Map and Compass Together

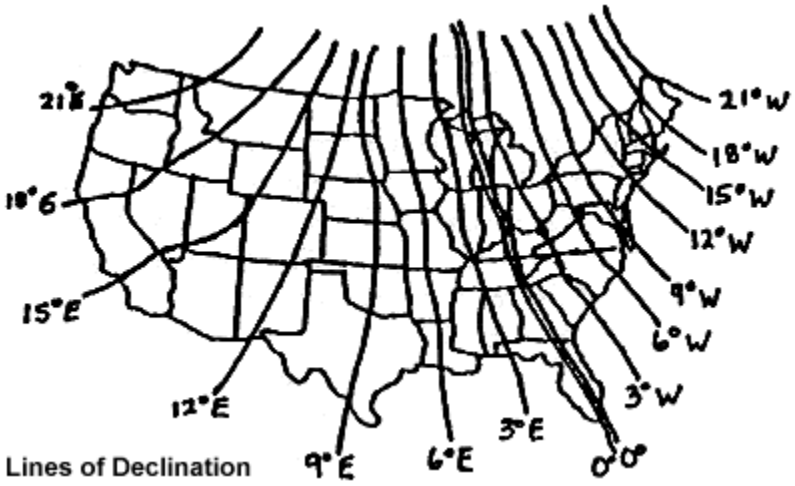
Putting Map and Compass Together: **Interpreting Contour Lines**

You can't appreciate the value of a good map until you understand how to interpret **contour lines**. These basics will get you through:

1. Contour lines are light brown lines on a map which connect points of equal elevation. Thus, closely spaced lines indicate lots of elevation change, whereas wide-spaced lines show the opposite.
2. The closed or "Vee" end of a contour line always points upstream.
3. Where contour lines cross or run very close together, you'll find an abrupt drop-a falls or canyon.
4. The vertical distance between contour lines is called the **contour interval**, and its value is given in the map legend. It is not the same for all maps.
5. The larger the contour interval, the more difficult it is to determine the characteristics of the land. In short, a map whose CI = 10 feet, gives a much clearer picture of the topography than one whose CI = 100 feet. Note that foreign maps give all information in meters, and these will need to be converted to feet to be meaningful to most Americans.

Orienting the Map - magnetic declination

Magnetic declination, also known as variation and deviation, is the difference in degrees between true (polar) north and where the earth's magnetic lines of force are actually focused. Declination fluctuates to a minor degree, since the magnetic lines of force themselves fluctuate in intensity. These magnetic lines of force currently come together in the Queen Elizabeth Islands region in northern Canada. Your compass's north-seeking arrow pivots within the housing to point at magnetic north, so to account for this deviation between magnetic and true north, you must either add or subtract the difference in degrees between the two norths, unless you happen to be standing on a line of no variation/deviation, called the agonic line. You can find that difference within the margin (you do have your topographic map with you?) in what is known as the declination diagram, shown here.



Lines of Declination

Note the difference marked in degrees between true north and magnetic north. In order to account for this difference so that your azimuths are accurate, you must orient your map and compass together and remove the difference. It's simple. Start by spreading out your map on some level ground in front of you with the bottom of the map closest to you. Now set your compass's straight edge along the true north line in the declination diagram with the compass's bezel ring set on directly north. Turn the map and compass together until the arrow (needle) and map are both facing directly north. If you have westerly declination, you must remove the difference between true and magnetic north by turning the map and compass together to the east (right) exactly the number of degrees of declination shown in the diagram, making sure the compass remains aligned on the true north line of the diagram. If you have easterly declination, you will turn everything to the left, or west.

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Watch your compass needle closely and stop when it is pointing at the bearing in degrees that is shown in the diagram to the left or west of the 'N' on your bezel ring. So, if you were standing atop Saddleback Junior near Rangeley, Maine, where your declination is eighteen degrees westerly, you would turn your map and compass to the east (right) eighteen degrees. At this point your needle should be pointing at 342 degrees, which is eighteen degrees less than 360 degrees, and is to the west of north. Now, if you had eighteen degrees easterly declination instead of westerly, you would turn everything to the left or west, and your needle would be pointing at eighteen degrees, which is east of north.

At this point your map and compass are aligned, and all bearings taken from this point are true, since you have removed the difference between the two norths. There is no need whatsoever to add or subtract degrees when you shoot a bearing now.

Another method of getting your map and compass in sync is to turn your bezel ring the number of degrees of declination for that area. Lay the compass's straight edge along the true north line again and orient your compass and map to magnetic north. If you have eighteen degrees westerly declination, shown on your declination diagram with the magnetic north line veering off to the left of true north, you must now turn your bezel ring eighteen degrees to the east. If you have eighteen degrees easterly declination, shown on your declination diagram with the magnetic north line veering off to the right of true north, you must turn your bezel ring eighteen degrees to the west (342 degrees). Now turn both your map and compass until the needle centers on the alignment arrow on the base of your compass. You're oriented. A simple way to remember this procedure is RALS, for Right Add Left Subtract. If the magnetic north line on the declination diagram is to the right of the true north line, you add the declination to 360 degrees. If it is to the left, you subtract.

Now that your map and compass are oriented, you have to figure out where you are. That is, since you are lost, you have to figure out where on the map you are, so that you can get to somewhere else on the map where you will not be lost. This can be done in a couple of ways.

Terrain Association

The first is the easiest in many situations. It's called terrain association (sometimes called inspection), which is matching up the terrain features you see on your map with the actual features they represent on the ground. Start by getting your map and compass oriented. Done? Okay. Now, take a look around you, and by that I mean that you should be looking at all the terrain you can see, which might be very close (such as the river you are standing beside) or which might be miles away (such as that cliff you can see across the valley). You can ascertain your position in many instances by just correlating what you see on the map and what you see on the ground.

But what if the weather won't allow you to see the surrounding terrain, or there is no major terrain? No prob-lame-oh. This situation calls for a very detailed map study. Examine the slight changes in slope, and look for tiny, perhaps intermittent creeks. Great attention to detail is the key.

And to help you not get lost in the first, perform a thorough map study before you head into the woods or desert. Note the major roads, rivers, ravines, and other terrain features that form the "boundaries" of the area you will be in. These help form your "escape" plan should things suddenly go bad.

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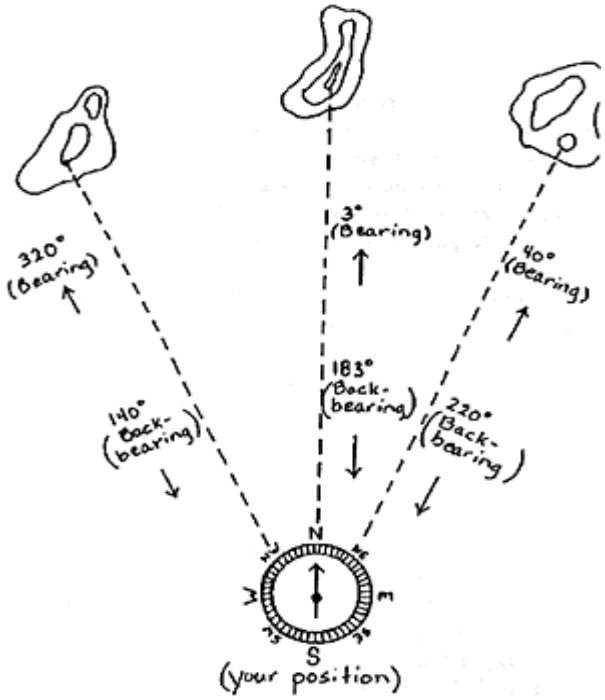
Triangulation (Resection)

The second method is called triangulation, also known as resection. You'll need a pencil or pen to perform this technique, and it does take a couple of minutes, but it is more accurate than terrain association. Get your map and compass oriented. Look around you and locate a prominent terrain feature, then locate that feature on your map. Next you need to shoot a bearing at it. Do this by holding the compass level at waist height and lining up the compass's sighting line with the feature. Now turn your bezel ring until the needle is aligned with the alignment arrow. Read the bearing to that feature where the bezel ring's degree marking is located below the luminous index line. That's the bearing to that feature.



Triangulation/Resection

Lay your compass's straight edge down on the map (which is still oriented) and draw a line from the feature back toward you. Now locate another prominent feature and repeat the process so that the two bearing lines intersect. Repeat this process a third time, using a third feature. The lines you have drawn back toward you will intersect forming a tiny enclosure (or if you are very accurate they will intersect perfectly). You are within that enclosure. You have found yourself! Well, on the map at least.

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Up to this point you have oriented your map and compass and fixed your position on the map. Now you must plot a route from your position (at the gates of Hell, beside the remains of the Chernobyl nuclear plant, etc.) to a position you would prefer to be, such as a bar, the Blue Quill Angler fly fishing shop in Evergreen, Colorado, a Bahamas resort, L.L. Bean's main store, or what have you. Study your map to determine where it is you want to go: a road, structure of some kind, trail, river, etc. Chances are that the easiest or safest route (in other words the best route) will not be along a direct line between you and the place you want to be, so you must refer to your map to determine the best route. To navigate along this route, you can either contour (referencing the lay of the land with the features on the map to guide you on your way) or plot (draw on the map) connecting legs (bearings).

Contouring is easy if you are adept at recognizing both prominent and subtle terrain features, but it takes an eye for detail and practice, i.e., I'll follow this creek down to this pond, skirt around the pond to this draw at the south end, go down the draw to this old logging trail, and follow the logging trail out to this road. Plotting legs takes just simple map and compass skills.

Plotting Your Course

To plot your legs, first get oriented, determine your position and final destination, then scrutinize the map so that you can avoid areas or features that would impede your travel, such as swamps, crocodile mating grounds, salt flats, and so on. That done, draw a line using your compass's straight edge from you to where you want the end of your first leg to be, which is made easier to find on the ground if it is prominent. With the compass still aligned on that leg, turn the bezel ring until the needle (again, the north-seeking arrow) is lined up with the alignment arrow. Now read the bearing on the bezel ring below the luminous index line. That is your bearing to the end of your first leg. Remember it (write the bearing along the straight line you just drew between your position, which we'll call Position A from now on, and the end of your first leg, now called Position B). Now select Position C (the end of your second leg), and draw another line, this time between Positions B and C. Turn your bezel ring again and line up the needle with the alignment arrow and read the bearing, then write it in along the line. Continue this procedure until the final leg puts you where you want to be. Your route is now plotted, but before you step off, take note of prominent (and perhaps not so prominent, but still recognizable) terrain features along the way. Circle them on your map to remind you along the way of what you should be seeing: when I get near Position C, I should be able to see the village of New Hope ten miles off to the west. Or, when I arrive at Position E, I should see these three dominant peaks off to the north about twenty miles.

Ready to go? Good. Set your compass for the bearing between Positions A and B. Do not make the mistake of following the needle! Remember, the needle always points to magnetic north, and unless your route just so happens to lie directly along that bearing, you don't want to follow your compass needle around. You should be walking in the direction of your luminous index arrow at the top of the base of the compass, right? Right.

But before you set out, look out before you and take note of some features along your first leg. Hey, you may only be able to see a little ways due to foliage or bad weather, so a feature at this point may be no more than a strangely-shaped tree or big rock. In any case, just walk to that feature, without holding the compass out before you (put it in your pocket, with one end of a 30-inch cord tied to it, and the other end tied to your belt loop or some other piece of your clothing so it doesn't get lost). When you arrive at that feature, take the compass out, shoot the bearing again, pick out another feature to walk to along that bearing, put the compass back in your pocket, and take off. Do this all the way until you reach Position B, which you must verify when you think you have arrived there.

Verification of each leg destination, known as a way-point, is done by either triangulation (resection), or terrain association (inspection). It is very important that you always verify your way-points. Otherwise, everything you do from that point on (all the bearings you shoot, etc.) will be wrong if you weren't where you thought you were.

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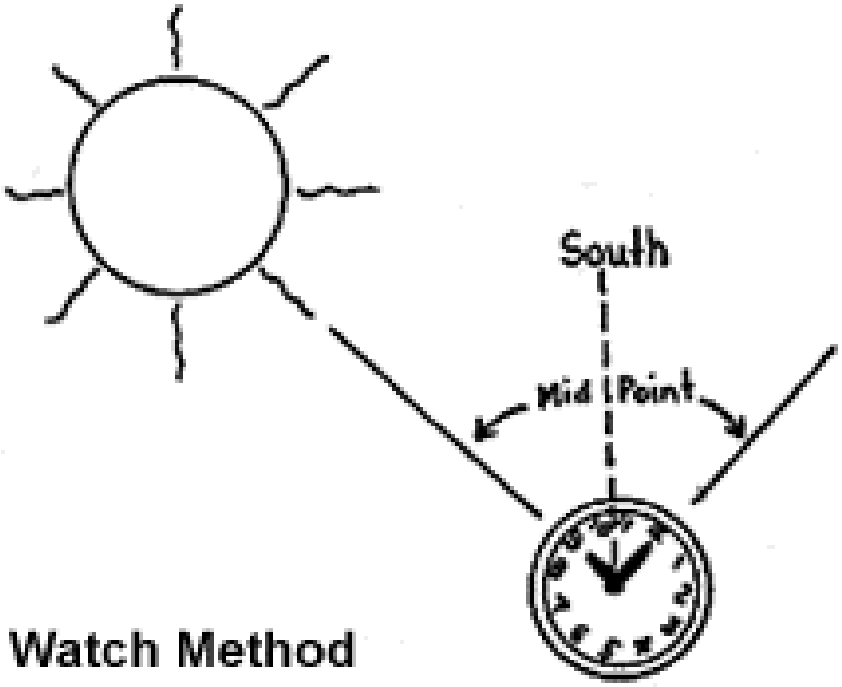
The "Old Ways"

How about a few ol' hiker's tricks to make your journey back to civilization a little easier?

- When you are contouring, feel free to use any game trails that are heading in the direction you are. Just be sure to get off them once they turn away.
- If you need some water and have found where two game trails meet, follow the single trail they form for a ways; there is probably water not too far down that trail.
- Take note of the drainage patterns on your map. If they all tend to gravitate toward a major river which flows toward civilization, you can just follow a stream downhill until it reaches the river, then follow the river.
- If you are walking along a slope on a certain bearing, be sure to regularly check to see that you are still on course. People have a tendency to drift off their bearing downslope when on an incline.
- Be sure to keep your compass away from metal such as belt buckles, pack frames, firearms, watches, and so on. Your compass's needle can easily be drawn to such items, resulting in a bogus bearing.
- Local anomalies in the ground, such as iron ore (magnetite) deposits can throw your compass off by quite a ways.
- If you are looking at the North Star (Polaris, or the "pole" star) but your compass is insisting that you are facing south, you are either near a lodestone (magnetite) or your compass is being thrown off by some other metal near you.
- Always believe your compass unless you can absolutely, positively prove it is wrong, or it is clearly damaged.
- Tie your compass to your body so you don't leave it somewhere.
- Laminate your map so that the rain doesn't destroy it.

Make sure you get a 7.5 minute-quad topographic map (7.5 minutes of one degree of longitude and latitude; there are sixty minutes in a single degree), which covers somewhere between 50 and 70 square miles of terrain. This series shows the right amount of detail for most outdoors folks.



Watch Method

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- To determine where north lies, aim the hour hand of your watch at the sun. No matter what time it is, south lies half-way between the hour hand and twelve o'clock, putting north exactly opposite that direction. Got a digital watch? Just draw a big traditional watch face on the ground with the hour hand pointing at the sun. In the Southern Hemisphere? Aim the 12 on your watch face toward the sun. Any point mid-way between 12 and the hour hand, regardless of the time, will give you a north-south line with north being half-way between the hour hand and the 12.
- Don't have a watch at all? Use the shadow-stick method of determining direction. Jab a two- to three-foot long stick straight into the ground so that it casts a shadow. Put a rock, pine cone, or what have you at the end of that shadow, and wait about half an hour or so for the shadow to move. Now put another object at the end of the second shadow. Step between the stick and objects (facing the objects) and place your left foot where the first object is, your right foot where the second one is. You are facing due north, which puts east to your right, west to your left, and south right behind you.

Want to find north at night? Just find the North Star. Locate the Big Dipper (Ursa Major) and draw in your mind a line running up through (from the bottom of the dipper towards the top, no matter how the constellation is situated) the two 'pointer' stars that make up the outer edge of the dipper itself. Now look to a point about five times the distance between those two stars; there you will find the North Star. Can't really pick it out? No big, bright, obvious star there? That's right, because the North Star is just a little brighter than those surrounding it. To make locating it easier, find Cassiopeia. She lies opposite the Big Dipper, has five stars, and looks like an 'M' which may be tilted at different angles. The North Star is half-way between the two constellations.

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