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BACKCOUNTRY NAVIGATION
USING THE MAP, COMPASS, GPS AND ALTIMETER TO FIND YOUR WAY

THE TOOLS

TOPOGRAPHIC MAP:

USGS or quality privately sold maps with topo contour lines and UTM grid for navigational use

Basic information to note and understand:

1. Dates, methods of production and revisions, the name of the map quadrangle
2. Scale (see the miles scale graphic)
3. Contour intervals (IE. 40 feet, 10 feet)
4. Declination and direction (IE. "20 degrees" and change per year), see the declination graphic
5. Map symbols, road legends
6. The Universal Transverse Mercator (UTM) 1,000 meter (1 kilometer) grid

The lat-lon grid in degrees, minutes and seconds is really not suitable for backcountry navigation

The red one mile square public land survey grid is really not useful. It does not relate to the GPS

Map modification:

The UTM grid lines on USGS maps are fine substitutes for true north-south lines

The maximum error north-south error at the edge of each Zone is about 2 degrees

You may need to add the UTM grid lines in number 2 pencil, using the light blue UTM tick marks

Fold all of your topo maps "correctly", use them in a Ziploc baggie in wet weather

Face up, fold in half north to south, then fold back to show map, then in half and quarters

The map name should show in your storage file

REQUIRED BASE PLATE (ADJUSTABLE DECLINATION) COMPASS:

1. A long transparent base plate with straight sides and a marked direction of travel arrow
2. A large rotating compass dial, also with a transparent base marked with parallel true north lines
3. The central dial must be liquid filled to dampen oscillations and allow fast accurate readings
4. The compass dial must be marked from 0 to 360 degrees clockwise, in 2 degree increments

Optional additions:

5. An adjustable declination arrow with it's tiny nonmagnetic key and gold screw adjustment
6. Markings along the base plate edges with inches and other map scales
7. Clinometer to make sure your tent is higher at the head of your sleeping bag
8. A mirror to check your hair
9. Magnifying spot for your bad eye
10. Hole for waist length shoelace lanyard (not the wimpy red shorty cord it is sold with)

Compass Declination modification:

The compass must have your area's magnetic declination adjustment dialed in, or

The declination adjustment must be marked by a taped arrow on the dial base plate

GPS RECEIVER

1. **GPS receiver adds the power of celestial navigation using military satellites**

OTHER NAVIGATION TOOLS:

1. **Wrist watch adds the passage of time to your dead reckoning**

   A stop watch function with multiple stored splits capability is best
2. **Wrist altimeter/barometer adds a third dimension**

   Comes with a watch, stop watch and other functions, three for the price of one!
3. **Cellular phone or ham radio to call authorities to get directions.**

SMALL STUFF:

1. **Pencil, a #2 with an eraser to annotate the map (use the map margins for your notes)**
2. Pocket plastic magnifying glass to read the fine print (and start a warming fire on a sunny day)
3. A 6 inch clear a plastic ruler to extend the straight edge of your compass' base plate
4. Surveyor's tape for marking your return, bamboo wands for snow

BACKCOUNTRY NAVIGATION
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MAPS

Planimetric and topographic maps:

Planimetric maps show the earth's surface in a flat perspective
Topographic maps provide a third dimension
All modern maps are based primarily on aerial photographs**, watch the dates**

Various types of planimetric maps used for trip planning:

State highway and roadmaps, say of Oregon
Auto club maps of a recreation area, say the Eastern Sierras or Grand Canyon Country
Recreation maps provided by Forests, Chambers of Commerce, resorts and the like
Commercial maps sold by private companies, say for hiking or fishing opportunities

Topographic maps of various types used for land navigation:

Commercial maps of a popular area, say Geo-Graphics Three Sisters Wilderness Map

1:83,000 .75 inches to the mile with contour intervals of 80' on one side and
1:27,000 2.25 inches to the mile with contour intervals of 40' on the other
This is the most useful map for the area because of its scale and large map size

USGS Quad Topo maps (United States Geological Survey)

1:250,000 1-inch equals four miles, with contours at 200'
About 100 miles from the Cascades crest to Mitchell;
And 70 miles from BrokenTop to Olallie Butte (Bend map)
1:100,000 1.25 inches equals 2 miles, with contours at 40 meters
About 30 miles from West of the Cascades to East of Bend
And from Sparks Lake to Three Finger Jack (Bend map)
1: 62,500 1 inch equals 1 mile, with contours at 40' (15-minute map)
This is the most useful scale for backcountry use, 14 by 17 miles
This scale is not available in our area but is great for the Sierras
Note: Use a common driver's State Atlas instead of the three maps listed above

1:24,000 2.5 inches equal 1 mile, 40' contours ("7.5 minute quad map")

This scale is sometimes to large, 7 by 8 miles, it is easy to out-walk
Needs to be used with a 1:100,000 map
Obvious bearing objects are off the map requiring many maps
But these are best for accurate routefinding off trail, hunting, climbing

Planimetric land use maps:

Central Oregon Public Lands, BLM, Prineville
Crooked River National Grassland
Deschutes, Willamette, Malheur, etc., National Forests
Upper and Lower Deschutes River and John Day River Public Lands
Note: Most of these maps are not suitable for modern land navigation

Special maps:

Pacific Crest National Scenic Trail, Southern, Central and Northern Oregon
OHV, Snowmobile, Cross-country Ski, Mountain Bike maps with UTMs are very useful
Forest District Fire Maps, showing logging roads in great detail, a must for forest travel

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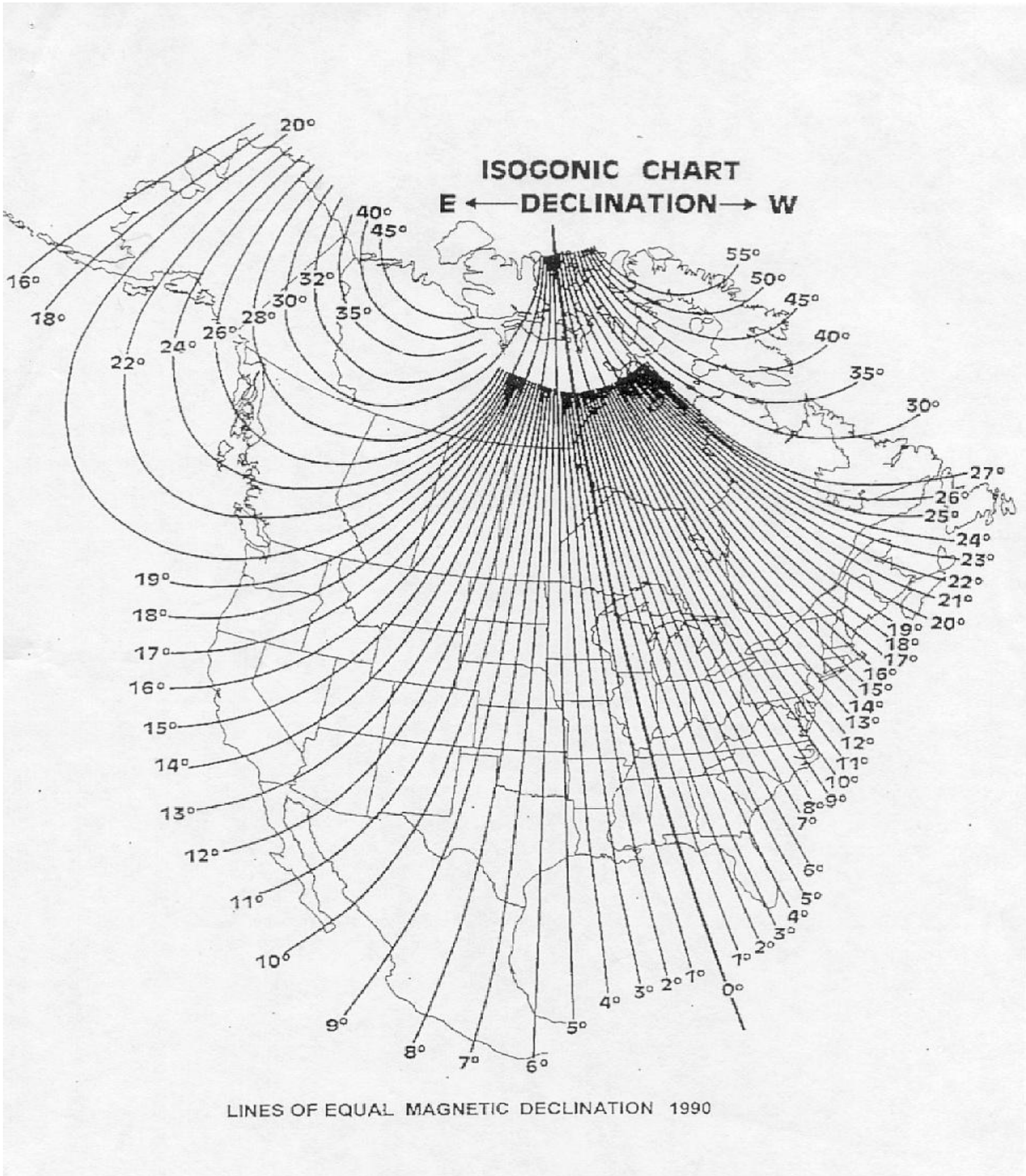
THE MAGNETIC DECLINATION FOR CENTRAL OREGON IS ABOUT 17 DEGREES



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BACKCOUNTRY NAVIGATION
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THE DECLINATION ADJUSTED COMPASS

Remember, the Required Compass Has the Following Attributes:

1. A long transparent base plate with straight sides and a marked direction of travel arrow
2. A big rotating compass dial, also with a transparent base marked with true north-south lines
3. The central dial must be liquid filled to dampen oscillations and allow fast accurate readings
4. The compass dial must be marked from 0 to 360 degrees clockwise, in 2 degree increments

Optional additions:

5. **An adjustable declination arrow with its tiny nonmagnetic key**
6. Markings along the base plate edges with inches and other map scales
7. Clinometer
8. A mirror to check your hair
9. Magnifying spot for your bad eye
10. Hole for waist length shoelace lanyard (not the wimpy red shorty cord it is sold with)

Note: Some compasses have a specialized "GLOBAL" needle, an un-necessary cost

MAGNETIC DECLINATION INTERFACE BETWEEN MAP AND COMPASS

The Isogonic Chart Attached:

This chart shows lines of equal magnetic declination as of 1990. It shows the magnetic compass "error" for Bend, Oregon as about 18 degrees in 1990. The annual adjustment is about 5 minutes Westward per year, or about one degree every 12 years. We will use 17 degrees declination

The declination problem and the solution:

1. Maps are always based on true north-south lines at the edges. You can not modify the map
2. The compass points to magnetic north, or about 17 degrees off true in Central Oregon

The compass reading must be modified to true bearings so as to interface with the map!

THE TRUE NORTH METHOD

The old time method:

1. "East is least and West is best**"** add or subtract 17 degrees each time you use the map?

The wilderness is no place to practice mental arithmetic with life or death consequences**!**

The modern true North method:

MECHANICAL ADJUSTMENT

The declination is set into the compass for your area, the bearing you read is the true bearing that you will use on your map

Declination modification:

The compass must have the area's declination adjustment dialed in. If it is not adjustable, the declination adjustment must be marked by a taped arrow on the dial base plate

TAPE ARROW IN PLACE OF MECHANICAL ADJUSTMENT

On compasses without adjustable declination arrows, you can get the same effect by sticking a narrow strip of tape to the bottom of the rotating housing to serve as the declination "shed" for the red end of the magnetic needle.

IS THIS IMPORTANT? WHAT IS THE MAGNITUDE OF ERROR?

One degree of error is 92 feet in one mile, 10 degrees error is 920 feet off in one mile. Eighteen degrees of error will put you 1,650 feet or one third of a mile off for ever mile you walk! Walk ten miles without declination correction and you will be over 3 miles off. Add instead of subtracting your declination, and friend you are really lost. **Use the true north declination adjusted method described above**.

USING THE MAP, COMPASS, GPS (AND ALTIMETER) TO FIND YOUR WAY

THE TOPOGRAPHIC MAP AND DECLINATION ADJUSTED COMPASS TOGETHER

The topographic map is a "blueprint" of the ground features. The contour lines, shown in brown, make the blueprint three dimensional. **Use your map, your eyes, your notes and wrist watch to stay found**.

FIRST, ORIENT THE MAP TO THE GROUND:

1. You can find your way with a map alone, but not with compass alone:
To work with the map alone, you simply align the map with the terrain. Hold the map flat with the ground and look for terrain features that match the map. Turn the map until you can look across it to the feature. Check your alignment with another feature, perhaps at a 90-degree angle to the first.

2. The compass applied to the map is the best method of orienting the map to the land:
Hold the map flat with the ground, directly in front of you, with the bottom of the map next to your body. Set your compass on North, align the compass with either north-south edge of the map and rotate the map and your body until the needle matches the indexed declination (put the "shed under the red", or over the taped arrow). Check the map orientation as in 1. above, without the compass, to get used to orienting the map by inspection..

NEXT, FIND YOUR EXACT LOCATION

1. With the map only, figure out your probable location along a trail, a stream, a ridge, on a lava flow, at a lake, at a trail junction. These features are called bases line. Now use your common sense to find where you are along that (base line) trail, stream, etc. The USGS maps are very accurate. Every elevation more than 10, 20, 30 or 40 feet (check your interval) is contoured. Brush and forest areas are shown in green, rock, scree, dirt or lava in a contrasting color. Permanent snow fields are in white. It might take 20 or 30 minutes to find your first location, or you might have to move along and try again at a different place. Then, "stay found" by looking at your map as often as you need to. Keep your map folded, in your pocket!

2. With the compass, find your exact location along that trail, stream, etc. **Transfer bearings taken by the compass *from you to a recognized feature*, to a pencil line back from that feature at the bearing shown, across the map and across your (base line) trail, stream, ridge, etc.** Take at least two bearings at about 90 degrees. With say three bearings, you can find your location without a base line trail, stream, etc. by triangulation (the pencil lines form a little triangle on the map). Then, every 30 minutes or so, "stay found" by following your position traveling along the map.

HOW TO TAKE A BEARING TO A FEATURE AND PLOT THE BEARING ON YOUR MAP:

1. Hold the compass at your belt, turn your feet and body to face the feature (say a mountain top), the base plate direction of travel arrow should now point at the feature, turn the compass ring putting the red shed or the taped arrow under the red end of the magnetic needle and read the degrees of the bearing at the direction of travel mark. With a little thought and some practice; you can be accurate to two degrees or better.

2. Use your compass as a preset protractor, forget that it is a compass (don't touch that dial!) and place it on the map. **Make sure the compass ring is oriented to the north end of the map,** then ***line up the true north-south meridian lines imprinted on the bottom of the compass ring*** with the true north-south lines of the UTM grid imprinted or drawn by you on your map. Slide the compass up or down the map until one edge of the clear base plate cuts across the feature. Draw a line along the side of the base. Extend the base plate with your ruler if necessary (or the folded edge of your map). You are located where the bearing crosses your base line or another bearing or two. You should jot down the degrees along the line and indicate the direction of the bearing (^112o).

HOW TO TAKE A BEARING FROM THE MAP AND USE IT IN THE FIELD:

1. Lay the edge of your protractor along a line from your know position to a feature. Turn the compass ring until the lines on the bottom are parallel with the north-south lines you have drawn on the map. **Make sure the compass ring is oriented to the north end of the map**. Note that the map need not be oriented. Then, holding the compass at your belt, turn your body until the red is in the shed or over the taped arrow (don't touch that dial!). You will be looking in the direction of travel.

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USING BEARINGS IN WILDERNESS NAVIGATION

A “bearing” is the angle, expressed in degrees of angle from north, of a line between two points. A compass, with its floating magnetic needle, is used to measure the angle of any line from magnetic north. The base plate compass is also used as a protractor, **disregarding the needle**, by using a long edge of the base plate and the north-south meridian lines printed on the bottom of the movable compass housing, matched to the UTM north-south grid lines.

TO MEASURE (NAME) A BEARING ON A MAP:

1. Place the ***protractor*** (your recommended compass) on the map with an edge of the base joining two points, direction of travel toward the goal.
2. Turn the housing to align the meridian lines with the map north-south lines, making sure the orienting arrow points north.
3. Read bearing name at the index line.

TO PLOT A BEARING ON A MAP:

1. Dial your bearing to the index line of your ***protractor*** and do not change the setting.
2. Put the protractor on the map with an edge of the base on the point from which you wish to plot the bearing.
3. Turn the entire protractor to align the meridian lines with the maps north-south lines.

TO MEASURE BEARINGS IN THE FIELD:

1. Your **compass** declination adjustment must be pre-set by movable arrow or tape.
2. Hold the compass properly, pointing the direction of travel arrow at the goal.
3. Turn the housing to align the needle above the arrow or tape.
4. Read the bearing at the index line.

FINDING YOUR POSITION ALONG A BASE LINE (TRAIL, STREAM, RIDGE, ETC.):

1. Take a bearing with your compass to a feature you identify on your map
2. Plot that bearing on the map with your protractor. You’re where the two lines cross.

IF YOU ONLY KNOW THE GENERAL AREA WHERE YOU ARE:

1. Measure with your compass and plot with your protractor on your map, two bearings at about 90 degrees from each other. You are where the lines drawn, cross. Take three compass bearings and you will be in the plotted triangle.

IDENTIFYING A MYSTERY FEATURE:

1. Take a compass bearing to the feature from your position, plot it and find it.

FINDING A SPECIFIC FEATURE FROM THE MAP:

1. Index the bearing from your map into the protractor, use your compass to sight the feature.

NOTE: With very little practice and thought you will be able to “convert your compass to a protractor and back again, in the blink of an eye”!

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LOCATION GRIDS

The world is round and maps are flat!

Many mathematical ways to depict the curved surface of the earth have been invented
Mercator, a Flemish geographer, first published his chart system in 1569
It distorts (enlarges) the Northern and Southern parts of the globe

Latitude and Longitude (Geographic Grid System):

This has been the fundamental method of defining a point on the earths surface for centuries
Latitude lines are parallel to the equator and stay equidistant, numbered N and S
Longitude meridians, numbered E and W, are equal at the equator, wider N and S
Other grid systems, satellites and surveys are based on the latitude and longitude grid
The lat/lon address of my home is 44 01.6N and 121 17.9W at 3770 feet elevation

Celestial Navigation and Dead Reckoning position locating

Celestial navigation uses the measured angles of celestial bodies and accurate time
This ancient system is used by sailors, airmen and surveyors
The GPS adds computerized satellite navigation for accurate positions
Dead reckoning uses all navigation methods except celestial navigation

The Public Land Survey grid:

In 1785, Congress decreed that all lands should be surveyed and marked on the ground in one mile squares. Most lands have been laid out in 24 mile blocks, each divided into six mile squares called **Townships** with those extending N/S called **Ranges.**

The six page Public Land Survey document on TraditionalMountaineering.org details this particular grid system. It is used by government land management agencies, woodsmen and private owners to address locations on the land. Knowledge of this grid system is not necessary for wilderness navigation but it may add to your enjoyment of general map work. (The red lines delineate one mile squares).

Universal Transverse Mercator (UTM) Grid:

The UTM Grid Coordinate System has been used recently for GPS based land navigation. The circumference of the earth has been divided into 60 N/S strips, each 6 degrees wide, numbered from 1 to 60 W to E. This provides minimum distortion of the map grid around the populated regions. These UTM Grid Zones are labeled W to E from the International Date Line (180 degrees). Horizontal lines, at 6 degrees, are counted N from the equator, creating the Northern Hemisphere UTM grid. Since each grid block is about 1,000,000 meters square, they can be divided by the decimal system.

GPS receivers can show both the Lat/Lon and UTM coordinates of a given point.
The UTM address of my home is 10 6**36**3XXE, 48**76**3XXN.

It is relatively easy to estimate an accurate point in a one kilometer square. The grid lines are listed on the sides of the topo quad map, the user can measure or can estimate the last three numbers within the kilometer.

Read more about the UTM Grid on www.TraditionalMountaineering.org.

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THE GPS SYSTEM

The **Global Positioning System** was conceived in 1960; the first **Satellites** were orbited by the Department of Defense (DOD) in 1978. Today, it consists of 24 **Ground Controlled** Satellites (plus many spares) circling the globe on non-synchronous orbital paths, two times every 24 hours. **GPS Receivers** monitor the radio transmissions of the Satellites they "see" and process the information to provide **continuous accurate Position Fixes** which can be saved and utilized as **Waypoints.** Civilian GPS Receivers contain a radio receiver, quartz clock, a memory and CPU chip. Magellan sold the first hand held GPS in 1989 for $3,000. **The Garmin eTrex HC GPS receiver sells today for about $99!**

ACCURACY:

The system by 1989, gives Position Fixes accurate from 1 meter to 15 meters!

For several years, the DOD, concerned about security, introduced **Ground Controlled Selective Availability (SA),** a system that introduced a wandering error of from 15 to 100 meters (49' to 327'), for nonmilitary receivers. Due to SA, civilian GPS receivers were accurate to a radius of 15m to 100m (a circle of 98' to 654' in diameter) around a Waypoint. Speed over the ground and compass direction were not continuously accurate below 11kph due to SA. SA wandered at 2.5kph. SA was within 50 meters 65% of the time; 95% of the time SA was within 100 meters; 5% of the time SA was over 100 meters.

Today, civilian GPS receivers are not subject to the Selective Availability wandering error. Receivers are obstructed by various molecular structures (wet trees but not glass or snowstorms, etc.) and are accurate to from about 0 to 4 meters.

REQUIRED ADDITIONAL TOOLS:

MAPS: Since the GPS provides Positions relative to a selected map Grid (Lat/Lon or UTM), it is **necessary to have in hand, the map and Grid matched to the GPS.**
COMPASS: Since the GPS can provide a bearing to a stored Waypoint, it is necessary to have **a declination adjusted compass in hand to point along the bearing used by the GPS.**
PENCIL AND NOTEBOOK: Since the GPS provides a continuous flow of information on Positions, Waypoints, Bearings (Azimuths) to Waypoints, Times and other facts, it is necessary to keep track of this information in writing. **The map margins may often be used for notes.**
KNOWLEDGE OF THESE TOOLS AND THE DESIRE TO USE THEM: Since the GPS by itself, will not keep you found on the ground, it is necessary to use sound land navigation and routefinding techniques. **One must practice with map, compass and GPS often, in order to use them when one is lost, tired, hypothermic and confused.**

GPS FROM SIMPLE USE TO A COMPLEX HOBBY:

If the navigator needs only to find a Bearing (or a compass course) to GO TO camp or truck, the few required functions of the GPS can be learned in a few minutes of explanation and use. However, if the navigator is an outdoors explorer or professional, the various GPS receivers available at low prices today, can provide hours of absorbing study and enjoyment in the Wilderness.

GPS BACKUP:

The GPS is a hand held electronic instrument designed for field use, however its use is subject to loss, theft, breakage, loss of battery power, and loss of data, obstruction of signal by trees and cliffs, immersion, freezing and fire and so on. **Simple navigation skills with map and compass, wrist watch and notebook are necessary backup to the convenience of GPS.**

IMPORTANT GPS FEATURES AND REQUIRED SET-UP

FIELD FUNCTIONAL DESIGN:

Well-known manufacturer and warranty
Strong, water resistant or waterproof design
Reasonable weight and size for hand-held field use
Keypad designed for use in the outdoors, with gloves
Small battery size and availability
Port for connection to a personal computer

NORTH SETTINGS:

True north or magnetic north can be selected. True north is compatible with map use. **The compass should be adjusted to true north bearings.**

COORDINATE GRIDS:

Selected Grid system for Land Navigation (LN) should be the Universal Transverse Mercator (UTM). Latitude/Longitude may be used by those familiar with the system on ships at sea, but it is outmoded for LN and need not be learned by the novice.

MAP DATUM:

Selectable Map Datum must include World Geodetic System 1984 (WSG84), North American Datum 1927 Continental (NAD27) and North American Datum 1983 (NAD83).
The unit must be set to the same coordinate system as the map - NAD 27 CONUS for use with USGS quad maps.

WAYPOINTS:

The Grid Coordinates of a location are recorded as a Waypoint. **The GPS must store at least 200 Waypoints.**

WAYPOINT MANIPULATION:

Access to the Waypoints must be simple: a keyboard menu selection to a list and a scroll function through the list to the selected Waypoint. **Waypoints must be easily stored from the present Position and from coordinates calculated from a map.** The list may be alphanumeric or by proximity to your Position.

GO-TO FUNCTION:

Navigation with the GPS begins when you GO TO a Waypoint. The information given will include the Bearing and Distance from your position TO the Waypoint.

ROUTES:

A Route is a list of up to say 20 Waypoints that describe a varied line of travel that you wish to follow. This is an important function because it allows the GPS to guide you from one Waypoint to the next in order, by Bearing, Distance and Time in its varied scales.

BACKTRACK:

This function allows you to load the reverse Route by pressing a few buttons.

NAVIGATIONAL INFORMATION:

When the Route or GO-TO functions are active, the GPS will provide the following information:

BEARING:

A Bearing is simply the compass direction expressed in degrees, 360 from north, from one position to another (a selected Waypoint). This Bearing may be given in true north or magnetic north format. Choose true north and use a compass with built in declination.

DISTANCE:

Distance expressed between two points on the GPS is the straight line distance, expressed in miles or kilometers as you choose.

SPEED:

Speed can be expressed as Speed Over the Ground (SOG) or as Velocity Made Good (VMG). SOG is the same as your car odometer; VMG is the rate at which you are approaching your objective. This feature is not very useful for the hiker.

STEERING:

Steering functions allow you to follow a Route by seeing on a screen that you are to the right or left of the direct line to the point, and how far you are off the straight course line (Cross Track Error). This feature is not very useful for the hiker.

PLOTTING:

Plotting functions can show you on your screen, the direct course line and your actual course line over the ground on your way to your next point. The scale of the screen can be changed and nearby Waypoints can be plotted. This feature is not very useful for the hiker.

ESTIMATED TIMES:

Estimated time of arrival (ETA) and estimated Time in Route (ETE) can be shown. This feature is not very useful for the hiker

ALTITUDE:

Accuracy of the altitude function of the GPS has improved greatly with 12 channel GPS receivers and the cancellation of the SA policy. **Use your GPS geometric elevation to correct your wrist altimeter/barometer and the aneroid barometer in your GPS.**

DATA FORMATS:

Users defined metric, statute or nautical miles can be selected. **Select statute miles.**

OTHER FUNCTIONS:

Waypoint coordination by reference, solar and lunar calculations and other functions are available for the serious Land Navigator.

COMPUTER INTERFACE:

Full use of the latest GPS models require the ability to connect with a cable to a computer. We suggest buying the $99.00 Garmin eTrex H (High Sensitivity Antenna) and an accessory cable.

WHICH GPS MODELS SHOULD BE CONSIDERED?

We suggest buying the $99.00 Garmin eTrex H without the map function and the State Series $99.00 National Geographic Topo or Map Tech's Terrain Navigator for Oregon. Print your own letter-sized personally annotated 1:24,000 topo maps and carry them in your pocket for use with your basic eTrex H GPS.

Do not buy an expensive GPS with an Altimeter or an electronic Compass or an FRS Radio, (unless you just have to have the most expensive model).

A good option is to pay a bit more for a Garmin eTrex Venture HC (High Sensitivity and Color). This model comes with a cable, saving about $35. and adds a Garmin TOPO 1:100,000 map capability. The Garmin TOPO program costs about $99.00. Buy the State Series $99.00 National Geographic Topo or Map Tech's Terrain Navigator for Oregon. Print your own letter-sized personally annotated 1:24,000 topo maps and carry them in your pocket for use with your new Garmin eTrex Venture HC GPS. I use this combination.

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HOW TO USE THE GPS FEATURES AND REQUIRED SET-UP

Use a simple GPS receiver for your serious adventures into the high backcountry!
Most of my friends and I use the simple yellow Garmin eTrex, now the improved eTrex H. This receiver does not have the 1:100,000 maps that are the latest available. This scale is of little use for hiking, and climbing. It is better to have contour intervals of 40 feet than to have contours at 140 feet!

A GPS has only five basic pages

1. The Satellite Page
The Satellite Page should be the first page to appear.
Two satellites are minimum, four satellites add accurate elevation. Viewing 7 or 8 satellites is typical, 12 is possible! The WAAS satellite seems to have little practical effect in the Pacific North West and can be turned off to conserve the GPS batteries.

2. The Track (or Map) Page
The GPS marks an electronic Track as you walk. The Track is shown on the GPS Map Page.
You can turn the Track on and off. You can save your Track and print it on a map. You can hold save several saved Tracks in the GPS, but you should store your Tracks on your computer.
You can insert Waypoints as you go. You can create and download a Track with a Map Program on a computer.
You can create a Route in a Map Program on a computer and download a Route.
You can also create waypoints by hand by calculating the UTM location and manually inputting the coordinates.

Note that GPS map models have an inherent problem: Limited Storage
Limited storage requires limited map size and detail. Garmin's "Map Source - Topo" contains all the Western States on 1 CD. Maptech's "Terrain Navigator" requires 9 CDs for all USGS Quad maps at 1:24,000 in full detail. Garmin's Topo is 1:100,000 but in very limited detail. Only a small portion of the Garmin CD can be loaded. Zooming in GPS maps makes them virtually unusable. Read more about computer generated 1:24,000 topo maps printed on standard letter sized paper, folded and carried in a baggie and handy in your pocket.

3. The Navigation Page
The Pointer Page is not a Compass Page! The Pointer only works when the GPS is moving! The Pointer always points directly to the Waypoint! The Pointer Page should show the Distance to go. The Pointer Page is often called the Go-To Page. The Pointer Page should list the Distance and Bearing to the Waypoint. The Pointer Page defaults may need to be changed (corrected) each time the GPS is powered up.

4. The Computer Page
Computer Page Options can number 40! Choose distance traveled, time stopped and time moving.

5. Menu Page
Mark: Make a Waypoint or manually make a Waypoint.
Waypoints: Review and select a listed Waypoint.
Routes: Review and select a Route from your list.
Tracks: Save, name, clear and start a Track.
Set Up: Set Time; Display brightness; **Select Units:** Miles vs. Kilometers; **North Reference**: True vs. Magnetic; **Position Format:** UTM(s) vs. Lat-lon(s); **Map Datum**: NAD 27 (Con US) vs. WGS 84.

USING THE MAP, COMPASS, GPS AND ALTIMETER TO FIND YOUR WAY

THE BAROMETRIC PRESSURE BASED WRIST ALTIMETER, ELEVATION GAIN AND LOSS, AND MULTI-LEG STOP WATCH/COMPUTER

The modern wrist watch/altimeter/barometer/split time stop watch such as the Avocet Vertech Alpine is an excellent addition to the Wilderness navigator's tool chest. Used by bicycle racers, skiers and alpine climbers, the altimeter gives an added dimension to locating ones position in the backcountry. The instrument can be used daily as a simple wrist time-keeper, and it makes a trendy addition to ones wardrobe.

Barometric pressure:
Barometric pressure goes down at a predictable rate as the altitude increases. A scale connected to the barometer function provides the altitude reading.

If the instrument is kept at a known altitude, say at camp overnight, changes in barometric pressure can help forecast a high or a low front moving through. The trend index function is easily set.

The constantly changing atmospheric pressure as it passes over you must be re-set often by correcting the altitude often from your basic geographic GPS information or calculated from the terrain lines bracketing your accurate location on your topo map.

Climbing information functions:
Reports the current elevation to an accuracy of 10'.
Calculates daily and annual vertical feet climbed.
Records the maximum elevation reached
Calculates the current, maximum and average rate of climb per hour.

Stop watch time functions:
Two stop watches in the Avocet Vertech Alpine run independently. One is linked to the average rate of climb. The other Can record split times for later analysis/documentation, say for marking side trails or landmarks. This function is very useful for Wilderness navigation/dead reckoning.

Thermometer:
Measures the temperature on your wrist or hanging in your tent.

The Adiabatic Lapse Rate:
The international standard for air density/altitude is known as the Adiabatic Lapse Rate. You can use it to gauge the temperature in the high elevations:

Altitude		**Temperature**	
	0		59F
	3000		48F
	7000		34F
	10000		23F
	13000		13F

If it is 48F in Bend it will be 23F on a nearby 10000' summit!

Altitude is simply another clue in the formula for staying found!