The Mountaineers
EXPLORE • LEARN • CONSERVE

Navigation Northwest

A Quarterly Newsletter of the Seattle Navigation Committee
Volume 3, Number 2 **June 2015**

-- Navigation Summit 2015 Special Issue --

--Navigation Northwest June Features--

Summit Proposes Fresh Navigation Content & Line Up

By Peter Hendrickson

Navigation and other committee leaders from Everett, Foothills, Seattle and Tacoma proposed development of a coherent "navigation curriculum ladder" across all branches. The 21 navigators, climbers, scramblers, hiker/backpackers, authors, and back country ski and snowshoe instructor/leaders met June 19/20 at Meany Lodge to chart a course for 2016 and beyond.

Hosted by Seattle Branch Navigation, they heard Friday night briefings on maps, compasses, altimeters, smart phone & dedicated GPSers, PLBs & satellite messengers, drafting of Freedom of the Hills, 9th edition (Freedom 9--2017), and an elearning navigation pilot (instructor guided basic navigation workshop) now under development. While the central and critical role of maps was reaffirmed, there was intense discussion around the role of altimeters and GPSers in the

backcountry. And there was strong support for "strongly recommending" altimeters as an essential backcountry tool.

Navigation Summit 2015 was convened to address the increased use of electronics in navigation, the upcoming revisions of Freedom of the Hills, and the impending navigation elearning pilot. The group has no authority to enact or command changes, only to report and recommend. Saturday breakout groups gave findings and suggestions by activity area.

It was acknowledged that GPS devices are now commonplace navigation tools and may soon be ubiquitous among both front and back country Mountaineers. Further, smart phones and wearables are pushing dedicated GPSers and altimeters aside. There was concern that these useful and powerful tools might lead to a decay of map and compass skills. Freedom 9 co-author Bob Burns asserted that map and compass skills would continue to be the heart of the navigation systems, the first of The 10 Essentials, but noted that more space and emphasis will be given to modern, electronic tools.

Several cautioned that navigation apps and devices are changing so quickly that navigation instruction and guidance needs to be more nimble. There was also a call for standard navigation terms (with common meaning) across the club. One suggested "ladder" for courses and seminars was:

- Introduction to Navigation (an evening seminar for beginners exploring The Mountaineers)
- Staying Found (front country skills for on-trail hikers, X-C skiers, snowshoers, and backpackers)
- Wilderness Navigation (skills for climbers, scramblers, and back country hikers, backpackers, skiers and snowshoers)
- Smart Phone and Dedicated GPS (strongly recommended for back country travel)
- Back Country Winter or Glacier Travel (special considerations for snow or ice)
- Advanced GPS Navigation (creating routes, sharing routes, saving tracks, .gpx file sharing...)
- Natural navigation (tool-less navigation with close attention to the natural world)
- Advanced Trip Planning (tool integration, weather, snow pack, and other conditions)

Several participants noted the wide range of skills and experience encountered in navigation classes and called for differentiated instruction. They also recommended pre-requisite activities to better prepare students for instruction. The proposed, self-directed elearning modules could provide pre-class learning, several said.

Elearning was also seen as a way to provide train-the-trainer lessons. Several committees noted a need for wider and deeper professional development for instructors. Many were reported to lack the teaching skills for altimeters and GPS. And it was generally agreed that trip leaders should focus more on pre-trip planning and trailhead briefings.

Support for modernization of curriculum and instruction was broad and deep. Participants cautioned however that a remake of courses and seminars would take time to generate understanding and buy-in across committees and branches. Seattle Navigation's Greg Testa warned, "Beware of the ripple effect of changes. Don't shortcut the process."

A more complete report of the proceedings will be circulated to branches and committees over the summer.

Participants were:

First	Last	Role(s)* and Branch
Jim	Bigelow	Navigation Co Chair Everett
Bob	Boyd	Compass Co Lead Navigation Seattle, SAR
Bob	Burns	Freedom 9 Lead Mountaineers Books
Doug	Canfield	Elearning Lead Mountaineers Books
Chuck	Cerveny	BC Ski Instructor Foothills, SAR
Dave	Coate	Navigation Chair Foothills, Scramble Leader
Bruce	Crawford	Electronics Lead Navigation Seattle, Musher
Tom	Cushing	Scramble & Navigation Instructor Seattle
Glenn	Eades	Climbing, Climb Leader Seattle
Rick	Finkle	Navigation Chair Tacoma, Snowshoe
Lynn	Graf	Past Navigation Chair & Scramble Seattle
Susan	Graham	Hike and Navigation Seattle
Peter	Hendrickson	Navigation Chair Seattle & Branch Secretary
Jimmy	Jet	Snowshoe Chair Seattle
Steve	McClure	Treasurer BOD, Climb & Scramble Seattle
Pat	Podenski	Backpack Seattle, Snowshoe
Brian	Seater	Navigation & Scramble Seattle
David	Shema	Past Climb Chair Seattle, SAR Naturalists, Youth Outreach
Brian	Starlin	Navigation Co Chair & Climb Leader Seattle, SAR
Greg	Testa	Navigation Co Chair Seattle
Heidi	Walker	Hike Chair & Navigation Instructor Seattle

**Note: Most participants had/have other leadership roles, too.*

Peter Hendrickson chaired Navigation Summit 2015 with organizing committee support from Bruce Crawford, Lynn Graf, Brian Starlin and Greg Testa. Contact him at p.hendrickson43@gmail.com.

Your Navigation Toolbox

By Bruce Crawford

One of the first tasks I set for myself when I teach navigation is to explain the role of all the things we might be introducing the students to--map, compass, altimeter and GPS.

A map represents real world objects, their attributes and the relationships between them. It is an understanding of the world, shrunk down and flattened onto a piece of paper or a screen. The map can be thought of as a human readable data storage device.

In many ways, the map is at the heart of navigation. We celebrate explorers as people who fill in the blanks on the map, not as people who take a bunch of measurements like bearings, distances and elevations, which are used to make the maps. We start by teaching map reading and hope that students go on to master that skill and route finding, which both use the map. The map is an essential tool.

Everything else, compass, altimeter, GPS, pacing and time traveled, are all field measurement devices. All these devices measure attributes in the real world that we can then compare to information on the map.

The compass can be used on the map as a protractor and straight edge. Similarly, GPS units can hold the map in memory, and allow you to save or use a chain of successive positions (tracks and routes). So, the compass and GPS are two-way tools from the map, to the real world, and back. Note--you should always carry a protected paper map in addition to the map on your GPS. Paper maps don't suffer from low batteries or cracked screens.

Another overview is to first think of all the attributes we can find on the map, then ask all the ways we can measure each attribute. The US Army (C10 section 7 (10-7), U.S. Army Field Manual 3-25.26 Map Reading and Land Navigation) has a nearly complete list of attributes we see and measure in the real world, then find on the map. See Table 1.

Table 1. Map Attributes

Attribute	Examples	Field Measurement Tool	Comments
Position	Coordinates, Address	GPS	
Hand Rail	Road, Trail, Ridge Line, Stream	Eye, Mind	
Shape	Convex, Concave, V, Peak, Valley	Eye, Mind	A human abstraction
Orientation	Bearing, Angle	Compass	
Size	Distance, Angle Subtended	Eye Pacing Watch Compass	 time * velocity sin(angle) * distance
Elevation	Summit, Top or Bottom of Feature, Location	Altimeter GPS	
Slope	Gentle, Steep	Inclinometer Eye, Mind	(On some compasses)

You can see that we use field measurement tools to supplement and inform our vision and mind. We are moving through a world with varying numbers of navigation clues. We can give ourselves multiple ways to discern and measure them. Knowing and regularly practicing with different field measurement tools and methods allows us to double check and use alternate methods when those navigation clues are rare or ambiguous.

Navigation is a bet of your life that you can figure out where you are and where you are going. Stack the odds in your favor by learning and regularly practicing with different field measurement tools and navigation methods. Also remember that while specific situations may favor one set of methods (everyone has a favorite method), other situations will favor or require other methods. Take some time on trips to practice the methods you don't favor, so you will have good skills when the conditions change. In the end, the most important tool in your navigation toolbox is your brain. Don't let it get rusty, keep it in good practice.

Bruce Crawford is a veteran Seattle Navigation Committee leader. Contact him at brucec@bikejor.com

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Maps Briefing: Hard Copy and Digital

By Lynn Graf

Topographic maps are basically a 2-Dimensional rendering of a 3-D landscape, helping us to orient ourselves and navigate in that landscape. A map is part of the 10 essentials system, so every participant on a mountaineering trip should bring an appropriate one for their activity….but in my experience they often don’t, for a variety of reasons. The types and availability of maps is changing rapidly. The need to be able to read one is not.

Commercial hard copy maps: Gold standard for hikes and backpacks is Green Trails, for off-trail is USGS 7.5' quad.

USGS 7.5' quads, 1:24000, traditionally have high quality graphics, reliable terrain contours, detailed geographic information and, because of their format (22' x 27'), cover a large area. Disadvantages are their increasingly more limited availability (no longer at REI, e.g.), which requires pre-trip planning, that they are not updated for roads and trails, and that same large format that means folding and unfolding. Note that the USGS Store ( ) does sell "updated" 7.5' quads called USTopo maps as well as the historical ones but the USTopo do NOT currently include many of the geographic features present on the old ones…..such as structures, trails, summit elevations and more. I would not buy one for recreational use.

Green Trails maps are updated for roads and trails and have much more detailed trail information, cover a wider area than the 7.5' quads and are readily available in outdoor stores. Their contour interval, however, is variable, mostly 1:69500 in WA and they are only available for some states and areas, plus they are not adequate for navigating off-trail.

Commercial software with printable maps?

National Geographic TOPO for specific states is the most common.

- **Advantages**: coordinates easily with GPS, user-friendly and customizable, easy to save and send gpx and maps to others
- **Disadvantages:** USGS based so not updated for roads and trails, software no longer available for purchase
- **For all maps printable at home** – The graphic quality is limited by the quality of your printer, and printing at 1:24000 scale for off-trail limits the area that fits on 8.5 x 11 paper or requires multiple sheets.

Free e maps: online map resources

- US Topo maps and the maps of the historical topographic map collection can be downloaded free of charge, in PDF format, from three applications on the **USGS Store website**.
- But the software for dealing with them is not user-friendly
- **CalTopo and gmap4** – one builds on the other, both build on USGS and other sites like Google Earth, OpenStreetMap, NAIP, ArcGIS
- Both require practice but are powerful
- Interface with GPS units and smart phones – "It's complicated"

Digital maps: dedicated GPS or smart phone with app

- **Advantages:** compact, map plus position, embedded waypoints, possible to zoom in and out

- **Disadvantages:** poorer for "the big picture", battery life, device cost, learning curve and over-reliance on downloaded tracks

Coordinating between the two (paper map and digital device)

- Size matters – namely, the small screen size on digital devices
- Scale matters – particularly if it's different on printed map and device
- And so does Datum (WGS84 and NAD27). Should be same on both or you could be off by hundreds of feet…in the wrong gully

Future of (paper) maps

- My prediction: Sales will decrease and people will be less likely to carry them – cost and inconvenience
- online availability for self-printing will become more widely known
- But more and more people will think a smart phone app with maps is adequate 'til the battery runs out or they realize that can't interpret it

Some stats: 2005-2011 saw 25% decrease in map sales….and 52% increase in rescue incidents (https://www.ordnancesurvey.co.uk/)

A Post-script on map sales: I was evidently wrong in my map sales predictions. Alan Coburn, president and CEO of Green Trails Maps, reported to me this week, "Map sales, both the paper and PolyArt, have been and are trending strongly and consistently up. Map sales have nearly quintupled since GPS came on the market. And easily tripled since apps hit the market...Maps are, after all waterproof, shock proof, solar powered (you can read them in the sunlight or headlamp light), no batteries required, and require no connectivity other than between the user's ears."

Lynn Graf is a long-term member of the Seattle Navigation committee and former Chair. Her main interest is scrambling, summer and winter and all seasons in-between. Off trail travel leads to the best experiences (and stories!) Contact her at lynn.graf@gmail.com.

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Effective Compass Use

By Greg Testa and Bob Boyd

The past few years have been a dilemma of sorts for compass manufacturers. As shown in Table 1, Brunton, once a great compass, introduced their tool-less declination in all of their compasses; the result in trying to adjust to our 16 degrees east has seen the compass fall apart many times. Suunto, the proud maker of the MC-1, introduced the MC-2 which has a 3-degree error that needs an additional calibration to ensure accuracy. We will not mention the issue with the inverted mirror in this writing…best left for another topic. So that leaves us with Silva, which has everything we need, if only the meridian lines were more visible

and the declination could be easily set. See Table 1 for a head-to-head comparison.

Despite these imperfections, compasses are still a vital tool for navigation and are essential for wilderness activities. However, the tool alone cannot be blamed for all of the potential errors that we encounter.

Blame the Compass.

In today's world, we've grown accustomed to having technology work for us with little error. So when we get an incorrect reading on our compasses and arrive 20 feet further away from our destination than intended, we instantly look to defects in the compass. In several instances this claim has merit. The aforementioned issue with an otherwise good Suunto MC-2 compass' bearing has caused many students in our navigation course to become confused and increases distrust in their instrument. And the Brunton line of compasses works well if you do not attempt to adjust the declination with their tool-less feature, again, creating distrust in the instrument. Moreover, we've recently seen a proliferation of cheaper Universal Survival Tools (UST) compasses sold online that fail in several categories.

While all of these issues create distrust, a simple adjustment on several of these compasses can make them reliable instruments. Suunto's incorrect bearing may be due to an issue with the metal supplier for the magnetic needle and could be solved with a manufacturing modification. However, remembering that you can adjust another 3 degrees east declination easily solves the bearing issue. Brunton can also reintroduce the standard declination tool and screw, but mere trial and error in working with the tool-less declination can also allow someone to be more comfortable with this brand. As well, if you're able to view the meridian lines on the Silva, the compass can also be a valuable tool.

Knowledge is Power.

The adjustments listed above illustrate that the more you know about navigation and are familiar with compass features, the more likely you can resolve the issues to become an effective navigator. Training in navigation is a key component in being able to successfully find your way in the wilderness. Even with the flawless compass, an untrained navigator can easily become lost. How does someone take the correct bearing? How do they hold the compass when taking the bearing? Are they dragging the needle? Are they wearing any metal or carrying a battery pack that can throw off the bearing?

All of these factors play into potential errors when using a compass in outdoor navigation. It's important that one understands compass features and knows how to use it. While the Mountaineers and other organizations provide courses and training in navigation, constantly practicing with a compass outside of the courses is essential. Summiting to a mountaintop, one should get out their compass, confirm the direction down, and try to take a bearing on visible peaks. Practice

makes perfect. The more you use your compass, the more familiar and comfortable you will be in its effective use.

Am I Correct?
The final ingredient in making an effective navigator is knowing that their bearing is accurate. Someone without a known reference point may steer blindly into unknown territory, as they trust their navigation training and compass skills. This is where calibration and establishing a baseline becomes effective.

Having a professional surveyor provide accurate bearing readings for a navigation training is a good way to establish a baseline and assess the compass accuracy as well as skills of the student. If they are off by a few degrees on known bearings, an instructor can better determine the root of the problem. Outside of this training, it's vital that an outdoor navigator be able to check their compass against a known baseline and be able to adjust the compass declination. Using a recreational grade GPS is not the preferred way to test a compass.

In Summary
It's apparent that the currently available compasses are not perfect. They can lead to errors in bearings and cause navigation issues. However, these can be addressed and corrected with the proper training and a baseline to calibrate bearings. Think of this scenario: Three hikers, all with different compasses, different levels of training, and random calibrations take the same bearing. What are the chances they will all be the same? By understanding there are differences in all three categories and making the proper adjustments, their chances for success become greater.

Table 1. Cited Compasses, Features, and Known Issues

Brand	Cost	Declination Adjustment	Base Plate	Meridian Lines	Ruler or Gradient Scale	Issues
Brunton Tru-Arc 20	$55	Yes	Yes	Yes	Yes	Tool-free declination makes it difficult to adjust
Suunto MC-2	$55	Yes	Yes	Yes	Yes	Incorrect bearings…need to adjust 3 additional degrees east
Silva Ranger	$55	Yes	Yes	Yes	Yes	Hard to read the meridian lines & declination
UST Folding Map	$7	Yes	Yes	Yes	Yes	Freezing weather may leave it locked, incorrect dip setting for North America, declination is upside down

Greg Testa is a navigation instructor and serves as a co-chairman on the Seattle Navigation Committee. He has been a workshop and field trip leader for several years as well as managing the intro to map and compass courses. Greg is an active climber, scrambler, and hike leader while also enjoying cycling. Greg works as a Finance Director at Microsoft in Redmond. Contact him at gtesta48@hotmail.com.

Bob Boyd, since 1978 has been a State of Washington Licensed Land Surveyor; since 1992 a Navigation Consultant and instructor for King County Search & Rescue; a member of the Seattle Mountaineers since 2004 as a Snowshoe and Navigation instructor; and is the owner of Boyd & Assoc Inc., a Land Surveying & Mapping Corporation. In the past three years both the State SAR community and the Mountaineers have experienced compass problems. After hours of testing and a sit down meeting with a Finland factory rep, he understands the issues. Contact him at robert.boyd@comcast.net.

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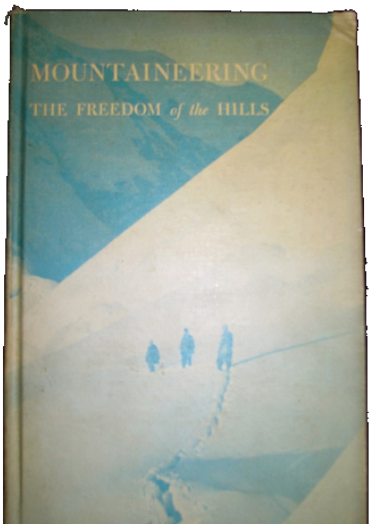
Altimeters: The Best Forgotten Navigation Tool

> "Since mountains are not two-dimensional… the ***altimeter*** is sometimes as helpful as the compass, particularly where topographical maps are available. With *altitude known* point-position can often be found with only one visible feature recognized; in any other case, altitude provides a check against map and compass orientation."
> ***Mountaineering: The Freedom of the Hills, 1st ed., 1960, p. 79***

By Steve McClure

It's hard to imagine an age when topos weren't available for all the US mountain ranges. But even then, we Mountaineers recognized the importance of knowing elevation for navigation. We understood that a map and a known elevation solve half of the navigation equation. With just one more scrap of data—a trail, a stream, a ridge or a bearing to a known peak—*we can know where we are.*



Many of us lusted after the altimeters in early REI catalogs with their 19 jewels and Swiss-made movements. At more than the cost of 100 pitons, this price-prohibitive tool has never been a part of the Mountaineers basic navigation course which has focused on the compass. But the Rolex of alpinism has given way to a sliver of silicon and the price of an altimeter

has fallen to that of a good compass. Our trusty wrist-mounted companion is now always there solving half the navigation question even in darkness, fog, or snowstorm, or what we in the northwest call a "good day in the mountains."

In the backcountry, the experienced mountain navigators I know rely on their altimeter for 90%+ of their traditional navigation needs. The Mountaineers are now embracing change and soon our altimeter-less course will be relegated to a dusty corner with a coil of manila rope.

The Modern Altimeter

Traditionally, altimeters have been instruments that measure atmospheric pressure the same as a barometer but calibrated in feet rather than inches of mercury (or meters vs. millibars). The trends for the modern altimeter are wearables and GPS devices, which usually means wristwatches and phones. (Yes, phones are the trending GPS device and work quite accurately beyond the reach of cell towers.) Here is a guide to the primary forms of altimeters available today. See Table 1.

ABC Watches

Watches are back in trend and at the REI electronics counter—*they've taken over.* The typical watch at REI is "ABC," sporting an Altimeter, a Barometer (which is basically the same thing), and an electronic Compass. A silicon chip beats at its navigational heart measuring the tiny variations in atmospheric pressure. And like their Swiss-made predecessors, they need continual recalibration tweaks for changes in weather.

ABC Watches with GPS

In the next display case you'll find GPS-savvy wrist-mounted navigational units that also tell time. Like all the ABC watches, these units determine elevation using barometric pressure. But these units solve the "weather change" vs. "I just hiked up a hill" dilemma by using 3 dimensional GPS location data to automate the recalibration. These units' primary GPS mission is to give location data but the most recent now display maps. Magnifying glass is optional.

Fitness Watches

Moving along, we spot the new category of "fitness watches" of Fitbit fame. REI has 50 different models that count steps and some use altimeter data to increase accuracy. But the sleek Fitbit-inspired models do not display their altitude data and so are no help for navigation.

Dedicated GPS Units

And in the corner, you'll see a small case of dedicated GPS handheld units. These rugged individuals still do an awesome job of determining location/elevation data and displaying it on tiny expensive maps wrapped in an indecipherable user interface. They now (post-2011) all use the USAF GPS *and* Russian satellites for quicker and more accurate readings. Some combine atmospheric sensors with GPS data for more accurate altitude readings. But like the cowboys of the old west they're from another era and retailers are movin' on.

Cell Phone + Apps

The final device can't be found at REI. It's that increasingly intelligent phone in your pocket. Within cell tower data coverage, smart phones are fed a constant stream of maps and location data to supplement their GPS capabilities. Outside of coverage, today's phones rival the best-dedicated units and exceed those from before 2012. That GPS power, paired with the right app, can turn your phone into a good altimeter. If your phone includes a barometric sensor, your phone can be a great altimeter.

To turn your phone into a full-blown navigation powerhouse, you will need to download a $20 app (I recommend Gaia GPS) and *free* maps before you leave home. Details in an upcoming issue.

Table 1. Modern altimeter comparison chart

	ABC Watches Non-GPS	**ABC Watches GPS**	**Fitness Watches**	**Dedicated GPS Units**	**Cell Phone +Apps**[i]
Typical Models	**Casio** Protrek and SGW	**Garmin** Fenix 3 or Sapphire; **Suunto** Ambit 3 or Core	**Fitbit** Surge, Flex, and Surge; Garmin (many models), Apple Watch, Microsoft Band	**Garmin** Etrex, GPSMAP or Oregon; **Magellan** eXplorist; **DeLorme** inReach or Earthmate	**iPhone** 6, 6+, **iPad** Air 2, Many **Android** Devices
Cost	$100-$300, some as low as $41[ii]	$350-$600	$80-$250, and up	$180 - $700	Apps are typically **free**
Battery	Excellent	Poor	Poor	Poor[iii]	Poor[iv]
Strengths	Easy to use, battery life, accurate	Easy to use, accurate	Counting steps	Rugged and accurate	Ubiquitous, cheap and accurate
Weaknesses	Needs calibration	Expensive	No elevation readout	Expensive, challenging	Fragile, best in a case

				user interface	
Comments	Common options: solar, compass, stopwatch, timer, Water-resistant to 100m (330')	Caution, some "GPS-enabled" watches are NOT for navigation only use GPS for distance/ pace data and viewing route on PC.	NOT navigation devices	Headed for extinction[v] and should be considered a specialty item for extreme environments	Multi-purpose device already in most people's pocket

[i] Android devices that contain a barometric sensor: Google Nexus (4, 5, 6, 9), Samsung Galaxy Note (1, 2, 3, 4), Samsung Galaxy S3, S4, S5, S6, Motorola Moto X, LG G3, Sony Xperia Z3, Xoom, RAZR MAXX HD, Xiaomi MI-2. Apple devices: iPhone 6, iPhone 6 Plus, and iPad Air 2.
[ii] Casio SGW300-1AV Multifunction Watch is $60 at REI, $41 at Amazon.
[iii] Battery issues can be mitigated (1) with spare batteries or external battery chargers, and (2) BY SHUTTING THE GPS UNIT OFF until needed.
[iv] Battery issues can be mitigated (1) with spare batteries or external battery chargers, (2) by running GPS in airplane mode (most units), (3) turning off Wi-Fi, Bluetooth, and other apps, and (4) BY SHUTTING THE CELL PHONE OFF until needed.
[v] According to an industry source, outdoor retailers are now preparing for the time when they will no longer sell dedicated GPS devices.

Steve McClure sits on the Mountaineers Board of Directors as Treasurer, chairs the Finance Committee, and sits on the Climbing and Scrambling committees. He loves many-day on and off-trail "rambles with scrambles" and teaching outdoor skills. He especially enjoys dropping students headfirst down steep slopes with a shiny new ice ax and shouting an encouraging "ARREST!" For similar treatment he can be reached at McNorth@Gmail.com.

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GPS Navigation Briefing

By Brian Seater

The Global Positioning System, or GPS, is a satellite based navigation system that provides accurate location information anywhere in the world. GPS was introduced by the United States Air Force in the 1970s and became fully functional in 1995. Since then, there have been a number of improvements to the technology and other countries are developing similar systems.

A GPS enabled device receives signals from a network of satellites, and using the information received it can calculate the devices position anywhere in the world. Typical positional accuracy is on the order of +/- 10-30 feet. Most devices made after 2011 are able to receive signals from the United States' NAVSTAR satellites as well as the Russian GLONASS system. The ability to use both systems has

greatly reduced the time required to obtain a position fix, and has also improved the position accuracy.

Most GPS devices include features beyond just giving a location (see Table 1). These include recording a 'track' of the route taken, and loading a preplanned 'route' and 'waypoints' (points of interest). All of this data can be overlaid on a topo map of the area. Some devices can also show satellite photography, wirelessly share position and track data with other devices, and interface with heart rate and bike cadence sensors.

While a GPS is certainly a handy device for quickly and accurately determining a location, they do have drawbacks. Regardless of the device type used, there are two major drawbacks to using a GPS; signal strength and battery life.

Introduction of newer technology and the addition of the Russian GLONASS system have made signal issues less frequent. A GPS requires a clear view and strong signal from least 4 satellites to get a position fix. While trees don't pose much of a problem for modern units, mountains, canyons, and buildings do. If there isn't a clear view of the sky positional error can increase, or the position fix may be lost completely.

The issue to be aware of is battery life. There are lots of options available for increasing the battery life of a device and in most cases battery life can be easily mitigated, but it is an issue to be aware of especially on longer trips. One of the simplest ways to increase the life of a device is to carry replacement batteries or an external power source, although this is added weight. Another option is to only turn the device on when a position fix is needed. This can have huge savings in power over having the device on all the time, but you lose the ability to record a track.

There are two main types of GPS devices for the outdoor adventurer, dedicated receivers and smart phone apps. A comparison of features and costs of select units is in a table below. They all use the same GPS satellite data, so position accuracy will be about the same regardless of the type of device used. The differences are in features available and cost.

Dedicated GPS receivers are available with a wide range of options, and a wide range of prices to match. Consumer grade units can be from around $100 to over $700. The main difference in the price range is the size and detail of the screen, the addition of a barometric altimeter, multi axis electronic compasses, and memory available to store maps and other trip data. Some devices are integrated with FRS radios and are able to transmit their position to similar devices up to 5 miles away.

Dedicated GPS units have two large advantages: ruggedness and batteries. Most devices are rated to the industrial standard of IP67, which means that the device

can be submerged under 1 meter of water for at least 30 minutes, while turned on. Dedicated devices also typically run on standard AA batteries, meaning that spares are easy to come by and relatively cheap.

There are a few drawbacks to using a dedicated GPS receiver. Screens on dedicated units are much smaller than on most phones, although they are usually designed for better performance in direct sunlight. Dedicated units also have a higher initial cost than a smart phone, assuming that you are going to have a phone anyway. The third drawback is available maps. While there are free topo and trail map sources, most official map sets must be purchased. Garmin offers maps equivalent to the USGS 1:24,000 scale for around $100 for two states.

There are a number of apps available for smart phones that turn them into fully functional GPS devices suitable for backcountry navigation. One big advantage of these apps is the low cost--most are under $20. They typically include USGS topo maps as the default, and there are many more map sources available that can be used for free. Like most phone apps, they are under continuous development, so new features are always being added. One downside of using a phone as a GPS is the ruggedness. Most phones aren't designed for use out in the elements, although waterproof cases are available. Viewing the screen in direct sunlight can also be problematic.

A GPS device, either a dedicated receiver or a smart phone app, can be a great tool for backcountry navigation, providing an accurate location quickly and in most weather conditions. It is important to remember, however, that all GPS receivers do have their drawbacks. A GPS should be used to augment, not replace, a compass and printed map.

Table 1. Comparing dedicated and smart phone GPS features.

	Dedicated GPS				Smart Phone		
	Garmin eTrex 10	**Garmin Oregon 650**	**Magellan Explorist 110**	**Magellan Explorist 710**	**Nexus 5**	**iPhone 6**	**Samsung Galaxy S5**
Screen Size	2.2", monochrome	3"	2.2"	3"	5"	4.7"	5.1"
Touch Screen	no	yes	no	yes	yes	yes	yes
Electronic Compass	no	3 axis	no	3 axis	yes	yes	yes
Barometric Altimeter	no	yes	no	yes	yes	yes	yes
Battery Type	Replaceable AA	Replaceable AA	Replaceable AA	Replaceable AA	Non Replaceable	Non Replaceable	Replaceable Custom
Internal Memory	--	4 GB	2 GB	8 GB	16 GB	16 GB	16 GB
Expandable Memory	No	Micro SD	No	MicroSD	No	No	Micro SD
Physical Size (in)	2.1 x 4.0 x 1.3	2.4 x 4.5 x 1.3	2.2 x 4.4 x 1.4	2.6 x 5.0 x 1.5	5.4 x 2.7 x 0.3	5.4 x 2.6 x 0.3	5.6 x 2.9 x 0.3
Weight	5 oz	7.4 oz	5.2 oz	6.87 oz	4.59 oz	4.55 oz	5.11oz
IP Rating (waterproof)	IP X7	IP X7	IP X7	IP X7	not rated	not rated	IP 67
Temp Range	5-158 F	5-158 F	14F to 140F	14F to 140F	-4 to 122 F	32-95 F	Not Listed
Cost	$110	$480	$140	$400	$350	$649	$396

*phone prices are unlocked, with no service contract

Brian Seater is a member of the Seattle Navigation Committee, and serves as a wilderness navigation and GPS navigation instructor. He is a scrambler, hiker, and backpacker with The Mountaineers. By day Brian is a Mechanical Engineer working in the aerospace industry. Contact him at bseater@gmail.com

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Satellite Messengers and Personal Locator Beacons (PLB's)

By Bruce Crawford

The most important things to know about these devices are:
They are not perfect.
Always leave your itinerary with a responsible person. If your party has an injury, even if you "press the panic button" you should also send out people to get help. The signal may not get through.

Which device is best for you depends on what you want it to do.

There are four main tasks for these devices; tracking to a web site, one way preset messages, two-way messages, and emergency SOS signaling. You need to know which of those you want your device to do before you can choose the best device for you.

The messenger products, SPOT and InReach, are "jack of all trades" products, allowing tracking, messages (SPOT one way preset, InReach two way) and SOS. PLB's differ from messenger products. They only do SOS signaling, but they do it very well. Tables 1 and 2 list the devices, their characteristics, and their satellite networks.

It's The Network.
If you have a cell phone, you likely know that the phone is only as good as the network coverage. While all these devices figure out their location using a built in GPS receiver, the satellite systems they use to send messages out differ. The ability of these devices to get a signal out is limited by their ability to contact those satellites and get a message through the systems.

The messenger products use commercial satellite networks to get their messages out. These networks are Low Earth Orbit (LEO) satellites that are moving relative to the earth, and each satellite sees a relatively small amount of the earth at one time. These LEO satellites are more likely to be low on the horizon. Not good if you are not on top of a ridge. My personal experience with tracking on my SPOT Generation 3 device is that you really do have to be on top of a ridge or in a pretty flat area to get a good chance to get a message out. I have SPOT tracks with lots of ridgeline and summit points, but below that, transmitted points are darn rare.

PLBs can talk to two, and in the future even more satellite networks. Historically PLB's have talked to LEO satellites (US and Russia) and geostationary satellites (high over the equator). The PLB's can send their GPS position, but the LEO satellites can also get an approximate position as they pass over by listening to the signal Doppler shift. The LEO and geostationary satellites complement each other. LEO satellites have a limited view (but store messages) while the

geostationary satellites have a bigger view, but sit over the equator, so are low to the south in the sky at our latitude.

PLB's have a new wave of satellite networks coming. As newer GPS, GLONASS and Galileo satellites are being launched, they incorporate PLB technology and new features (e.g. acknowledgement of message receipt). GPS satellites are Mid Earth Orbit (MEO). Lots of MEO satellites, orbiting every 12 hours, will be listening for your PLB. The service may start by December 2015. By 2018 there should be enough MEO satellites to be fully operational. You will likely see PLB's with the new features then.

Using GPS, GLONASS and Galileo satellites to listen for PLB's and send receipts is exciting. If you can get a GPS position, then there will be a good chance you can send a message, because more than one satellite is likely to hear your call for help. These satellites are positioned to be likely to be visible in all but the worst situations. They can even get your message and try and get a rough location for you in situations where you can't get a GPS position.

Table 1. Messenger and PLB Features (As of May 2015)

Brand	Features	Cost	Annual Cost	Global	GPS Locating	Doppler Locating	Transmit Power (Watts)	Weight (Ounces)	Battery Life (Hours)
SPOT	Tracking, One Way Preset Messages, SOS	$130	Varies, $200/year w/ tracking	No	Yes	No	0.4	4.0	150, Lithium
InReach	Tracking, Two Way Messages, SOS	$300	Varies, $300/year w/ tracking	Yes	Yes	No	1.6	8.2	100, Lithium
ACR (PLB)	SOS, homing, strobe, message receipt in future	$280	No fee, Battery change/service every 5 years	Yes	Yes	Yes	5.0 SOS, 0.05 Local homing signal, whip antenna	4.6	30, then new unit

Table 2. Messaging Network Features

Brand	Receiving Satellite System	Type	Satellite Count	Orbital Planes	Orbit Inclination	Advantages
SPOT	GlobalStar, no sat to sat, need ground station	Low Earth Orbit, 895 mi	40?	8	52	Low cost and tracking
InReach	Iridium, has sat to sat	Low Earth Orbit, 485 mi	66	6	86.4	Two way messaging and tracking, global
ACR (PLB)	COSPAS-SARSAT, sats have memory, GPS, GLONASS, Galileo soon	Low Earth Orbit 530 mi + Geostationary, Medium Earth Orbit soon	5 LEO, 7 GEO, MEO on GPS, GLONASS, Galileo starting 2015	GPS 6	99, Polar LEO, 0, Geostationary, 55 GPS	No fee, good probability SOS, global

Bruce Crawford is a veteran wilderness navigation instructor and serves on the Seattle Navigation Committee. A longtime field trip and GPS instructor, he is a keen bikejor musher and a scrambler. Bruce is principal wastewater engineer in the Modeling and GIS Group with King County Public Works. He was Seattle Branch 2014 Volunteer of the Year. Contact him at brucec@bikejor.com*.*

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Recommendation for Navigation Tools Treatment in *Freedom 9*

By John Bell, Bob Burns and Mike Burns

The *Navigation* chapter of *Mountaineering, the Freedom of the Hills*, **8th edition** includes descriptions and uses of **the map, the compass, the clinometer, the altimeter**, and the dedicated **global positioning system (GPS) receiver** for mountaineering applications. For the 9th edition, our primary recommendation for change is to **add material on signaling devices such as SPOT, In-Reach, and personal locator beacons (PLBs), and also to explain mountaineering usage of the GPS capability of smart phones**, such as Android devices and the Apple iPhone, including how to carry and protect them in the wilderness, and how to use them when outside of cell tower range. Due to power limitations of all electronic devices, we also recommend **adding options for field recharging of such devices** with user-replaceable batteries, battery packs, solar chargers, stoves, and other means, as well as their advantages, disadvantages, cautions, and limitations. We also recommend a general updating of the chapter, in accordance with new topo map availability, changes in declination, and new models of compasses, altimeters, and GPS devices.

Chapter 24 (*Alpine Search and Rescue*) of the 8th edition contains a description of radios and cell phones, satellite phones, and personal locator beacons (PLBs). It will be important to ensure coordination between these two chapters to ensure adequate coverage without unnecessary repetition. We could simply mention the existence of such devices in the navigation chapter, and refer to the *Alpine Search and Rescue* chapter for more detail regarding their use.

Chapter 2, *Clothing and Equipment*, page 34 of the 8th edition, contains *The Ten Essentials – A Systems Approach*. Item #1 is the *Navigation System*, which states the following:

> "**Always carry a detailed topographic map** of the area you are visiting, and place it in a protective case or plastic covering. **Always carry a compass.** Climbers **may also choose to carry other navigational tools**, such as an **altimeter** or global positioning system **(GPS) receiver**; additional aids include route markers, route descriptions and other types of maps or photos. Know how to use map and compass and other navigation aids – refer to Chapter 5, *Navigation*, for more information. Route markers (such as glacier wands) should be removed after use to leave no trace. If you are separated from your party, a whistle can be a simple but reliable signaling device."

We recommend adding signaling devices to this list of other navigation tools, such as SPOT, In-Reach, PLBs, and charging equipment, and any other equipment that is added to the *Alpine Search and Rescue* and/or *Navigation* chapters. We may consider listing *personal* navigational equipment, to be carried by every climber (including map and compass) as well as *group* navigational equipment, such as at least one GPS device, or preferably more, per climbing party, particularly if GPS is planned for use as the primary navigational tool.

The writers are authors of the navigation chapter of ***The Freedom of the Hills*** *9th Edition scheduled for release in 2017 and (Bob & John) the current 8th edition. John Bell is Seattle climb leader and former recipient of the SCC Climb Leader of the Year award. Bob and son Mike Burns are co-authors of Wilderness Navigation, 3rd edition 2015 and Wilderness GPS. Bob has hiked, scrambled, climbed and snowshoed throughout western North America. He has taught navigation through the Mountaineers, SAR and other groups. Mike is a rock, ice, and expedition climber, filmmaker and outdoor gear consultant with climbs across the world including a Himalayan first ascent. He has written several articles for Mountaineers and Climbing magazines. Contact Bob at burnsrobert@comcast.net.*

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New Tools For Outdoor Education: Elearning

By Doug Canfield

The Mountaineers Board of Directors this year has named three "Quantum Leap" goals it believes will help lay the groundwork upon which our organization will thrive in the future. Two of these goals address our mission to provide best-in-class outdoor education. They are (1) to evaluate and update our course curricula, and (2) to explore delivery opportunities through elearning.

I and three others—Tab Wilkins, Mountaineers Past President, Peter Hendrickson, Seattle Branch Chair of the Navigation Committee, and Margaret Sullivan, Mountaineers Books Managing Editor—have been working for several months to develop an elearning pilot project proposal to be presented the Board of Directors for funding.

Our work, to date, has largely been about selecting the course topic for the pilot, determining how to aggregate the best of our branches' curricula for the project, and researching the tools needed to deliver the course content online. The Navigation Summit specifically addresses the second of these tasks, while simultaneously also leading the organization in modernizing our training.

What can elearning do for The Mountaineers?

Our organization offers between 350 and 400 educational opportunities in a typical 12-month period. More than 5,000 students attend these courses, seminars and lectures. The primary goal for elearning is to capture, curate and make this content available for reuse by volunteers in every branch, either in an in-person context or as an online experience. Furthermore, elearning can support volunteer teaching assistants by allowing them to take train-the-trainer instruction in a self-paced course when and where it's convenient for them. And finally, we can extend our education to learners who are not located near our classrooms, who have missed a lecture, or who would like to re-visit the course a second or third time at their convenience.

Basic Navigation Elearning Pilot, Spring 2016

Basic Navigation has been chosen for the pilot because it is a foundational skill for much of The Mountaineers' more advanced outdoor training. Its length and relative complexity also make it an excellent template that the organization can use for future online courses.

We plan to include three types of online learning in the pilot: informal learning, such as short videos that learners can access anytime (free content); self-paced instruction, that are full courses but not led in real time (e.g., Train the Trainer); and instructor-led courses, where students take the training in real time and interact with the instructor and fellow students (e.g., Basic Navigation). The plan is to introduce the online version of Basic Navigation in Spring 2016, in conjunction with the in-person classes and field trips.

Enrollment for the pilot will be limited so we can learn from it in a more controlled way, and so that the field trips are not over stressed.

Adjustments to this plan will be made as time and funding require. Your deep knowledge and passion for this topic is needed to provide the content that will make this program not just successful on its own, but also to provide leadership for our entire organization.

Doug Canfield is the Elearning Project Manager and Director of Sales and Marketing for Mountaineers Books, a position he has held for the past 14 years. The Elearning Project is a way to link Mountaineers Books instructional texts more directly with the organization's curricula, improving content relevance and synchronicity with our training. Doug is an avid cyclist and winter sports enthusiast. You can contact him at dougc@mountaineersbooks.org.

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Northwest Wilderness Navigation—Looking Past 2020

By Peter Hendrickson, Seattle Navigation Chair

Scratch a wrinkled Mountaineer and you'll likely hear about the stack of topo maps tucked on a bookshelf and the Silva Ranger baseplate compass that has served for many years. "Why the declination was 21 degrees east when I joined the Club," they'll reflect. Ask further and the conversation turns to Garmin or SmartPhone, wrist or pocket altimeter, PLB or SAT messenger, tablet or hard copy, free e maps or 1:24000 USGS quads…

The reminiscing about outings past soon turns to plans for much-anticipated climbs, scrambles, hikes, backpacks, and backcountry snow and ski trips. Where and who leads to when and how. And a key element is always navigation, first of the 10 Essentials. How will we find the trailhead? Which route is best (newest, oldest, hardest, easiest…)? How will we return? How will we stay on track or on trail and what will we do if…?

We're together this weekend to sort out navigation futures across the Club but we've no authority to prescribe or mandate, only to recommend to our branches and committees. We have 2007 Minimum Clubwide Standards for navigation tucked into climb, scramble, hike, snowshoe and backcountry ski documents https://www.mountaineers.org/about/board-of-directors/minimum-activity-standards:

- Basic & Intermediate Climb: Leaders have competence in "use of topographical maps, compass, and altimeter." Content of the course shall include, "Use of topographical maps and compass."
- Alpine Scramble: Leaders have competence in "use of topographical maps, compass, and altimeter." Content of the course shall include, "Use of topographical maps and compass."

- Hike/Backpack: Leaders have competence in "use of topographical maps and compass." Participants: No prerequisite for signing up for a hike.
- Snowshoe/Ski: Snowshoe leaders have competence in "use of topographical maps, compass, and altimeter." BC participants "Use of topographical maps, compass, and altimeter." BC ski leaders "completed avalanche level one training." Silent on navigation tools for leaders and participants.

They certainly need scrutiny, likely an update.

We're here because navigation committees are wondering if they should update instruction. Because *Freedom of the Hills, 9th edition* (Freedom 9) is in the works for 2017. Because Seattle Climbing Committee recently sent a list of 10 navigation considerations to Seattle Navigation. Because the Board of Directors has authorized funding for a soon-to-launch navigation ELearning pilot. Because Seattle's GPS course was renewed last year. Because map sales are plunging and GPS apps and devices are soaring. Because we want to remain relevant as international leaders in mountaineering navigation.

We represent the many branches, the wilderness committees requiring navigation instruction, the Board of Directors, Mountaineers Books and we touch many other activities through our diverse interests from photography to rare plant care. Navigation committees, like first aid, are uniquely positioned to instruct and draw instructors from the other backcountry committees. We're geeky about navigation, what a glorious science, but we see navigation in service of climbing, scrambling, snowshoe… I live for multi-day treks, scrambles and urban explorations around the world. Our navigation skills and ideas are shaped by our experiences.

Branch by branch, the courses (badge offered) and seminars vary although the committees borrow from each other and some instruct at multiple branches.

Bellingham does not have a navigation committee. Navigation instruction is embedded within climbing and scrambling instruction. Contact: Minda Paul, Branch Chair, mindapaul@hotmail.com.

Everett offers a single day Basic Navigation Course twice a year at Camp Brinkley on use of map, compass, and altimeter for backcountry travel. Contact: Nav Chair Jim Bigelow jebigelow@comcast.net or navigation@everettmountaineers.org.

Foothills piloted a Staying Found on trail, single day course this year using the shelter area and braided trail system on the north flank of West Tiger Mtn in the Issaquah Alps along I-90. Contact: Acting Nav Chair Dave Coate, coateds@outlook.com.

Seattle offers a Basic Navigation course, an evening at the Program Center and full day on Heybrook Ridge near Index (5 pairs). A new SmartPhone & Dedicated GPS evening class is offered (6/year). An evening Introduction to Map & Compass is

offered in the Getting Started series (6/year). Variations on the Intro to M&C session are provided as a service to youth and community groups. We publish the quarterly *Navigation Northwest* newsletter/journal. Contact: Nav Chair Peter Hendrickson, p.hendrickson43@gmail.com

Kitsap offers Basic navigation but the longtime leader has retired and new leadership is sought. Contact: Jeff Schrepple or Dave Burton, Kitsap Branch Council. Jeff: avdfan@aol.com

Tacoma offers a map and compass Basic Navigation Course with two lectures in the Tacoma Great Hall and a field trip at the Irish Cabin property in Carbonado. There is a required pre-workshop assignment. Contact: Nav Chair Rick Finkle, rickfinkle01@gmail.com

Olympia offers a map and compass Basic Navigation Course with two evenings of instruction and a full day field trip Contact: Nav Chair Mike Kretzler, mkretzler@comcast.net.

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Dang, My SmartPhone App Died in the Kauai Wilderness

By Mary Aulet

So, most folks go to Kauai for the beaches, fancy resorts, and sunshine. A few intrepid souls head to Kauai for the hiking.

For those of you who have not been to Kauai, let me give a bird's eye view. Kauai has a road going around the perimeter – about 50 miles long. It is not a complete circle as the jungles of the Napali Coast have not yet been paved. Tons of resorts, golf courses, and spectacular beaches line the coastline. In the middle is Mt. Wai'ale'ale, the rainiest place on earth. The weather is such that the North side is blessed with lots of rain – and the south side is blessed with lots of sunshine. While most folks are basking in the sunshine, perpetual rain is but a few miles away.

We were intrigued by a hike to "the secret tunnel" in The Ultimate Kauai Guidebook (2014). The secret tunnel is a mile-long irrigation tunnel built in the 1920s, during the days of large sugar plantations. The straight-as-an-arrow tunnel was blasted thru the mountain to bring water from the wet north side jungles to the sunny south side plantations. Times have changed and neither the tunnel nor the plantations have been operational for decades. Now-a-days, the 'trail' is an unmaintained hunters track thru dense jungle. We started out equipped with a guidebook trail description, a guidebook map (p 202), baseplate compass, and an iPhone app associated with the guidebook. At the trailhead (Elev 830') around 8 a.m., we met a tall, thin, young Australian who was finishing up his cup of tea before

heading out. After all, it was only three miles to the tunnel entrance (Elev 1200').

For those of you not familiar with hunter trails in Hawaii, let's just say that they are plentiful, go in all directions, and are unmarked. They make most boot trails in Washington look like highways. Using the trail description, map and the iPhone app, we were able to thrash our way thru some pretty impressive foliage, including mud holes that easily ate up hiking boots. There were several areas where a step in the wrong direction would result in – well, let's just say we couldn't see the bottom of the gaping holes. We traversed steep hillsides with spiffy roots as handholds, and cruised "roller-coaster" sections where we scrambled down ~20 feet only to scramble back up 20 feet. Repeat 10 times.

Figure 1. Splashing thru Kauai's secret, sugar cane irrigation tunnel

The app was quite good at pinpointing exactly where we were, even without cell phone reception. We were both pretty scratched up by the time we waded thru the last stream to reach 'the secret tunnel' entrance as hunters don't believe in brushing out their

trails. After splashing our way thru the mile-long tunnel to the south side (Figure 1.), we were relaxing when the Australian came trotting by. He was most interested in learning about the iPhone app. However, on the way back our iPhone battery died. Yes, we simply left the iPhone on with taking power saving measures. This did not slow us down as map, compass, trail description, and our route experience served us well on a fortunately cloudy day. Strangely enough, we did not run into anyone else on bug-free, February adventure. We reached the TH at 4:30p.m., about 7 miles RT, .

The next day, we headed for the Blue Hole hike (p 196-197) again using our iPhone app. Unfortunately, the trail description, map and iPhone app didn't match up. After a bit of discussion, we decided that the trail description and map must be the correct as there was no hint of a trail where the app directed us.

So next time you are in Kauai and tire of beaches, pack a good guidebook, map, compass--and the iPhone app--and you'll be off for quite an adventure! A high clearance 4WD drive vehicle is essential. And you might consider a waterproof case for your smartphone.

References

Doughty, D. (2014). *The ultimate Kauai guidebook, Kauai revealed, 9th edition*. Lihu'e, HA: Wizard Publications, 272 p, ~$16.

Kauai Revealed 9th Edition iPhone app is available through iTunes ($8.99) at https://itunes.apple.com/ca/app/kauai-revealed-9th-edition/id912061441?l=fr&mt=8

--Mary Aulet is a veteran basic navigation and GPS course instructor. She and partner Pete McCormick have served on the Seattle Navigation Committee for many years. Contact her at mraulet@comcast.net.

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Smart Phone and Dedicated GPS Navigation Course

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 in Magnuson Park, split between a classroom lecture and a hands on outdoor exercise. This course is open to Basic Navigation students and graduates.

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 locating beacons (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.

We have scheduled six GPS classes annually. Lead course administrator is Brain Seater.

The current URL provides a description and the 2015 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-2014-1

Smart Phone & Dedicated GPS Course	Location
Tuesday, August 11	Seattle Program Center
Monday, October 05	Seattle Program Center

Basic Navigation Course Offerings 2015

https://www.mountaineers.org/about/branches-committees/seattle-branch/committees/seattle-navigation-committee/course-templates/basic-navigation-course/basic-navigation-course-seattle-2014

Date & Day	Workshop	Date & Day	Fieldtrip
29 Oct, Thursday	Program Center	07 Nov, Saturday	Heybrook Ridge

Introduction to Map & Compass—Getting Started

The Seattle Navigation Committee has scheduled six 2015 Introduction to Map and Compass dates at the Sandpoint Way Program Center from 6:30 to 8:30 p.m. Instructors are drawn from the pool of Basic Navigation Course teachers. You can 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-2014-1. Primary Leader is Greg Testa. This Getting Started introductory class does not satisfy the navigation requirement for Alpine Scramble, Basic Climbing, Snowshoe or Backcountry Ski.

Introduction to Map & Compass 2015	Location
Tuesday, July 14	Seattle Program Center
Monday, August 17	Seattle Program Center
Thursday, September 17	Seattle Program Center

Finding Navigation Courses, Activities and Events

Here are some tips for instructors and students to find and enroll in Seattle navigation courses, clinics and events.

- **Basic Navigation Course, Introduction to Map & Compass, Smart Phone & Dedicated GPS Course** are best located by:
  - Clicking the Learn tab on the Mountaineers home page.
  - Choose Select An Area...Navigation and click on Find Courses
  - Scroll down the Courses, Clinics and Seminars page to the Seattle course of your choice, for example Basic Navigation Course—Seattle
  - Course Activities will be listed so click on the date(s) wished
  - Click on the Registration Call Out for either Student or Instructor
- **Navigation Committee Meetings and other Events**
  - These are events so start with About on the home page
  - Click on Branches & Committees, then select Seattle Branch
  - Click on upcoming EVENTS to display a monthly calendar grid where you find activities and events in the Program Center and elsewhere
- Need More Help?
  - Committee Chair Peter Hendrickson responds to emails most days: p.hendrickson43@gmail.com
  - Activity leaders listed with the activity description also respond.
  - Program Center staff are deeply knowledgeable at Home Page: About tab, Contact Us, QUICK HELP: info@mountaineers.org or TEL 206.521.6001 Member Services

Navigation Projects

Our Seattle Volunteer Park effort to create a navigation map and compass practice course remains "under construction." Efforts to engage high school students in the planning and execution have not panned out to date. Drop me a line if you'd like help in this project.
--Editor

Links, Apps of Interest

Our often-consulted Seattle Navigation website has lived "outside" the official The Mountaineers website for many years. Sub-Committee Chair Wes Rogers is working with staff and other committees to bring our pages into the fold. Your comments and suggestions are ever welcome.
--A CalTopo blog with up-to-date features: http://caltopo.blogspot.com/
--Quick route to your compass declination, anywhere (tap calculate link): http://ngdc.noaa.gov/geomag/declination.shtml

Navigation Gear--Compasses

Required Features of a Compass for Seattle Basic Navigation Course

Seattle Mountaineers—Revised October 2014

1. **Adjustable declination**: A moveable orienting arrow, which provides a built-in declination adjustment. 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.
    - All students MUST have a compass with adjustable declination. The presence of a declination scale does not guarantee that it can be adjusted. We also recommend not having the 'tool-less' declination feature (we have no experience with newest models.
    - 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 **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.

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. The 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. Compasses with other additional scales facilitate advanced navigation.

6. A **3 to 4-inch base plate**. A longer straight edge makes map work easier.

Additional recommendations

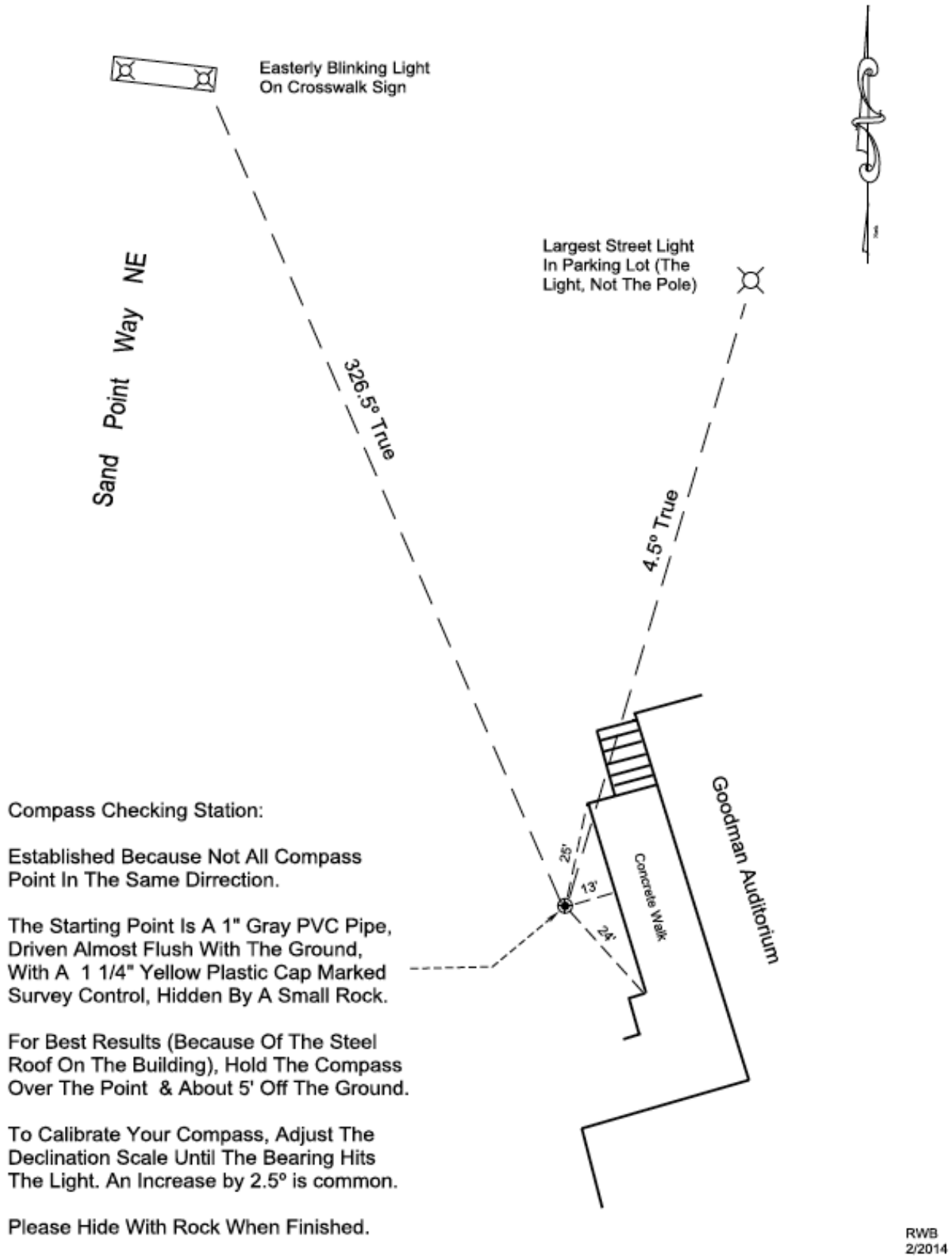
- A sighting mirror in the cover: This reduces errors introduced when moving the compass from eye-level after sighting to waist-level for reading the dial.
- A liquid-filled housing: Reduces erratic needle movement (only needed on some compasses). In some cases, steadying the compass needle can be difficult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

Current favorites with a sighting mirror include the Silva's Ranger CL and Ranger 75.
Recommended compasses without a mirror include the Suunto M-3 IN and the Silva Explorer Pro.

Please note that not all of these recommended compasses are available at REI. Silva can be purchased online at Campsaver.com and at Cabela's. Suunto is currently available at REI and online. Keep any receipt! We have unfortunately had many defective compasses in the past.

Brunton compasses have also been recommended. However, current offerings all now include 'tool-less declination' which requires pressing down on the bezel to set the declination. We have found this to be difficult and may not provide the best accuracy. While Brunton compasses meet all our specifications, tool-less declination makes them problematic and we do not recommend using this brand for the class.

We also recommended the Suunto MC-2 last year but experienced issues with warped mirrors as well as incorrect declination settings. The manufacturer has corrected the mirror, but a local SAR has reported that most compasses still exhibit the declination problem. Most can be corrected with an additional 2 degrees East adjustment (e.g., 16 degrees East would need to be 18 degrees east). If you are comfortable with declination settings and taking accurate bearings with this issue in mind, the MC-2 is OK. However, we would not recommend using it for the Basic Wilderness Navigation course.



Seattle Program Center Compass Calibration Station

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

OK to Forward

Email Navigation Northwest to any friends/outdoors partners to distribute

Guidelines for contributors: Kindly contact editor.

"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. 25June2015/ph

Kindly disregard footnotes below.

[i] Android devices that contain a barometric sensor: Google Nexus (4, 5, 6, 9), Samsung Galaxy Note (1, 2, 3, 4), Samsung Galaxy S3, S4, S5, S6, Motorola Moto X, LG G3, Sony Xperia Z3, Xoom, RAZR MAXX HD, Xiaomi MI-2. Apple devices: iPhone 6, iPhone 6 Plus, and iPad Air 2.
[ii] Casio SGW300-1AV Multifunction Watch is $60 at REI, $41 at Amazon.
[iii] Battery issues can be mitigated (1) with spare batteries or external battery chargers, and (2) BY SHUTTING THE GPS UNIT OFF until needed.
[iv] Battery issues can be mitigated (1) with spare batteries or external battery chargers, (2) by running GPS in airplane mode (most units), (3) turning off Wi-Fi, Bluetooth, and other apps, and (4) BY SHUTTING THE CELL PHONE OFF until needed.
[v] According to an industry source, outdoor retailers are now preparing for the time when they will no longer sell dedicated GPS devices.