



Navigation Northwest

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Looking for a Track? Have a Track to Share?

A childhood friend dished out ~\$300 for a coastal Maine Garmin chart pack (a chip) some weeks ago to help us avoid fog-bound city docks, sand bars and the thousands of hard spots (rocks, ledges) hungry for our hull sailing out of Brooklin. I had GPS flashbacks to stories of automobile blunders (drove off the dock), aircraft crashes (flew into the ground), and

mountaineering mishaps (never saw the rock shelf and bloodied his forehead).

Denzel was head down learning the new software (and hardware) while I worried that situational awareness was compromised. Lobster pots were everywhere and it is bad form to foul your prop on a float line. I offered to drive Erma, navigating with the hard copy, waterproof chart that had served us for several years along that coast. We moved safely hour after hour, Green Nun to Red Can.

At the same time we laid down and admired myriad tracks working as a chase boat to support the 60+ traditional small craft sailing and rowing to small islands in Penobscot Bay. By Day 4 the digital learning curve had flattened and we both could steer and navigate with the digital aid.

The Mountaineers is awash in GPS devices (dedicated and smartphones) with new tracks collected daily and established ones retrieved to answer the questions, "Where am I? How far is it to my destination? Will I be able to find my way back?" (Burns & Burns, 2016).

This issue focuses on mountaineering tracks, asking:

- How do I make a track and save it for further use?
- Where can I find reliable tracks to use for my next outing?
- What is the club doing to collect, curate and ease track retrieval?
- What are appropriate warnings and disclaimers about using others' tracks?

--Editor. For a taste of Maine marine life

<http://www.offcenterharbor.com/tour/>

GPS Tracks: Dave's GPS/GPX Collection and Invitation

By Dave Coate

I just spent a fair amount of today posting 6 months of GPS/GPX tracks to my website. You can find them here:

<http://www.davecoate.com/MountainNavigation/>

Yesterday, I had an opportunity to follow the GPS track recorded by a non-Mountaineer friend that documented a new trail whimsically named Shangri La up to Change Peak. This is another of several new and in-progress trails that can be accessed off of I-90, exit 38. He recorded the track using his Windows smart phone so no GaiaGPS, but I was able to import the file into GaiaGPS on my iPhone quite easily (once you know the trick) and it came in handy in locating and hiking this trail myself.

So given that GPS on a smartphone is inexpensive enough for everyone with the will to learn to use it what can we do to share the data we collect? One answer is share GPX files as I have done. See Figure 1, Appleton Pass. This is not a new idea in the Mountaineers, but the lawyers got wind of this and warned us it might not be a good idea. Please note the link on my page: [Warnings and Disclaimer for using GPS Tracks](#). I am not a lawyer, nor do I play one on TV, but this is my attempt to tell people not to rely solely on a GPS/GPX track to keep them safe in the mountains. My site is not heavily advertised, so I am not all that worried about it. If any of you reading this is a lawyer and would like to help me out, I would welcome the feedback!

Another thing that could be done is to contribute to crowd sourced maps such as OpenCycle. I have done naught minute one on researching this, but we could get our data posted to OpenCycle and have it show up in GaiaGPS. That would be kinda cool! I would want to keep this limited to distinct trails, so I still have my scramble routes recorded and just itchin' to be shared.

I have also had it expressed to me that the current, Seattle Dedicated GPS and Smartphone class is not a very good how-to course, as it tends to be a bit more on the theoretical/technical side. I do not think that is a bad thing, but for people that simply want to use a smartphone GPS without learning all of the tech behind it, the class might be disappointing. [*Ed—Class does not advertise track loading but does include outdoor session.*]

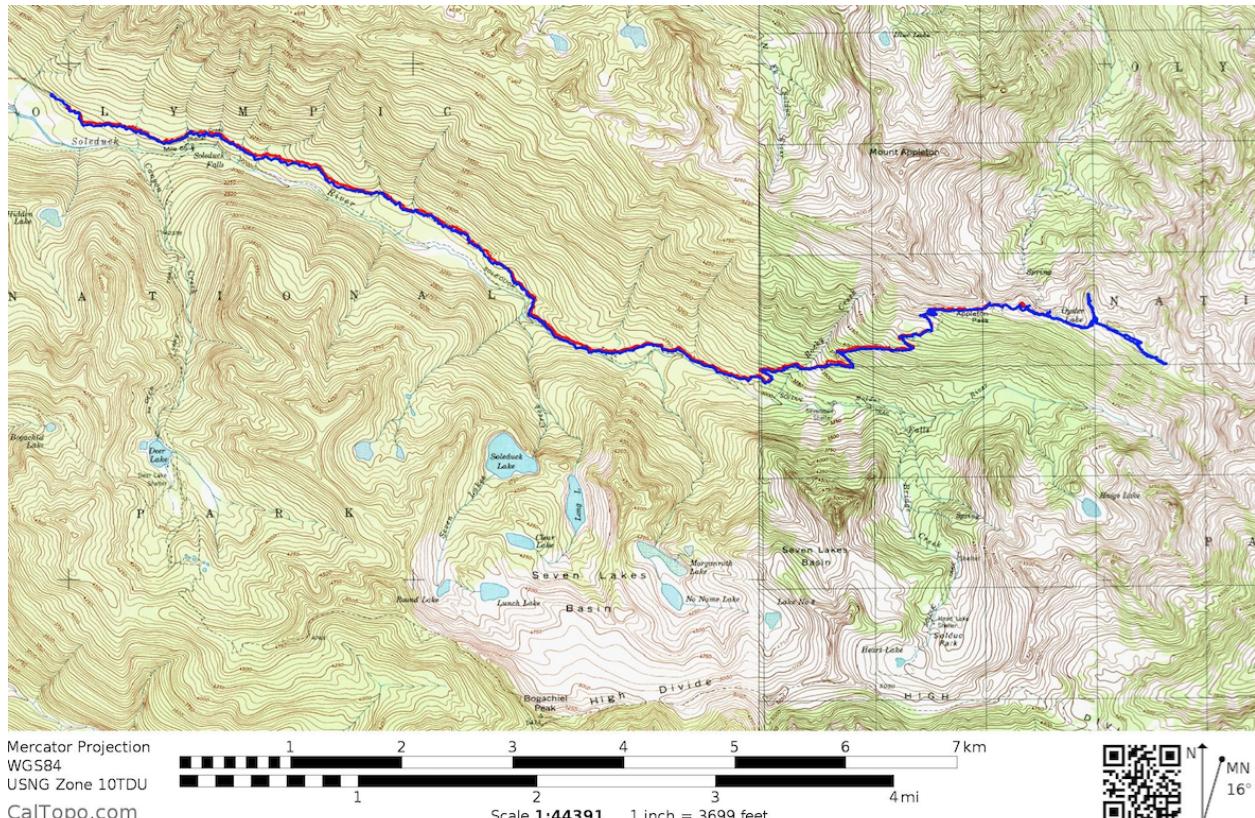


Figure 1. Appleton Pass July 1 and 2 backpack track.

So if any of this piques your interest and would like to peek into ideas for documenting routes to peaks (I could not resist, folks), I would like to hear from you. I could imagine doing things like building a new curriculum for smartphone GPS users (likely heavily skewed toward GaiaGPS). Or perhaps something more like a GPS user group that meets several times a year and exchanges ideas and information while consuming pizza and beer. (We'll try to avoid mass quantities as my head is a bit too pointy as it is!)

--Dave Coate is Foothills Navigation Chair, leads the Staying Found course, and is a frequent instructor for Seattle Branch navigation classes. He emailed this invitation to Staying Found instructors in June. Contact -- coateds@outlook.com.

A Mazamas Gift - GPX Track Sharing for Climbers

By John Godino

Climbers have all heard some version of the following:

- *"We got turned around on the snowfield when the clouds rolled in . . ."*
- *"I know I need a 10 essentials map, but where do I get a good one?"*
- *"Our team got lost on the approach hike, which is super-frustrating because this route has been climbed thousands of times..."*

In 2015, I created a set of navigation resources for the Mazamas intended to mitigate these common problems. These files are available to everyone, Mazamas member or not. They are currently on the public part of the website, although that may change in a year or so. All files are hosted on shared Google Drive folders. This greatly simplifies file management and web maintenance.

For about 50 of the most popular NW climbs, users can find: GPX track files, KML files (shows the route in Google Earth), PDF maps with shaded relief, a UTM grid, the climbing route, and trailhead coordinates.

A note on trailhead coordinates: If you type latitude, longitude coordinates into a smart phone mapping app or a Google search, you get a map and driving directions to that exact spot; very helpful to find remote trailheads. Lat/long coordinates are used because Google and mapping apps do not recognize UTM coordinates. Decimal degree format is easiest to enter. Here's Mt. Stuart, try it: **47.4369, -120.9373**. Don't forget the negative sign (-) for the longitude.

GPX Track Files

Everything starts with a GPX track file. From this, you can make the other three components (a map with the route drawn, KML file, and trailhead coordinates.)

A GPS track file is primarily a long string of latitude longitude coordinates. You can get a track file in one of three ways: 1) record one yourself, 2) draw it using mapping software such as CalTopo, or 3) downloaded from the web.

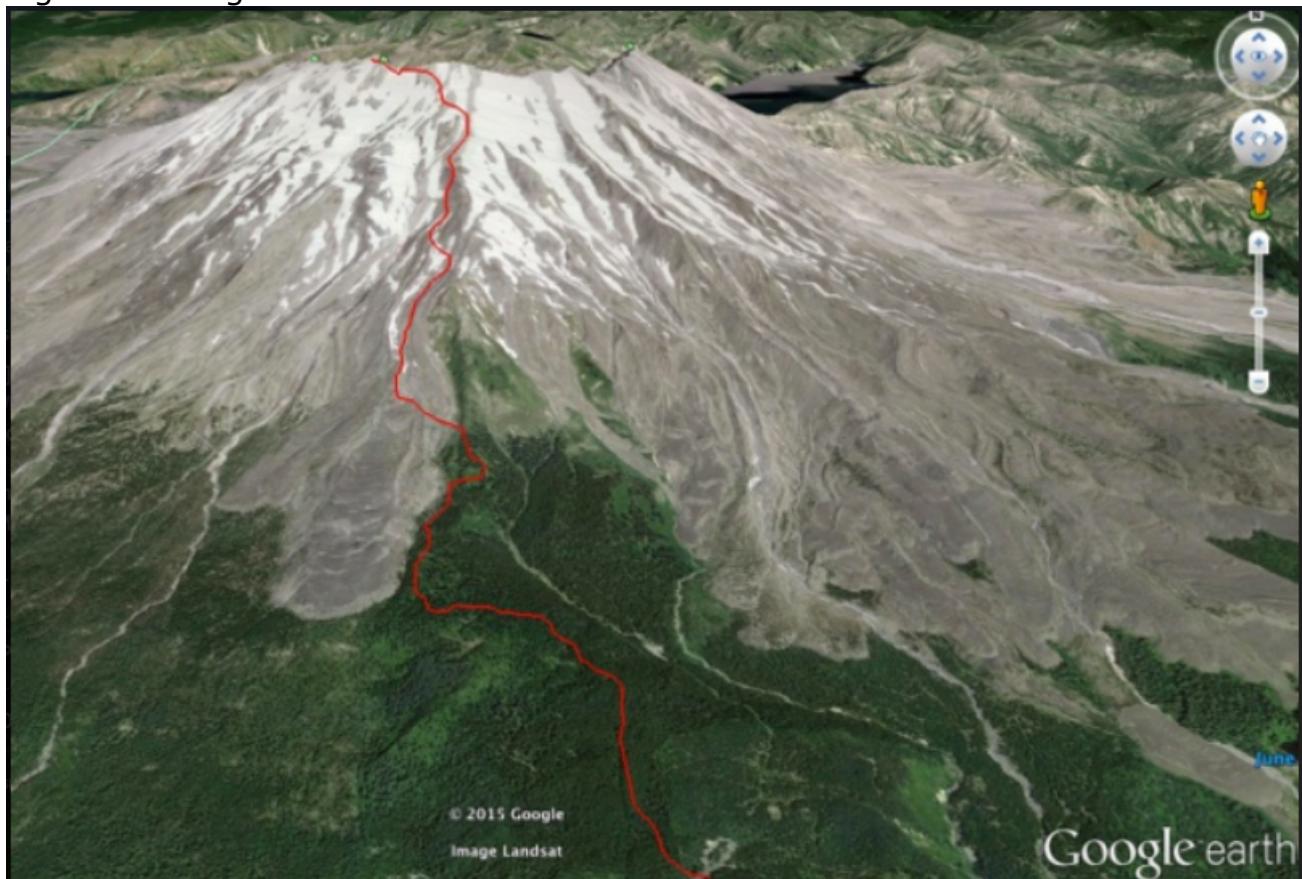
Most of the GPX files were recorded or drawn in by myself after personally climbing the route. The remaining GPX files were downloaded from sites like www.GPSies.com, www.GPSfly.org, or www.peakbagger.com. For every file procured from the web, I first loaded it into CalTopo and Google Earth as a quality check, and emailed it to other climber friends who had in fact climbed the route, to get an additional thumbs-up before posting.

Gaia GPS is my go-to phone app for backcountry navigation. Mazamas and Gaia have partnered to offer the Gaia Pro version of the app for free to members. Importing the track to your phone is straightforward; just email it to yourself.

CalTopo for maps

CalTopo is the best online mapping software I've found, paid or otherwise (www.cal topo.com). In addition to having a great variety of map base layers (try the "MapBuilder Topo" layer, it's great) and quality print functions, CalTopo also allows easy export to both KML (Figure 1) and GPX (Figure 3) formats. You can draw a freehand line in CalTopo, add a few waypoints for good campsites or key decision points, and export your track and waypoints to GPX or KML format with a few clicks.

Figure 1. Google Earth KML format Mt St Helens.



To make a PDF map in CalTopo (Figure 2): Import or draw a track, choose a good map layer (again, MapBuilder Topo):

1. choose a map scale (usually 1:24K for the U.S. but 1:25K is handy),
2. add a 1 Km UTM grid,
3. click "generate pdf,"

4. wait a minute or so for the map to appear, and then right click (or other) to save as to your hard drive

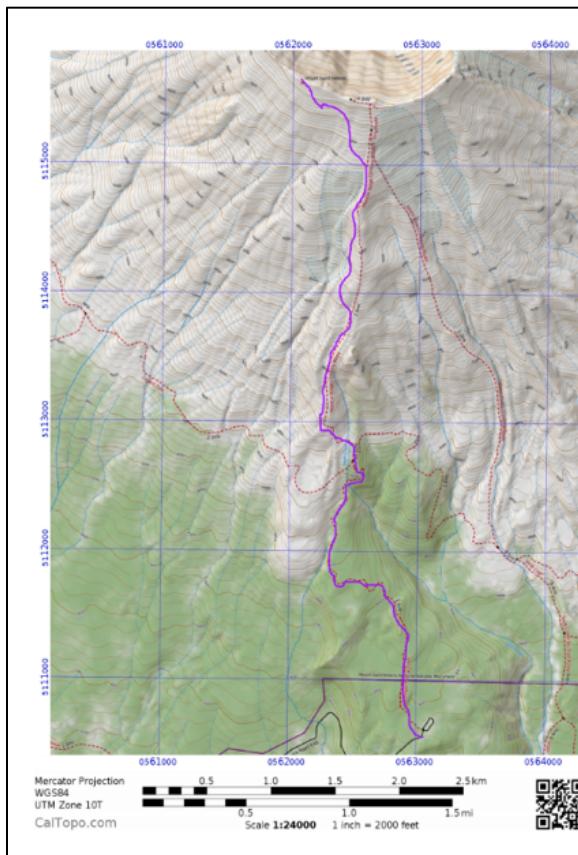


Figure 2. CalTopo PDF Mt St Helens

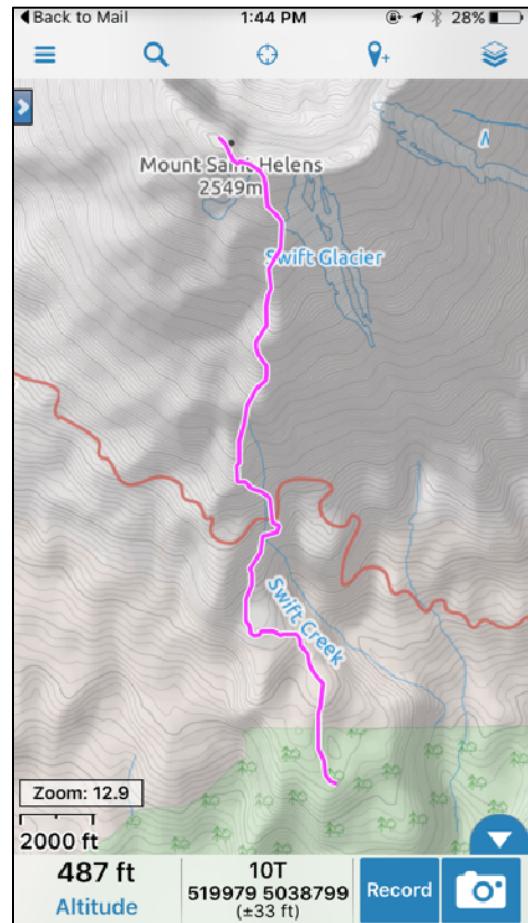


Figure 3. Gaia GPS screen shot, Mt St Helens with GPS track

Reactions from users have generally been positive. I made some tutorial videos on using CalTopo and Gaia GPS, which are helpful to get people started. One small hiccup is that certain web browsers apparently add an .XML extension onto the GPX file when it's downloaded. This is solved by simply renaming the file, but it still can be confusing.

Links to these map resources are included in the climb prospectuses sent to every climber on a Mazamas climb, so this will further educate members about this resource.

Looking ahead

Longer term goals: 1) Have maps and tracks available for every climb that Mazamas do, not just the most popular ones; 2) Educate more members

about how easy it is to use CalTopo and Gaia GPS, so they can be empowered to make maps for their own trips, 3) Add more "front country" trail hikes, 4) Hopefully collaborate with organizations like The Mountaineers to get more of our mutual members sharing tracks.

Maintaining a sense of adventure and exploration is important, but it never hurts to have a little insurance in your pocket. A few guidelines to emphasize:

A GPS track on your phone, or a GPX track printed on a map, is meant for general route finding only. Routes change, sometimes on a daily basis. Keep your head up from the screen and do not blindly follow a track.

The map and compass are the primary navigation tools, and the GPS is a back up, not the other way around.

Always carry an auxiliary battery and charging cable. From Amazon, I bought an Anker 3350mAh battery about the size of my thumb (<https://www.amazon.com/gp/product/B005X1Y7I2/>) and a 4-inch long charging cable (<https://www.amazon.com/gp/product/B010U3XA0I>). Cost: about \$20, weight about 3.5 ounces.

Links:

Mazamas maps and tracks: <http://mazamas.org/resources/maps-for-climbing-and-hiking/> or: Mazamas.org > Resources > Maps for Climbing and Hiking

Tutorial videos for map compass use, CalTopo and Gaia GPS: <https://www.youtube.com/channel/UCoaYxGKAtMnSnVVEGDWs-6g>

-- *John Godino is a former US Forest Service wilderness ranger. He holds a Masters in Geosciences from Oregon State University, emphasis in cartography/GIS, and was a professional cartographer for six years. A 20-year Mazamas member and 12-year climb leader, he is President of the Columbia River Orienteering Club (croc.org) and principal navigation instructor for Portland's Mazamas. Contact him at johngo.pdx@gmail.com.*

GAIA GPS: International Cell Phone Navigation

By Ailene Gardner

Use Gaia GPS anywhere in the world with offline digital maps, route planning tools, and map printing. You can use your smartphone's internal GPS chip to navigate, regardless of cellular service.

Free GaiaPro for The Mountaineers

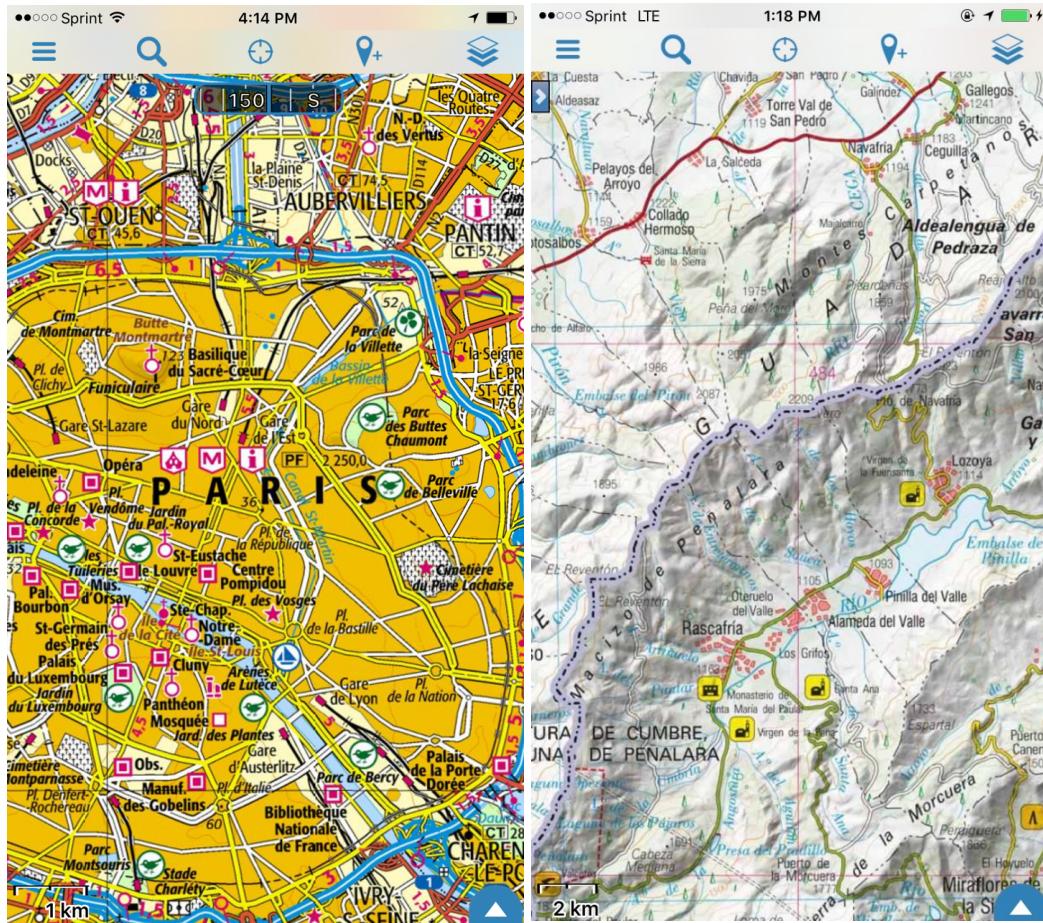
As part of a partnership with The Mountaineers, Gaia GPS provides 1 free year of the GaiaPro subscription to all members. Read more about GaiaPro below and check out the member-only web page for details on how to redeem the offer.

Worldwide topo, satellite and road maps

Gaia GPS offers the highest quality, most up-to-date maps available to download for offline use. Get global coverage with map sources like Gaia Topo, OpenHikingMap, and MapBox maps.

The app's unique Gaia Topo is the only worldwide topo map available in metric and imperial units for features such as contour lines and peak elevations. American users find this option especially nice when traveling internationally, as most global maps use metric units. You can also access several highly requested country-specific sources such as: Spain IGN Topo, Swiss Topo, Luxembourg Topo and Aerial, Finland Topo and Satellite Imagery, Austria Topo, Norway Topo, New Zealand Topo, and France IGN Topo—See Figure 1.

Figure 1. Downloadable French and Spanish topo maps.



The Gaia GPS team adds new maps to this list as often as possible, and users can easily import custom maps. With a GaiaPro subscription, layer sources together and adjust opacities for a custom view like Figure 2.

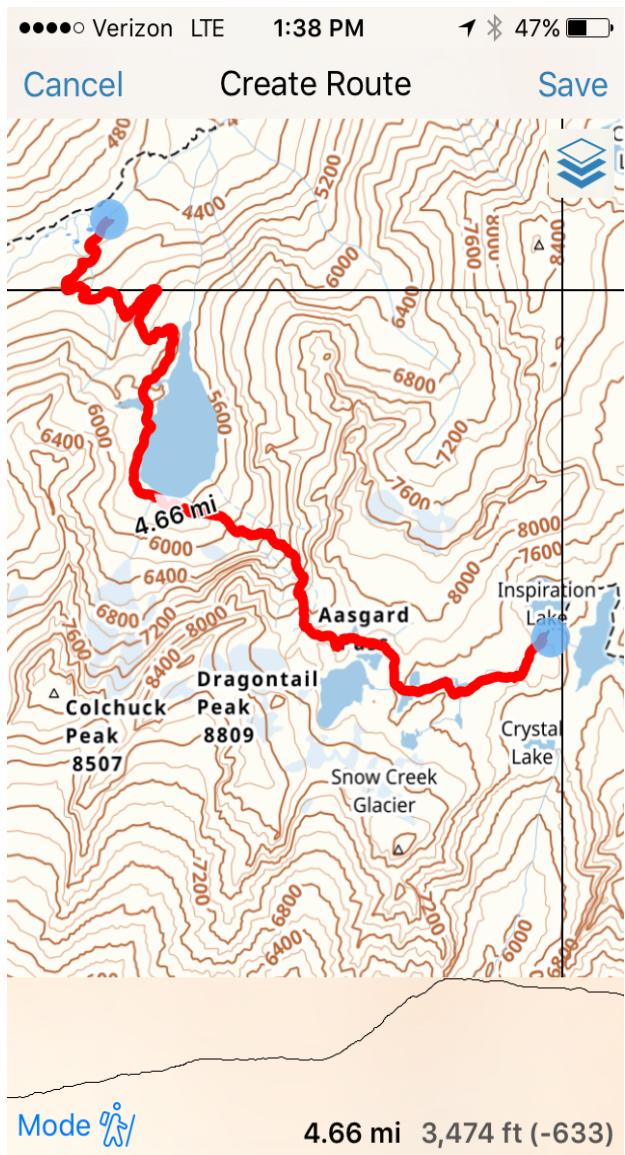
Figure 2. Custom view of Mt Shasta using CalTopo with GaiaGPS.



Plan Your Route

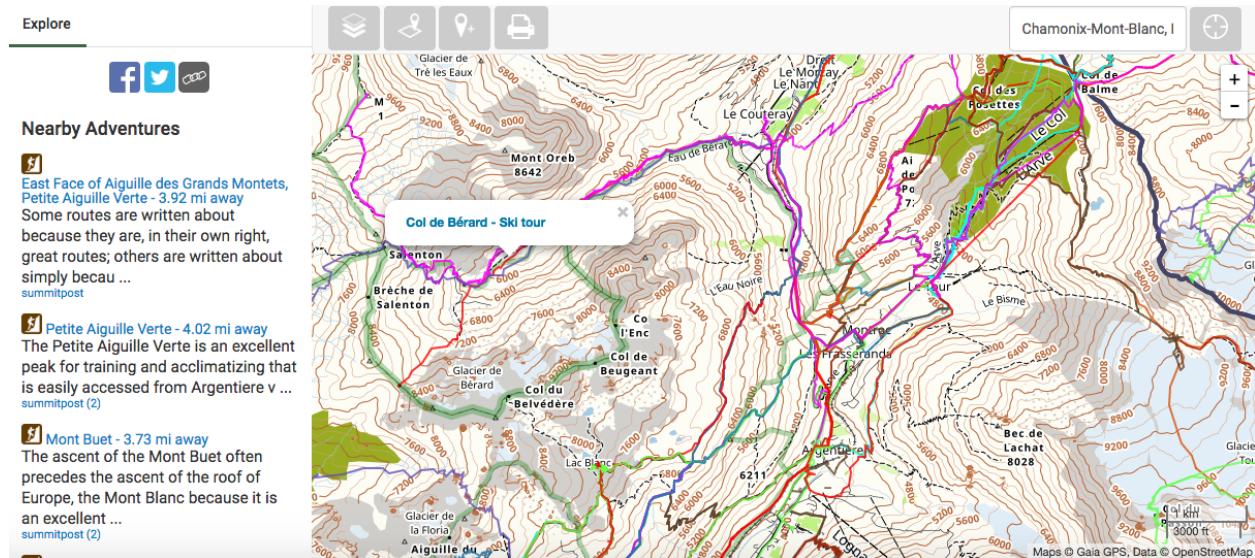
Plan point-to-point routes manually or use the snap-to-trail feature— both available on the Gaia GPS website and directly in the app—Figure 3.

Figure 3. Aasgard (Colchuck) Pass snap-to trail feature with elevation profile.



Overlay planned routes on pre-downloaded maps using the seamless in-app routing User Interface (UI) or browse and add public trip data contributed by international users every day on gaiagps.com. See Figure 4.

Figure 4. Aiguille des Grand Montet and environs.



Print a back up

Paper maps make a great companion to the Gaia GPS app, just in case something happens to your device while in the field. With a GaiaPro subscription, you can print custom maps (and routes/waypoints) to back-up digital versions saved in the app:

<https://youtu.be/qDzJKr0yY04>

<https://youtu.be/qDzJKr0yY04>

Don't have the app? No problem. Print maps and plan routes on gaiagps.com using GaiaPro as a standalone desktop service.

Questions?

The Gaia GPS team has continuously improved the app since 2009. To this day, each member of the team receives every support message, including the developers. Get in touch at support@gaiagps.com.

--Aileen Gardner is Gaia GPS Partnerships and Media Manager. Aileen lives in Bend, Oregon, spending most of her time riding single track and climbing around The Cascades. Reach her at support@gaiagps.com.

Coming Soon – Enhanced Trip Navigation Resources

By Jeff Bowman

Climbers, scramblers, hikers, snowshoers...we're all keen to find good beta for the next outing. Sometimes a simple, downloadable map customized for the trail or route is enough. In other circumstances tracks to follow or consider may make the difference in travelling efficiently in questionable terrain. There is no shortage of private and public collections of maps and tracks but The Mountaineers want to make these materials more accessible.

A [feedback idea](#) has current plans to add a "materials" folder to the collection of current and future [Routes & Places](#). At minimum we anticipate adding custom maps and tracks to these folders. Three elements are needed for each of the materials:

- A filename in a format to be determined (e.g. Mt St Helens - Monitor Ridge - CalTopo - Map 23June2016)
- A title (e.g. Mt St Helens - Monitor Ridge - Winter Route Map)
- A summary (aka brief description, e.g. The winter scramble route from Marble Mountain SnoPark via Monitor Ridge (standard southern route). Map created from CalTopo and submitted by C. Las Fiver, Seattle Scramble Committee.)

Our website searches are optimized on titles and summary. We need to develop a process for vetting the submissions and anticipate going live with roughly 20 routes to test the system in early 2017.

Comments and suggestions are welcome. This effort also needs navigation-oriented volunteer support — are you interested in the idea or helping vet materials? Add a comment to the [Display trail or route on route/place map](#) feedback idea.

--Jeff Bowman is the IT Manager (and Bookstore Manager) for The Mountaineers. He joined the club in 1994 and is a climb leader, Seattle Mountain Rescue member, and former chemical engineer. Contact: jeffb@mountaineers.org

Navigation Committees Invited to eLearning Navigation Workshop and Instructor-Training Courses

By Doug Canfield

The Mountaineers' elearning pilot in navigation instruction will continue for at least another year and branches are encouraged to offer it in the upcoming instructional season. The online workshop was rated highly by students who took it this past spring.

There are two ways branches can offer this course:

1. As an online experience for the self-study portion, followed by students attending your in-person field trip in order to earn their Navigation badge.
2. As the curriculum used in an in-person workshop, followed by the field trip.

As an online workshop, students register, as usual on mountaineers.org, at which time they can also buy the book, *Wilderness Navigation, 3rd Ed.*, and the needed maps (Mountaineers Books will stock and ship your branch's particular field trip map when requested).

The online course should be open to students for 4 weeks, and in advance of your field trip opportunities. We recommend that you have a ratio of one instructor per 20-or-fewer students. The Seattle/Foothills pilot of the course used a ratio of 1:8, but that wasn't necessary. Other scenarios, such as having four volunteer instructors—each answering student questions for one week apiece—would also work. Seattle/Foothills and Kitsap have committed to the online course this fall.

Online students in the initial pilot did not need much instructor interaction, though each was contacted and welcomed by one of the pilot instructor volunteers. (The piloted workshop was the first Mountaineers course taken by 86% of the online students and we wanted to be sure they felt welcomed. One hundred percent of survey respondents also indicated that they were satisfied with their online course experience.)

Why should your committee offer this course? You'll reach students who may not take your instruction in another format. Here are reasons students said they took the online pilot:

- "It was more convenient to study at times of my choosing"
- "There wasn't an in-person workshop near where I live"
- "I like online learning"
- "I work nights"

Instructor courses

Does your branch train new instructors in how to teach your in-person navigation workshop and field trip? This too can be done in the online learning management

software. The idea for the self-study instructor courses is to take the pressure off both the training volunteer who has to devote another evening to teaching new instructors, as well as make more convenient for new-instructor volunteers to learn this information.

Each branch nav committee can access the initial Seattle/Foothills versions of these instructor courses to see the format and determine how they'd like them to be edited to fit their branch's needs.

Questions?

Contact Peter Hendrickson at p.hendrickson43@gmail.com

--*Doug Canfield is Sales and Marketing Director for Mountaineers Books and a keen cyclist (75 miles to Meany Lodge, ~6000' elevation gain). He has volunteered at many Seattle and Foothills navigation courses.*

Navigation Summit 2016: DRAFT Clubwide Minimum Standards

By Brian Starlin

An initial draft of Navigation Instruction Clubwide Minimum Standards is currently circulating clubwide for comment—see below. The June 2016 Navigation Summit at Meany Lodge generated much of the proposed language. The draft was also influenced by work from earlier navigators some 9 years ago. Our work plan:

1. Draft the standard -- 9/22
2. Feedback Round-1 -- 9/22 to 10/10
3. Share with the other branch chairs via email and get initial feedback via Word "comments".
4. Share with Seattle Committee via hard copy or email and get initial feedback via "comments".
5. Update online Survey for other stakeholders based on Round-1 feedback.
Focus on areas that received the most feedback. 10/10 to 10/24
6. Update Standard based on Nav Chair feedback and Committee feedback.
10/24 to 11/4
7. Send updated Standard. Hold a conference call and review how the feedback was incorporated into this revision. Note items in contention. 11/4 to 11/18
8. If necessary, survey again, but only items not already at consensus. 11/18 to 11/30
9. Arrange time near the Seattle Leadership Summit on 12/3 for face to face with Branch Nav Chairs.
10. When the branch Navigation Chairs generally agree on the draft, present it to the Branch Leadership Council (BLC). If some items are in contention, seek counsel from BLC on sticking points.
11. BLC provides response. Make updates based on response. Resubmit to BLC for approval
12. Once approved, publish as the standard. Broadcast new standard to impacted parties.

DRAFT Navigation Minimum Clubwide Standards As of 20 September 2016

[Please direct any comments to your Branch Navigation Chair]

Proposed Minimum Clubwide Standards: Navigation

Application

This standard applies to club sponsored workshops, classes, clinics, seminars, field trips and any other event relating to teaching Navigation skills for the club-recognized Navigation Badge, all referred to herein as the "Wilderness Navigation Course". Courses or other instruction not leading to the Navigation Badge, such as "Beginning Map and Compass" are exempt from these Standards. Throughout this standard participants in Courses shall be referred to as either Instructors or Students.

Prior to 2015, the Wilderness Navigation Course was known as Basic Navigation and the badge that one obtains upon completion of the course is still named such. The Wilderness Navigation Badge is required as a component of certain other Mountaineers courses such as Basic Alpine Climbing, Alpine Scrambling, Backcountry Snowshoeing, and Backcountry Skiing.

Definitions

Wilderness Navigation refers to navigation performed off trail or in the backcountry, and includes navigating in an emergency or in poor conditions when the trail may be obscured or lost. It may include on-trail and front country skills in the progression toward backcountry navigation. Prior to 2015, this was called "Basic Navigation."

Workshop is a tabletop, indoor or sheltered class teaching session. It need not be indoor. It can also include online modules (elearning).

Field trip is an outdoor exercise for teaching and evaluating navigation skills.

Route is a plan for the path to be taken to a destination and back. In navigation terms, it includes identifying handrails, baselines or catchlines, compass bearings to follow, coordinates of crucial locations, the time necessary to complete it, elevation gain, distance, features, and so forth.

Trip is an entire activity that includes the planning, travel to and from the activity, and the activity itself.

Trips

Any Wilderness Navigation Course generally will be taught in two phases: an indoor "Workshop" and an outdoors "Field Trip."

Equipment

Each Student must appear for any Field Trip with appropriate clothing and equipment as stated below.

Minimum Compass Standard: Any Student's compass used in any Workshop or Field Trip leading to any certification must include:

1. Adjustable declination: A moveable orienting arrow.
2. A transparent base plate with an index line or direction of travel arrow and a straight edge on at least one side. The straight edge must be at least 3 inches or greater.

3. A capsule containing a magnetized needle calibrated for North America (A global needle is acceptable).
4. A rotating bezel marked clockwise from 0 to 360 degrees in increments of two degrees or less. (Some compasses are numbered counterclockwise. Some are numbered in quadrants of 0-90 degrees per quad. Neither of these is suitable in the Wilderness Navigation course.) In general, bezels should be large to allow use while wearing gloves and the larger size also improves readability and accuracy.
5. Meridian lines: Parallel marks on the bottom of the interior of the circular housing, or imprinted on the bezel ring itself, which rotate with the bezel when it is turned. The meridian lines run parallel to the north-south axis of the bezel, however turned. Meridian lines are necessary for plotting and triangulating on the map.
6. A ruler and/or scale inscribed on one of the straight edges, used for measuring distances.
7. An Orienting Arrow. A marking on the bottom of the compass housing, usually represented as an outlined red arrow.

Recommended But Not Required Compass Features: A branch or course may require some of these features at their own discretion but the minimum standards are described above.

A built in inclinometer.

A mirror.

A global needle, calibrated for northern and southern hemispheres.

Glow in the dark luminescence for visibility in low light.

Magnifying lens on the transparent baseplate.

A 1:24,000 measurement scale for plotting within USGS 1,000 meter grid squares.

Any additional measurement scales or rulers.

A lanyard.

Field Trip Equipment: at any Wilderness Navigation Field Trip Students shall bring the 10 Essentials, and the items described in the course materials and/or the following minimum levels of equipment:

Altimeter or Altimeter App

Sturdy hiking or mountaineering boots

Appropriate clothing, no cotton

Rain gear and extra warm clothing, including hats and gloves

Any field trip handouts or other necessary documents

Lunch, extra food and an appropriate amount of water

Zip lock bags for maps and handouts

Pencils/pens and paper

Instructor Field Trip Equipment: Instructors shall have or have access to the following to aid in instruction:
Altimeter or Altimeter App.
GPS set to UTM and the datum of the map being used.
Communication devices (Personal Locator Beacon, Satellite Messenger, Cell Phone)

Leaders

Leaders must be approved to lead trips by the sponsoring committee.

Participants

Unless specified by the Chief Course Instructor or Sponsoring Committee there is no prerequisite for taking any Navigation Course. Students attending a Field Trip must be in reasonable physical condition and capable of traveling substantial distances off-trail in steep, rugged terrain.

Instructors

Instructor qualifications are: active Mountaineer membership; current certification in Wilderness Navigation issued by any Mountaineer Branch pursuant to this standard; or permission of the Navigation Committee Chair or Sponsoring Committee.

At any Wilderness Navigation Course Workshop or Field Trip there shall be a minimum of one instructor for every six students, to ensure appropriately intensive instruction and safety.

To ensure adequate group safety and leadership on any Wilderness Navigation Course Field Trip, there must be a minimum of two instructors, and there must be a minimum of two persons, Instructors or Students, who have current Wilderness First Aid certification or similar appropriate first aid or medical training.

On any Workshop or Field trip where a youth under 18 is present, the Mountaineers Youth and Family Policy requires at least one Youth Qualified Leader be present on site at all times.

Courses

Mountaineers Branch Navigation Committees may offer a Course entitled Wilderness Navigation, plus such other Navigation courses as they find appropriate. Certification in any branch's Wilderness Navigation Course shall be accepted by any Mountaineers branch or activity. For this reason, some degree of uniformity among the various branches' Wilderness Navigation courses is appropriate. Any branch's Wilderness Navigation Course shall include a Wilderness Navigation Workshop and a Wilderness Navigation Field Trip:

I. Wilderness Navigation Workshop - Students shall learn:

Identify items related to topographic maps

What is Declination and how does it relate to the difference between magnetic north, true north, and grid north?

What do the colors mean? (black, blue, green, red, brown)

Identify the scale of the map and the distance scales

Recognize a combination of topographic, area, and man-made features:

What are the contour lines, contour interval, and what type of slope do they indicate? (steep, gentle, flat)

Identify and discuss a ridge, valley, hill/summit, pass, cliff

Identify and discuss a pass, saddle, or col

Identify and discuss a valley, gully/draw, or couloir

Identify and discuss contour trends (up/down) for ridges/spurs compared with contour trends for valleys and gullies

Identify and discuss lakes, ponds, tarns, creeks, streams and rivers

Identify and discuss vegetated vs. less-vegetated areas

Identify several different types of roads, a railroad, power line, and trail

Identify the parts of a compass

Transparent baseplate

Capsule

Rotating bezel

Magnetic needle

Orienting arrow

Degree markings

Index marking or Direction of Travel line

Meridian lines

Straight edge and measurement markings

Declination adjustment

Demonstrate basic procedures for using a compass alone, in a classroom environment.

Define what a "bearing" is in the context of a 0 to 360 degree circle.

Follow a bearing: Given a bearing measurement toward some object, set the compass to the bearing, sight it, and identify the object to which it points.

Take a bearing of an object in your environment and read the bearing from the compass.

While taking and following bearings, demonstrate the basic techniques for boxing the arrow, using the direction of travel arrow, turning the whole body, and sighting appropriately for the type of compass (mirrored or un-mirrored).

Demonstrate how to use a compass with the map.

Given two points on a map, measure a bearing from one point to the other.

Given a specific feature on a map, and a bearing to that feature, plot the bearing on the map.

Given one or more of these elements, determine your line and point position on the map:

- A bearing
- A UTM coordinate
- An altitude
- A topographical feature

UTM coordinates

Measure your position in UTM from a map.

Plot a UTM position on a map.

Discuss briefly how UTM relates to or differs from Latitude/Longitude

Understand GPS as a source of UTM coordinates and why we use UTM for precision locating on a map

Plan a Route:

Given some information from a route description, plan a route.

Identify parts of the route on the map.

In planning the route, include techniques to keep you oriented -- handrails, aiming off, and backstop/catchline.

II. Wilderness Navigation Field Trip - Students shall learn:

Throughout the field trip, demonstrate "Situational Awareness". Constantly answer the questions, "Where am I?", "How far is it to my destination", and "How will I be able to find my way back". Follow an ongoing cycle that includes: Observe, Confirm, Decide, Act.

Relate items in the field to items on topographic maps:

Orient the map two ways, with a compass and with terrain association to identifiable features (field trip area dependent).

Relate map landmarks to actual landmarks.

Relate contour lines, slopes, and elevations to actual terrain.

Discuss variations within a map's contour interval that aren't on the map.

Relate man-made features on the map with actual features.

Relate map distances with actual distances.

Demonstrate the skills to use a compass in the field.

Take bearings on several stationary targets until consistently within ± 2 degrees.

Follow a bearing accurately cross-country as part of a team, using leap-frog and back (reciprocal) bearing techniques.

Follow a bearing accurately cross-country as a solo person using the landmark technique (for safety, a partner may be assigned to follow the same bearing)

While shooting and taking bearings, demonstrate proper techniques for boxing the arrow, using the direction of travel arrow, turning the whole body, and sighting appropriately for the type of compass (mirrored or un-mirrored).

While following a bearing, get around an obstacle using the 90 degree offset method and resume the line of travel on the other side.

Determine your line and point position (Where am I?) using the map and one or more of these other elements obtained from instruments in the field or predetermined by the instructor. (Note: the instruments required of students are the Map, Compass, and Altimeter. Students may have a GPS, but it is not required.)

- A bearing of an object and/or a fall line
- A Universal Transverse Mercator (UTM) coordinate
- An altitude
- An intersection
- A terrain feature
- A man-made feature

Plan and Follow a Route:

Plan a route of at least one mile through the field trip area.

Follow the route through the field trip area.

Discuss route options throughout the field trip that include a handrail, a backstop/catch line, and a turnaround time.

Field Trip Students shall complete at least one "long navigation problem" that requires traveling cross-country, off-trail, over terrain that should be steep, scree, wooded, brushy, swampy, or any combination of these characteristics, accurately on one bearing for a distance of at least one-half mile, exiting the problem within an acceptable range of error from their target bearing. (as a solo navigator in one exercise and with a partner or team (leap frog) in another exercise)

Safety issues to consider (not mandatory) in field trip exercises include:

Use of whistles in case of needed immediate attention – lost navigator (panic)

Use of two way radios for instructors manning the start/stop and boundary lines

Flagging to identify out of bounds areas (handrails)

Related Minimum Clubwide Standards

Climbing Minimum Standards, dated 03-22-2007

Hiking Minimum Standards, dated 03-16-2016

Scrambling Minimum Standards, dated 04-27-2007

Snowshoe Minimum Standards, dated 08-20-2012

Sea Kayaking Minimum Standards, dated 04-20-2016

Comparable Standards

UIAA Standards for Voluntary Leaders and Instructors (Version July 2012) – UIAA include different types of navigation knowledge in their Training Standards for Mountain Walking, Trekking, and Snowshoeing as well as their Sport, Rock, Alpine, and Ice Climbing.

[http://www.theuiaa.org/upload_area/files/1/training_standards\(0\).pdf](http://www.theuiaa.org/upload_area/files/1/training_standards(0).pdf)

They are stated as

"Route finding and navigation through typical and difficult terrain" in their Skills training standards.

"Route choice, grades, and use of way marks and guidebooks" in their Knowledge training standards.

--*Brian Starlin is Seattle Navigation Co-Chair and is active with several other outdoor organizations. He is a Seattle climb leader, WTA crew leader, Boy Scout leader and Seattle Mountain Rescue volunteer. Contact him at brian.starlin@comcast.net.*

Mt Stuart Rescue—A Reflection on Communication Issues

By Rob Busack

[Note: As Branch Chair I see incident reports Clubwide and pass along Seattle reports to respective committee chairs. Rob's account of a Seattle party rescuing a solo climber from Tacoma highlighted backcountry communication challenges. Current Freedom 9 drafts call for navigation to include communication. I asked Rob to comment on communication elements of the August rescue. -Ed.]

After summing Mt Stuart via the West Ridge, rockfall became an issue during the descent in the already melted out Cascadian Couloir. Around 5 pm our party (Rob, Sherrie, Greg & Vasily) had microwave-size rock near misses after passing a solo scrambler returning from the summit. More rockfall. At this point everyone was a hundred or more feet below the trigger-point, except the solo scrambler. We were also somewhat around a corner, so no one could directly see the trigger point. Again, everyone down-slope managed to avoid being struck. However, we had heard repeated screaming at the time the rockfall was triggered that was unintelligible, and not the word "rock," so we were very concerned. We yelled back up asking if everyone was okay. The response we got was "I am not okay." And the rescue commenced, concluding with a Navy Blackhawk helo extraction around 10 p.m. from a high angle, exposed slope.

Figure 1. Climbing party Rob, Sherrie, Vasily and Greg



About cell phone reception:

While cell phone signal should never be relied-upon anywhere in the backcountry you haven't personally verified it before, there is one carrier that is clearly ahead of the pack in terms of coverage: Verizon. Sherrie was the only one in our group with Verizon as a carrier, and she was the only one who could successfully place a call. Not just on Stuart, but I've seen this as true on many other mountains: there may not be service, but if anyone does happen to get service, it's the Verizon customers first.

It's well-known enough that I even have some Mountaineers friends who've intentionally switched to Verizon to up their odds of having cell phone signal if they're ever involved in an accident. Personally, I have AT&T, which did not get signal, but I didn't mind because I carry a DeLorme InReach. It's important that everyone *tries* dialing 911, even if their phone shows no signal, since I've heard that 911 can work if you're right at edge of service. Via cell phone, we only attempted voice-calls to 911, we did not attempt texting 911. (Can you even send texts to 911? I have no idea, I've never tried.) [Ed. FCC says "yes" if the call center has requested the capability. See [FCC and texting 911](#).

As for cell phone battery life, I think that's another thing that should NOT be relied upon, mainly because cell phones have so many uses. In present day, for a lot of people in the backcountry, their cell phone is also their GPS (Gaia is a good app for that) and their cell phone is also their camera. Those non-emergency uses are common and understandable, and the power-consumption of a cell phone is designed for front-country life where it gets plugged in every night, so it's not designed to last more than a day. That means the battery is likely to already be half-way drained (or more) by the time an emergency happens.

That was also the case for Sherrie's phone during our trip. I know her battery was somewhere under 50% at the time, which allowed her 20 minutes of speaking time with 911 before the phone died. I think it's fine that cell-phone batteries might be depleted in an emergency, since before the trip started, everyone understood that we never planned to *rely* on a cell phone in an emergency, rather we planned to rely on my DeLorme InReach in the event that emergency communication was necessary, and its battery is a very different story.

About the Branch Personal Locator Beacon Pilot

Seattle Branch purchased 10 PLBs for climb leaders to sign out as a pilot for the club at large. Those are true PLBs (ACR ResQLink brand I believe, not SPOT.) I did not check one out for any trip because I already own a DeLorme InReach. I purchased my InReach in early 2015, shortly after getting approved as a new Climb Leader, because I personally felt I had a responsibility to the people I'd be taking out on trips to have a reliable means of emergency communication.

I'm glad that the club policy has come to match my personal feelings since then. I would strongly encourage every climbing party to have at least one PLB or satellite messenger somewhere in the party. (I think at present day the community is not ready for the language to be as strong as to say "required," but "strongly encouraged" is right for now, and maybe it can become "required" a few years down the road.)

Figure 2. Protecting the victim including handline for rescue party.



It is absolutely fantastic that the club owns those 10 PLBs that climb leaders can optionally check out, it removes the financial hurdle that would have prevented some climb leaders from carrying one, upping the odds that more teams will actually have one. Additionally, if a climb leader wants to purchase their very own personal PLB or satellite messenger, the club should pick up some of the cost. [Climb Chair Stef Schiller has proposed a policy to underwrite costs for active trip leaders.]

Owning my own is better for a few reasons: (1) I carry it every time I leave a trailhead, without exception, whether it's a Mountaineers trip, a personal trip, whatever. (2) I don't have to make a special trip to the Clubhouse before & after every climb. I lead a lot of climbs, and making a special trip that often just to pick up/drop off a PLB would be a huge hassle for me personally (for those who don't own their own, it's better than nothing though!) (3) It allows me to own a

DeLorme InReach, which is immensely more useful in an emergency than a true-PLB or SPOT device.

Use of the DeLorme InReach

The DeLorme InReach was a godsend in this situation. The InReach is very different than true-PLBs or a SPOT device, which are limited to communicating one and only one thing (they can only say "Something terrible has happened at such-and-such latitude and longitude, no further details") and do not have any capability to receive a reply. Unlike a true-PLB or SPOT device, the InReach allowed us to [actually describe our situation](#) to Search and Rescue. Not only that, but the InReach allowed us to receive a reply from Search and Rescue! Something you can do with no other device short of a working phone.

Figure 3. DeLorme inReach Explorer



We knew what to expect from SAR, and when to expect it, and that was priceless to us. By knowing a helicopter was coming and roughly when, we were able to prepare for it, like setting up the handline that ultimately saved Sherrie & me from what would likely have been a 200' tumbling fall during the extraction (we were both knocked over as the helicopter left.). If we had not known the helicopter was coming, we might have done something counter-productive, like go to sleep for

the night instead of wait up for it, or be otherwise caught unprepared when it arrived.

Also, since the InReach allowed us to describe things to our rescuers, we were able to send them the name & phone number of our patient's emergency contact person, so she was able to meet them at the hospital and provide additional useful information about the patient. Since our patient had been a complete stranger to us before the incident, there's no way anyone from SAR would have known who to call as their emergency contact until *after* the rescue had been completed.

If you ever are involved in a rescue, gather and write down all of the following before calling for help:

- Patient first & last name (exact spelling matters)
- Patient exact date of birth (not just age)
- Name & phone number for patient's emergency contact person (really valuable)
- condition/list of injuries for the patient
- exact latitude, longitude, and altitude
- Make an explicit statement of what form of help you are asking for. (In our case, we knew a helicopter was the only way she was getting off the mountain, so we should have said so earlier.)

Figure 4. Helo approach by moonlight. Climbers had headlamps on strobe.



Some practical usage notes about the InReach: typing out texts is slow, and requires rather full concentration. It would be best if there are enough people in your party to assign a single person the role of manning the InReach, and don't let them get distracted from it. My InReach was in the SOS state for 4 hours, and sent about 50 text-messages by satellite during that time. When it was all said & done, the battery status remaining was 80%, which is pretty darn good! I've also paid attention to the InReach's battery consumption during non-emergency uses (like recording a GPS track.) It can be left on and recording a GPS track for at least three days straight before the battery dies. Much better than a cell phone.

About Walkie Talkies

When trying to communicate at a distance of 200 feet away on the mountain, shouting does indeed have its limits. Messages need to be kept very simple (say 3 words or less) pronounced carefully, clearly, and slowly. Not a lot of detail can be communicated. Our throats did feel a bit raw the day after. However, walkie talkies really were not a viable solution either. First, we opted not to carry them. It was critical that kept our pack weights as light as possible. We were climbing 5th class terrain with overnight packs, so a light pack lessened the chance of us getting thrown off balance or falling, which was very important to our own safety.

I just weighed a pair of my walkie talkies with batteries: 12 ounces. What piece of gear would I have had to leave at home to offset the weight of the walkie talkies? Sleeping pad? Down jacket? No, both of those were more useful during the rescue than walkie talkies would have been. Second big problem with walkie talkies: more than half of our shouting communication was communication to other parties. (Asking the woman if she was alright, telling other parties we didn't need help, and they could continue descending.) Walkie-talkie communication would have only worked if we had them, *and* they had them, *and* we somehow agreed upon a channel & sub-code. Too unlikely.

Shouting, although imperfect, was easier. Maybe walkie talkies would have really helped us when Sherrie was 200' away and needed someone to read our exact lat & long to her so she could repeat it to 911, but that also could have been prevented if we had just thought to write down our lat & long on paper before she placed the call.

Walkie talkies wouldn't have been much help to us overall, but I do carry them on some other trips. If I'm doing a multipitch climb with long pitches and some other environmental noise is likely to be present (like a river, as in Leavenworth, or nearby highway noise) then I will intentionally bring walkie-talkies to communicate the climber's commands. But because of their weight, I only bring them when I know ahead of time that I'll certainly need them.

Lastly: I've found walkie talkies to not exactly be 100% reliable. Sometimes the batteries die unexpectedly, or sometimes one does something weird like stop

transmitting even though it can still receive (maybe because mine have gotten banged around on a lot of multipitch rock climbs). They do not do well in cold. Maybe they'd be helpful if you happened to have them and they happened to be working, but there should be no expectation that they're assured to be useful part of emergency communication.

UTM vs. Lat/Long:

Converting was never an issue for us. The only issue we had was when Sherrie was speaking on her cell phone to a 911 operator, who asked her for her GPS coordinates, and she did not have them written down. We thought she'd be able to get them from her Gaia app if she needed, but unbeknownst to us, if an 911 call is active, you cannot switch to another app. If she had not been on the call, she could have gotten those coordinates easily from the Gaia app on her cell phone--she knows how. Or, if she had had someone else close to her, they could have read coordinates off of their device for her to repeat to the 911 operator. However, she was far enough away that shouting a long string of numbers was sure to screw up or transpose a few, so we refrained from doing so. Fortunately, since the DeLorme InReach attaches a lat/long to every message it sends, rescue services found out our location that way.

GPS Devices in the party:

There were at least 7 GPS devices present amongst the five of us (counting our patient.) None were wrist GPS devices. I wear an altimeter watch, but it just tells altitude & time, not a GPS. Four of us had GPS capable cell phones and apps like Gaia. Vasily was also carrying a dedicated GPS device as was our patient. My DeLorme InReach "Explorer" model (with the orange faceplate) provides functionality similar to a standalone GPS device.

It is capable of displaying a crude map on its little screen, with support for waypoints & GPS tracks. It can pre-define them ahead of a trip, and/or record them in the field, with on screen viewing. The Explorer is far less power-hungry than a cell phone (mostly thanks to the smaller screen,) so it holds a charge for multiple days--a cell phone seeing the same usage would die within 1 day's use.

Rob's Take on PLB Terms in the Freedom 9 Working Draft

A geeky note on terminology: It seems that Freedom 9 is going to use the term "PBL" as an umbrella term for *both* types of devices traditionally referred to as Personal Locator Beacons before, *and* the types of devices that are "satellite messengers." This is a departure from the current vernacular. Is it because we need an umbrella term and none exist?

On one hand, it may be confusing to some people. On the other hand, since Freedom's following is so big, it may be powerful enough to redefine the public vernacular. Here are the differences:

- A radio signal can be used for *communication* (sending information, which may contain a written description of a location), or a radio signal can be

used beacon-style *locating* (just as one avalanche beacon hones in on the signal of another). This can be confusing because both ultimately communicate a location.

- One is akin to being told only the address of a building, and the other is akin to being told "the building is a lighthouse, go towards the light." Until now the term PLB has meant that a device definitely has the "lighthouse"-style radio capability -- it broadcasts a beacon. Many PLBs have another radio antenna that sends a "message" containing GPS coordinates via a satellite network.
- Devices known only as "satellite messengers" (including brand names Spot and DeLorme) currently do *not* include a radio "beacon" (their radios are not designed to be metaphorically "lighthouses"). They only send messages, but that's okay because the content of the message includes latitude & longitude coordinates, giving rescuers a specific-enough location, even if there is no "beacon" for searchers follow.

I don't think the true-beacon functionality is that useful. Lat/Long coordinates are enough to get rescuers close enough for visual contact 99% of the time, so a true radio beacon to help further refine location is unnecessary. [Note: Bruce Crawford reflected on PLBs and Messengers in the July issue, *Thinking About Freedom 9: Navigation & Communication Toolsets*. -Ed.]

--*Rob Busack is a Seattle climb leader and Intermediate Chair. Contact him at rob.busack@gmail.com.*

Ingalls Leader Rescue: A Reflection on Communication Issues

By Olympia Assistant Lead (OAL)

[Note: As Branch Chair I see incident reports Clubwide and pass along Seattle reports to respective committee chairs. OAL's account of an Olympia party rescuing a climb leader highlighted backcountry communication challenges. Current Freedom 9 drafts call for navigation to include communication. I asked OAL to comment on communication elements of the August rescue. -Ed.]

An August party of six Olympia climbers (three basic students) abandoned a chimney approach to Ingalls Peak (SW face, East Peak) and re-routed late morning to a South Face approach. At 2pm Leader fell 15 to 20 ft onto rock and OAL (also the MOFA Lead) initiated the injured climber response. Communications oriented excerpts from the incident report follow.

Party was able to communicate w/ fallen climber L. L relayed to Party that he fell and was injured, and Party instructed L to stay in place. Student 1 ("S1") was charged with maintaining conversation with L so that Party could monitor L's condition until he was reached. OAL, now belayed by S2, climbed to L. OAL arrived to L and began conversing with L to monitor condition, make sure he remained in place, and to let him know a MOFA check would ensue once OAL was secure. Even while injured, L was able to communicate clearly and provide some guidance as to MOFA protocols to the Party.

Figure 1.Images from Suunto's MovesCount software

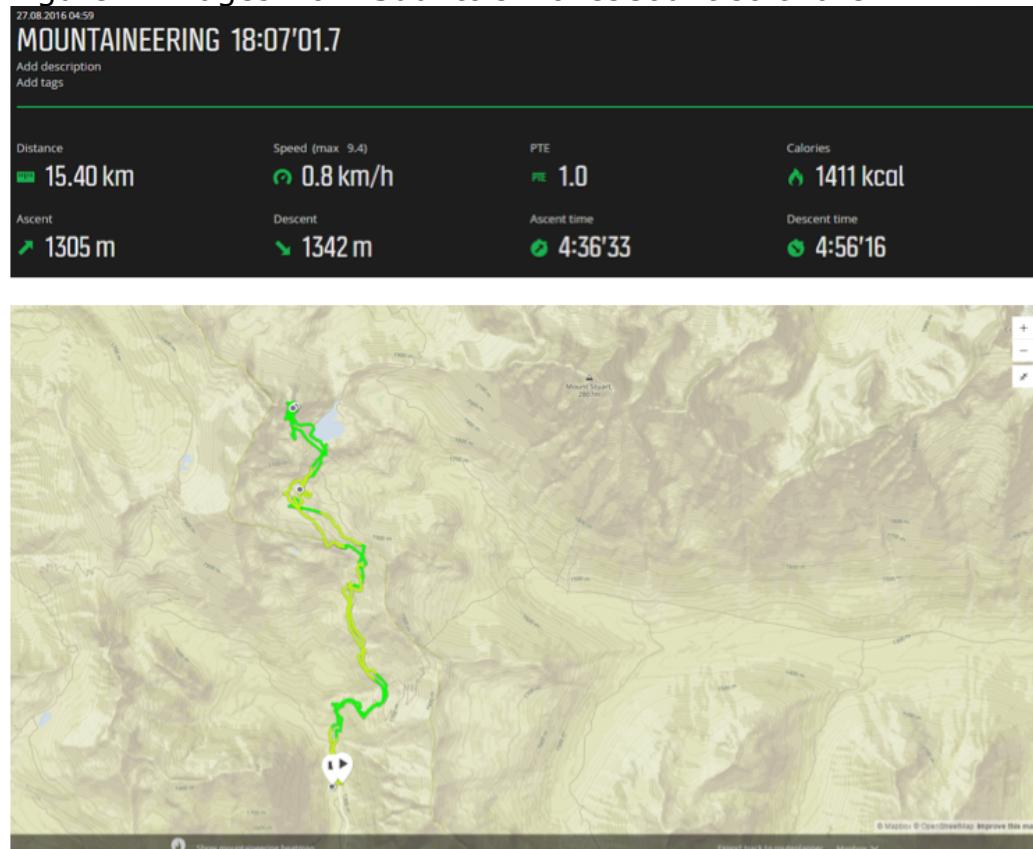




Figure 2. Aiding Ingalls fallen climber

From Rap 2, just below the third and final pitch, two 60m ropes made the rappel to Rap 1. L was lowered, unable to rappel with only his left arm. At Rap 1 a bar of cell service was discovered and so a text blast went out with hopes of contacting Mountaineers Emergency per understood protocols. Message out to Oly Leadership read "Incident on ingalls, [L] had a leader fall. Vitals OK and stable. We are lowering him down. I have a good co asst and three solid students...anticipate three raps and then a walk out to Ingalls Lake TH." Everyone in the party had headlamps and worked to help guide L down to the trailhead.

Commentary on Communications

>>Cell phone reception, choice of carrier, battery life, 911 text?

Four of the party searched for service immediately at Rap 2, and again at Rap 1. By way of Sprint (of all carriers), I was able to get text messages out. Texts were as described in trip report. I have a Samsung Galaxy S6 and keep it in airplane mode. In airplane mode I generally have no issues with battery life on trips up to three days.

>> Seattle is running a pilot for climb leaders to check out ACR ResQLink beacons. Does Oly supply them to climb leaders?

N/A – no PLBs. We're an Oly group and news of the PLB pilot had not trickled down to me.

>>Use of the DeLorme InReach with much texting... Yours was in reserve. Wondering what might have tipped the scales to use it.

Fallen leader L appreciated having his Delorme to text wife and let her know we'd be late to return. L was talked out of providing full detail, as to not panic any loved ones at home. Message, sent once we were off climb and on trail, was toned down to read something like "had a fall, shoulder injured but being helped out by group." Full call for rescue, by way of Delorme, would have been activated upon any suspicion of a spine or neck injury, or in the case of heavy bleeding or symptoms of shock.

>>Limits to shouting...any parties now routinely carrying walkie/talkies? Is use standard in Oly climbs?

Per my understanding, this is not standard in Oly climbs but the club does make walkie talkies available. In our case, L and our other assistant lead made their personal units available for this trip. We were rappelling off twin 60 m ropes and there were gusts of wind, which would have made communication clumsy at best and impossible at times. The walkie talkies were critical in maintaining communication b/w both assistant leads when one initiated a rappel and ensured a safe landing space, while the other remained at a rap station to lower the injured climber and double check students' systems for rappel.

>>What was your experience was on Ingalls with 911 call not allowing simultaneous UTM or Lat/Long lookup.

I may be unfamiliar with this issue/type of functionality from a cell phone. I routinely use an app called "gps status" for UTM from my cell phone and to verify that of my wrist device, a Suunto Ambit3.

>>Any wrist GPS devices in the party? Hand-holds?

I am an obsessive GPS tracker and tracked the day with my Suunto Ambit3. In a pinch I could have back tracked the route, but navigation was not a concern for us during this rescue as visibility to Ingalls Lake (and good trail) was not a problem.

--OAL is an Olympia Intermediate Student and Scramble Leader. He joined the Mountaineers in 2014, and completed Olympia's Basic Climbing Course in 2015. Contact him via Editor.

What's The Grams Cost to Navigate & Communicate?

By Peter Hendrickson

We're all up against it—packing the necessary and not a gram more. The Mountaineers keep inviting ultra light speakers—folks who (not counting food and water) are at the TH with under 4kg on their backs, pack included. For decades I packed many "just in case" items. It made sense as father of five, scoutmaster, trip leader, keen photographer...you get the picture.

More recently I've scoured incident reports with the upcoming Freedom 9's Chapter 3 (gear) in mind. As past Seattle Navigation Chair, futures for navigation and communication gear came to mind. A trip leader reported walkie talkies too heavy. Another relied on them. [See this issue.] See Tables 1 and 2.

Table 1. Navigation gear

Item	Make	Model	Grams
Baseplate, Mirrored Compass	Suunto	MC-2G Navigator	074
Baseplate, Compass	Suunto	M-3G Global Pro	048
Baseplate, Mirrored Compass	Silva	Ranger w lanyard	065/084
Baseplate, Compass	Silva	Explorer Pro	028
Baseplate, Mirrored Compass	Brunton	TruArc 15	091
Baseplate, Compass	Brunton	TruArc 5	051
Baseplate, Tiny Mirror Compass	Brunton	TruArc 7	062
USGS Quads (2) in Ziplock	USGS	Legacy	068
Green Trails (1) Map in Ziplock	Green Trails	Tiger Mtn	037
Guide Book	Cicerone	Trekking Dolomites	232
Dedicated GPS	Garmin	Oregon 600	209
Headlamp	Black Diamond	Cosmo	085
Romer (credit card size)	MapTools	UTM – SC24	004
SmartPhone w barometer	Apple	6S	143
SmartPhone w barometer	Samsung	Galaxy S7	152
SmartPhone w/o barometer	Apple	5S	112
SmartPhone w/o barometer	Samsung	Galaxy A3	132
Wrist Watch w barometer	Casio	SGW300H-1AV	047
Wrist Device	Suunto	Core	064
Wrist Device	Suunto	Traverse	078
SmartPhone Case iPhone 5	LifeProof	Fre	030
SmartPhone Case iPhone 6	LifeProof	Fre	035
SmartPhone Case Galaxy S7	LifeProof	Fre	042
Tablet	Apple	iPad Air 2	437
Tablet	Microsoft	Surface 3	622
Tablet	Google	Pixel C	517
Tablet	Samsung	Galaxy Tab S2	265
Two golf pencils	--	Stubby #2?	003
Waterproof Paper Options	Rite in the Rain	Universal/Memo	022/061

Table 2. Communication gear—see SmartPhones in Table 1

Item	Make	Model	Grams
Personal Locator Beacon	SPOT	Gen3 Satellite GPS Messenger	113
Personal Locator Beacon	ACR	ResQLink Plus 406	204
Satellite Messenger	DeLorme	InReach Explorer Satellite Communicator	422
Satellite Messenger	BriarTek	Cerberus Two-Way	454
Four pack AAA batteries	Duracel	Alkaline	046
Satellite Phone	SPOT	Global Phone	198
VHF Digital Communicator BlueTooth to SmartPhone	goTenna	Text and Location Communicator, 2 Pack	051 each
GPS/2-Way Radio	Garmin	Rino 600 Series, 5W	320
Walkie Talkie	Motorola	APX 4000 P25	
Walkie Talkie	Midland	GXT 5W	215
Walkie Talkie	Midland	T10 2W	077
Whistle	Acme	Thunderer #58	020
Backup Power Bank	Anker	PowerCore 5000 5A	080
Backup Power Bank	Anker	PowerPort 5 8A	235
Backup Power Bank	Anker	PowerPort 6 Lite 6A	155
Chemical Hand Warmer	HeatMax	2Pack HotHands	033
Rubber snake	Unknown	Pit viper, forked tongue	063

MyWeigh Model KD 1000 has proved to be a versatile and accurate home scale for cooking and making tough decisions about what to take and what to leave behind on day hikes, multi-day treks, backpacks and scrambles.

--Peter Hendrickson is Seattle Branch Chair and a free-lance journalist of many decades. He founded and edits *Navigation Northwest*.

US Topo GeoPDF File Conversion to TIFF [Abbreviated]

By Larry Moore

[Note: The Introduction and Appendix text below is harvested from a longer and more technical May 2016 USGS PDF. For full text and any updates, follow <http://www.usgs.gov/faq/categories/9797/3704>.--Ed]

Introduction/Background

"In 2009 the U.S. Geological Survey (USGS) began publishing digital quadrangle maps modeled on the legacy 7.5-minute topographic series of 1947-1992. The new maps, branded US Topo in 2010, are published in GeoPDF® format – Portable Document Format (PDF) with geospatial extensions. PDF was chosen as the physical format because it is the only format in common use that

- Can carry vector, raster, and text data.
- Can display complex structures on a typical office computer without specialized software or expertise.
- Allows a map to be printed at correct scale without specialized software or expertise. PDF geospatial extensions were implemented in US Topo because they add value "for free" – no cost to end users, and do not conflict with base PDF¹.

US Topo was intended to be a map product, not a GIS product. US Topo maps are fundamentally an output of, not an input to, GIS. They are derived directly from national GIS databases and represent a repackaging of existing data, not creation of new data. Nevertheless, there is demand for the ability to load these symbolized maps into GIS software. The basic benefit of this capability is to supply the GIS user with a pre-built, symbolized background map.

There are several potential solutions to this GIS user problem. The USGS is working on ways to distribute GIS vector data and symbol libraries corresponding to US Topo². It is also likely that the major GIS vendors will eventually implement geospatial PDF import functions. Web services (Appendix E) also provide partial solutions. Converting US Topo PDFs to some other format is also an option, and is the subject of this paper.

A common question from GIS users is "how can I convert a US Topo to GeoTIFF?" GeoTIFF is a raster image, not an intelligent GIS format, but provides a simple mechanism to display map symbols and annotation. GeoPDF-to-GeoTIFF conversion would seem like a relatively easy way to import US Topos into GIS. Unfortunately, this reformat is not especially simple, mostly due to the lack of powerful software for manipulating layered PDF files and for preserving georeferencing through reformat processes.

¹ These extensions are currently added with TerraGo software, so the resulting files can be referred to with the trademarked term GeoPDF®. "Geospatial PDF" is a generic term for georeferenced PDF documents.

² For more information (as of 5/16), and sample products, about a new product of GIS vectors with symbol templates packaged in 7.5-minute cells, see <http://viewer.nationalmap.gov/tools/topotemplate>."

Appendix E. Finding USGS GIS data

"As noted in the introduction to this paper, US Topo maps are GIS outputs -- a repackaging of GIS data for non-specialist map users that were not intended to be GIS inputs. Before going to the work of reversing this process and making GeoTIFFs for GIS uses, consider USGS products designed for GIS use. Web services (point 2 below) can be especially convenient for accessing GIS-friendly base maps.

Following is a summary of distribution interfaces for all products of the USGS National Geospatial Program (NGP), and gateways to other USGS programs and products.

1. The National Map Download Client (<http://viewer.nationalmap.gov/basic/>) is the primary interface for all data of The National Map (<http://nationalmap.gov>). Many NGP data products can be downloaded through this viewer. Data download FAQs (<https://www2.usgs.gov/faq/categories/9852/>).
2. Data from many of The National Map databases are also available through GIS services (<http://viewer.nationalmap.gov/services/>).
3. Current US Topo topographic maps, and legacy maps in the Historical Topographic Map Collection, can be downloaded through The National Map Download Client (point 1 above), or through other interfaces (<https://www2.usgs.gov/faq/categories/9797/3571>) dedicated to topographic quadrangle maps.
4. Individual data themes (e.g., elevation, hydrography, geographic names...) also maintain interfaces to specific products. Go to The National Map homepage (<http://nationalmap.gov>) and select a data theme.
5. More orthoimage, elevation, and land cover data are served from the Earth Resources Observation and Science (EROS) Center, including satellite data not served through other interfaces. See <http://eros.usgs.gov/find-data> for general information. The Earth Explorer viewer (<http://earthexplorer.usgs.gov/>) is the primary download application. Some archived datasets are also served through Earth Explorer; see the Long Term Archive page at <https://lta.cr.usgs.gov/>.
6. Bulk data deliveries and downloads are also available for some products (<https://www2.usgs.gov/faq/search/node/bulk>).

For paper maps, books and scientific reports, educational literature, and other hardcopy products, visit the USGS Store (<http://store.usgs.gov>) or the USGS Publications Warehouse (<http://pubs.er.usgs.gov>). To search for other types of

earth science data from USGS scientific disciplines, start at the USGS home page (<http://usgs.gov>). You can also contact USGS by email or phone (<http://www.usgs.gov/ask>)."

--*Larry Moore is a longtime cartographer with the U.S. Geological Survey. Contact him at lmoore@usgs.gov. Global Mapper is commercial GIS software ~\$500. See <http://www.bluemarblegeo.com/products/global-mapper.php>*

Wilderness Navigation Course Offerings 2016-2017--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. We are developing a Seattle version of Foothill's Staying Found, which does not meet back country course requirements. <https://www.mountaineers.org/about/branches-committees/seattle-branch/committees/seattle-navigation-committee/course-templates/basic-navigation-course/basic-navigation-course-seattle-2016>. Fee and Badge.

Date & Day	Workshops*	Date & Day	Fieldtrips
Thur, Oct 27	Program Center	Sat or Sun, Nov 5 & 6	Heybrook Ridge
Sept 20 to Oct 24	eLearning	Sunday Nov 6	Heybrook Ridge
Thur, Jan 26	Program Center	Saturday, Feb 18	Heybrook Ridge
Tuesday, Feb 7	Program Center	Saturday, Feb 18	Heybrook Ridge
Thur, Feb 23-Mar 6	eLearning	Sat or Sun, Mar 18&19	Heybrook Ridge
Thursday, Mar 9	Program Center	Sat or Sun, Mar 18&19	Heybrook Ridge
Tuesday, Mar 28	Program Center	Saturday, April 01	Heybrook Ridge
		Saturday, April 22	Heybrook Ridge
Wednesday, Oct 25	Program Center	Sat or Sun, Nov 4 (Nov 5, if needed)	Heybrook Ridge

*Note: Students may also 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 some select GPS apps 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. This course is open to Wilderness Navigation students and graduates. Fee and Badge.

Topics include:

- Overview of how GPS works
- Common accuracy issues and solutions
- Review of UTM coordinates
- 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)

and Garmin dedicated units. Other brand GPS units are welcome, but instructors may not be familiar with them. Lead course administrator is Brian Seater.

The current URL provides a description and the 2016 & 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-2016>

Smart Phone & Dedicated GPS Course	Location
Monday, October 3	Seattle Program Center
Tuesday, January 31	Seattle Program Center
Monday, April 17	Seattle Program Center
Wednesday, May 24	Seattle Program Center
Tuesday, June 27	Seattle Program Center
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:

<https://www.mountaineers.org/about/branches-committees/seattle-branch/committees/seattle-navigation-committee/course-templates/introduction-to-map-compass/introduction-to-map-compass-seattle-2016-1>. Administrative lead is Brian Carpenter. This Getting Started introductory class does not satisfy the navigation requirement for Alpine Scramble, Basic Climbing, Snowshoe or Backcountry Ski. Fee, no badge.

Intro to Map, Compass & Altimeter	Location
Monday, January 23	Seattle Program Center
Tuesday, April 11	Seattle Program Center
Wednesday, May 17	Seattle Program Center
Thursday, June 15	Seattle Program Center
Monday, August 14	Seattle Program Center
Wednesday, September 13	Seattle Program Center

Other Branches 2016 & 2017 Navigation Courses*

Branch	Course	Dates
Everett	Basic Navigation	TBD
Kitsap	Wilderness Navigation Wkshp/Field Trip	Oct 19/Oct 22
	Wilderness Navigation eLearning Option	Sept 15 to Oct 22
Olympia	Basic Navigation	TBD

Tacoma	Wilderness Navigation Lectures 1 & 2; Field Trip	Mar 13 & 20; Mar 25
Tacoma	Wilderness Navigation Lectures 1 & 2; Field Trip	Apr 13 & 19; Apr 22
Tacoma	Wilderness Navigation Lectures 1 & 2; Field Trip	Aug 10 & 17; Aug 19

* Be sure to check mounaineers.org for up-to-date listings.

Mazamas (Portland, OR) 2017 Navigation Instruction*

Portland	Intermediate Climbing School Lecture & Field Trip	December 6 & 10
Portland	Navigation Skill Builder Class	Feb TBD
Portland	Navigation Skill Builder Class	April TBD

*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.

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.

>>A second practice course focused on GPS use is under development for Lincoln Park in West Seattle by Mountaineers Safety Chair Dave Shema.

Navigation Gear, Apps & Links of Interest

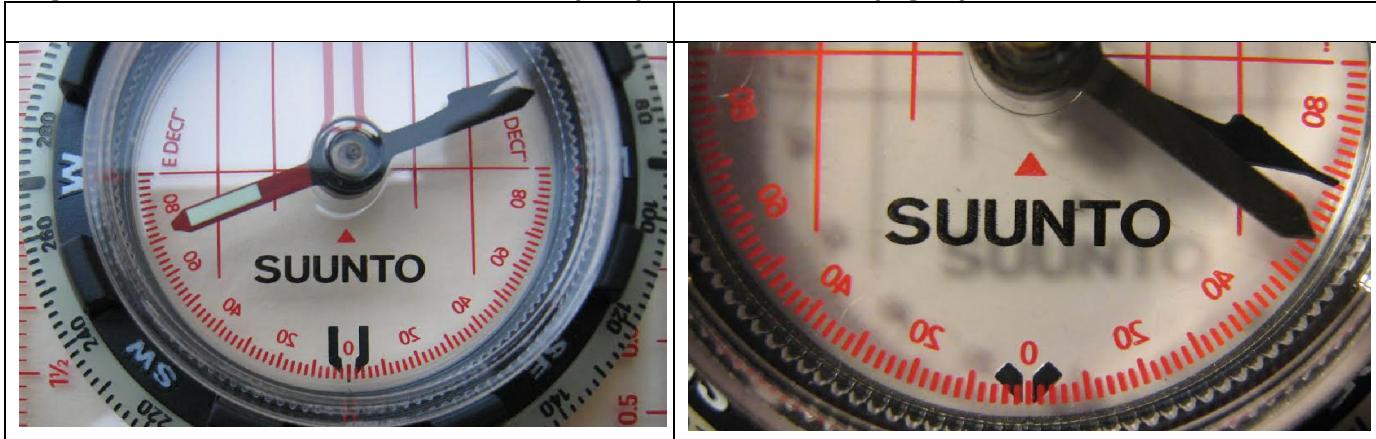
Your comments and suggestions are ever welcome regarding the Seattle Navigation website and links in Navigation Northwest.

The Gear...

Navigation Gear—Compasses

Hand-bearing compass declination adjustments require good vision and some help from the manufacturer. Figure 1 shows screen shots of Suunto MC 2 compasses. Guess which one is easier to adjust.

Figure 1. Late 2016 Suunto MC-2 (left); Older MC-2 (right)



The Apps...

None to report this issue.

And the links... --Thanks to Pat Podenski

- Hyperlite Mountain Gear publishes thorough and nuanced outdoor blogs.
Check Maps & An Ethical Compass for Grand Canyon Travel
<http://blog.hyperlitemountaingear.com/maps-compass-grand-canyon-travel/>
- Here are two National Geographic videos detailing the trek noted above.
PART 1 <http://video.nationalgeographic.com/video/magazine/160812-ngm-grand-canyon-part-1?source=relatedvideo>

PART 2 <http://video.nationalgeographic.com/video/magazine/160812-ngm-grand-canyon-part-2?source=relatedvideo>
- Adventure Alan (since 1999) provides a thorough domestic and particularly strong international review of Smartphone use for backpacking or trekking. The [blog post](#) is frequently refreshed He claims up to 10 days of battery life in the field including point location checks, photos and guide reading for iPhone 6 Plus or Samsung Galaxy s6/s7. Hint from Mr Dixon: Airplane Mode!
- Why you should make a trip plan (Adventure Alan) [Trip Plan](#)
- Best satellite messenger: inReach versus SPOT (Adventure Alan)
[InReachvSPOT](#)

Navigation Gear--Compasses

Required Compass Features: Seattle Wilderness (Basic) Navigation Course & Foothills Staying Found Seattle Mountaineers—Revised July 2016

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 and triangulate 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, steadyng 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.

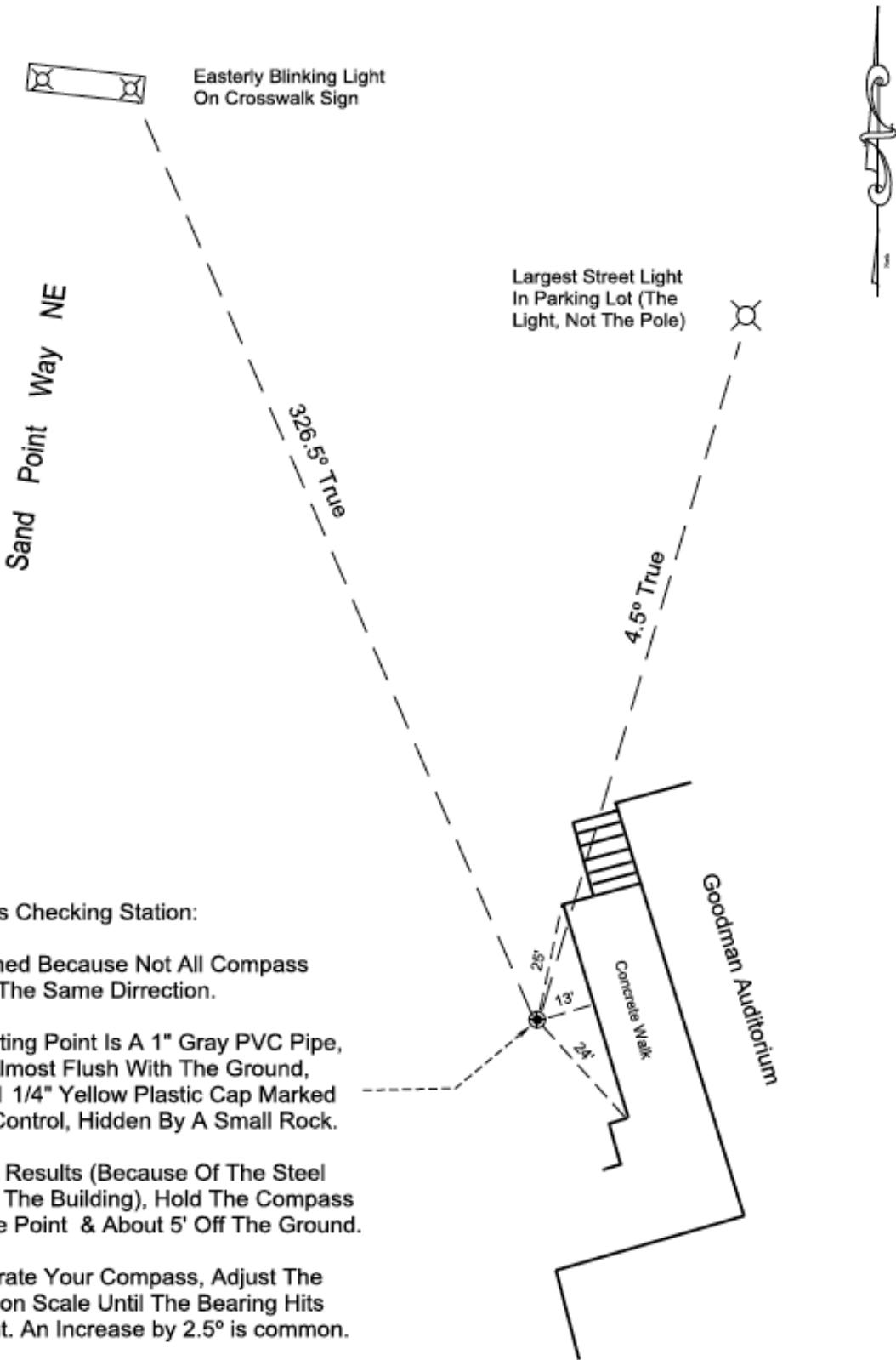
--K & R has the Sherpa and Alpin using 1:25,000 vs. 1:24,000 rulers. They are available online.

--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—a batch of eight was locally tested. Older MC-2s frequently needed to be set 2-3 degrees higher (i.e., 165 degrees East became 18-19 degrees East). Suunto is currently available at REI, Feathered Friends and online.

Some older Suunto M-3 and MC-2 lines exhibited a 2-degree magnetic error and are corrected by adding 2-3 degrees East (i.e., 16 degrees East would need to be 18-19 degrees East). Needles in 2016 and later models are not impacted. Meridian line length has also been sacrificed for Suunto branding on both models. If you are comfortable with foreshortened meridian lines, the M-3 and MC-2 lines are OK. Manufacturers make continuing improvements and corrections in models.

(Rev Sept2016/b5.ph)



Seattle Program Center Compass Calibration Station

Navigation Northwest Copy and Publish Deadlines 2016-2017

Calendar 2016	Copy Deadlines	Publish Dates
Volume 4, Issue 4	December 1	Late December 2016

Calendar 2017	Copy Deadlines	Publish Dates
Volume 5, Issue 1	March 1	Late March 2017
Volume 5, Issue 2	June 1	Late June 2017
Volume 5, Issue 3	September 1	Late September 2017
Volume 5, Issue 4	December 1	Late December 2017

Inquiries, Contributions, Letters to the Editor to Peter Hendrickson
p.hendrickson43@gmail.com

Notes on Current Issue: Yes, footer numbering resisted all efforts to unify across sections.

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Guidelines for contributors: Kindly contact editor

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(Rev. 29Sept2016ph)