NAVIGATION TOOLS: What Is GPS?

ASK

Have you ever wondered what GPS is and what it can do? Maybe you already use GPS, but do you know how it works? In this section you will learn about GPS.

WHAT IS GPS?

GPS is short for Global Positioning System. GPS is a network of satellites which send signals that help us find locations. GPS can be used to find specific locations anywhere in the world. Global Positioning System technology was originally developed for military use, but it is now available to anyone.

GPS units receive satellite signals. At any given time, 24 satellites are circling the Earth. The satellites circle the Earth twice a day from about 12,000 miles away. To pinpoint a location with GPS, it is only necessary to have a good signal from three satellites, and four to measure elevation. It is possible for buildings and landforms to block a satellite signal. With handheld GPS units, accuracy is generally within 10 to 30 feet of the location. GPS is useful day or night, rain or shine. In geospatial terminology, the point or area occupied by a physical object is called a “position.” Positions can be found by using data such as latitude, longitude, and altitude.

Nebraska - Dec. Week 2: Activity 9 Geographic Coordinates (More Info section contains a great map and definitions)

It is important to know that latitude and longitude lines are given in degrees, and specify positions around the world. Latitude lines run horizontally, with “0°” being the Equator, gaining in numbers going north or south. Positive latitude coordinate numbers are north of the equator and negative latitude numbers are south of the equator. Illinois’ latitude reading is approximately N 40°. Longitude lines run vertically and are measured from the Prime Meridian (Greenwich Meridian) in the United Kingdom, which is indicated as 0° longitude. Longitude degrees indicate east and west positions. Positive longitude coordinate numbers are east of the Prime Meridian and negative longitude numbers are west. A longitude coordinate west of the Prime Meridian would be indicated with a “W” coordinate, such as “W 088°... in Illinois. A longitude coordinate east of the Prime Meridian would be indicated with an “E” and the degree in a negative number.

INVESTIGATE: HOW DOES GPS WORK?

A satellite signal sends a time signature, which is received by the handheld GPS unit. By measuring the length of time it took to receive the signal, the handheld unit can then determine its distance to the satellite. That distance could place the earth position of the handheld in relationship to the satellite anywhere on the circumference of a circle. Think about a fixed length of string hanging from above; the ground end of that string could be moved around the circumference of a circle. Another satellite sends a time signal to the ground receiver, and that establishes a circle overlapping the first; now the GPS ground receiver can be at either of the points where the two circles overlap. The GPS unit’s location is established by the third satellite whose circle will intersect with one of the points determined by the first two satellites.
WHAT CAN GPS DO?

• Find your current position (latitude, longitude, and elevation)
• Determine direction and distance to specified waypoints
• Locate the coordinates of a city or town
• Provide the speed (maximum and average speed) of travel
• Provide the direction of travel
• Determine sunrise and sunset times
• Supply the time of day
• Show headings and bearings

HOW IS GPS USED?

GPS units are most commonly found in cars, on cell phones, or as handheld receivers. GPS is used in many different ways. Here is a list of a few GPS uses:

• The military uses geospatial technology to navigate. GPS units are carried by soldiers on the ground. Units are also attached to vehicles, helicopters, and aircraft instrument panels.
• Airline pilots use GPS to fly the most direct routes between airports.
• Farmers use GPS units, available on newer tractors, to plant fields and to decide how much fertilizer to apply — depending on soil sample data which is entered on a map of the field.
• Surveyors and Map Makers use GPS for precision positioning such as placing telephone poles, sewer lines, and fire hydrants.
• Foresters use GPS to check and record forest health — locating diseased trees or monitoring insects.
• Emergency response crews (police, fireman, rescue teams, etc.) can respond quicker when locations are found by GPS units.
• Hikers, bikers, boaters, etc. use GPS to mark where they parked their car before they take off on a trip, so they can find their way back. Or if a person wants to return to a special place, a GPS waypoint or set of coordinates, allows them to do so.
• Campers and hikers sometimes place caches of food or supplies along a long route so they don’t have to carry everything with them. It is important that they find their supplies when they need them, and GPS can mark the supply location.
• Fisherman use GPS to record a favorite fishing area.

GPS receivers are also used for scavenger hunts all around the world, seeking and finding hidden caches. This sport is called Geocaching. (See “Intro to Geocaching”.)

Youth in communities can be very helpful in collecting data with GPS receivers. Many towns would like to collect information about street signs, manhole covers, or high crime areas.

A GPS RECEIVER

Global Positioning System receivers range in cost from under $100 to thousands of dollars. An inexpensive GPS receiver can provide you and your friends or family hours of fun and exploration.

You may know people who own GPS receivers or use one in a car that tells how to get to a destination. Most cell phones also offer GPS as an optional service. Receivers are available for loan or rent from some Extension centers; contact your local Extension office for resources. Receivers vary greatly in type, but all are capable of basic functions identifying latitude and longitude coordinates. GPS unit screens and features may vary slightly.

Helpful Tips:
• If programming the GPS unit indoors, you will not get a satellite signal.
• Buildings and landforms can block a satellite signal.
• You must be moving for satellites to lead you to your target location.
• “Simulator mode” saves batteries and allows hands-on experience in programming coordinates. Turn on regular mode when you go outside.

CREATE

**Interactive: Match basic GPS features (name with picture) –information page, compass page, etc.
**Activity with Latitude and Longitude or “quiz” on satellites, latitude, longitude, etc.

DISCUSS

• What have you learned about Global Positioning System?
• What else do you want to know about GPS?

REFLECT

• How can you use GPS?
• Do you think GPS will become more popular or useful in the future? Explain.
• What other uses for GPS can you think of?
• If you want to learn more about GPS, where can you get information?