password

Members login

Welcome to...

MAGNET[™]

All your precise positioning applications,
support, services, and data in one place.

[Take the tour ▶](#)

Storage Assets Real-Time Networks Projects Exchange Chat News

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Asset Manager

- Model: Controller
Serial: SN133333
[View on map](#)
- Model: GPS receiver
Serial: SN1234567890
[View on map](#)
- Model: Controller
Serial: 1123-2223-33-21231
[View on map](#)
- Model: Controller
Serial: SN 1
[View on map](#)
- Model: Controller
Serial: SN 1
[View on map](#)
- Model: Controller
Serial: SN 1
[View on map](#)
- Model: GPS receiver
Serial: dmussino_SN
[View on map](#)

[Advanced Search](#)

Map

- Dealers
- TopNEXT Networks
 - Alabama-Kentucky-Mississippi-Tennessee
 - Connecticut-Massachusetts-Maine
 - Eastern Canada
 - Eastern Pennsylvania-New Jersey
 - Florida
 - Georgia
 - Illinois-Indiana-Wisconsin
 - Northern California
 - Southern California
 - Virginia-Maryland-Delaware-Pennsylvania
 - Western Pennsylvania
- Devices
 - 1123-2223-33-21231 (Controller)
 - dmussino_SN (GPS receiver)
 - ETereshin_SN (UNKNOWN)
- Job file data
 - MAGNET.taj (Demo project)

[Advanced Search](#)

Device position

Model: Controller
Serial: 1123-2223-33-21231
Creation time: 06/24/2011 04:40:37 m.
Sender: Andrea Morando
WGS84 Latitude: 40.102618
WGS84 Longitude: -82.986802

Location: [Search](#)

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The screenshot displays the MAGNET web application interface. At the top left is the 'MAGNET' logo. The top right shows the user 'Jason Hallett' and a 'Logout' button. A toolbar with various icons is located below the header.

Map Panel: On the left, a sidebar lists 'Dealers' and 'TopNEXT Networks' with regional sub-items like 'Alabama-Kentucky-Mississippi-1', 'Connecticut-Massachusetts-Ma', etc. Below this is a 'Devices' section with items like '1123-2223-33-21231 (Controlle...', 'dmussino_SN (GPS receiver)', and 'ETereshin_SN (UNKNOWN)'. A 'Job file data' section includes 'MAGNET.tsj (Demo project)'. The main map area shows a satellite view of a site with a 'Device position' popup window containing the following details:

- Model: Controller
- Serial: 1123-2223-33-21231
- Creation time: 06/24/2011 04:40:37 m.
- Sender: Andrea Morando
- WGS84 Latitude: 40.102618
- WGS84 Longitude: -82.986802

Map controls include 'Hybrid', 'Map', 'Terrain', and 'Satellite' options. A 'Location:' search bar is at the bottom of the map panel.

Chat Panel: On the right, a 'Chat' window shows a list of users: 'Morgan Smith' and 'Andrea Mora...'. The active chat with 'Andrea Morando' contains the following messages:

- Jason Hallett (08:11:30 m.):
- Jason Hallett (08:11:59 m.): Make sure you pick up some detail at the SE corner of the site.
- Jason Hallett (08:15:29 m.): It looks like rain tomorrow, so we better wrap it up today.

At the bottom of the chat window is a text input field and a 'Send' button.

To Do List Panel: Below the chat is a 'To Do List' window with one task: 'Columbus Site Topo' (07/27/2011) with a sub-task 'Detail Topo at SE Corner'.

Weather Panel: At the bottom right is a 'Weather' widget for 'Columbus, OH (U.S.A)'. It shows:

- Wind direction: E
- Wind speed: 3 Mph
- Humidity: 62%
- Current temperature: 79°
- Forecast for Wed, Thu, Fri, Sat with icons and temperatures: 89|70, 97|75, 91|74, 87|71.

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MACNET Jason Hallett [Logout](#)

Data Manager

Inbox: Demo project. Files: 2

File name	Type	From	Received Time
<input checked="" type="checkbox"/> MAGNET.tsj	Field Job	Evgeny Tereshin	07/08/2011
<input type="checkbox"/> m_f_inwork.tsj	Field Job	Andrea Morando	07/05/2011

Map

- Dealers
- TopNEXT Networks
 - Alabama-Kentucky-Mississippi-T
 - Connecticut-Massachusetts-Ma
 - Eastern Canada
 - Eastern Pennsylvania-New Jerse
 - Florida
 - Georgia
 - Illinois-Indiana-Wisconsin
 - Northern California
 - Southern California
 - Virginia-Maryland-Delaware-Pen
 - Western Pennsylvania
- Devices
- Job file data
 - MAGNET.tsj (Demo project)**

Location: [Search](#)

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MAGNET

Username
 Password Members login

Map

- ▶ Dealers
- ▶ TopNEXT Networks
 - ▶ Alabama-Kentucky-Mississippi
 - ▶ Connecticut-Massachusetts-N
 - ▶ Eastern Canada
 - ▶ Eastern Pennsylvania-New Jer
 - ▶ Florida
 - ▶ Georgia
 - ▶ Illinois-Indiana-Wisconsin
 - ▶ Northern California
 - ▶ Southern California
 - ▶ Virginia-Maryland-Delaware-P
 - ▶ Western Pennsylvania

Reference Station: TPLM

Antenna type: TPSG3_A1_NONE
 Receiver type: ODYSSEY
 Satellite constellations: GLONASS, GPS
 Services: Network RTK, RTK, DGPS
 Agency: Topcon

Location

Latitude: -116.3991
 Longitude: 33.8217
 Ellipsoid height (m): 50.8100
 Country: U.S.A
 State: California (U.S.)
 City: Thousand Palms

[Go to the store widget](#)

Location: Advanced Search Search

- **Improved Accuracy in some cases**
 - Better code and phase measurements
 - Better geometry
 - Operation at longer baselines
- **Improved Availability**
 - More satellites in view
 - With 4 GNSS, users now have over 100 satellites
- **Improved Reliability**
 - Receiver Autonomous Integrity Monitoring (RAIM), Fault Detection and Exclusion (FDE)
 - Ambiguity resolution reliability

