Group 6 ES Training:

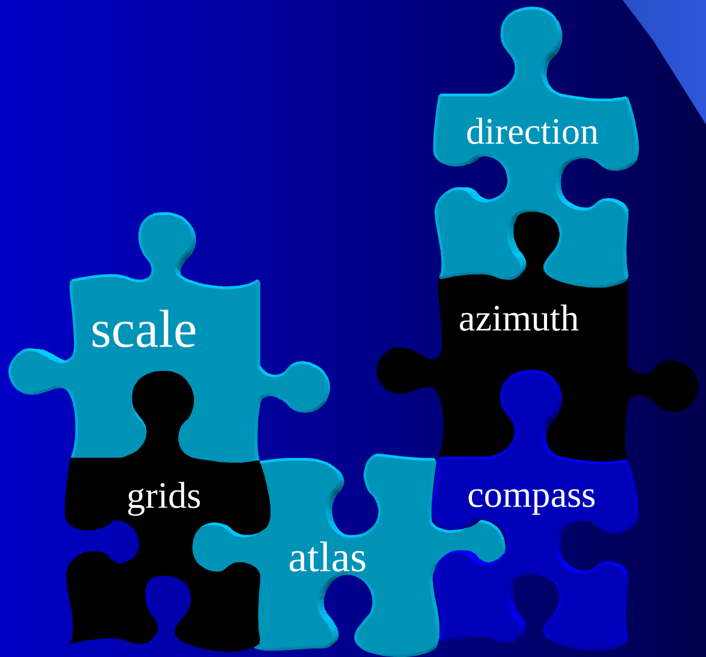
MAPS and Compass Use 2 parts…PART II

Agenda

- PART I
- MAP READING
- LAND NAVIGATION
- PART II:
- COMPASS USE AND GPS

Overview

- 2 PART TRAINING:
- JANUARY: MAPS READING AND LAND NAV
- FEBRUARY: COMPASS USE AND GPS



Getting Started

NAVIGATION EQUIPMENT AND METHODS

Compasses are the primary navigation tools to use when moving in an outdoor world where there is no other way to find directions. Personnel should be thoroughly familiar with the compass and its uses. Part One of this presentation discussed the techniques of map reading. To complement these techniques, a mastery of field movement techniques is essential. This presentation describes lensatic compass, baseplate compasses and their uses, and some of the field expedient methods used to find directions when compasses are not available.

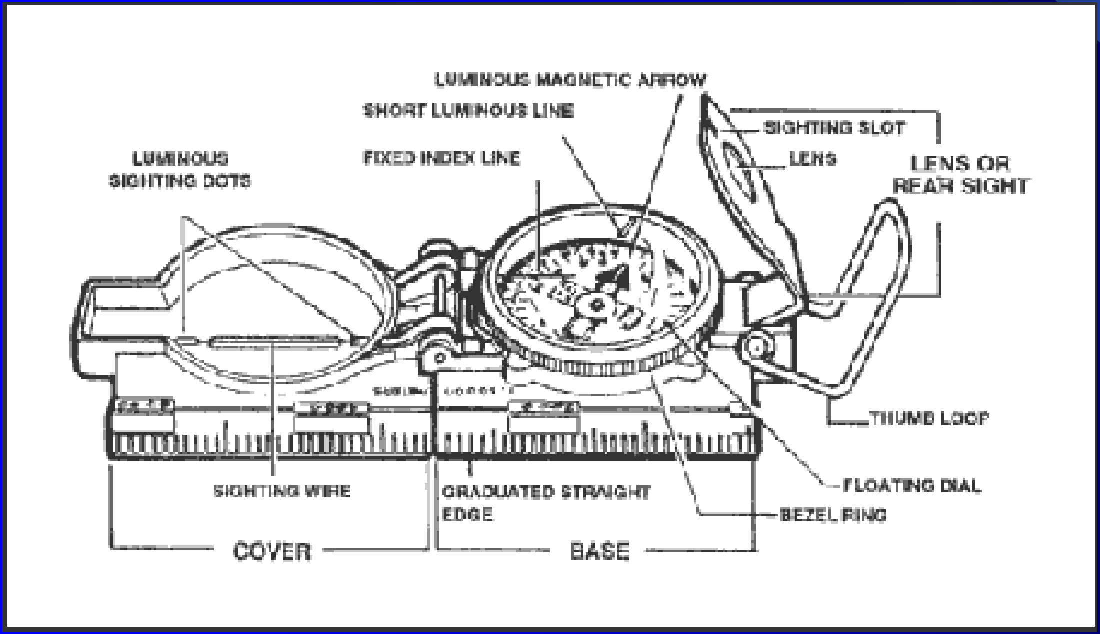
- Types of Compasses
- Compass Handling
- Using a Compass
- Field Methods
- GPS Global Positioning System

The **lensatic compass** is the most common and simplest instrument for measuring direction.

The **wrist/pocket compass** is a small magnetic compass that can be attached to a wristwatch band. It contains a north-seeking arrow and a dial in degrees. A **protractor** can be used to determine azimuths when a compass is not available. However, it should be noted that when using the protractor on a map, only grid azimuths are obtained.

LENSATIC COMPASS:

consists of three major parts: the cover, the base, and the lens.



Cover. The compass cover protects the floating dial. It contains the sighting wire (front sight) and two luminous sighting slots or dots used for night navigation.

Base. The body of the compass contains the following movable parts:

(1) The floating dial is mounted on a pivot so it can rotate freely when the compass is held level. Printed on the dial in luminous figures are an arrow and the letters E and W. The arrow always points to magnetic north and the letters fall at east (E) 90° and west (W) 270° on the dial. There are two scales; the outer scale denotes mils and the inner scale (normally in red) denotes degrees.

(2) Encasing the floating dial is a glass containing a fixed black index line.

(3) The bezel ring is a ratchet device that clicks when turned. It contains 120 clicks when rotated fully; each click is equal to 3°. A short luminous line that is used in conjunction with the north-seeking arrow during navigation is contained in the glass face of the bezel ring.

(4) The thumb loop is attached to the base of the compass.

Lens. The lens is used to read the dial, and it contains the rear-sight slot used in conjunction with the front for sighting on objects. The rear sight also serves as a lock and clamps the dial when closed for its protection. The rear sight must be opened more than 45° to allow the dial to float freely.

When opened, the straightedge on the left side of the compass has a coordinate scale; the scale is 1:50,000 in newer compasses.

Using the Centerhold Technique.

Lensatic: First, open the compass to its fullest so that the cover forms a straightedge with the base. Move the lens (rear sight) to the rearmost position, allowing the dial to float freely. Next, place your thumb through the thumb loop, form a steady base with your third and fourth fingers, and extend your index finger along the side of the compass. Place the thumb of the other hand between the lens (rear sight) and the bezel ring; extend the index finger along the remaining side of the compass, and the remaining fingers around the fingers of the other hand. Pull your elbows firmly into your sides; this will place the compass between your chin and your belt. To measure an azimuth, simply turn your entire body toward the object, pointing the compass cover directly at the object. Once you are pointing at the object, look down and read the azimuth from beneath the fixed black index line. This preferred method offers the following advantages over the sighting technique:

(1) It is faster and easier to use.

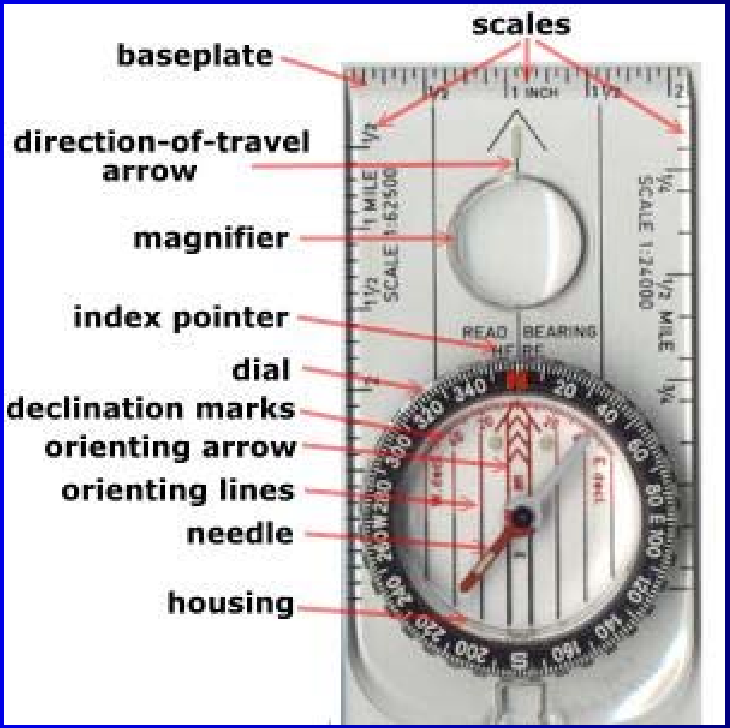
(2) It can be used under all conditions of visibility.

(3) It can be used when navigating over any type of terrain.

(5) It can be used without removing eyeglasses.

Parts of a Compass

There are many types of compasses ranging from tiny thumb compasses to complex high-tech gadgets. For most hikers and outdoors guys like us, an orienteering compass or baseplate compass is shown here

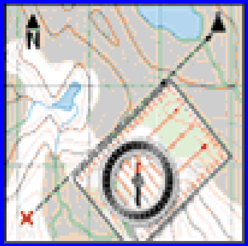


HOW To Use a Map and Baseplate Compass

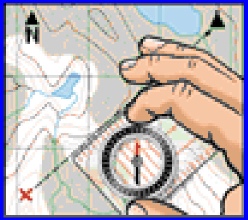
The baseplate or protractor compass

This type of compass was invented by the Kjellstrom brothers during the World War II era and consists of a rectangular baseplate, which is marked with a red arrow pointing along the long axis, and a rotating compass housing marked in degrees (360 degrees for the full circle in most of the world, but 400 on some European compasses). Marked on the floor of the rotating compass housing are an arrow and a set of lines parallel to that arrow. Additional features may include a lanyard for attaching the compass to the wrist, scale bars for measuring map distances along one or more edges of the baseplate, a magnifying glass for reading fine map detail, and templates of a circle and triangle for marking orienteering courses on the map.

First, you need to determine your bearing (the direction you need to travel). Use the following procedure to obtain an exact travel direction towards your desired destination. The procedure will work if the magnetic North-South lines are drawn on the map.



1 a) Place the compass on the map so that the long edge connects the starting point with the desired destination.
b) Make sure that the direction arrows are pointing from the starting point to the place of destination (and not the opposite way).
c) At this point, you may want to use the scales on your compass (if available) to determine the distance you need to travel.



2 a) Hold the compass firm on the map in order to keep the base plate steady.
b)Turn the rotating capsule until the North-South lines on the bottom of the capsule are parallel with the North-South lines on the map.
c) Be sure that the North-South arrow on the bottom of the capsule points to the same direction as North on the map. It is here you will make adjustments for declination, if necessary.

3 a) Hold the compass in your hand in front of you. Makesure that the base plate is in horizontal position, and that the direction arrows are pointing straight ahead.
b) Rotate your body until the North-South arrow on the bottom of the capsule lines up with the magnetic needle, and the red end of the needle points in the same direction as the arrow.
c) The directional arrows on the baseplate now show your desired travel direction.

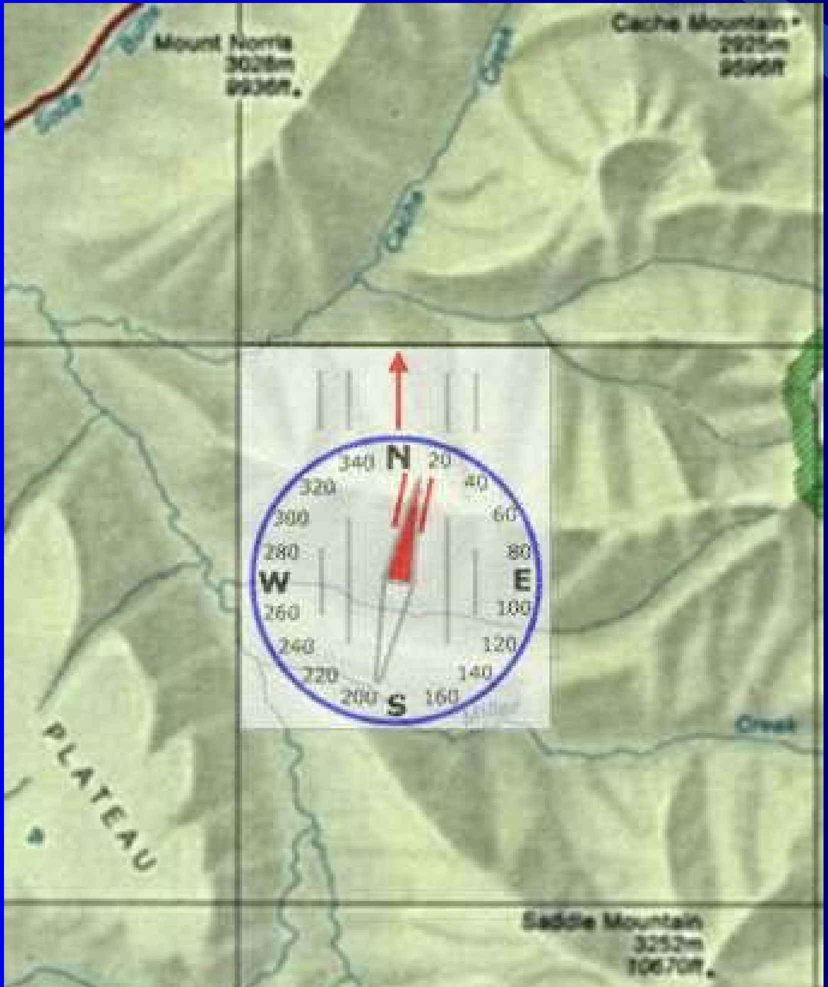
Tip 1: Sometimes the compass capsule may get turned accidentally while you are walking. Remember to check from time to time that the capsule has not deviated from the direction that had been set on the compass.

Tip 2: Remember the difference between the magnetic needle that always points to the magnetic North Pole and the direction arrows that show the travel direction.

A map represents the real world. By orienting a map, you are positioning it so its North is actually pointing north. When you orient a map and know where you are on the map, you can look in a certain direction and see a real landmark and find it on the map.

Orienting, or aligning, the map is really easy with just 3 steps:

- Lay your map out on a relatively flat, smooth surface.
- Turn your declination adjusted compass dial so due North is at the index pointer.
- Place your compass on your map with the edge of the baseplate parallel to the north-south meridians on the map. Notice the orienteering lines and direction-of-travel arrow are all parallel with the map lines.
- Turn the map and compass together until the compass needle is "boxed" in the orrienting arrow (**Red in the Shed**).

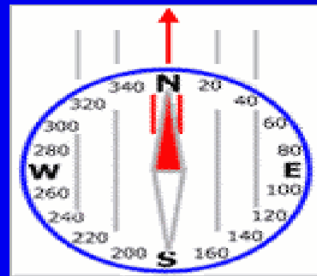


Two North Poles

There are actually two north poles - the *Geographic* north pole which is the axis around which the earth spins, and the *Magnetic* north pole which is where compass needles point.
Why are there two different poles? Good question!
The magnetic north and south poles are the ends of the magnetic field around the earth. The magnetic field is created by magnetic elements in the earth's fluid outer core and this molten rock does not align perfectly with the axis around which the earth spins.
There are actually many different sources of magnetic activity around and in the world. All those influencing factors combine to create the north and south attractions at each spot on the globe. The actual strength and direction of 'north' is slightly different everywhere, but it is generally towards the 'top' of the planet.

Magnetic Declination

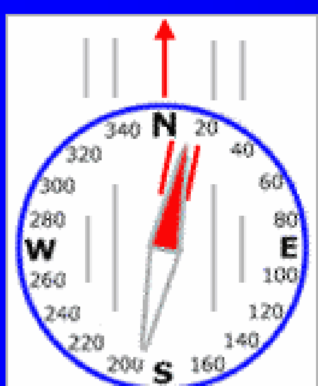
The difference between the north geographic pole and the north magnetic pole is called *magnetic declination* or usually just declination.
Depending on where you are on the earth, the angle of declination will be different - from some locations, the geographic and magnetic poles are aligned so declination is minimal, but from other spots, the angle between the two poles is pretty big.



Adjust Your Compass

On many compasses, you are able to adjust the declination by twisting a ring, using a screw, or some other method of changing where the *orienting arrow* sits in relation to the ring.
If you used a compass set with 0 degrees declination in Wyoming where the declination is 12 degrees East, the compass would tell you that you're heading North when you're actually heading 12 degrees East of North.
You'd quickly wind up off course and lost.

By adjusting the compass to match the declination on our map, the orienting arrow now appears to be offcenter from North, which is how it should be.
Now, when you put **RED in the SHED** (needle inside orienting arrow), the North indicated at the index pointer is true north and matches your map.
You can continue to check your location and chart your course correctly.
Whenever you stop and check your heading or take a bearing on a distant object, the degrees read on the dial will be the actual true degrees. The only thing that looks a bit odd is that the north end of the compass needle does not point directly at the **N** when you are heading due North.



COMPASS HANDLING

Compasses are delicate instruments and should be cared for accordingly.

a. **Inspection.** A detailed inspection is required when first obtaining and using a compass. One of the most important parts to check is the floating dial, which contains the magnetic needle. The user must also make sure the sighting wire is straight, the glass and crystal parts are not broken, the numbers on the dial are readable, and most important, that the dial does not stick.

b. **Effects of Metal and Electricity.** Metal objects and electrical sources can affect the performance of a compass. However, nonmagnetic metals and alloys do not affect compass readings. The following separation distances are suggested to ensure proper functioning of a compass:

High-tension power lines	55 meters.
truck	18 meters.
Telegraph or telephone wires and barbed wire	10 meters.

Accuracy. A compass in good working condition is very accurate. However, a compass has to be checked periodically on a known line of direction, such as a surveyed azimuth using a declination station. Compasses with more than 3° + variation should not be used.

Protection. If traveling with the compass unfolded, make sure the rear sight is fully folded down onto the bezel ring. This will lock the floating dial and prevent vibration, as well as protect the crystal and rear sight from damage.

FIELD-EXPEDIENT METHODS

When a compass is not available, different techniques should be used to determine the four cardinal directions.

a. **Shadow-Tip Method.**

(1) This simple and accurate method of finding direction by the sun consists of four basic steps

Determining directions and time by shadow.

Step 1. Place a stick or branch into the ground at a level spot where a distinctive shadow will be cast. Mark the shadow tip with a stone, twig, or other means. This first shadow mark is always the west direction.

Step 2. Wait 10 to 15 minutes until the shadow tip moves a few inches. Mark the new position of the shadow tip in the same way as the first.

Step 3. Draw a straight line through the two marks to obtain an approximate east-west line.

Step 4. Standing with the first mark (west) to your left, the other directions are simple; north is to the front, east is to the right, and south is behind you.

Watch Method.

(1) A watch can be used to determine the approximate true north and true south. In the north temperate zone only, the hour hand is pointed toward the sun. A south line can be found midway between the hour hand and 1200 hours, standard time. If on daylight saving time, the north-south line is found between the hour hand and 1300 hours. If there is any doubt as to which end of the line is north, remember that the sun is in the east before noon and in the west after noon.

(2) The watch may also be used to determine direction in the south temperate zone; however, the method is different. The 1200-hour dial is pointed toward the sun, and halfway between 1200 hours and the hour hand will be a north line. If on daylight saving time, the north line lies midway between the hour hand and 1300 hours.

Star Method.

(1) Less than 60 of approximately 5,000 stars visible to the eye are used by navigators. The stars seen as we look up at the sky at night are not evenly scattered across the whole sky. Instead they are in groups called constellations.

(2) The constellations that we see depends partly on where we are located on the earth, the time of the year, and the time of the night. The night changes with the seasons because of the journey of the earth around the sun, and it also changes from hour to hour because the turning of the earth makes some constellations seem to travel in a circle. But there is one star that is in almost exactly the same place in the sky all night long every night. It is the North Star, also known as the Polar Star or Polaris.

(3) The North Star is less than 1° off true north and does not move from its place because the axis of the earth is pointed toward it. The North Star is in the group of stars called the Little Dipper. It is the last star in the handle of the dipper. There are two stars in the Big Dipper, which are a big help when trying to find the North Star. They are called the Pointers, and an imaginary line drawn through them five times their distance points to the North Star. There are many stars brighter than the North Star, but none is more important because of its location. However, the North Star can only be seen in the northern hemisphere so it cannot serve as a guide south of the equator. The farther one goes north, the higher the North Star is in the sky, and above latitude 70°, it is too high in the sky to be useful.

GLOBAL POSITIONING SYSTEM

The GPS is a space-based, global, all-weather, continuously available, radio positioning navigation system. It is highly accurate in determining position location derived from signal triangulation from a satellite constellation system. It is capable of determining latitude, longitude, and altitude of the individual user. It is being fielded in hand-held, manpack, vehicular, aircraft, and watercraft configurations. The GPS receives and processes data from satellites on either a simultaneous or sequential basis. It measures the velocity and range with respect to each satellite, processes the data in terms of an earth-centered, earth-fixed coordinate system, and displays the information to the user in geographic or military grid coordinates.

The GPS can provide precise steering information, as well as position location. The receiver can accept many checkpoints entered in any coordinate system by the user and convert them to the desired coordinate system. The user then calls up the desired checkpoint and the receiver will display direction and distance to the checkpoint. The GPS does not have inherent drift, and the receiver will automatically update its position. The receiver can also compute time to the next checkpoint.

MORE ON GPS FROM WIKIPEDIA.COM

The **Global Positioning System** (**GPS**), is currently the only fully-functional satellite navigation system. More than two dozen GPS satellites are in medium Earth orbit, transmitting signals allowing GPS receivers to determine the receiver's location, speed and direction.

Since the first experimental satellite was launched in 1978, GPS has become an indispensable aid to navigation around the world, and an important tool for map-making and land surveying. GPS also provides a precise time reference used in many applications including scientific study of earthquakes, and synchronization of telecommunications networks.

Developed by the United States Department of Defense, it is officially named **NAVSTAR GPS** (**Nav**igation **S**atellite **T**iming **A**nd **R**anging **G**lobal **P**ositioning **S**ystem). The satellite constellation is managed by the United States Air Force 50th Space Wing. Although the cost of maintaining the system is approximately US$400 million per year, including the replacement of aging satellites, GPS is free for civilian use as a public good.

Orienteering Anyone?

- For more information on compass use sources:

www.compassdude.com (easy)

www.buckskin.org

Get Started!

www.us.orienteering.org

Presentation by Lt. Col. Carol Schaubschlager, DO/DOS Group 6