

# Scout Skills: GPS Navigation



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A hand-held Global Positioning System Receiver is usually referred to simply as a GPS. The core function of a GPS is to tell the user where they are.

## How Does It Work

The system is owned by the United States Military and became widely available for civilian use in May 2000. It consists of 24 satellites (plus spares) orbiting at approximately 12,000 miles and by receiving the signal from 3 or more satellites, the receiver can determine its position.



Imagine circles drawn on a map. If you are 150 miles from London and 150 miles from Manchester, there are two possible places you can be. But if you also know your distance from Newcastle, you can know which one you are at. A GPS uses this principle with the signal from the satellites, orbiting some 12,000 miles above the Earth. By receiving 4 or more signals, altitude can be calculated. The accuracy can be affected by several factors. If all the satellites whose signals are being received are in the same general direction, the triangulation will be poor because all the distance measurements are from the same direction. But 4 satellites at right angles will give excellent triangulation.

Buildings and trees can cause signal blockage or multi-pathing, much like a ghost reception on a terrestrial TV channel. If the signal has bounced off a few buildings, it will have taken longer to get to the receiver, thus your GPS will think the satellite is further away. Equally, atmospheric conditions can affect the signal as it travels through the ionosphere and troposphere.

Globally, the GPS will give a position using Latitude and Longitude to the WGS 84 Datum (see page 5), but all hand-held units will display regional coordinates such as the UK Ordnance Survey Grid.

## Uses

This technology can be used to provide satellite navigation for all forms of transport, on land, sea and in the air. Cars, buses, ships and aircraft can all benefit from knowing their position to an accuracy of a few metres. Combined with electronic mapping we have the car sat-nav that can tell you which turn to take. Very expensive commercial systems using multiple frequencies can be used to plot locations down to a few centimetres, but public use systems are usually accurate to about 5 – 10 metres, more than sufficient in relation to an OS map.

When used as a hand-held device for walking, it is necessary to know which reference system is displayed as there are many that either cover the entire globe or just a small area. It is important to remember that a GPS is another tool to navigation; it is not a substitute for a map and compass. The signal may be lost or batteries may go flat.

A GPS will enable you to follow a bearing and know your location, even in fog. There are a wide variety of functions available on even the most basic of

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hand-held GPS, whilst more advanced models will include electronic compass, through to comprehensive maps, both inbuilt or on memory devices. Although all GPS will give an indication of where North is, it is important to remember that a basic GPS only has this information whilst you are moving. This is because it is simply calculating your movements and where North is. If you change track, the GPS will take a few metres to detect the change and give you a different pointer to North. More advanced receivers will include an electronic compass and even a barometric altimeter.

## Scouting And GPS

There are clearly areas where a GPS will enhance the outdoor experience. Even the most basic unit will enable waypoints to be entered to make up a route, thus it is possible to programme the GPS with the route plan for an entire hike, with the rest stops and direction changes plotted. It will display your average speed and tell you how long to the next waypoint or the end of the route. Any activity on open space, hills or at sea, becomes much safer because a sudden fog will no longer stop you knowing where you are, where your destination is and where you started from. Incident hikes, treasure hunts or any sort of journey can be enhanced by using GPS navigation.

## Geocaching

Geocaching started when an American wondered what would happen if he hid a container of trinkets and a log book out in the wilderness and posted the coordinates on the internet. Would people go and look for it? They did, and now it has grown into a recreational activity that covers the globe. Normally referred to as Geocaching, it involves the participants seeking out hidden containers (caches) using the published coordinates. When found, they record the find in the log within the container and on the website that listed the location. Although other websites do exist, the activity is dominated by [www.geocaching.com](http://www.geocaching.com). Basic membership of the site is free, although advanced facilities are available for those willing to pay. Within the United Kingdom, there are other websites that supplement the

provisions of [geocaching.com](http://geocaching.com) and provide essential information and rules specific to the UK.

From a Scouting perspective it is important to remember that this activity is based on locating a hidden container, whilst ensuring that non-geocachers do not find the cache.

In many respects Geocaching is very much in the spirit of the Founder and *Scouting for Boys*: Geocaching is an activity for the initiated, to be kept secret from those who might not be trusted to observe the code of conduct.

A Geocache may be of any size from *Micro* (simply large enough to hold a paper log - 35mm film canisters are frequently the item of choice) to *Regular* containers of several litres capacity. For the rural environment, a new cache category is appearing, the *Nano* cache, a specialist container just large enough to hold only a long thin strip of paper, often magnetised and secured behind road signs etc. Weather sealing is an important consideration for all caches.

Geocaching.com specifies in their Cache Listing Requirements, 'Caches perceived to be posted for religious, political, charitable or social agendas are not permitted.' This does not prevent caches being placed that are owned by Scouts and that contain Scouting items. It is perfectly acceptable to state that a particular Scout Troop, Group or District own a cache and to give some Scouting information in the cache description, including a link to [www.scouts.org.uk](http://www.scouts.org.uk).

Ultimately the information provided by the cache owner in submitting the listing is reviewed by one of the moderators before release, but making a blatant recruitment advertisement from a cache listing would not be acceptable.

A search of [geocaching.com](http://geocaching.com) for caches using the keyword 'scout' will reveal several hundred with a Scouting connection, principally in the USA and often placed by Scouters or Troops but including waypoint GCM40K at Paxtu, the Founder's house in Kenya and two caches in the grounds of Gilwell Park.

## Glossary Of Terms

**Bearing** - The direction to the selected Waypoint.

**CITO** - Cache In Trash Out. A principle that should be followed by all cachers which can result in specific CITO Events. All cachers should try to do their bit to keep the countryside clean by collecting litter, but a CITO Event is organised with that specific goal. A community clean-up usually followed by a social gathering of geocachers with a cache hunt or two

**GAGB** - The Geocaching Association of Great Britain. A volunteer organisation that has done much to help Geocaching in the UK. It has brokered several landowner agreements and developed a specific UK list of guidelines for safe caching.

**Geocache** - Often called simply a 'Cache', the actual container placed at the waypoint. From 'Geo' for Earth and 'Cache' being a store of goods or supplies, often left by explorers.

**Geocaching** - A recreational activity that entails seeking a container hidden at specific coordinates. Finding it, recording your details on the log within and then concealing it for the next person.

**Geocoin** - In North America 'Coins' are used as commemorative gifts or souvenirs, usually colourfully enamelled and approximately 4 cm diameter. A Geocoin is of a similar nature but with a tracking number allowing them to be moved and tracked in a similar manner to Travel Bugs.

**GPSr/GPS** - A Global Positioning System receiver, more regularly referred to as a GPS, even though in reality the satellites and the receiver make up the system.

**Heading** - The direction in which you are travelling.

**Latitude** - The North/South component of determining a location on the Earth.

**Longitude** - The East/West component of determining a location on the Earth.

**Muggle** - A non-Geocacher. A person who must not see you with the cache in case they find it and potentially remove or destroy it. A common risk in Urban Caching. Taken from the term for non-magical persons in the Harry Potter books.

**Multi-Cache** - A type of Cache that requires several waypoints to complete. The first waypoint may contain a small cache containing the coordinates of the next stage. Or several waypoints might each contain components of the coordinates for the final waypoint.

**Route** - A path between two or more waypoints.

**Trackback** - The ability to reverse a route on a GPS to enable the user to return to their starting point.

**Track Log** - The ability of the GPS to automatically record track points. An electronic 'breadcrumb trail'.

**Travel Bug** - An item with an Identity Tag attached, which through a unique tracking number can be tracked on the internet as it is moved from Cache to Cache by Geocachers. A TB typically has a mission; in 2006 several thousand of a special issue were released to increase global awareness of Diabetes.

**WAAS** - Wide Area Augmentation System. A Federal Aviation Administration funded project to improve GPS accuracy in North America. There is the potential for a similar system in Europe as the EU is planning to set up its own GPS service.

**Waypoint** - A specific point defined by coordinates, which may be programmed into a GPS in advance or marked along a route whilst at the

location. For example to return to the same point later.

## Further information

[www.geocaching.com](http://www.geocaching.com) - The principle website where geocaches are listed across the globe (over 324,000 in 222 countries as at October 2006).

[www.geocache.co.uk](http://www.geocache.co.uk) - An excellent co-ordination point for the UK, with links to many informative websites covering UK specifics.

[www.gagb.org.uk](http://www.gagb.org.uk) - The Geocaching Association of Great Britain. Established to provide an elected voice for its members in the UK. Its aims are to establish good practice, provide a focal point for public liaison and support the growth and enjoyment of Geocaching in harmony with the law and environment. Responsible for many land owner agreements.

[www.geocacheuk.org](http://www.geocacheuk.org) - A website that provides resources and links for the UK Geocaching community. It includes diverse information such as a map that plots all UK caches, from the geocaching.com website, in relation to each other. Another link is to a map of the London Underground showing all caches next to Tube stations.

[www.cacheintrashout.org](http://www.cacheintrashout.org) - CITO has proven so popular it now has its own website

Books that cover GPS navigation can be useful for new users. A recommended guide is **GPS for Walkers** (Jarrold Publishing, ISBN 0-7117-4445-9, 2006)

## TEACH YOURSELF

Understanding how to use a hand-held GPS is much like trying to use any other item of electronic equipment. It is full of functions, of which you may only require a few, but later might find more useful. After the core function of it telling you where you are, the rest are for you to discover and see how relevant they are for the way you are using the unit. This factsheet only attempts to cover the basics; always refer to your receiver's manual for the specific details of your particular model.

## Choosing A GPS

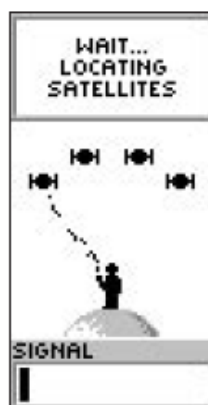
There are a wide range of models from several manufacturers, with an equally wide range of features. The factors that should be considered are:

- Screen Display size
- Colour or Grey tone Display
- Battery Life
- Battery type AAA/AA or rechargeable
- Integral Maps
- Controls layout (side or front)
- Number of channels (12 is normal)
- WASS Enabled
- Computer Interface (to directly download data to unit)

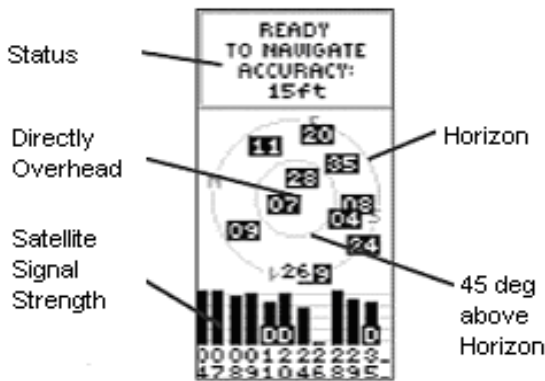
If possible, find other Adults/Leaders who have a GPS and ask their opinion. Personal recommendation by someone with experience of the equipment is always a good option. The on-line forums of [www.geocaching.com](http://www.geocaching.com) have specific areas for new GPS users and geocachers looking for advice on what to buy.

## Using your GPS

[Note: This overview cannot substitute for exploring the functions of your particular model of GPS using the manufacturer's handbook or other reference guide.]



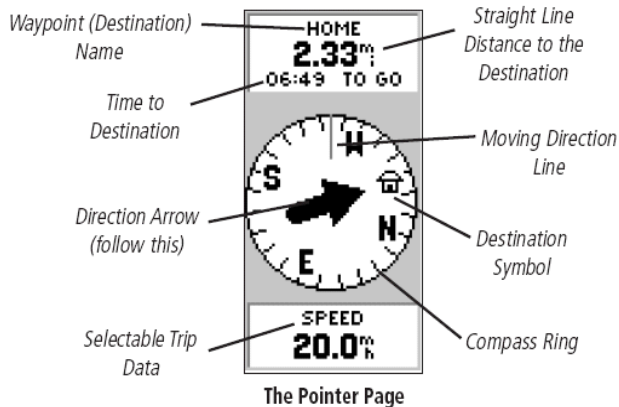
When you first turn on your GPS, it may take 5 minutes or more to autolocate. Ensure you are outside in a large open area with a clear view of the sky. Subsequently, your GPS should find your location within a minute. If you are indoors or some other zero reception environment, the GPS will ask some questions to determine if it should revert to the initial autolocate locate mode. Once the GPS has locked onto sufficient satellites, the screen display will change to show the overall signal strength, an estimate of the degree of accuracy and a status message.



In the advanced view, the GPS will display the relevant location of satellites, from overhead to the horizon and the relevant signal strength.

### Basic function

The menu system of your GPS will include several options for setting up the device. It is important that it is set to correspond with the use you are making of it. Even the most basic model will allow for displaying functions such as Trip Meters for distance, elapsed time, time to next waypoint or final destination and many more.



The basic Pointer Page will show the direction to the next waypoint and the straight line distance to it. Often, there is a selectable data field for the user's preference of information. Typically, the user can choose from Bearing, Course, Heading, Lat/Long, Max Speed, Odometer, Current Speed, the time spent not moving or even Vertical Speed.

### Choose your coordinate system

A GPS can display your location in several formats. The GPS will use WGS84 (World Geodetic Survey 1984) as the global standard reference. It may be

convenient to use standard 'British Grid' when out with an Ordnance Survey map in the UK, but it must be realised that this is a conversion to OSGB36 (Ordnance Survey Great Britain 1936).



It is particularly important to ensure that whatever Units are being displayed as the Position Format have the correct Map Datum set. British Grid being displayed will need to have the datum set to OSGB and a Deg/Min display should have WGS84. Making a mistake in this could put your location out by up to a mile.

### Marking a waypoint

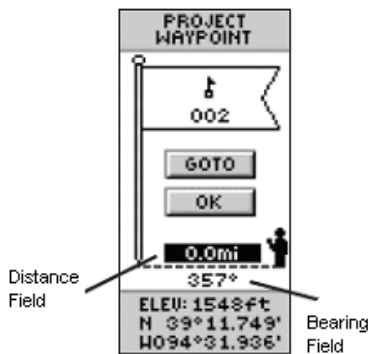


A Waypoint can either be marked to record where you are at that time, or entered into the GPS as somewhere to be heading towards. If you have the required software and connection you can download waypoints from your computer. Without this, they must be entered manually using the GPS controls. Once entered,

waypoints will remain in memory until deleted, even removing the batteries does not affect the data stored in your GPS.

Waypoints can be called up from a menu and edited. The name can be changed, as can the location details. You may also be able to project a waypoint as being on a specific heading and distance from a listed waypoint.

When marking a waypoint, the default will normally be a sequential number, but this can be edited. If downloading waypoints, they will likely be named. Those from geocaching.com are always prefixed GC. Some GPS are only capable of storing a 6 character waypoint name, and geocaching.com have exhausted all 6 digit combinations, moving onto 7 digits. If downloading these, they can be edited before sending to the GPS.



**Walking a BEARING or HEADING**



Anyone used to navigation with a compass will know about walking a bearing, using the direction-of-travel arrow. Using a GPS has similarities. Having selected the desired waypoint the user selects GOTO and the display will change to the Pointer Page. Whilst the pointer is showing straight up the display, the user is

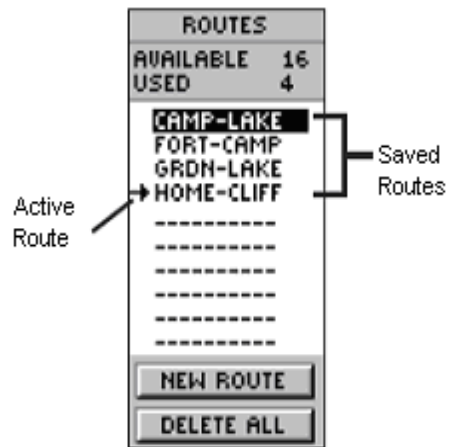
heading on the direct bearing towards the selected waypoint. Although not the usual manner for use of a GPS, if the user wished to walk on a specific compass bearing without selecting a destination waypoint, this can be achieved by using the HEADING Field.

An alternative to using the Pointer Page is to use the Map Page, which gives a simple representation of where you are in relation to the waypoint. This can be orientated either MAP AHEAD or North. If using a unit with in-built maps, this would be replaced with a true map.

**Routes**

Use of the GOTO option will only take you to the selected waypoint. Even the most basic GPS will enable you to combine a series of 2 or more waypoints to compile a route and several routes can normally be stored.

When you start your trip you activate the route feature and the GPS begins to navigate towards the first waypoint in the route. When you reach the waypoint, the GPS will automatically switch to the next waypoint on the route.



**TRACK LOG and TRACK BACK**

Your GPS should have a Track Log feature which when activated records your wanderings for later recovery. Thus it is possible to repeat a journey at a later date. Equally, a Track Back feature will enable you to retrace your steps and return to your starting point. The exact method for activating and using this feature will depend on the manufacturer and model being used.

**Planning your route**

The exact method of using your GPS for navigation will depend on the activity being undertaken. You may have the facility to download waypoints direct from your computer, or you may be inputting them from your own observations of an OS map.

It must be remembered that:

- Your GPS arrow points you "as the crow flies," which might not be the best route.

- You may lose signal.
- Your accuracy may be very low.
- The receiver's batteries can die.
- You might have programmed in the wrong information.
- Your GPS might breakdown or you could lose it.
- On less expensive models, the 'Compass Points' are only accurate when you are moving.

Overcast weather, power lines, trees, buildings, steep canyons, and valleys can all affect the signal strength and therefore change the accuracy of the GPS readings. A GPS unit will be most accurate when the user has a clear, unobstructed view of the sky and horizon.

If you are going on a significant journey, remember that a GPS is not a substitute for a map and compass, it is a companion. Even a more expensive unit with inbuilt maps can only display as big an area as its screen size accommodates.

## Geocaching

Geocaching is an entertaining adventurous activity for GPS users, with hundreds of thousands of active members in more than 200 countries. It is a modified treasure hunt using GPS coordinates to locate the prize, or cache. There are numerous public geocaches hidden around your community, probably very close to where you live. Finding many of these treasures involves taking beautiful hikes and, perhaps, puzzles to solve. From open countryside to the urban jungle, geocaching presents the ideal opportunity to undertake GPS navigation.

New Scouting geocachers must ensure that they follow all the guidelines, especially those related to the UK. Scouting associated with geocaching can be very positive, but get it wrong and the activity and Scouting could get a bad reputation.

This is especially important when it comes to placing a geocache. In the UK there has been much effort by individual geocachers and the GAGB to establish agreements with local authorities and major woodland owners, such as the Woodland Trust and Forestry Commission for permission to place caches

on their land. Scouting geocachers must ensure that they abide by all such agreements.

It is very important that a cache does not cause a security alert by being mistaken for an explosive device. Urban caches must be placed with care, with police approval if necessary.

## Event caches

Event caches are gatherings organized by geocachers that are open to all geocachers. Whilst it is possible for a Scout event to be organised, to comply with the Association's Child Protection Policy the event must be held in such a manner that non-members are only involved afterwards. This could be achieved as follows:

- 1 The organiser (cache owner) may compile a new cache listing but not mark it as 'active': therefore it will not be seen by a reviewer nor any other web site member. This is standard practice when building a new cache page.
- 2 By invitation, Scouting geocachers attend the event before the listing 'goes live'; the organiser having brought paper copies of the cache listing.
- 3 After the event, the cache page is marked 'active' by the owner and submitted for review. Once published the Scouting geocachers may log their entries.

Any Scouting event that is not to be subsequently opened up for general caching must not be listed through the geocaching.com website.



## HOW TO TRAIN OTHERS

This section is designed to give some practical ideas on how to introduce GPS Navigation to others. This might be Leaders or young people.

GPS navigation requires skill, knowledge and a reasonable level of supervision, so thought should be given to what level the activity is introduced to a young person in their Scouting experience. Younger members may enjoy the 'treasure hunt' aspect of geocaching, but struggle with some of the technical elements of operating a GPS.

Scouts can easily geocache in Patrols or small teams and it would be suitable to introduce geocaching as an activity for a family event, so that all young people are adequately supervised and supported. The element of keeping caches hidden from non-cachers is an important one to stress.

### Objectives

- Gain an understanding of how GPS technology works.
- Practice using a hand-held GPS receiver.
- Describe geocaching and how it can be used to support the Scouting program.
- Understand geocaching rules and etiquette and why they are important.
- Develop a plan to use geocaching for recruiting.
- Begin thinking about how geocaching can be used in public relations events.
- Experience the fun of a geohunt themselves.

### Time

Allow 3 or 4 hours for initial principles of GPS use and an introduction to geocaching. For Leaders, why not hold a Training Day and for youth members, introduce it over a series of shorter meetings.

### Equipment

- Handouts.
- IT, OHP or Flipcharts.
- Basic GPS Units, minimum of 1 per Team, no more than 5 persons per team.
- Sample cache container.

- Selection of caches to hide locally.

If individuals are to use their own GPS receivers, it is important to ensure that they are suitable hand-held units. If you are not specific, do not be surprised if an adult brings their in-car system that can only navigate between postcodes.

### Training Methods

Details of all the topics that should be covered are in the preceding sections.

A typical session outline would be:

- Introduce the concept of GPS navigation, the ownership of the system and Selective Availability.
- Describe the basic features and practice using a hand-held GPS receiver outside.
- Introduce Geocaching. Explain its origins, the websites available and the registration process.
- Discuss the range of potential geocaching locations, from urban to extreme terrain.
- Discuss how it can be used to support the Balanced Programme (Scout Navigator Activity Badge - alternative D).
- Explain geocaching rules and etiquette, the UK specifics and why they are important. Following the Country Code, GAGB guidelines, land access, permission and agreements. Especially the security aspects, where suspicious containers can be misidentified as terrorist devices.
- Explain Travel Bugs and Geocoins
- Find a selection of caches hidden near to the venue. Start with a specially placed cache or two, within the immediate vicinity and then move further a field, perhaps to a 'live' cache.
- Cover Child Protection issues and explain how a Scout geocache event could remain off-line until after it has been and gone.
- Discuss how geocaching can be used for recruiting, of young members and adults. If a person is out geocaching, could they be a potential Leader?
- Explain CITO.