

# Navigation Northwest

A Quarterly Publication of the Seattle Navigation Committee  
Volume 5, Number 2 June 2017

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### Editor's Note

We continue our search for outings where navigation and/or communications issues provide "Lessons Learned." Featured is a spring scramble outing on Mt Defiance – and it is still "spring" in the mountains this year.

Gaia GPS rolled out a major revision of the popular navigation app. See advice on updating your device.

Freedom 9 is scheduled to be available for sale (paper, hard copy and e-version) in late October.

Reprinted from March: Seattle Navigation Chair Brian Starlin provides a Q & A Navigation Minimum Standards rollout on changes and new emphases.

## Springtime: Special Navigation Challenges for Scramblers

By Andy Cahn

Navigation during a scramble is often thought of as two skills: one involves knowing how to translate where you are on the ground to a location on the map and the second involves knowing how to translate your route on the map to a passage through the terrain. While it is important to know how to follow a route on the map, it is also important to know how and when to deviate from your intended route. This is especially true in the spring when conditions are in flux.

The weather during the spring is especially variable. You can have hot and sunny weather one day, and a snow storm the next. A warm, snow-free terrain at the trailhead may lead to deep, fresh snow at the summit. I recall one year when I planned a scramble up Iron Peak in the Teanaway. Trip reports from the previous weekend indicated that the road to the trailhead was snow free as was the first half of the trail. A week later, after a midweek snowstorm, we had to park the cars 3 miles from the trailhead.

Flexibility is the key to planning spring trips. Always have a backup plan (or two) in mind. Earlier this year, I planned a scramble up East Snoqualmie. But when a last minute weather forecast predicted 40-knot winds, I moved the trip to the tree-covered Humpback Mt. And when the Highway Department closed I-90 shortly before the Humpback exit, we crossed the median strip and scrambled up to Mason Lake instead.

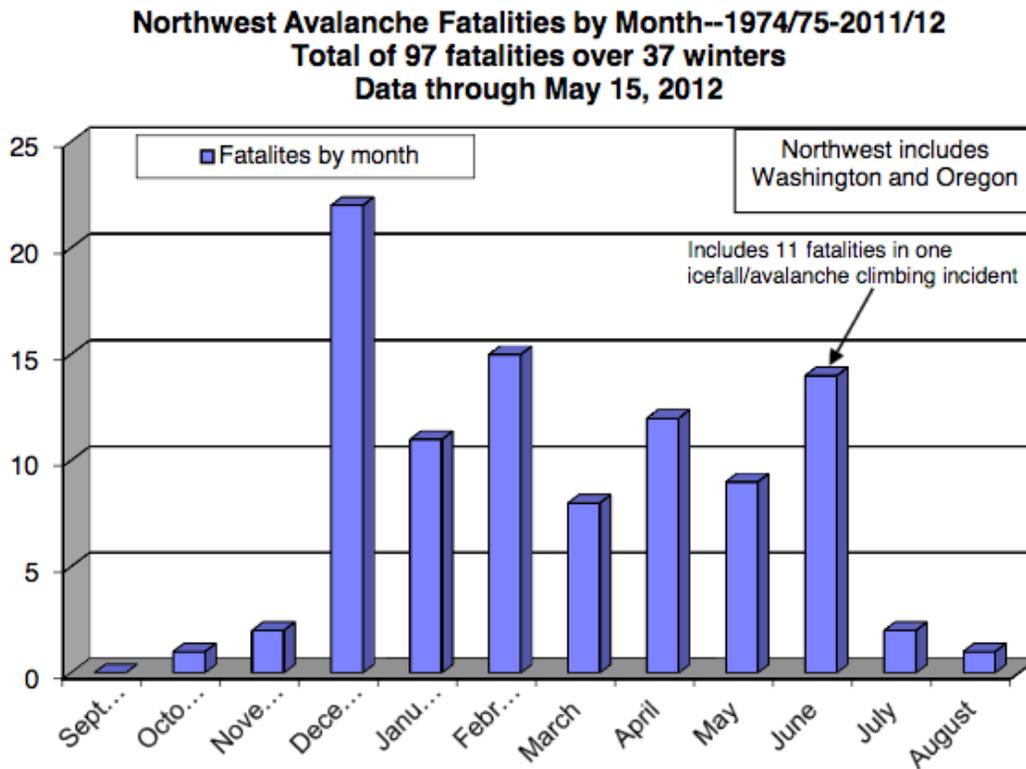
I often describe spring scrambling as time travel. You can start at the trail head in May, surrounded by rhododendron and columbine, hike into April with only trilliums, snow lilies, and skunk cabbages in bloom, then climb into March with crusty, duff-covered snow, and finally reach February with fresh snow at the summit. Retreating off the mountain reverses the time travel. Each of these zones has its own navigational challenges.

In the lowlands, stream crossings may be the biggest challenges. Rivers and streams run highest during the spring melt. A stream that is a trickle in summer, or is covered by thick snow bridges in winter, may be raging in spring. Routes that are easily followed the rest of the year may require sizable detours during the spring. On one sunny spring trip to Bare Mountain, a creek we had crossed in the morning was so swollen with fresh snow melt when we returned that afternoon, that it was no longer crossable. We had to travel upstream for more than a half mile before we found a safe crossing.

Heading up into the zone of crusty snow, the biggest danger is hidden voids. The snow around boulders and fallen logs often melts from the ground up, leaving just a crust of snow obscuring the void. Old snow may also be quite icy. You may need to alter your route to find a different aspect, either more southerly in hopes of finding bare ground, or more northerly in hopes of finding deeper snow that has gone through fewer freeze/thaw cycles and is less icy.

The summit region, with its copious amounts of snow even in spring presents two dangers that may necessitate deviating from your intended route: cornices and

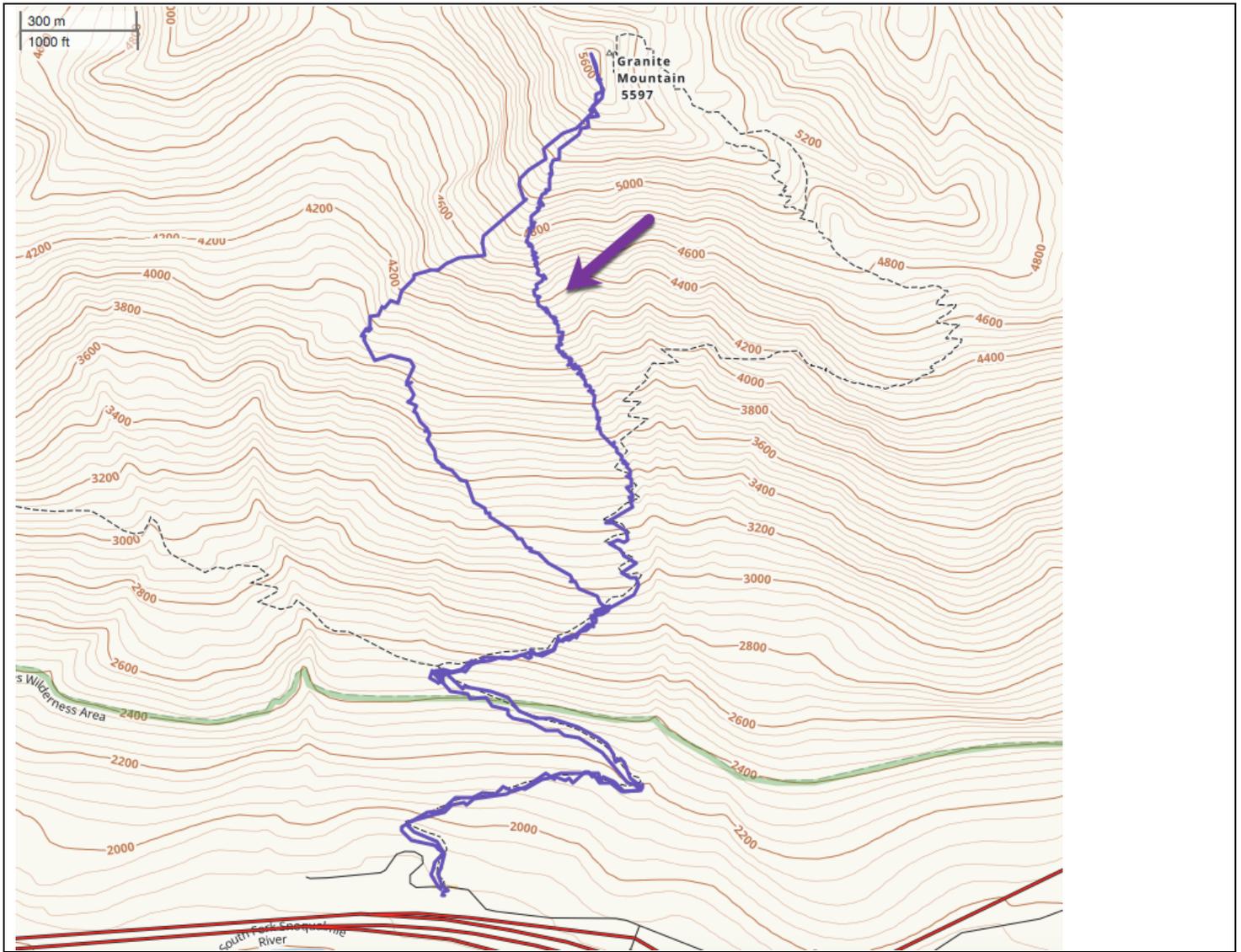
avalanches. Figure 10 shows fatalities by month. Be prepared to reroute a trip if you encounter cornices or if the avalanche danger becomes considerable. Avalanche risks are forecasted until around mid-April by the Northwest Avalanche Center at WWW.NWAC.US. Weekend reports continue until around mid-May with special bulletins if conditions warrant. Always check this site before heading out in winter or spring.



**Figure 10. NW avalanche fatalities by month, 1974-2012.**

On a recent trip to Granite Mt, we ascended the standard winter route up a south-facing ridge. In the cool of the morning, the snow was adequately firm. But by the time we were ready to descend, the snow had softened considerably in the bright sunlight and our ascent route was no longer safe to descend. (In fact, when we tried it, we touched off several large avalanches.) Instead, we descended by way of a nearby ridge with a more westerly aspect that had not softened as much.

See Figure 1. It was a longer route, it was an unintended route, but it was the safe route.



**Figure 1.** Granite Mtn Gaia .gpx track by Mike Vier. Ascent via eastern track (arrow), descent via western.

The avalanches started at about 5000', where the two tracks diverge, and swept down to at least 4200', completely obliterating the ascent route.

Remember, summits are optional, but returning to the car is not. The route you picked on the map is simply a plan – Granite was our second choice that day. It must be adjusted according to the conditions you find on the ground.

--Andy Cahn is a frequent instructor with the Scramble and Navigation courses and has led more than 100 scramble trips. Reach him at [AndyCahn@gmail.com](mailto:AndyCahn@gmail.com).

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## NextGen Gaia: Updating to the New Gaia GPS

By Bruce Crawford

This is a different app than the old version, now called Gaia Classic. On the iOS platform at least, your data is lost unless you do one of two things: sync back to the Gaia server using your account, or export your waypoints and tracks by emailing them to yourself. I'd suggest doing both.

After you've synced your Gaia Classic back to Gaia's servers, the new Gaia app will try to autoload everything, including maps, when you install it. The trick is you REALLY don't want to autoload the maps, especially if you have old ones Gaia can't recognize. The old maps made my first installation attempt fail, after they took far too long to load, and were incorrect.

So install the new app, allow the login to your account, check to see that your waypoints and tracks are all auto loaded, then stop the process of downloading and delete the map downloads. No pain for deleting downloads like there is for dealing with your old maps.

Next check the tracks and waypoints in more detail. If you find them missing or corrupted in the new app, you can look at the emailed gpx or klm with a text editor and recover what you need. If you don't have or use a Gaia account, importing these files from your email will be how you transfer all the info. I also have kept both apps on my phone, which allows a fail back to Classic if needed (memory constraints may prevent you from doing that).

Once you have your waypoints and tracks you'll want to load new maps. This will take a while, and a WiFi or wired connection, so you will need to schedule some time in a good location for doing this.

The Gaia topo mapping is lighter weight than the USGS topo (significantly less memory and quicker load) so loading the Gaia version is beneficial. The Gaia street maps are not lightweight.

Both the Gaia topo and street maps show more features as you zoom in. While that reduces clutter, you have to zoom in a lot to see everything. Sort of like trying to view your map through a microscope. If you are trying to follow a road or trail, you may have to scroll around a lot while zoomed in enough for it to be shown. It's hard to both follow a trail on the map and see the big picture.

No settings to alter the behavior of what is visible at differing zoom levels that I've found. It seems to be optimized for a tablet-sized screen, not a phone sized screen. The USGS mapping may be a memory hog, but it is just a scan, and is all-visible no matter what the zoom level is.

This is a different app than Gaia classic, but the structure is so similar that the learning

curve is minor. For example, track editing is the same, but I had to stumble around a bit to find the duplication and cropping features. There are a few other things I'll tinker with in the field. But I'm comfortable with the new app as is.

As to the subscription revenue model, I realize the cost will impact people. My take on the cost, \$10 or \$30/year, is far less than what I spend on keeping paper maps stocked. Also, I don't begrudge anyone making a living if I get a good app out of it that I use to get myself home safely. If the payment also helps ensure the app is updated and doesn't stop working when the op system is updated, I'm happy.

*--Bruce Crawford is a veteran member of the Seattle Navigation Committee. A keen scrambler and musher, he models METRO wastewater flow by day. Contact: [brucec@bikejor.com](mailto:brucec@bikejor.com)*

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## Mountaineers Navigation Instruction Goes National

By Doug Canfield

Fifty-seven years ago The Mountaineers pulled together their climbing notes, mimeographs, photos, and illustration scrap. Volunteers with editing chops organized those materials and had them printed neatly in a book they called *Mountaineering: The Freedom of the Hills*. Before long, word of this book got out and climbing instructors and eager beginning mountaineers all over the world began buying it. Something similar is being tested with our online navigation instruction.

In early 2016, Seattle and Foothills navigation committees stepped up to experiment with a Wilderness Navigation elearning workshop pilot. Both branches are still teaching the workshop in this format, and this past January, the committee chairs from those branches and Kitsap made updates to the course, based on their experience and feedback gathered from the pilot. Shortly after those modifications were made, Mountaineers Books reworked the course into a standalone version that could be offered to students everywhere without the field trip. With limited marketing, this standalone workshop went live to the world in June 2017.



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An elearning workshop

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The standalone course is named "Navigating Through the Wild", and is accepting a rolling enrollment through August. There are currently 10 students, which has no field trip and does not offer the opportunity to earn a Mountaineers navigation badge. Neither does it satisfy the prerequisite required by progressive skills courses such as scrambling and climbing. The course fee is \$49 (nonmembers) and \$45 (members), and includes the USGS Baring map with the price of registration.

Here's the course link: <https://www.mountaineers.org/mountaineers-books/mountaineers-books-committee/course-templates/navigating-through-the-wild-webinar-the-mountaineers/navigating-through-the-wild-2017>

Five students live out of state (North Carolina, Kansas, California, and Oregon). The only marketing has been through a Mountaineers blog post, newsletter inclusion, and the course posting, and through one email sent to the Mountaineers Books promotional list of roughly 19,000. Marketing will be the biggest challenge for the publishing division, since the channels it needs to reach students are different from those through which books are sold (almost entirely via retailers).

Still, the publisher has a huge trove of instructional content (Freedom 9 is due late October in stores), and the elearning navigation pilot showed that outdoor enthusiasts enjoy using this format to learn new skills. Readers are invited to suggest ways to tap that trove for novel instruction. For Books we'll probably team a course with an upcoming book – the new edition of "Staying Alive in Avalanche Terrain", for example, which is on the schedule for Fall 18. Crafting the right strategy will take more experimenting before the view clears and we see where we're headed. Until then, it feels like we're on the right path.

At this writing a new Elearning Manager position was close to being filled. CEO Tom Vogl will set priorities for content development.

*--Doug Canfield is marketing director for Mountaineers Books and an experienced Wilderness Navigation instructor. He was lead developer and trouble-shooter for the initial online course. Contact: [dougc@mountaineersbooks.org](mailto:dougc@mountaineersbooks.org).*

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## Block by Block -- Gaia in the City at Night

By Peter Hendrickson

It was one of the rare late winter weeknights with a full moon and a clear sky but I missed a turn. Our Seattle Stairway Walks hiking group was passing several back doors (or were they front doors?) going up many unintended Magnolia steps.

This was not the Gaia route I had planned and followed the prior week. Nor was it the highlighted route on the map tucked in my trouser pocket. Or the same Gaia route on my iPhone. We were chatting, ever so pleased to be outside with headlamps and I had turned a block too soon. The fault was not in the route, the paper map or the iPhone map – it was the trip leader. I've planned and led 16 of the 25 Jaramillo (2013) walks since January. Below are the steps I've come to follow in creating new, urban adventure day hikes.

### Mountaineers Web Work

1. With or without a guidebook to set a precise route, plan a general route.
2. Go to Route(s) & Places (under Volunteers, Schedule an Activity) and key your anticipated route title to see if the trip or place already exists. For example, "Queen Anne" will generate a trio of options. If the description is pretty close, use it to post your hike with leader notes indicating how you will actually lead a modified hike.
3. If not, you'll create a new draft route or place using the Mountaineers widget to provide the essential information. I copy and paste from earlier entries to maintain parallel formatting. But you'll need distance, elevation gain and high point data (see Gaia Route Details below).
4. Once submitted, you'll need to wait for approval (and likely some style and content edits) from IT Manager Jeff Bowman, an expert on trails and places. Jeff has a good eye for language and information that will work for the many trip leaders, not the few.

### Using Gaia To Detail the Route

Several digital and hard copy tools are available to map a detailed route. I start with any recent guidebooks and hard copy maps at hand. The City of Seattle publishes large format city walking maps and several fold out city maps I find helpful for big picture planning

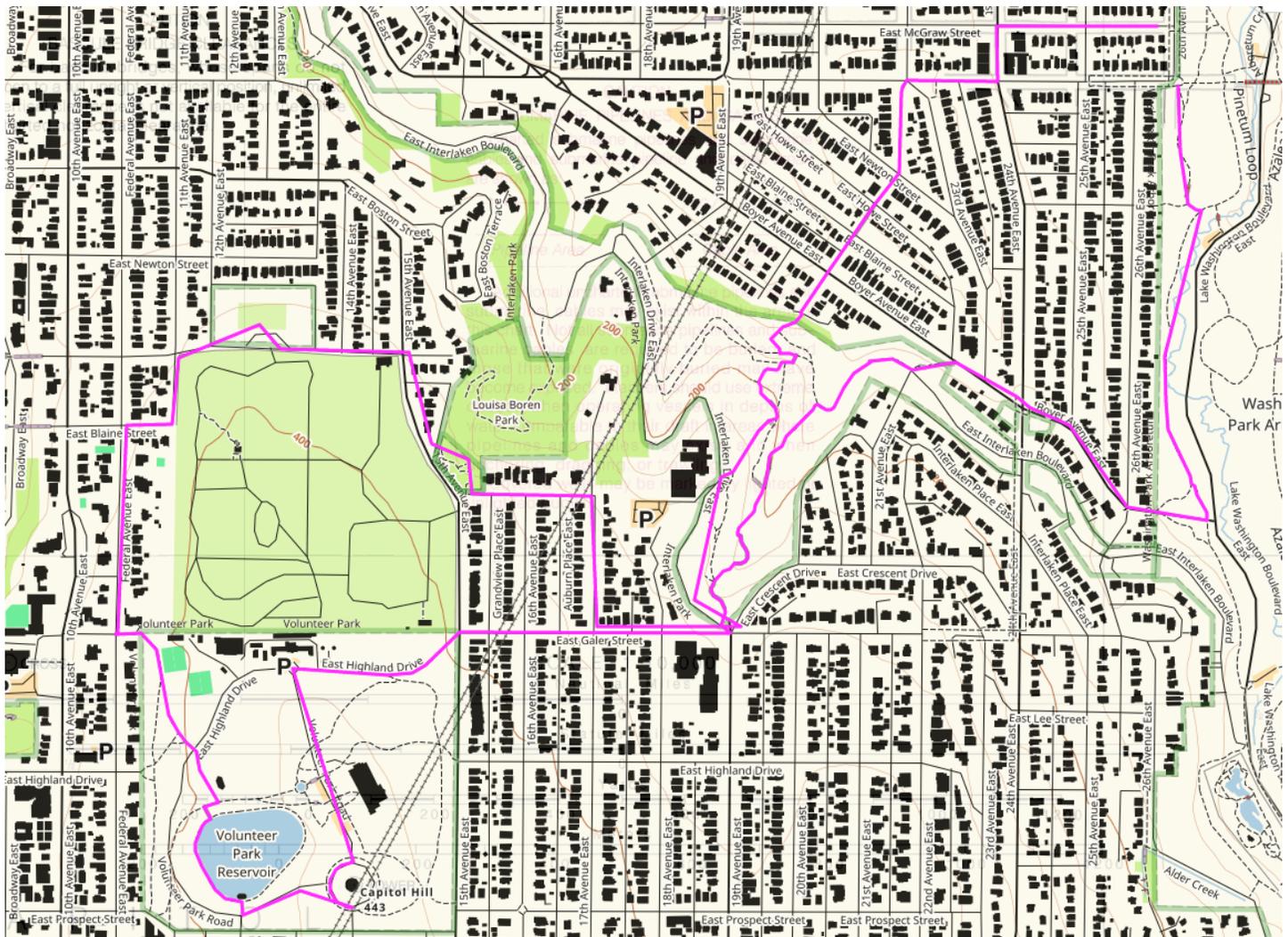
The three most powerful city walks books are:

- Jaramillo, Jake & Cathy. (2013). *Seattle stairways walks*. Seattle, WA: The Mountaineers. *This turn-by-turn walker's guide provided a first rate template for our walks. Many were amended to add some miles and points of interest.*
- Westerlind, Linnea. (2017). *Discovering Seattle Parks*. Seattle, WA: The Mountaineers. *The newest title brings fresh detail to the inevitable passage through or to 122 Seattle and Regional Parks.*
- Williams, David (2017). *Seattle walks*. Seattle, WA: University of Washington Press. *Rich in historical, cultural, geological and natural world details, the walks make up in density what they lack in length or elevation gain.*

My particular criteria for this series are:

- Two to 2.5 hours with a 6p.m. start
- Easy+ over about 4 miles at around 2 mph including cultural and natural history stops
- Maximize stairways – many do these for conditioning
- Pass by or through one or two special places
- Be mindful of safety concerns at night in the city

Resources at hand, I open Gaia (these were done in Classic, not NextGen) and go to the Route function. See Figure 1, a three parks night hike.



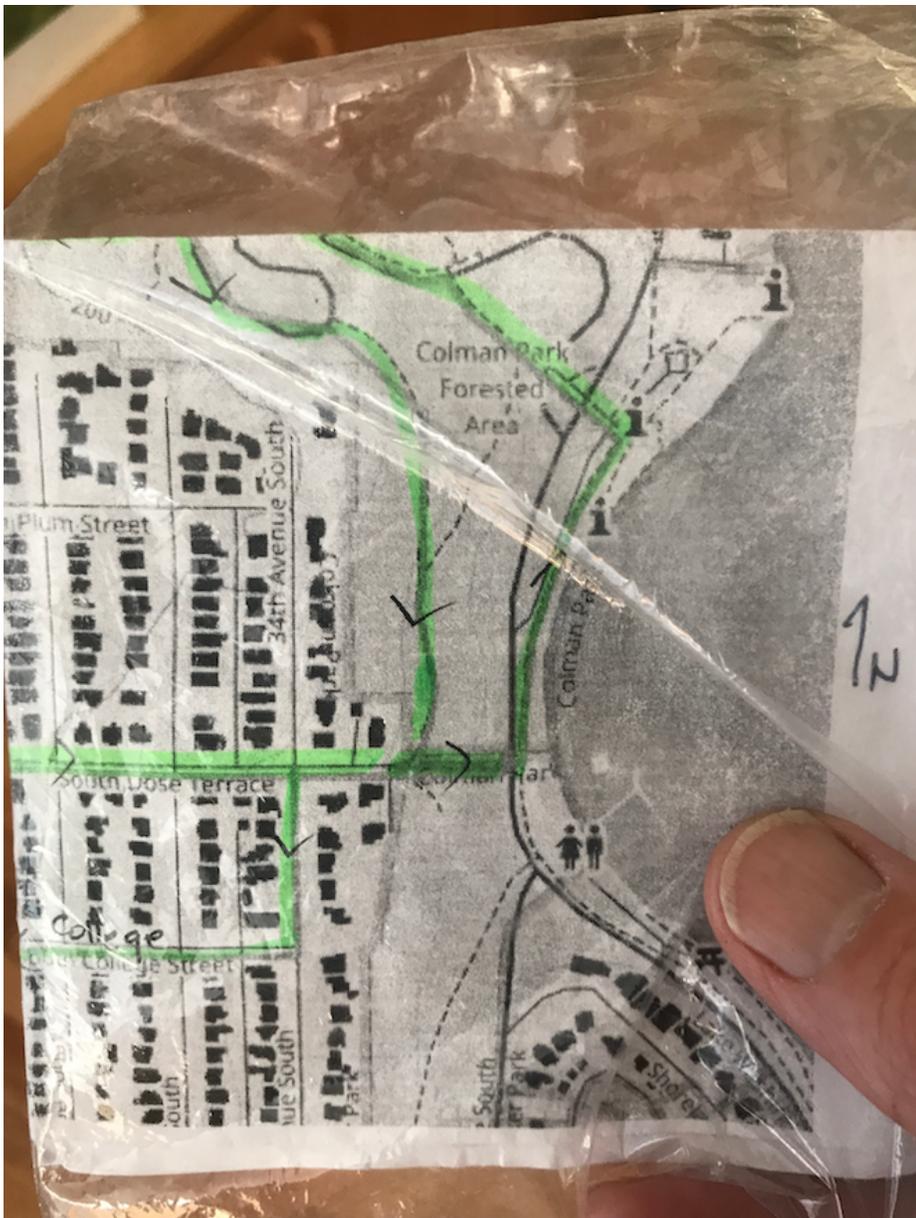
**Figure 1.** From the Arboretum through Interlaken Park to Volunteer Park and return.

I learned to:

1. Zoom the map large enough to cover the first half hour (about 1 mile) of the route.
2. Make sure I'm using WGS83 and have UTM coordinates activated – the grid squares will be 1km on a side for easy distance calculating.
3. Tap the cursor at the TH and continue (slowly) clicking at turning intersections. You'll likely need to wait for Gaia to connect the dots, which simultaneously generates a graphic route profile.

4. Loop rather than out-and-back to explore more territory. The developing route profile tells me if I'll likely stay close to my distance/time parameters.
5. Save and print a BW map after closing the loop at the TH. Gaia is optimized for 8.5 \* 11" paper but sometimes I do one or two screen grabs to paste, then print a custom Word doc.
6. I return to the Mountaineers widget with actual, on-the-ground distance and elevation measures in hand.

With a Mountaineers approved new place/route, I'm ready to post the hike, then test walk the route. I make notes on the backs of old business cards. They resist a little damp and can be alligator-clipped and cupped in your hand for ready note taking. While I could cut corners and speed through parks, lingering gives me grist for narrating the walk later. I introduce tiny mysteries to be solved along the route with careful attention to passing details – a brass benchmark, a hidden path entrance or site of an historical event. And I lay down a track to send to the assistant leader and for later reference.



**Figure 2.** Gaia Mt Baker Stairway Walk #20 in baggie-- ~3.7 mi, 372 steps, 834' Navigation Northwest (V5.2) June 2017

At home I highlight the intended path and fold the map to fit into a sandwich bag. See Figure 2. Over time, I began inserting north arrows to keep me oriented. A second copy goes to the sweep. The hard copy trip roster fits nicely in the bag, too.

While the iPhone app provides near absolute point position, I mostly use the tiny hard copy map as it comes to hand so easily and I save the phone for photos. Headlamps really help for reading in the dusk or dark. Starting the hike is optional; returning with all who started is essential. That head-mounted string of lights tells drivers, "Mountaineers crossing the street. Beware."

An unanticipated benefit of frequent Gaia use was advancing from an informed novice to a comfortable intermediate user, better prepared to problem solve and teach others in the city or in the mountains.

*--Peter Hendrickson has decades of city hikes behind him, most recently circumnavigating Manhattan and Brooklyn Boroughs, making long forays around Zurich, Bolzano, Bariloche & London, and enjoying midnight strolls through Buenos Aires & Bogotá. Contact: p.hendrickson43@gmail.com*

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## Revised Wilderness Navigation Standards Approved

By Brian Starlin

Branch Leadership Committee on second reading unanimously approved revised Clubwide Minimum Standards for wilderness navigation without comment at their March 15 monthly meeting. Some changes reflect anticipated revisions in next fall's *Freedom of the Hills*, 9<sup>th</sup> edition. Below, in a Question and Answer format, are details worked out over many months across branches and activity committees impacted by navigation standards. [Find standards here.](#)

Q: Why change the standards? A: *This isn't a change in standards, but the first setting of the standard for Navigation.*

Q: What instruction and which activities are impacted? A: *This only covers the Wilderness Navigation Course or any similar course that leads to the awarding of the Basic Navigation Badge.*

Q: When do these standards go into effect? Are courses changing this spring? A: *The branches will determine if any changes are necessary and how long they will need to effect changes. However, the standard was written with all existing courses in mind, so the changes should be minimal.*

Q: Do I still need to carry a hard copy map if I have digital maps? A: *The course still focuses on using the paper map because it shows the overall area covered by the training and is easier for instructors and students alike. And it avoids issues with digital-only mapping, such as battery life, power constraints, size of screen, etc.*

Q: I have a digital compass on my smartphone. Is that enough? A: *The course still focuses on the traditional consumer-grade compass with adjustable declination and the digital compass is not sufficient for the course.*

Q: Do all students now need altimeters for back country outings? A: *The altimeter is not required in the workshop or the field trip. Students may bring one and practice with it during the "Where are you" questions, but it is not required equipment.*

Q: Will GPS be the major focus of instruction going forward? A: *The standards position the GPS as a "source of information" and as a tool that may be available within the team, but not as an individual item, and not as a major focus of instruction.*

Q: My Gaia app has maps, gps, altimeter, bearings. Is that all I need? A: *No, the course focuses on the foundational skills using paper map and handheld compass. Branches may offer an additional course on GPS, using Gaia as an instructional tool, but it is not yet part of the minimum standards.*

Q: Why are expensive emergency, satellite communicator devices noted in the standards? A: *Satellite communication devices make use of the GPS system, and GPS is already heavily used by navigators. It helps to understand the technologies used by our tools, along with the strengths and limitations of such tools.*

Q: I've taught Wilderness (Basic) Navigation for several years. Do I need to retrain?

A: *You may need a refresher. The Seattle Branch offers instructor training twice a year and has online courses available to help instructors understand any new material.*

Q: Does the online Wilderness Navigation elearning workshop reflect these new standards? A: *The Online Workshop definitely covers these standards, and more. It's an excellent course for those who need an alternative to the in-person workshop.*

Q: How are trip leader or instructor navigation standards different from student or participant standards? A: *Instructors are expected to be more experienced in the use of altimeter and GPS so that they can share such information during the field trip. For example, students need not have their own altimeter or GPS, but the instructor at a field trip should have their own altimeter and GPS, or have access to one, and be able to provide information from these tools to help the student understand, "Where am I?"*

Q: What happened to position triangulation and 2 degree accuracy as skills? A: *Triangulation relies only on Map and Compass and takes time. It can be one component in the decision making process. A group of people in the wilderness often has access to other tools, to include map, compass, altimeter, and GPS, so it makes sense to teach how to take advantage of multiple tools at once, rather than relying solely upon the compass readings. And the use of multiple tools can be faster than triangulation alone. The ability to plot a bearing from the field onto the map, however, is still an important component among the entire toolset.*

Q: Do these standards mean more work before classes or outings? A: *It may mean more time during the workshop and/or more homework for the students before the workshop or field trip.*

Q: Who was consulted in drafting these standards? A: *The document includes feedback from every active navigation committee across branches Seattle, Tacoma, Everett, Olympia, Kitsap, and Foothills. It also includes feedback from other committee chairs in across branches, including Climbing, Scrambling, Snowshoe, Skiing, and even Kayak committees.*

Q: Could my branch or activity committee demand higher standards for participants, instructors or trip leaders? A: *This is a "minimum" standard. Any course can go above and beyond the minimum. For example, the core skill is map and compass, with GPS as a possible source of coordinates. A course can go into more detail on GPS, or more detail on altimeter, without contravening the "minimum" standard.*

*--Brian Starlin is Seattle Branch Navigation Chair. He is a volunteer climbing trip leader & instructor, Seattle Mountain Rescue member, Boy Scout trip leader and Washington Trails Association crew leader. Contact him at [brian.starlin@comcast.net](mailto:brian.starlin@comcast.net).*

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## Recognizing and Rewarding Navigation Volunteers

--Editor

Navigation courses, seminars and events call for scores of volunteers each year to serve the 100's of students. Recognition and reward for those efforts varies widely across branches and over time. Branch Leadership Committee (BLC – branch, safety and global adventure chairs) is committed to establishing and supporting improved “R&R” in all branches. A recent Clubwide inventory of practices by COO Bill Ashby showed:

- No formal recognition program across branches. Those who volunteer have Basic (Wilderness) Badge renewed. Verbal thanks are offered after workshops and fieldtrips.
- Rewards include unfunded cafe invites to dine post field trips and (in early 2017) Seattle gifts of gear and software subscriptions.

In this issue we list all navigation volunteers, by branch, to recognize freely given time and talent. We understand that many volunteers volunteer beyond instructing or leading activities and events. Foothills Branch has pioneered a weighted point system that recognizes and rewards hike, navigation and backpack instructors, trip leaders, committee leaders, curriculum developers and others. Weights vary from year to year depending on emphasis areas. The 2015-16 leader recognition weights were:

- Day Hike, Snowshoe Trip, Navigation FT/Classroom support (1.0),
- Overnight Backpack/winter camp, Mentor of new leader (1.5),
- Multi-night backpack, CR instructor (2.0), and
- Course administration and/or content development (4.0)

A minimum number of points

is set as a threshold and the available funds are then divided according to volunteer point totals. REI gift cards standard awards—maximum \$150.

Other branches may adopt variations of the point system. BLC is considering a draft Recognition and Reward policy that states in part:

*"Volunteers are the collective engine that inspires and powers The Mountaineers. Volunteers are the key to increasing our capacity for delivering high-quality programs. Recruiting, training, and mentoring volunteers are necessary but not sufficient without recognition and rewards.*

*We flourish as a club when we recognize and reward volunteers' freely donated time, inspired leadership and deep talent across committees, courses, activities and events.*

*Volunteers should be broadly and equitably recognized across branches for their contributions of time, leadership and talents.*

*Volunteers should be rewarded in a systematic and transparent fashion within branches for their contributions of time, leadership and talents."*

The draft policy also calls for a minimum reward expenditure of at least 10% of committee operating budgets.

## Navigation Course(s) Volunteers 2016 – Leadership Bold

### Everett

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Luke Angelis, 1  
Mike Braun, 1  
Tracy Buchanan, 1  
Norman Buckley, 2  
Laura Culver, 1  
Brittany Darnell, 1  
Randy Furnas, 1  
Lyle Harvey, 1  
Doris Hatton, 1  
Andy Kemberling, 1  
Matthew Kuhn, 1  
Dan Labovitch, 1  
Jessi Loerch, 1  
Dennis Miller, 1

### Per Monts-Homkey, 2

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Lisa Romberg, 1  
Rachel Sadri, 1  
Hillary Shearer, 1  
Edward Smith, 1  
Brian Starlin, 1  
Don Swanson, 2  
Charlie Waite, 1  
Jeff Wilcox, 2  
Bruce Wolverton, 1

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Anda Cornea, 1  
HeidrunEberhardt, 2  
Barbara Folmer, 1  
Steve Lebrun, 2  
Sarah McCroy, 1  
Karen McFarland, 2  
Nichole McMullen, 1  
Monty Pratt, 2  
Michele Ritala, 3  
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Cheryl Talbert, 1

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Cyndie Bruner, 2

Brian Carpenter, 5

Jorge Cascante, 2

Suzy Diesen, 2

Scott Ekin, 1

Tina Fox, 2

John Howard, 2

**Troy Hubbs, 5**

**Jerry Logan, 8**

Ed Lucas, 5

Lonny Moore, 2

Dan Prince, 1

Jeff Schreppe, 2

Debbie Straub, 6

John Straub, 2

Greg Thies, 2

Max Thornton, 1

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**David Geeraerts, 4**

**Terri Hoselton, 3**

Doug Hutcheson, 1

Theresa Jump, 2

Bob Kernanen, 1

Neal Kirby, 1

**Mike Kretzler, 4**

**Michael Mellors, 3**

Patti Miller-Crowley, 2

**Todd Mooney, 3**

Matt Pahs, 1

Tiffany Pahs, 1

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Kim Pohlman, 1

Karen Pyle, 1

Curt Rosler, 1

Ginger Sarver, 1

Michael Silverstein, 3

Jan Skoropinski, 4

James Stage, 3

Andy Weber, 2

David Wilson, 1

Janice Wu, 1

Janette Zumbo, 1

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Mary Lou Biggs, 2

Jeff Boersema, 1

Bill Borom, 2

Lisa Boynton, 1

Mike Braun, 3

Janine Burkhardt, 2

Richard Burt, 2

Andy Cahn, 1

doug Canfield, 2

**Brian Carpenter, 16**

Chris Caviezel, 2

Suj'n Chon, 2

Peter Clitherow, 1

David Coate, 7

Wes Cooper, 2

**Nina Crampton, 8**

**Bruce Crawford, 5**

Tom Cushing, 1

Brett Dyson, 2

Tad Englund, 2

Todd Enos, 3

Glen Ferguson, 1

Rick Finkle, 1

Mathew Gilson, 2

**Lynn Graf, 2**

**Peter Hendrickson, 14**

Brian Hill, 2

Elise Hollowed, 2

Michael Hutchens, 4

Brian Kennan, 2

Fritz Klein, 13

Sam Kohl, 2

Takeo Kuraishi, 1

shawna leatherby, 2

Kristine Linn, 1

Kate Lunceford, 1

Dick Maguire, 6

Sean Mathias, 1

**Steven F McClure, 2**

**Patricia McDonald, 3**

Frank McJannet, 3

Noel Miller, 2

Aaron Molskness, 1

Barbara Motteler, 2

Brandon Myers, 1

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**Jeff Panza, 7**

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Jeffrey Patterson, 1

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Kirk Peterson, 1

Chris Pribbernow, 2

Rojesh Punnath, 2

Jill Reeder, 6

Craig Rixon, 1

Shelley Rixon, 1

**Wesley Rogers, 13**

**Stevie Russell, 2**

Courtney Jacquelyn Ryan, 1

Gwen Sauvage, 4

**Brian Seater, 16**

**Brian Starlin, 23**

Jerry Stein, 1

Heath Stewart, 1

Cheryl Talbert, 1

Nancy Temkin, 8

**Paul Thomsen, 5**

Win Van Pelt, 2

Thomas Vogl, 2

Walter Von Der Linden, 1

Robert Waage, 2

Heidi Walker, 5

Bryce Wentworth, 2

Rayna Weth, 2

Jason Williams, 2

### Tacoma

Rick Finkle, Chair

Bill Carver, 3

**Kevin DeFields, 9**

**Rick Finkle, 13**

PeterHendrickson, 1

Gene Keltgen, 3

**Philip Owens, 6**

**Susan Rowe, 3**

Scott Schissel, 1

Dave Schultz, 3

**Gary Zink, 3**



## Wilderness Navigation Course Offerings 2017--Seattle

Basic Navigation transitioned to Wilderness Navigation in 2016, clearly focused on wilderness/back country travel including off trail navigation to meet requirements for Alpine Scramble, Basic Climbing, Snowshoe and BC Ski students (and others). Altimeters and GPS units (basic point position) are included.

<https://www.mountaineers.org/about/branches-committees/seattle-branch/committees/seattle-navigation-committee/course-templates/basic-navigation-course/wilderness-navigation-course-seattle-2017>

<b>Date &amp; Day</b>	<b>Workshops*</b>	<b>Date &amp; Day</b>	<b>Fieldtrips</b>
Tuesday, Sep 26 to Tuesday, Oct 24	Online Classroom	Sat, Nov 4 or Sun (Nov 5, if needed)	Heybrook Ridge
Wednesday, Oct 25	Program Center	Sat, Nov 4 or Sun (Nov 5, if needed)	Heybrook Ridge

*\*Note: Students may enroll in the elearning program, as available, to complete the workshop online prior to their fieldtrip.*

## Smart Phone and Dedicated GPS Navigation Course—Seattle\*

Are you interested in learning to use your smart phone as a wilderness GPS? Maybe you have had a dedicated GPS for years and want to get the most out of it? The Smart Phone and Dedicated GPS Navigation course is for you! We will cover basic usage of both dedicated GPS units and the Gaia GPS app for smart phones, as well as common issues that can affect GPS accuracy and ways to avoid them. This course is an evening at the Mountaineers Seattle Program Center, split between a classroom lecture and a hands on outdoor exercise. Prior completion of the Wilderness Navigation course is strongly encouraged. Fee and Badge.

### Topics include:

- Overview of how GPS works
- Common accuracy issues and solutions
- Review of UTM coordinates – Working knowledge is assumed
- Entering waypoints
- Navigating to a way point
- Back tracking a route
- Overview of emergency communication devices (SPOT & PLB)

Students need to bring a GPS enabled device to the class; loaners are not available. We cover both Gaia for iOS and Android devices (\$20, pro not required/Free to Mountaineers) and Garmin dedicated units. Other brand GPS units are welcome, but instructors may not be familiar with them. Lead course administrator is Brian Seater assisted by Michael Hutchens.

The current URL provides a description and the 2017 dates are on the calendar:  
<https://www.mountaineers.org/about/branches-committees/seattle-branch/committees/seattle-navigation-committee/course-templates/smart-phone-dedicated-gps-seattle/smart-phone-dedicated-gps-seattle-2017>

<b>Smart Phone &amp; Dedicated GPS Course</b>	<b>Location</b>
Wednesday, August 16	Seattle Program Center
Tuesday, October 17	Seattle Program Center

### **Introduction to Map & Compass (& Altimeter) – Seattle\***

The Seattle Navigation Committee scheduled six 2017 Introduction to Map and Compass dates at the Seattle Program Center from 6:30 to 8:30 p.m. Instructors are drawn from the pool of Wilderness Navigation Course teachers. Enroll at URL below or others posted: <https://www.mountaineers.org/about/branches-committees/seattle-branch/committees/seattle-navigation-committee/course-templates/introduction-to-map-compass/activities/introduction-to-map-compass-mountaineers-seattle-program-center-17>. Administrative leads are Nina Crampton & SuJ'n Chon. This Getting Started introductory class does not satisfy the navigation requirement for Alpine Scramble, Basic Climbing, Snowshoe or Backcountry Ski. Fee, no badge.

<b>Intro to Map, Compass (&amp; Altimeter)</b>	<b>Location</b>
Monday, August 14	Seattle Program Center
Wednesday, September 13	Seattle Program Center

### **Other Seattle 2017 Navigation Seminars/Clinics\***

<b>Seminars/Clinics</b>	<b>Dates</b>
Instructor Training in Person – No fee	Thur, Oct 5
Instructor Training Elearning – No fee	To Be Scheduled
Mentor Session Wilderness Navigation – No fee	Thur, Nov 2
Wilderness Navigation Equivalency – No fee	Rolling enrollment
Contact Leader Lynn Graf	

### **Other Branches 2017 Navigation Courses\***

<b>Branch</b>	<b>Course</b>	<b>Dates</b>
Everett	Basic Navigation	TBD
	Wilderness Navigation eLearning Option	Under Consideration
Foothills	Staying Found	Fall TBD
Kitsap	Both series have Elearning Wkshp Option	Sep 18 thru Oct 16
	Wilderness Navigation Wkshp/Field Trip	Oct 18/Oct 21
Olympia	Wilderness Nav eLearning Wkshp/Field Trip	Sep 18-Oct16/Oct 21
Tacoma	Wilderness Navigation Lectures 1 & 2; Field Trip	Aug 10 & 17; Aug 19

\* Be sure to check [mountaineers.org](http://mountaineers.org) for up-to-date listings.

### **Navigating Through the Wild Elearning Course – No Badge**

Books -- National	Online Lessons Support Backcountry Off Trail Travel -- Contact Doug Canfield, Books	Jun 8 thru Aug 31
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## Mazamas (Portland, OR) 2017 Navigation Instruction\*

Portland	Navigation Skill Builder Class	TBD 2018
	Smartphone GPS	TBD 2018

\*Northwest climbing clubs support similar goals for exploration, learning and conservation. Reciprocity is routinely granted across state lines. Mazamas lead navigation instructor is John Godino, contact [johngo.pdx@gmail.com](mailto:johngo.pdx@gmail.com).

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### Navigation Project(s)

>>Our Seattle Volunteer Park effort to create a self-guided navigation map, compass, and SmartPhone (altimeter & UTM coordinates) practice course is online. You may download the PDF (with answers) here:

<https://www.mountaineers.org/about/branches-committees/seattle-branch/committees/seattle-navigation-committee/files/seattle-navigation-self-guided-practice-volunteer-park/> Thanks to Nancy Temkin and Bob Boyd for 2015 beta testing. And to Brian Starlin for 2016 improvements.

### >> Seattle Navigation Ad Hoc "Modernization Committee" Formed

Freedom of the Hills, 9th Edition (Fr9) is anticipated in late October and newest co-author of Chapter 5 (Navigation), Steve McClure, reported on innovations expected in the new edition at a March Seattle Navigation Committee meeting.

- Ten Essentials navigation tools lists map, altimeter, compass, GPS device (many choices) and a (Personal Locator Beacon) PLB-type device.
- Map now is either physical or digital, if no hard copy map is available.
- Workflow is emphasized in trip preparation and trip execution. Checklists are available but may need to be recreated for navigation use.
- Situational awareness introduces the "OODA Loop" -- Observe, Orient, Decide and Act to encourage the use of the full suite of navigation tools.
- The ethic of self-reliance encourages prudent risk taking in the face of ever more powerful tools which may tempt bolder outings

Some nine climb, scramble, and navigation committee members are meeting as a joint committee under the banner 'Navigation Innovation' to pioneer a possible new approach for the continuing effort toward modernizing our navigation practices. They will make recommendations to the Seattle Navigation Committee this fall. Steps will be:

1. Determine current best practices in modern navigation for multi-day, off-trail wilderness mountain travel among: guides, experienced travellers, and AMGA, NOLS, OB and similar organizations.
2. Prioritize tools and techniques to be taught roughly within the footprint of the class-- about 12 hours.
3. Pilot class as part of an evaluation plan.

The committee was charged to determine best practices for new navigators, develop a course, teach it, and evaluate the experience. This could be tried out with Intense Basic Alpine Climbing, Compressed Alpine Scrambling, or by any navigation, hiking, scrambling, or climbing committee from any branch that would like to help pioneer a new approach.

Experienced navigators skilled in all five of the modern navigation tools [map, altimeter, compass, GPS (both cell and Garmin-type), and PLB or satellite communicator] are invited to contact the ad hoc Navigation Modernization Committee.

Contact Steve at [mcnorth@gmail.com](mailto:mcnorth@gmail.com).

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## Navigation Gear, Apps & Links of Interest

Your comments and suggestions are ever welcome regarding the Seattle Navigation website and links in Navigation Northwest. –Pat Podenski, Section Ed

### The Gear...

--Here's a fresh way to drain your iPhone battery. Make a few photos at the TH. Tuck the phone in your trouser front pocket. Climb onto the horse. Get outta town onto the cloud forest, mountain trail, an elegant, paved foot and llama path in pre-Incan times. A few hundred years of cattle, horses and rain transformed trail to deep mud, scrambled rocks and steep. Hang on but remain curious at the occasional beeps from your front pocket. That evening enjoy >3 hours of airplane mode, black-out video with a clop-clop sound track. Be grateful your wife tucked her phone in a more secure spot. --Editor

### The Apps...

## Free (or nearly) Altimeter Apps For Smart Phones

By Lynn Graf

	App Name	Device	Developer	Cost
	<a href="#">Gareth Altimeter</a>	Android	Gareth Price	free
	<a href="#">Accurate Altimeter</a>	Android	AR Labs	free
	<a href="#">Pro Altimeter</a>	iPhone	Hunter Research and Technology	\$0.99
	<a href="#">Altimeter Plus</a>	iPhone	Sichtwerk AG	free

### Short guide to a few recommended altimeter apps for cell phones

Don't want to spend the money for a classic wristwatch altimeter, one more gadget? Basically all SmartPhones nowadays have GPS capability. This means that they can pinpoint your spatial position without cell service, which is often spotty or non-existent in the backcountry (and searching for a signal drains the battery, in case you haven't noticed). Many of the newer models (iPhone 6 and later, for example) also have a pressure sensor. This can be used for extra correction or a cross-check of elevation by barometric pressure (which is what wristwatch altimeters use) but that is not really necessary and requires more frequent calibration.

Here are recommendations for two very basic apps for Android and two for iPhones.

**Selection Criteria (not in order of importance):** low or no cost, easy to use, no cell service required, no ads, low memory and storage usage, reasonable speed at obtaining GPS signals, clear numerical display, recommendation from Mountaineers member(s) who have used it in the field.

There are many more out there, more all the time, and increasingly with features in addition to GPS-based elevation. We invite you to try them, see how they work for you, and let us know if they don't work as advertised. If you want additional information, see the article in Navigation Northwest

(<https://www.mountaineers.org/blog/how-to-pick-an-altimeter>) describing a systematic comparison of several Android apps.

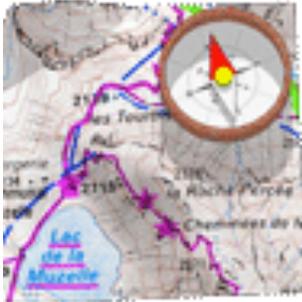
Also, The Mountaineers currently has a deal for free use of GAIA Pro that basically turns your cell phone into an advanced GPS device. Check the website under "Benefits" (<https://www.mountaineers.org/membership/benefits/instructions-for-redeeming-member-benefits>). It is highly recommended but requires time and practice to set up and use efficiently. The Seattle Navigation GPS class features Gaia as the app of choice. Backcountry Navigator, another full-service GPS app, also has many followers. Both are well worth it, in my opinion, but a paper map, compass and altimeter app will get you a long ways, both on and off-trail.

*--Lynn Graf is a past Seattle Navigation chair and an active hikes and scrambles trip leader. She is a frequent contributor to Navigation Northwest. Contact her at: [lynn.graf@gmail.com](mailto:lynn.graf@gmail.com).*

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## Free (or nearly) GPS Apps for Smart Phones

By Brian Starlin and Emma Agosta

Screen Shot	App Name	Device	Developer	Cost
	<a href="#">MyTrails</a>	Android	FrogSparks	Free Pro €2
	<a href="#">GPS Essentials</a>	Android	Schollmeyer Software Engineering	Free
	<a href="#">Handy GPS</a>	iPhone	Anthony Dunk <i>[Note: Also authored Coordinate Master to convert Lat/Long to UTM]</i>	Free
	<a href="#">Altimeter GPS</a>	iPhone	Andrea Piani	Free

### Criteria for Android and iOS GPS:

- 1) Backcountry oriented (Topo Maps rather than street maps)
- 2) Works offline, in airplane mode, with only the GPS on

- 3) Can display UTM and Lat/Long
- 4) Has at least NAD83/WGS84, but gets extra points if it has NAD27
- 5) Extra points if it's available for Android and iOS
- 6) Able to save data and send in GPX format
- 7) Able to import GPX format
- 8) Accurate (although I believe it's based on underlying GPS hardware)
- 9) Extra credit if tracks can be shared on a cloud service
- 10) Free

We used a 10-point scale with higher numbers meaning more of the above features were found. Also, there is a main point we need to make. Gaia is a serious app for backcountry use and has all the features we want. And Gaia Pro is currently free to Mountaineers members.

### **Android Reviews (Brian)**

>>GPS ESSENTIALS ([mictale.com](http://mictale.com)) -- 5 points

Only available on Android.

It only uses cached maps, which limits its offline usefulness.

Very robust dashboard, highly configurable.

Limited selection of map sources

The UI is clunky. It uses a thing called "streams" to store data. The Import/Export functions were hidden in the "streams." The track recording was also buried in the stream screens. The Dashboard is great, but the other functions are clunky.

>>HANDY GPS (BinaryEarth) -- 2 points

Great for just displaying your coordinates in various formats. It has very limited maps -- a blank screen, and the Google Maps. The map does not work offline and cannot be downloaded.

>>MYTRAILS (FrogSparks) -- 6 points.

Great selection of maps. I think it has only NAD83/WGS84 because I don't see a Datum setting. Tracks and waypoints can be saved as GPX. The free version can only save the current track, plus one. And can only store 100 tiles at a time in the offline storage. UTM displays on the screen. It's on Android.

>>RAMBLR (Bientus) -- 2 points

This is more of a journaling and trip sharing app than a GPS app. It's very focused on tracking and sharing details of a trip. It has Google Terrain and OpenCycle maps. It can use an offline map. It does not display coordinates, but it can show you your location on the map background. As I said, it's a journaling app.

### **iOS Reviews (Emma)**

Additional features I noticed are under "other features and comments."

>>ALL TRAILS -- 3 points, free

Hiking oriented but by trail (not backcountry). More like WTA app. Works offline. WGS 83/84. Available for IOS and Android. Map overlays (such as USGS topo) are in the Pro version (\$29.99/year). No UTM or Lat/Long. Other features/Comments: ability to track a route, keep history etc. Many other apps do this for hiking, biking, running and other sports. I do not believe these are the kind of apps our readers are looking for.

>>ALTIMETER GPS -- 4 points, free.

Not backcountry oriented. Lat and Long: yes. No UTM. Elevation (ft/meters). Accuracy: unknown. Available on both? Some features only work with internet (i.e. choice of map format). Other features/comments: Weather, barometric pressure. Compass heading, Step Counter. Speedometer. Save position. Ads (non intrusive at the bottom, yet one can accidentally click). Find feature to search for location.

>>DECLINATION -- 1 point, free

Not backcountry oriented (map: satellite view). Lat and Long and UTM. Works offline: yes. Accuracy: unknown; Datum: ? Other features/Comments: Declination; Ability to search by Lat and Long. Ads.

>>HANDY GPS -- 6 points, free

Not backcountry oriented. Works offline: yes. UTM and Lat/Long, (plus elevation); Datum: ? Available for both IOS and Android. Able to save data and email : yes. GPX file: no; Accuracy level (+-10m). Other features/comments: nice display: uncluttered; intuitive, user-friendly; key features: Map. Digital Compass. Can save way points and email position from within the app. No ads. My favorite among free but cannot compete with Gaia.

>>MAP TOOLS -- 3 points, \$0.99

Street oriented; Works offline; Lat and Long and UTM; Datum: ?; GPX format: no; accuracy: unknown. Other features/comments: Not intuitive. Confusing zoom in and out feature. Declination provided.

*--Brian Starlin is the Seattle Navigation Chair and a frequent Navigation Northwest contributor. Contact him at [brian.starlin@comcast.net](mailto:brian.starlin@comcast.net)*

*--Emma Agosta is a Seattle Navigation instructor and committee member. A geologist, she is fluent in land forms (and Italian). Contact her at [emagosta@gmail.com](mailto:emagosta@gmail.com)*

## And the links...

- Epic 34 day backcountry ski trip from Snoqualmie to Canada.

*Sometimes, they simply stayed put. They'd purposely left their plan vague to adjust their route for weather and avalanche conditions. Each night, they'd lay out topographic maps and examine their options. With phones sapped of charge by trip's end, the two navigated with altimeters, paper maps and a compass.*

*"When you use these less powerful tools ... you really get involved in the terrain," McBrien said.*

<http://www.seattletimes.com/life/outdoors/from-snoqualmie-pass-to-the->



A tent used by the skiers sits below Gunsight Peak, on top of the Chickamin Glacier. (Scott Rinckenberger / www.scottrinck.com)

[canadian-border-in-34-days-on-skis/](#)

- A map from 1513 - the Piri Reis map.  
<https://m.thevintagenews.com/2016/08/11/the-mysterious-piri-reis-map-is-this-evidence-of-a-very-advanced-prehistoric-civilization/>
- A handy tool for planning hikes on the PCT.  
<https://www.pctplanner.com/>
- Andrew Skurka on navigation (includes links for 7 video navigation course).  
<http://andrewskurka.com/2017/early-season-navigation-skills-resources/>

- Some lessons learned on the Wind River High Route.  
<http://andrewskurka.com/2017/lessons-learned-wind-river-high-route-david/>
- Gaia GPS now includes the National Geographic Trails Illustrated maps  
<http://blog.gaiagps.com/next-generation-gaia-gps-now-national-geographic/>
- You've been declined! Just kidding! But what's your declination?  
<http://www.magnetic-declination.com>
- Assorted navigation links at [sectionhiker.com](http://sectionhiker.com)

Gaia GPS offline mode

<http://sectionhiker.com/how-to-use-the-gaia-gps-smartphone-app-in-offline-mode/>

[caltopo.com](http://caltopo.com) off trail hike planning

<http://sectionhiker.com/how-to-plan-an-off-trail-hike-with-caltopo/>

UTM

<http://sectionhiker.com/the-universal-transverse-mercator-utm-grid-system-by-blake-miller/>

Compass Accuracy

<http://sectionhiker.com/magnetic-compass-accuracy/>

- Another UTM resource  
<http://dmap.co.uk/utmworld.htm>
- And finally, navigation about as hard as it gets  
<http://www.adventurealan.com/escalante-overland-route/>

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# Navigation Gear--Compasses

## Required Compass Features: Seattle Wilderness (Basic) Navigation Course & Foothills Staying Found Seattle Mountaineers—Revised March 2017

1. **Adjustable declination:** If there is one feature that simplifies map and compass work, this is it. Compasses with adjustable declination can often be identified by the presence of an adjustment screw, usually brass or copper-colored, and a small key attached to the lanyard. It allows you to move the orienting arrow in relation to the azimuth ring.
  - All students **MUST** have a compass with adjustable declination. The presence of a declination scale does not guarantee that it can be adjusted. Avoid the 'tool-less' declination feature on the Brunton (see below).
  - Even if you already have a compass without adjustable declination, you may not use it in this course. Experience indicates that such compasses detract from the learning experience.
2. A **transparent rectangular base plate** with a direction of travel arrow or a sighting mirror.
  - Transparency allows map features to be seen underneath the compass.
  - A rectangular shape provides straight edges and square angles to plot on the map.
3. A **0 to 360 bezel** (the rotating housing) marked clockwise from 0 to 360 degrees in increments of two degrees or less. In general, bezels should be large to allow use while wearing gloves - the larger size also improves accuracy. Do not get one marked in 0-90 degree quadrants OR one marked in 0-6400 mils!
4. **Meridian lines:** Parallel 'meridian lines' on the bottom of the interior of the circular compass housing rotate with the bezel when it is turned. Longer lines are better. Meridian lines run parallel to the north-south axis of the bezel, however turned, for plotting and triangulating on the map.
5. A **ruler and/or gradient scale** engraved on one of the straight edges, used for measuring distances. In the U.S. 1:24000 scales (rather than 1:25000) are preferred.
6. A **3 to 4-inch base plate**. A longer straight edge makes map work easier.

### Additional recommendations

- A sighting mirror in the cover: Reduces error introduced when moving compass from eye-level after sighting to waist-level for reading the dial.
- A liquid-filled housing: Reduces erratic needle movement (common on better compasses). In some cases, steadying the compass needle can be difficult
- An inclinometer: A gravity driven arrow that allows you to measure slope angle.

**Current favorites:** Silva, Suunto, Kasper & Richter, and Brunton are the common favorites. Their quality and usability varies, so **keep any receipt**. We have unfortunately seen many defective compasses in the past. Beware the UST ~\$7 knock-off baseplate compass available via Amazon and other outlets. Our gear tests show it to be unreliable.

--From Silva, with a sighting mirror, is the Silva Ranger 515 CL (not the CLQ). Without a mirror is the Silva Explorer Pro (not the 203 or Polaris). Silvas are available at Cabela's or online.

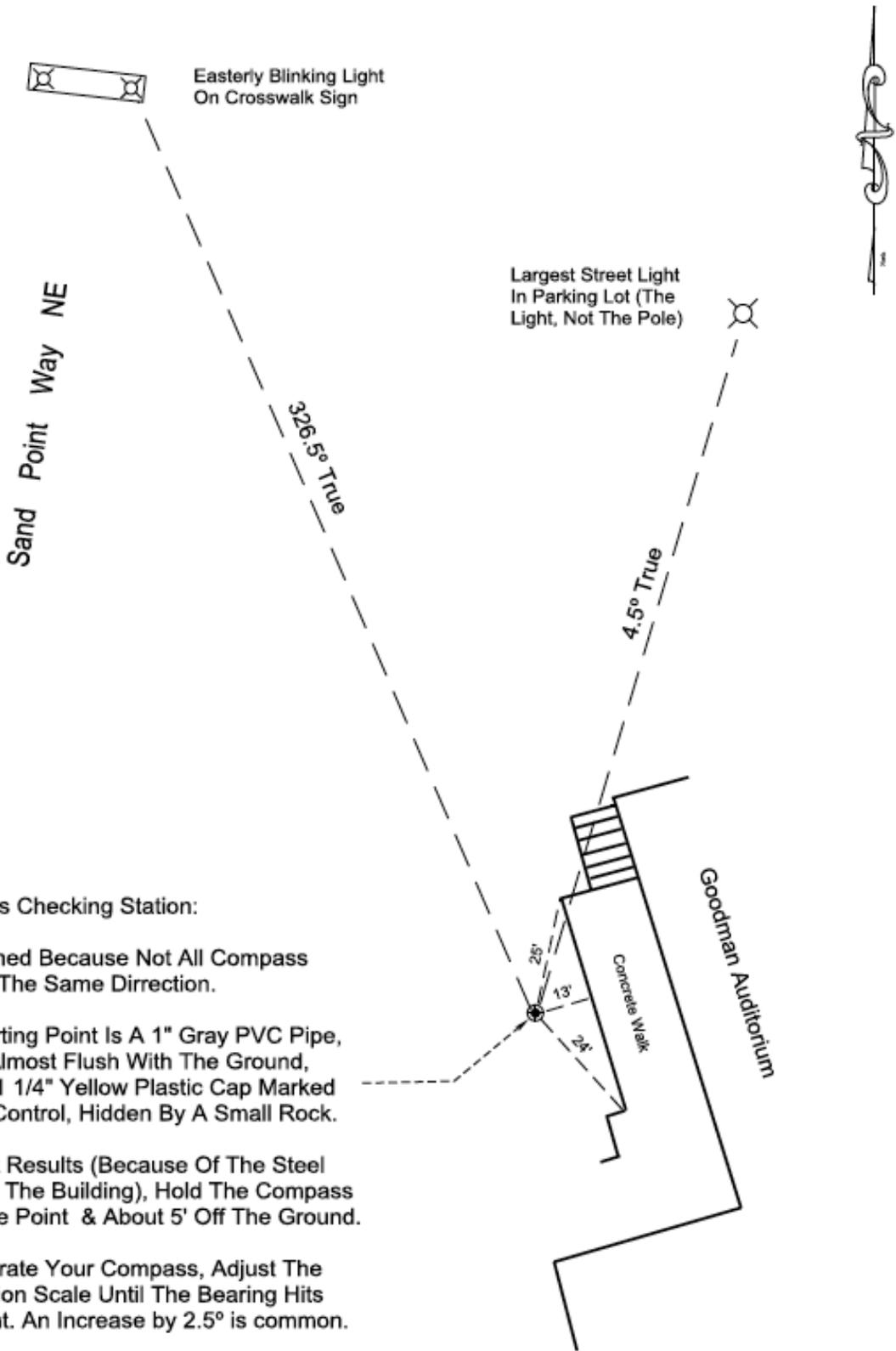
--K & R has the Sherpa and Alpin using 1:25,000 vs. 1:24,000 rulers. They are available online.

--Brunton has several compasses that meet our requirements but present issues with "tool-less declination", lack of clearly visible meridian lines or scales and curvy shapes. Several tool-less declination models have come apart in user hands. Preferred models are TruArc 15 (mirrored), and TruArc 5 (non-mirrored). The TruArc 10 has measurement scales (good) but curvy sides (not good). The TruArc 3 lacks clear meridian lines and is short. Bruntons are available at REI, Cabela's or online.

--Newly available retooled Suunto MC-2 (mirrored) and M-3 (non-mirrored) 2016 models passed all bench tests with flying colors. Suunto is currently available at REI, Feathered Friends and online.

Manufacturers make continuing improvements and corrections in models.

(Rev Mar2017/bb)



**Compass Checking Station:**

Established Because Not All Compass Point In The Same Dirrection.

The Starting Point Is A 1" Gray PVC Pipe, Driven Almost Flush With The Ground, With A 1 1/4" Yellow Plastic Cap Marked Survey Control, Hidden By A Small Rock.

For Best Results (Because Of The Steel Roof On The Building), Hold The Compass Over The Point & About 5' Off The Ground.

To Calibrate Your Compass, Adjust The Declination Scale Until The Bearing Hits The Light. An Increase by 2.5° is common.

Please Hide With Rock When Finished.

RWB  
2/2014

**Seattle Program Center Compass Calibration Station**

## Navigation Northwest Copy and Publish Deadlines 2017

<b>Calendar 2017</b>	<b>Copy Deadlines</b>	<b>Publish Dates</b>
<b>Volume 5, Issue 3</b>	<b>September 1</b>	<b>Late September 2017</b>
<b>Volume 5, Issue 4</b>	<b>December 1</b>	<b>Late December 2017</b>

**Inquiries, Contributions, Letters to the Editor to Peter Hendrickson**  
[p.hendrickson43@gmail.com](mailto:p.hendrickson43@gmail.com)

**OK to forward**

**OK to use with attribution**

**Email Navigation Northwest to any friends/outdoors partners to distribute**

**Guidelines for contributor submissions:**

- Word doc...Google doc OK but not a PDF
- 12 pt Verdana
- Standard margins
- Indicate in body of text where you would like figs/tables etc. to go
- Send figures, tables, photos as attachments or by separate email
- Refer to figs by number in body of text
- No footnotes, header or footer
- Author blurb with preferred email contact address

**Kindly contact editor for further information regarding topics, length, tables, figures, deadlines...**

**"Do not go where the path may lead, go instead where there is no path and leave a trail." --Ralph Waldo Emerson, American writer, 1803-1882**

(Rev.04July2017/ph)