

OREGON GNSS USERS GROUP MEETING MINUTES

Date: June 15, 2018

Location: Deschutes National Forest Office, Bend, Oregon

Board Members Present: Bill Ham, Chair
Casey Varnum, Chair-Elect
John Minor, Treasurer
Chris Munson, Secretary

Called to Order: 9:00 am

Adjourned: 3:30 pm

Contact Hours: 5.0 hours

Introduction & Business Meeting

- Welcome by Chair Bill Ham.
- Secretary's Report by Chris Munson. Currently have 87 paid members, 302 people total on the email contact list.
- Treasurer's Report by John Minor. Currently have around \$13,000 in our bank account.

GNSS Technology Update by Eric Gakstatter

- Overview of 4 major constellations. GPS currently has 31 satellites, GLONASS has 24, Galileo has 14, and Beidou has 16 satellites (with more regional-only satellites).
- Four Galileo satellites are scheduled for launch in July. Beidou has 11 satellites scheduled for launch in 2018 (some are regional satellites only).
- A slide was shown showing the different orbit levels of the satellite constellations.
- Eric has done some single-baseline testing using the WSRN (GPS+GLONASS) and Eric's own private base station (all 4 constellations). He is reporting horizontal errors of 0.25 inches on an 8-mile baseline, 2 inches on a 40-mile baseline, and 3.5 inches on a 60-mile baseline.
- Discussion of single-, dual-, and triple-frequency receivers
 - L1 RTK: Reach RS+ receiver/\$799
 - Long-initialization times
 - Short baselines
 - Need a base/rover combo (no RTN)
 - May be useful for drones (short baselines)
 - Do not work well outside of good conditions.
 - Trimble Catalyst
 - \$350 for hardware
 - Works on a software subscription model.
 - GPS & Galileo only
 - Android device and cable hookup required (no Bluetooth)
 - Has RTK accuracy

- Uses phone CPU for processing.
- Many GNSS manufacturers are concentrating on the automobile and drone market.
- Good news:
 - GNSS equipment remains backward-compatible.
 - Consumer markets will drive down RTK costs and increase technology updates.
 - More satellites are being launched.
- Bad news:
 - Windows Mobile software is discontinued.
 - End of life for Trimble Nomad.
- Eric made a stop in Sisters on his way over to today's meeting, in which he compared a 155-mile baseline from his private base station to the ORGN (receiving 7 GPS and 7 GLONASS satellites). He reported a 3 mm horizontal difference and 4 cm vertical difference between the two.

Comparative Post-Processing Services by Marian Jamieson

- Objective: To compare accuracy among services using the same data sets.
- Relative positioning vs. PPP
 - Relative: OPUS-S, AUSPOS
 - PPP: CSRS-PPP, GAPS, Trimble RTX
- 500 hours of observations taken over 6 stations.
- General takeaways:
 - Services using the same data sets performed similarly, converging around 4+ hours of observation time.
 - Using faster logging rates marginally improved results.
 - Addition of GLONASS improved results, with notable differences between sites with minimal and moderate obstructions, especially with Trimble RTX (and less so with CSRS-PPP).
- Marian's paper is being published in the American Society of Civil Engineers Journal of Surveying Engineering.

OSU/NGS Partnership Projects by Dr. Jihye Park

- OSU is converting some courses to online format, starting with Least Squares Adjustments first.
- Overview of NGS/OSU partnerships
 - NGS58 is outdated and uses loop network design. Looking to upgrade to hub network design.
 - Development of NGS-PPP multi-GNSS processing software. Also working on replacement of PAGES software used in OPUS.
 - Cascadia Lifelines Project (CLiP): How to recover from earthquake for survey marks and stations.
 - GNSS meteorology: Can use tropospheric delay to determine precipitable water vapor.
 - Case study: Hurricane Matthew in 2016.
 - Model works well for 12-hour prediction of hurricane data. Looking to refine model for 24-hour prediction.

- GNSS reflectometry: Uses multipath analysis to determine adjacent water surface compared with tide gauge station data, offshore drill platforms.

Review of a “Tale of two RTNs” and Release of NGS NCAT by Casey Varnum

- “Tale of Two RTNs” study used ORGN and South Carolina RTNs.
 - Compared network vs. single-baseline solutions, optimal observation times, and baseline lengths.
 - Test results indicated that 3-5 minutes was the optimum observation time. Adding GLONASS noticeably improves accuracy. Firmware updates greatly affect results in both receivers and RTNs.
- NGS NCAT (NGS Coordinate Conversion and Transformation Tool)
 - Uses NADCON 5.0 along with other NGS programs to perform horizontal conversions of points.

Bridge Inspection with UAS by Chase Simpson, Erick Caine, and Chris Glantz

- Brief historical overview of bridge inspections and legal requirements.
- Almost 7000 bridges in the ODOT national bridge inspection inventory.
- Types of inspections and frequency.
- Trying to move to drones because of expense—can work in the daytime instead of nighttime. Safety is also an issue, as drones limit having to have people climbing around the bridge for inspections.
- ODOT’s UAS inspections originally used OSU to fly the drones under an FAA COA, but now fly under FAA Part 107.
- OSU research used a Sensefly Albris with HD and thermal cameras. Also equipped with ultrasonic sensors to assist in precise flight and holding. Camera rotates from full zenith to nadir (for looking underneath structures).
- Also used a DJI S900 with zooming camera.
- Testing program used 5 bridges.
- Used Structure from Motion software to create 3D model from overlapping photos. Also used Cloud Compare, Agisoft, and Pix4D software.
- Many bridges are not suitable for drone inspection due to FAA airspace control, short length of bridge, or low-elevation decks.
- ODOT has their own UAS policy. They are currently operating 14 airframes of 5 different types.
- ODOT is building on OSU research with a program of bridge inspection in Summer 2018.
- Additional OSU projects:
 - Transportation system monitoring with drone equipped with lidar.
 - Shallow bathymetric mapping with drones.
- OSU Transportation/UAS Expo held July 30-31.

Ride with GPS by Zack Ham and Tomas Quinones

- 18+ employees, located in Portland.
- Three customer types: “Prosumer”, rider, organizations.
- Route planner with turn-by-turn navigation.

ORGN Update by Randy Oberg

- ORGN Team: Reconnaissance, installation, support, monitoring, and maintenance.
- 110 stations, 39 owned by ODOT. 96 stations in network, 14 redundant, and 6 planned.
- Over 1000 rover accounts (over 50% private firms/individuals)
- Within 6 months of NGS moving to NATRF 2022, the ORGN will do the same.
- GPS on Benchmarks now on Geometronics On-line Toolkit
- ODOT hired two temporary employees this summer to support GEOID18. Still too much work. Even if you don't have time for observations, recovering the benchmarks and letting ODOT know will help.

Respectfully submitted,

Chris Munson, Secretary
Oregon GNSS Users Group