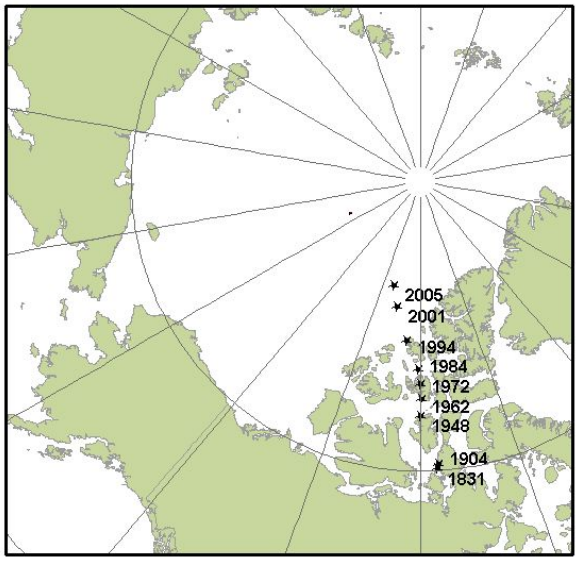
Magnetic wander—North to the Canadian Arctic

by Mark Laker



GPS & Magnetic North Pole

It's that time of year again, when many folks dig out those old topographic maps, compass, and possibly that new GPS unit (which they scored last Christmas) and head for the woods. For some, these are tools to figure out where they are and where they are going. For others, like myself, these are tools which help me find my truck at the end of the day. As with any technology or tool, a little bit of knowledge can be a dangerous thing. After many years of providing navigational support and basic orienteering training to field crews, I've observed many creative ways of getting lost. I would like to share a few lessons that I've learned (some the hard way) over the years.

It's easy to become over-confident in technologies such as GPS—the Global Positioning System based on navigational satellites. I usually get a few calls every year from lost crews and the occasional hunter/hiker. The request is typically for the coordinates of their vehicle or camp (as best as they can describe the location). Though I consider these individuals rather courageous in publicly advertising that they are lost, I rarely get the full story on how they lost themselves. My guess is that in the rush to get out in the woods, they took just the GPS and failed to record the coordinates of their vehicle or camp. All new GPS units are capable of quickly storing your current position as a "waypoint," or allowing the user to manually enter the coordinates. These are basic and essential skills that anyone relying on a GPS should master. If you don't have time to read those directions, take them along. Additionally, it is prudent to record the coordinates of important locations or waypoints on paper to take with you. Stored waypoints can be accidentally erased or lost if your batteries die, so plan on this happening to you.

It is easy to be impressed by the utility of GPS devices, especially if you previously spent years depending on a compass and map to get around in the woods. This summer we used a helicopter to visit approximately 150 remote sites. Precise coordinates were loaded onto both the helicopter and field crew GPS units. After the project was underway I asked the pilot how helpful the GPS was over the traditional practice of pointing to a spot on the map. The pilot estimated the GPS saved at least five minutes per site. That would equal at least $10,000 saved over the summer. For field crews, being able to navigate to within five feet of a metal stake in the weeds on a 2-million acre wildlife refuge is—"priceless."

Early this summer one of the field crews came to me with an interesting problem. While navigating to survey stakes they noticed each time they stopped, a new bearing correction was needed. Each course correction was to the right, resulting in a clockwise or "right-bending" arc to their destination, which sometimes added many extra meters through mountainside thickets on their route from the helicopter landing spot to the survey stake.

When navigating to a waypoint, I always instruct people to set their handheld compass to the bearing given by the GPS. A bearing is the compass direction (in degrees) you must follow to reach the target point. Using a compass provides many benefits. First, if you are walking in a relatively dense forest, the GPS may not receive a good signal and will be of little use. Tree cover does not affect a compass because trees don't shield the Earth's magnetic field.

Second, most GPS units assist in navigation by dis-

playing an arrow pointing to the destination relative to the direction you are traveling. That means you must keep moving (sometimes rather quickly) to know which way to go. Finally, I don't believe in depending on anything that requires batteries, so I want our crews to be able to navigate with a compass and map.

My first guess as to why the crew might be bending to the right was sloppy compass navigation. A good compass will have a mirror with a sight line and notch at the top. After the dial has been set to the correct bearing, the compass is held at arm's length and the mirror is used to view the compass face and sight line. Ideally you will be able to sight a landmark a good distance away as a target toward which to walk. Often it is not possible to see a distant target in a forest, so people try to rely more on their sense of direction.

Most people tend to veer one way or another. Myself, I tend to veer to the left. You have probably heard stories of lost people walking in circles. It takes about a half an hour up to two hours for a lost person to walk in a complete circle. These thoughts led me to question if the crew was relying on their personal sense of direction over the compass. If they were naturally veering to the left, this would explain their need to continually make corrections to the right. However, after careful questioning it appeared they were using the compass properly.

My next guess was the compass they were using had not been adjusted for magnetic declination. A compass needle points to the North Magnetic Pole, not the True North Pole. True north is the North Pole. The vertical lines on a map (lines of longitude) end up at the North Pole. The North Magnetic Pole is approximately 1300 miles south of the North Pole in the Canadian Arctic. Simply stated, the vertical angle between True North and Magnetic North is the "magnetic declination."

Most USGS topographic maps provide the magnetic declination for the center of the map; depending on your location, the declination will be different. To further complicate matters, the magnetic pole is moving northwest at a rate of 25 miles per year. In Soldotna, the current magnetic declination is 20° 19' East, decreasing by 0° 13' westward per year. What this means is, if you have not set the declination on your compass, you must subtract approximately 20° from 360° (=340°) to find True North.

GPS and Magnetic North Pole

A very handy declination calculator can be found on the web at: http://www.ngdc.noaa.gov/geomag-web/. You provide the calculator with coordinates or a zip code, and it shows the present declination.

As a general rule I set the declination on my compass so that North (0°) is pointing to True North. In addition, adjusting for magnetic declination allows you to estimate your desired bearing using USGS topographic maps. If you walk 20 degrees off course for one mile, you will be about 1/3 mile off course. So it pays to be sure that your compass has the magnetic declination properly set for the area in which you are working.

Did this solve the "right-bending" mystery for our field crew? Unfortunately not; failure to set the compass declination would have resulted in the need to continually correct the bearing to the left, not the right.

My next hunch was to check the settings in their GPS unit. Remember what I said earlier about a little bit of knowledge being a dangerous thing. In the Setup menu of the GPS the user can customize settings such as location format (Decimal Degrees, Degrees Minutes Seconds, etc.), and North Reference (True North or Magnetic North). I soon found that the North Reference on their GPS unit was set to Magnetic North with a declination of 21 degrees East. This setting had been chosen because the users recalled needing to set their compass for declination and assumed it would be a good thing to set the GPS too. This would have been OK if their compass declination had not been set. The result was a combined magnetic correction of -42 degrees. Each bearing they took from the GPS was 21 degrees to the left of their target destination. Each time they stopped to check their bearing with the GPS, it would direct them to go right, since they had "mistakenly" gone 21 degrees (left) off course.

Though this was an unusual mistake, with the complexity of modern GPS devices, it is not difficult to make such a mistake. Remember, don't rely solely on a GPS; get a good compass. All compasses do essentially the same thing, but more expensive models offer more features that make them easier to use. One convenient feature is a liquid-filled capsule that slows the needle down. A compass with a rectangular base is easier to use with a map than a round compass. Compasses with features such as rotating dials, built in declination settings, and direction of travel arrows are easier to use.

It is good to practice navigating with just your compass and map. There are plenty of Internet re-

sources to help in basic orientation. GPS devices are great tools to increase your proficiency, but remember, a compass doesn't need batteries.

Mark Laker is an ecologist, data manager and GIS specialist at the Kenai National Wildlife Refuge. Previous Refuge Notebook columns can be viewed on the Web at http://www.fws.gov/refuge/kenai/.