

Navigation: Key Concepts

The fundamental tenant of secure navigation is to remain constantly aware of your approximate bearing and altitude and your progress across a known terrain feature in an estimated time frame. In addition, you are predicting new values of all of these upon arrival at the next leg of the climb. This constant awareness of bearing, altitude, terrain and time should supercede any other navigational adjunct you use such as a trail, boot prints of a previous party, a trusted leader or a smart phone working offline with the app such as Gaia.

This bearing/ altitude/ terrain/ time, (I will use BATT for short), awareness requires map preplanning and carrying a set of paper maps. This awareness should cover the approach roads and trail as well. While we all use navigational adjuncts, (trails, etc.), adjuncts can disappear or become non-functional without warning.)

The litmus test of BATT navigation is that should a trail become snowed over or a GPS device fail, you remain confident of your ability to continue navigating with absolute surety. Remember, the pioneers who led the first ascents in this region did so with only paper maps, compass and altimeter.

BATT navigation is not just having a fancy for tradition or a resistance to new technology. Here are some reasons to maintain BATT navigation in the background no matter what other adjuncts you may use: Climbing is a team sport and visual situational awareness is critical to safety. Electronic devices are notorious for taking face time and attention. Some require lots of hand and finger fine motor manipulation. At altitude, wind and cold can render this impractical. Using a dedicated magnetic compass and a dedicated digital or aneroid barometric altimeter, bearing and altitude can be monitored with only quick glances. You can check these devices while wearing heavy mitts and while maintaining a grip on your ice ax. Terrain, for the most part should be committed to memory. Brief study of a waterproofed map or digital display map should be relegated to safe rest stops and not mid glacier. Finally, BATT navigation inherently alerts you to errors. You can follow the wrong trail for hours and never realize your mistake. While mindful of BATT, however, any error in route will quickly show up as a different than expected bearing, altitude, terrain feature or arrival time.

Wilderness Navigation Tools

- **Paper topographic map(s)** of high clarity based on the USGS 7.5" to include: /1: A map or set of 8 ½ X 11 printed maps with 40' or less contour intervals and UTM coordinate grids at 1000 m spacing covering key technical portions of a climb. /2: A overview map or printed map that covers your entire climb and surrounding area larger than you would expect to traverse even if off route. Maps of 1:60K+ scale and 80-100' contour interval such as GreenTrails work well for this.
- **Magnetic needle compass** with adjustable declination
- **Barometric altimeter** (as opposed to satellite-based such as a GPS); aneroid, (powered by barometric pressure alone) or digital watch style both acceptable.
- **Waterproof container for paper maps** (not needed if maps are waterproof)
- **Pen or pencil** for note taking
- **Group GPS device**
- **Group PLB locator**: Recommend at least one way or better two way text capable

Map resources:

/1; Caltopo.com: For printing of USGS or custom maps (multiple layer options, including popular trails) Since the USGS 7.5" maps disappeared from climbing stores in around 2012, home printing of custom maps from Caltopo or similar websites has become the norm.

/2: Gaia GPS & Topo Maps: Gaia GPS is an app that works on smartphones and tablets with GPS capability. With an inexpensive subscription you can download large tracts of backcountry to the device, (normally at home using Wi-Fi). Gaia then works offline in the backcountry displaying your location on a selected base map. For reasons discussed earlier, this instructor recommends carrying a Gaia capable device packed in the off mode.

Sparing use of Gaia include:

- As a map display device
- As a confirmation of location
- As a navigation device in emergency or specialized situations, such as in rescue when rescue teams may deploy without time to gather paper base maps.

The standard subscription uses utilizes several of the most climbing friendly USGS 7.5" base maps as well as an aerial photo version and is likely all a north American climber needs. The premium version has a host of base maps for specialized or international uses.

/3: www.usgs.gov: (Less pertinent but still a useful resource): For downloadable 7.5', 15', and 30X60' quads in PDF format of all of North America, Alaska and Hawaii. Note that you are limited to the confines of a traditional map "quad" and not a seamless database. Printing from these involves taking a "snapshot" of terrain from pdf software such as Foxit. The 15' map series has been out of print since the late 1980s except for Alaska where it is still the standard. The scale is similar to Greentrails but covers all of continental US. The 30X60 maps are 1:100,000 scale maps that are suitable only for large overview. Physical copies of these maps can still be ordered from USGS.

/4: Purchased maps: Climbing outlets carry maps for selected climbing destinations such as the Greentrails 13S for Mount Baker. The Mt Baker side of this map is 1:24K scale and 40' contour interval. The clarity is excellent and the map is waterproof. National Geo also produces many specialty maps. Examine any map before you purchase to be sure that scale, contour interval, and the absence of clutter suits your route-finding needs!

Evolution of Map access

USGS has spent much of the 20th century developing the data base for the 15' and 7.5' maps. Printing of 15' maps were discontinued in the late 1980s and Greentrails took over that scale. Development of the USGS 7.5" series stopped around 2006. USGS shifted its focus to the US Map which is the layered maps where features such as topo lines, and other man made and natural features can be added or removed. USGS also began to digitize their library of maps. They were initially grainy, and did not reach adequate clarity, such as we now see on CalTopo or Gaia until around 2012. It is worth keeping in mind that the amazing display of maps we can access on Cal Topo or Gaia is the result of the public domain sharing by USGS of a century of mapping and field checking.

GPS Device Overview

Handheld GPS devices have become increasingly popular within the climbing community. Utilizing offline maps & preparing/sharing your route in advance is a significant advantage.

There are considerations when relying on technology for navigation. Cold weather is a common culprit for sudden device shutdown. Apps should be checked often for potential required updates and can often require annual subscription for services. Backup batteries, power cells, and corresponding cord adapters are highly recommended. Offline Maps, tracks, and routes, should all be downloaded and prepared ahead of time & shared with at least one other team member. It is recommended to follow online tutorials for before using any GPS Device.

Personal Locator Beacons/Satellite Messengers are extremely helpful when medical assistance is needed. Devices that allow messages, instead of only signals, are recommended as they are a significant asset to responding Rescuers. Messaging allows for confirmation to Rescuers that this is not an accidental SOS and also allow a person to provide additional on-scene medical and logistical data helpful to Rescuers.

Miscellaneous Navigation concepts:

Baseline: A linear feature (road, trail, river, etc) that borders one aspect of an area you plan to hike or climb. The premise is you can always turn to a known direction toward the baseline and find your way to safety. **WARNING:** In the North Cascades, most straight lines off of a mountain traverse technical or hazardous terrain.

Intermediate objective: An objective that is closer to you than your ultimate goal. Used when the final goal isn't visible, or for selecting the safest/easiest route.

Handrail: A linear feature that runs parallel to the area that you are exploring and remains generally visible (and thereby keeps you oriented). Even sound (as from a river or nearby highway) can act as a handrail.

Intentional offset: Intentionally aiming to one side or another of an objective to ensure arriving at an associated linear feature. Useful when attempting to reach a point at the end of a linear feature (roadway, trail, etc.) such as a trailhead or parking lot.

Gully VS Ridge: Gullies are often choked with thick vegetation and have a tendency to become steep/vertical. Ridgelines tend to be drier; less vegetated, and afford better visibility, often allowing for faster and more guided travel.

Micro Terrain: Micro terrain is a terrain feature that is too small to be revealed by contour lines. Certain parts of the Pine and Cedar lakes area are rich in micro terrain. Navigating such areas requires good navigation techniques and confidence in your tools.