The WSRN at 25

By: Forest McBrian, Assistant Operator, WSRN

Intro

The Washington State Reference Network is celebrating 25 years of operation as a unique cooperative effort, serving surveyors, scientists, and a variety of other groups interested in fast, accurate GNSS locations. If you've ever used the WSRN, then you are part of that cooperative effort: our network is now among the most modernized and comprehensive in the nation, and that is due to the collaboration, volunteerism and feedback of our users, subscribers, and partners. We are ready for the future: datum shifts, new technologies, new applications, and a new generation of surveyors.

Like many Washington surveyors, I first connected a rover to the Washington State Reference Network having no idea what exactly it was. Martin Paquette gave me a login and a password and sent me out on the lawn at Renton Technical College to map some sidewalks. All I knew was that this GNSS gizmo was very powerful, and once connected to the WSRN, it was like magic: plus or minus one centimeter, rendered in NAD83-2011 state plane coordinates right on my controller. I imagined the WSRN folks as some kind of wizards in a workshop surrounded by old surveying gear and piles of books and computer monitors.

That turned out to be quite accurate. Training as Assistant Operator at the WSRN over the last several years, I've learned how the magic is done: the ingredients include duct tape, sweat, blood, miles of coaxial cable, mountains of emails, and large volumes of coffee consumed while visiting every single drive thru espresso shack in the state during site maintenance trips. And outstanding partners and end users—y'all built this!

As one of the first real-time networks, and one of the few purely cooperative ones, we've hosted delegations from all over the world who were beginning to design their own. The founding WSRN Administrator is retiring next year, and there will be big, wizardly shoes to fill, but his legacy is ours to carry on: a vital, resilient, cost effective geodetic framework for our state.



The Past

Throughout the 1980s and much of the 1990s, surveyors worked directly with GPS satellites to dramatically accelerate geodetic positioning. All of the infrastructure—the space vehicles, ground control installations, and geodesy laboratories—were distant and invisible, while the processing and adjustment of GPS measurements was demanding and terribly slow. But it was also clear that this technology was destined to evolve at a rapid pace: receivers got smaller, cheaper, and better, while techniques proliferated.

By the mid- to late-90's, permanent reference stations began to crop up around the state in response to local and regional needs: many, like the City of Renton's station, were driven by local surveying needs; but the station established by the collaboration of Seattle Public Utility, UW Geophysics and the Pacific Northwest Geodetic Array in 1999 foreshadowed what was to come: multi-agency, cross-disciplinary cooperation to create infrastructure and data access. Increasingly, surveyors began to have local GNSS resources, in the form of reference stations but also expertise developed by the enterprising folks spearheading these efforts.



The idea of a state-wide network of continually operating reference stations coalesced around this time, but local and regional networks continued to grow, providing proof-of-concept and attracting interest and funding. It was a case of a bridge being built from both ends (to use an apt geodetic metaphor): by the time the core network of 10 WSRN stations was completed in 2004, the demand for the service was clear on the ground, and the viability of the model had been proven in the eyes of institutional decision makers. Partners began to rapidly add stations firstly around the Puget Sound "subnet" and a new subnet around Spokane. That same year, the WSRN took a big step toward becoming a geodetic framework for the state, committing to constraining its stations to the National Spatial Reference Framework of the NGS—which at the time meant NAD83-CORS96 Epoch 2002.00.

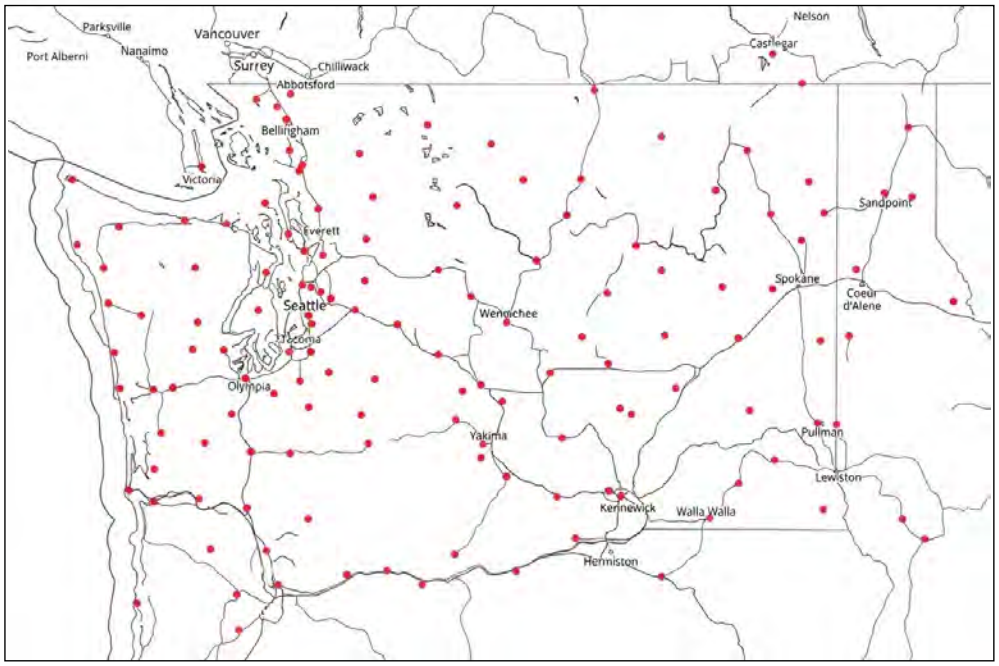
The momentum continued to build, with PANGA, WSDOT, and WGS formally committing to develop the network. By 2009, with 85 stations, the WSRN covered 80% of the state: by 2011, 95% of the state with 104 stations.

The Present
Today our network includes 180+ stations and covers the entire state. Areas of high use have a dense network with high redundancy to accommodate the inevitable power outage, lightning strike, or coffee-spilled-on-receiver incidents. Dave Doyle, retired NGS geodetic surveyor and prolific lecturer/Grateful Dead fan, called our network one of the most modern in the country.

When the WSRN began, there was one constellation (GPS) and only two signals (L1 and L2). Now, there are 5 constellations and 23+ signals between them. Remember struggling with a handful of satellites in view? Now, it is not uncommon to see 30-40 in view. The tech upgrade cycle for the WSR has been continuous. User gear has improved and so has performance.

And what Dave said is true: 90+ percent of our stations feature multi-constellation receivers equipped to manage the next wave of satellite measurement technology. We deliver corrections from two identical servers, providing a redundancy that keeps our services available 99% of the time. Working closely with the NGS, we're already deep in the process of preparing coordinates in the new datum, and we've been working with additional servers to prepare for a seamless transition when that datum arrives. We are solvent, strong, and well-resourced.

The Future
We're looking ahead to evolving technologies, changing needs, and improved systems. The shift to NATRF 2022 will bring challenges for the surveying community, and we will be there to help. We've designed a transition we believe will minimize headaches and confusion (at least as far as your corrections go). See more about this in this issue—"The WSRN and the Transition to NATRF 2022".



You've likely heard a lot recently about Low Earth Orbit (LEO) satellites; communications constellations delivering internet from space, going up in substantial numbers. Historically, GNSS satellites are Mid Earth Orbit (MEO), but soon, LEO constellations will begin to augment GNSS positioning, and in time, services available to WSRN users.

That is, in part, why we and our partners have invested in state-of-the-art upgrades—they are ready to leverage the wave of LEO technologies coming our way. We are also experimenting with satellite internet as an alternative for stations in cell-challenged locations; our network is excellent, but we're always looking for ways to make it better.

While we've nearly completed the network in terms of coverage, we continue to watch usage patterns—we'll grow density as the state develops. We're also working to ensure adequate coverage with NGS CORS, as OPUS and associated tools will continue to be a vital geodetic toolkit for the foreseeable future.

But the future I'm most excited for is the growing community. We recently installed a station near Monroe, Washington, at the headquarters of a local surveying firm. The owner invited us to come drill holes in his shop despite being on notice for the arrival of his third child. "I thought it would be cool to get involved with the network," he said. This kind of collaborative spirit is how the WSRN was built.

With thousands of subscribers and partners, the real "network" in WSRN is the human one: the folks who offer facilities, equipment, know-how, the correct sized socket, or an after-work trip to cycle the power on the odd modem that has flaked out. And, importantly, the folks who direct us to their favorite coffee stand when we come to town. We look forward to seeing you at LSAW, chatting on the phone when you have a question, or waving when we see you out on the work site. ■