**OREGON GPS USERS GROUP**
**MEETING MINUTES**

**Date:** June 3, 2016

**Location:** Hollinshead Park, Bend, Oregon

**Board Members Present:** Dave Hills, Chair
Eric Gakstatter, Chair-Elect
John Minor, Treasurer
Chris Munson, Secretary

**Called to Order:** 9:00 am
**Adjourned:** 3:30 pm
**Contact Hours:** 5.5 hours

**Business Meeting**

- Introduction by Dave Hills, Chair.
- Secretary's Report by Chris Munson. Currently have 73 paid members, 261 people total on the email contact list.
- Treasurer's Report by John Minor. Currently have $10,345.45 in our bank account.
- Announced upcoming August 23 workshop on Unmanned Aerial Systems (UAS) in Salem, Oregon. Details and official announcement to follow.
- Discussed an official name change to "Oregon GNSS Users Group". A motion was made and seconded, and all present voted to effect the name change. Dave Hills and John Minor will carry out the necessary paperwork and details with the State and the bank.

**GNSS Basics & Review by Eric Gakstatter, Chair-Elect**

- Dave Hills began by explaining the difference between ITRF and NAD83 reference frames, which becomes more important as we have higher accuracy receivers. Dave then introduced Eric Gakstatter.
- Eric pointed out that WAAS correctors are ITRF, as are most satellite-based correctors such as Trimble RTX. State departments of transportation typically give NAD83 correctors in their real-time networks.
- A quick overview was given of GPS and GLONASS systems.
- Eric discussed active satellite-based augmentation systems (SBAS) such as WAAS, MSAS (Japan), EGNOS, Omnistar, and Trimble RTX.
- Galileo system is being fast-tracked to completion, launching 2-4 satellites per rocket. Beidou (China) is also going worldwide.
- Planned SBAS systems are SDCM (Russia) and IGSRT (Worldwide).
- Accuracy for GPS ranges from 5-10+ meters (cost: $2) to centimeter ($7000+)
- Sources of corrections
    - DGPS/USCG (sub-meter, being decommissioned)
    - WAAS (sub-meter)

    - Commercial satellites (Omnistar, Trimble RTX). Can be very accurate, but require long convergence times (20+ minutes)
    - RTK (centimeter accuracy)
- GPS World magazine has a published article of free public real-time networks such as Oregon and California RTN's.
- Eric did a test on some SBAS receivers for accuracy. His results:
    - DGPS: 0.64 m (1-σ), 0.98 m (95% confidence), 1.2 m (99% confidence)
    - WAAS: 0.45 m (1-σ), 0.69 m (95% confidence), 0.86 meter (99% confidence)
    - Consumer Garmin model: 5+ meters
- Effects of space weather on GNSS
    - Solar cycles mostly affect WAAS, single-frequency receivers
    - Eric believes space weather is exaggerated by the media.
    - There are likely only about 10 events in an 11-year solar cycle that would severely affect GNSS.
    - Can sign up for space weather alerts through NOAA. Level of alerts can be specified when you do so.
    - Ken Bays mentioned that the National Geodetic Survey (NGS) has published a document on solar storms and GNSS data collection.
    - The level of storms that start to concern Eric are K7, G3, and higher.
- Specified accuracy of a GNSS receiver is completely up to the manufacturer, there is no standard test.

**Using the RTK in a Cellular- or Radio-Challenged Environment by Randy Oberg, Oregon Department of Transportation (ODOT)**

- Randy gave a presentation on how to extend the range of an RTK base radio when distance or topography limits the range. A Satel radio can be configured as a repeater and placed an intermediate distance between the rover and base. More than one repeater can be used. Distance dependent errors still apply during the use of radio repeaters.
- Can also extend rover range by using an Intuicom RTK bridge. Can be set up in an area with cellular signal and configured to receive ORGN correctors via cellular data and rebroadcast via radio to a rover in a cellular-challenged area. Cost is $3000-5000.
- Another RTK bridge option is GNSS Internet Radio 1.4.11, a free application that can be downloaded to a regular laptop. Allows you to connect to the ORGN via internet, while plugging a separate radio transmitter to the laptop that rebroadcasts the signals. Dave Hills mentioned that it worked great in a job that the U.S. Fish and Wildlife Service did several years ago where the RTK rovers had poor cellular reception.
- Randy also discussed a smartphone app, NTRIP Client, which can be used to verify if the ORGN is broadcasting correctors. Can be useful in troubleshooting situations.

**Vendor Technology Presentations**

- **Chase Fly, ElecData**
    - Trimble Geo 7X (sub-meter to centimeter level accuracy)
    - Trimble R2 (sub-meter to centimeter level accuracy)
    - Trimble R1 (sub-meter, single frequency)
    - Nomad

    - Juniper Tablet (2-5 meter accuracy, post-processing available)
- **Shawn Billings, Javad**
    - 864-channel Javad receiver, capable of RTK and also immediate post-processing on Javad server (centimeter level accuracy).
- **Bryan Tyson, Geoline**
    - Trimble R10 (centimeter level accuracy).

**Field Trials of Equipment**

- The meeting separated into different groups to test the accuracy of vendor equipment. Several members also brought their own equipment.
- Dave Hills demonstrated consumer-grade (Garmin) units and smartphones.
- Shawn Billings and Bryan Tyson demonstrated centimeter-grade RTK equipment.
- Eric Gakstatter and Chase Fly demonstrated mapping/GIS/resource-grade equipment.
- Reports were made after the trials of the tested equipment.
- A Q&A session was held with the vendors presenting.

**Oregon Real-Time GNSS Network (ORGN) Update by Ken Bays, Oregon Department of Transportation**

- ODOT has a new Engineering Automation unit, headed by Ron Singh.
- ODOT recently purchased a Leica Aibot X6 hexacopter.
- 59 of 98 ORGN sites are now GLONASS-enabled.
- A member asked what PBO stood for, and a brief history was given of the Plate Boundary Observatory (PBO) and UNAVCO.
- ODOT is to upgrade 19 PBO stations to GLONASS and UNAVCO will upgrade 13 PBO stations by the end of Summer 2016.
- A GLONASS products PDF is available online on the ODOT Geometronics website.
- Ken gave a brief demonstration of the Geometronics On-Line Toolkit.

**NGS Update by Mark Armstrong, National Geodetic Survey**

- NAD83-based State Plane coordinates will not be maintained after 2022 (switch to global reference frame).
- Mark explained low-distortion projections (LDP), including the Oregon Coordinate Reference System (OCRS).
- 39 OCRS zones now cover the entire state. The newest zones still need to be written into Oregon Administrative Rules (OAR).
- When State Plane coordinates were developed, elevation was not considered. Linear distortion is +/- 40 ppm at best.
- With the OCRS, most of the state, including the highways and most populated areas, linear distortion is +/- 10 ppm (0.05 ft/mile)
- The Central Oregon Coordinate System, while better than State Plane for Central Oregon, has greater distortion than OCRS, mostly due to advances in technology over time.
- A good rule of thumb is that you will have 0.25 feet of linear error for every 1000 feet in elevation change over your survey.

**Conclusion**

- Thank you by Dave Hills
- Call for volunteers to help with Malheur National Wildlife Refuge.