“How the New GNSS Systems Will Make Your Job Easier”

A Presentation

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Presentation Contents

- GPS is now GNSS
  - Why GNSS is important
  - Constellation Review
  - Equipment Review
- L5: The new signal is coming
- PDOP – May it Rest in Peace
- Sub-Meter Equipment Test
- The Future is Coming to us soon

LT 500

GNSS is the New GPS

- GNSS = Global Navigation Satellite System
- GNSS refers to all Satellite Systems available

Satellite Constellations

- GPS - United States(Active)
- GLONASS – Russian (Active)
- SBAS (Satellite Based Augmentation Sys.)
  - US, European, India, Japan (Active)
- Galileo (Partially Active)
- Beidou (Partially Active)

United States GPS System

- 37 Satellites
- 31 are set as healthy
- Full constellation is considered as 24
- Civil Signals
  - L1 C/A
  - L2C
  - L5 (Now have 12 Satellites w L5) Rest by 2018
  - L1C

The Russians GLONASS System

- *Full Constellation with 24 Satellites*
- *Satellites have 10 to 12 year design life*
- *Very Helpful under tree canopy*

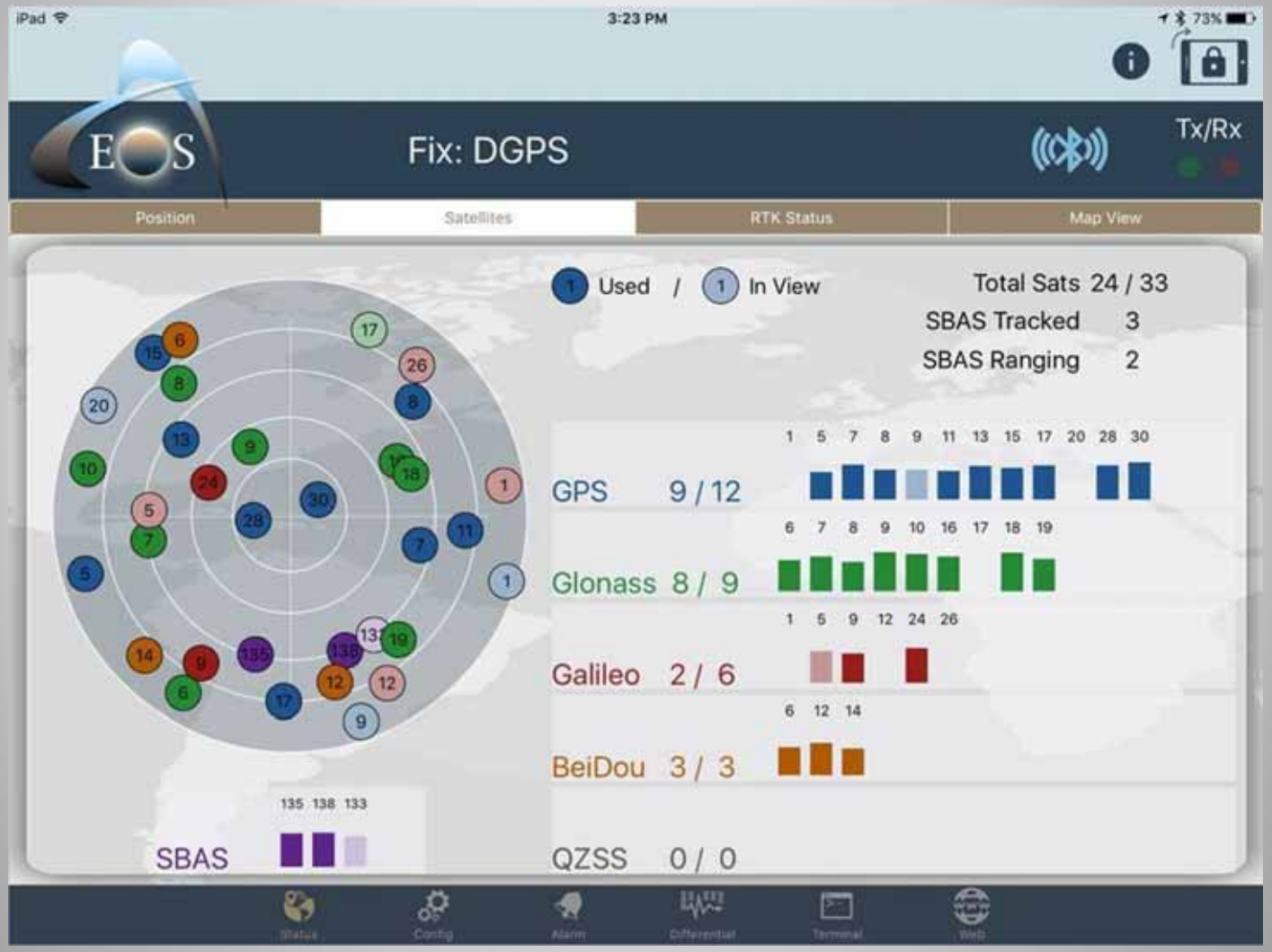
European Galileo System

- 18 Satellites in Orbit (2 not really usable)
- Satellites launched four at a time
- More satellites to launch this year

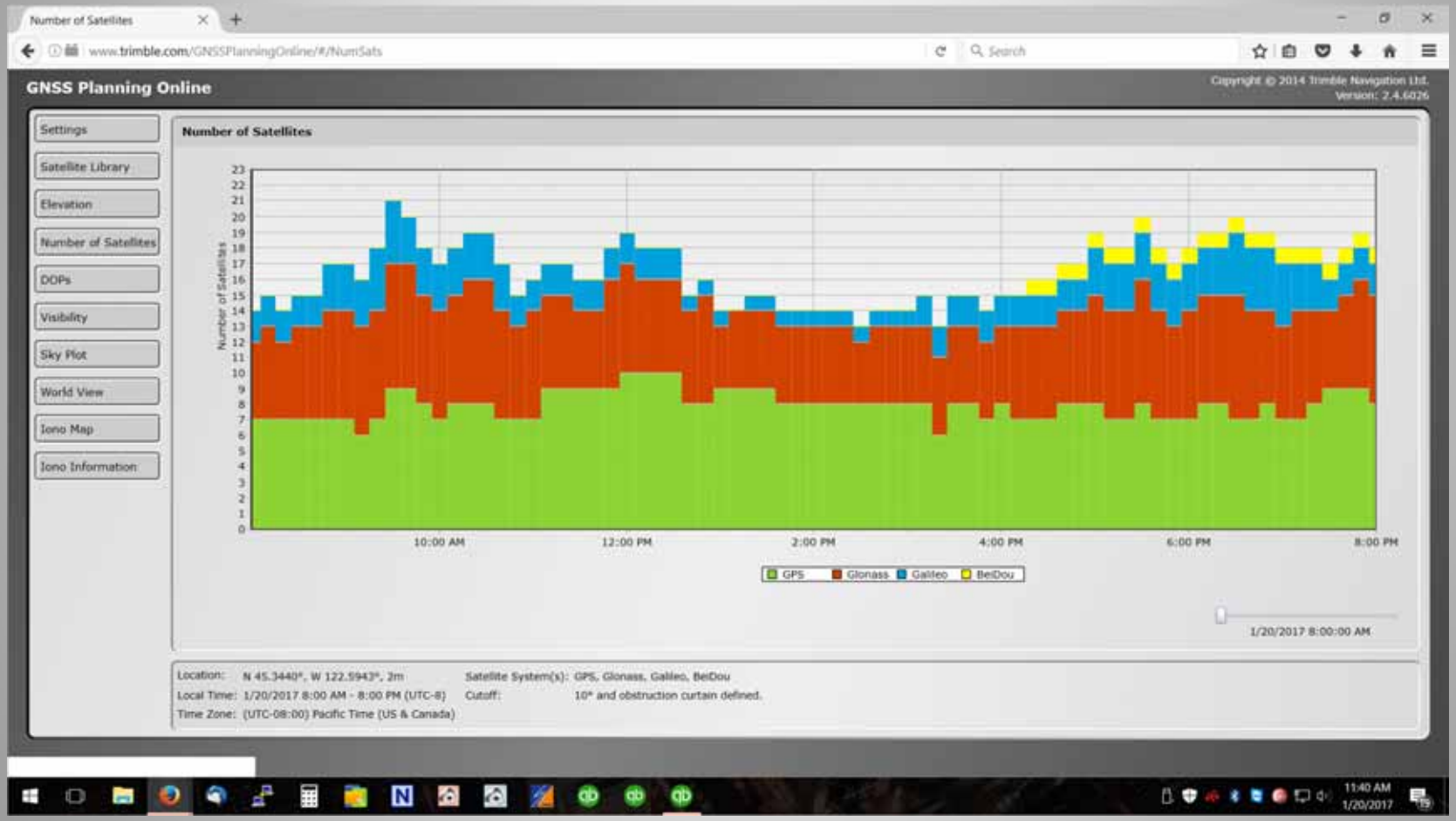
Chinese BeiDou System

- Regional System Now (Over Mainland China)
  - Still helpful to us in the Northwest
- By 2020, full world coverage

All Constellations



All Constellations - # of Sats



L5 Signal – It's Starting To Help

- 12 New GPS Satellites have L5
- 18 GPS Satellites by 2018
- All Beidou and Galileo Satellites will have L5
- 25% stronger signal that L1
- More accurate atomic clock
- Still waiting on more satellites and ground stations to be fully functional

PDOP – Dead and Dying For Usefulness???

- Used to be a good measure of accuracy
- Estimated Accuracy is now calculated by receiver
- Estimated Accuracy can be quite accurate and useful
- Although...

Lies, Damn Lies, and GPS Statistics

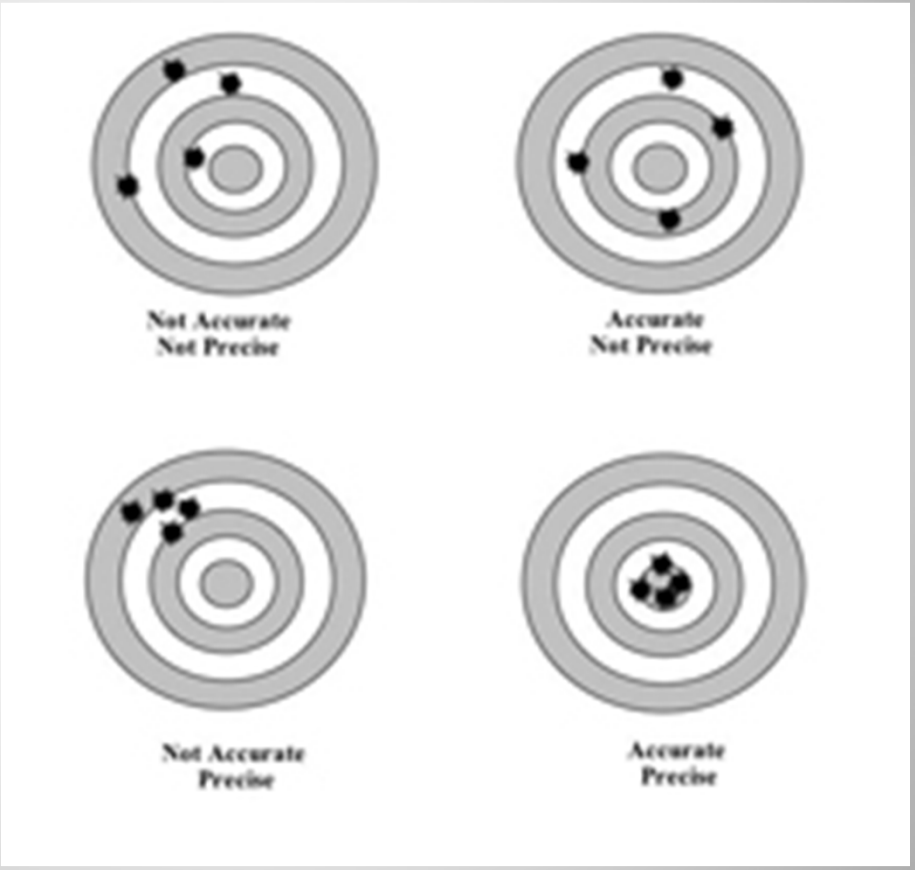
- Estimated Accuracy is Calculated differently by different manufacturers.
- Some Manufacturers are very good.
- Some Manufacturers are quite good.
- Some Manufacturers assume all data is collected in a freshly mowed corn field in Nebraska. (no trees, no hills)

Sub-Meter GNSS Receiver Test

- EOS Arrow 100 (4 Constellations)
- Bad Elf Surveyor (US & GLONASS)
- iSXBlue II GNSS (4 Constellations)
- Trimble R1 No Ext. Antenna (4 Const.)
- Trimble R1 with Ext. Antenna (4 Const.)
- Trimble GeoXH 6000 (US & GLONASS)

Test Results

- Accuracy
- Precision



Accuracy Results Under Dense Tree Canopy: Sub-meter GNSS

- Bad Elf Surveyor 3.6 meters
- EOS Arrow 100 2.4 meters ★
- Geneq iSXBlue II GNSS 2.2 meters ★
- Trimble R1 w Ext. Ant. 2.7 meters
- Trimble R1 no Ext. Ant. 3.2 meters
- Trimble GeoXH 6000 3.0 meters

(Four Test Points Occupied 4 times each)

★ Most Precise

GPS Procedures – Know the basics! (for all GPS units)

- Update almanac (track in open 15 minutes
- Track 2 to 5 minutes in open before start
- Keep GPS unit on at all times
- Use averaging (10 to 60 readings/point)
- Hold em high (for best satellite view)
- Use external antenna if appropriate
- Take GPS offsets if appropriate

Future of GNSS for Use In Forestry

- GNSS receivers on drones are common place right now
- Self Driving Cars (Nap Time to Job Site?)
- 100+ Satellites will be available by 2020
- Eric Gakstatter Quote: “GNSS will change faster in the next 5 years than in the past 15 years.”

Conclusion

- Expect Less Waiting and Better Accuracy with GNSS
- Equipment is getting better all the time
- Over 65 satellites available now
- Don’t be afraid to invest in new equipment
  - The really new receivers track everything

Thanks!

For all your GPS Work, May your:
- **Estimated Accuracy Be High**
- **And your wait time low.**

For data collection:
May your handheld never crash
May your batteries last all day

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