Where Exactly Are We?

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Where are we headed?

- Latitude & Longitude
- GPS
- Your turn
- Ag uses

'X' Marks the Spot

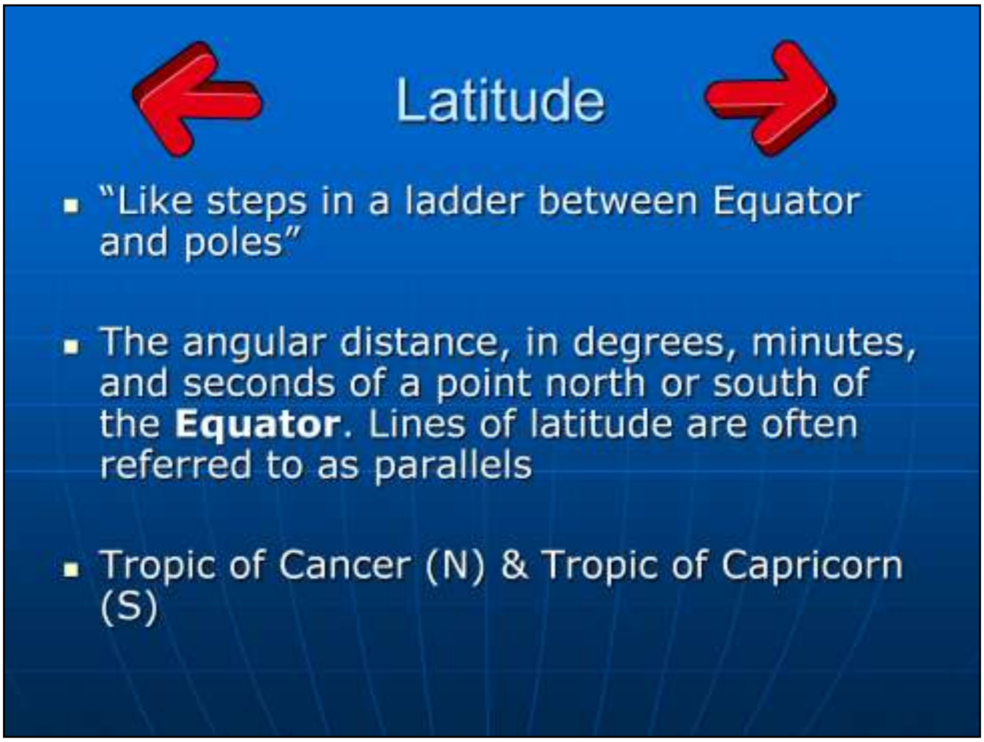
- Two volunteers…
  - One, describe where the X is on the balloon to the other.
  - Draw an X when confident they know the location of X.
  - Do they match?
  - What would be some ways that would have helped get the X Closer?

‘X’ Marks the Spot

- Label the balloon N (North Pole) & S (South Pole) N where balloon is tied
- Draw Equator (latitude)
- Draw Prime Meridian (longitude)
- Draw 0 at Equator, 30 N, 30 S, 60 N, 60 S, 90 N at N Pole, 90 S at S Pole.

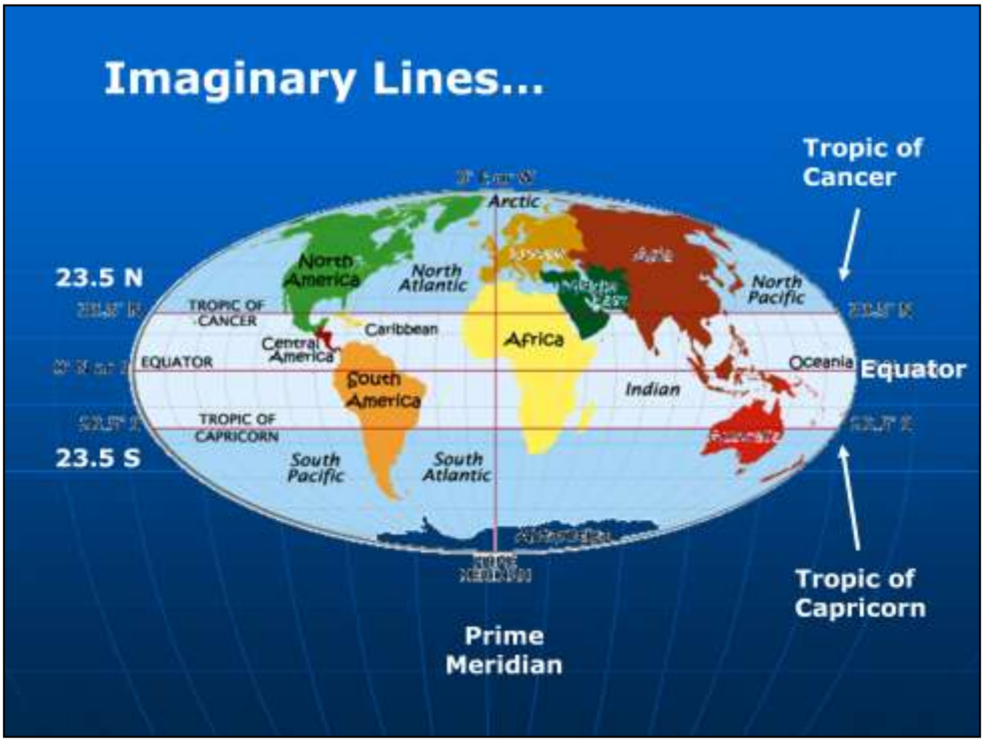
Longitude

- "Long way from North to South Pole"
- The angular distance, in degrees, minutes, and seconds, of a point east or west of the **Prime Meridian**.



The **first number series** on the data screen represents ***Latitude*** *(prefixed with the letter "**L**"). Latitude 0° is at the equator and increases to 90° North (suffix "**N**") at the North Pole and 90° South (suffix "**S**") at the South Pole. These lines are called Parallels of Latitude because they are, indeed, lines that stay parallel to each other and thus can never converge.*

Each degree of Latitude equals 60 nautical miles



Distance between Lines If you divide the circumference of the earth (*approximately 25,000 miles*) by 360 degrees, the distance on the earth's surface for each one degree of latitude or longitude is just over 69 miles, or 111 km. **Note:** As you move north or south of the equator, the distance between the lines of longitude gets shorter until they actually meet at the poles. At 45 degrees N or S of the equator, one degree of longitude is about 49 miles.

Minutes and Seconds For precision purposes, degrees of longitude and latitude have been divided into minutes (') and seconds ("). There are 60 minutes in each degree. Each minute is divided into 60 seconds. Seconds can be further divided into tenths, hundredths, or even thousandths.

For example, our office on Galveston Island, Texas, USA, is located at 29 degrees, 16 minutes, and 22 seconds north of the equator, and 94 degrees, 49 minutes and 46 seconds west of the Prime Meridian.

The Equator, Prime Meridian, Tropic of Cancer and Tropic of Capricorn are all **imaginary lines.**

Equator: Located at zero degrees latitude (*North or South,*) is 24,901.55 miles long and divides the Planet Earth into the Northern and Southern Hemispheres.

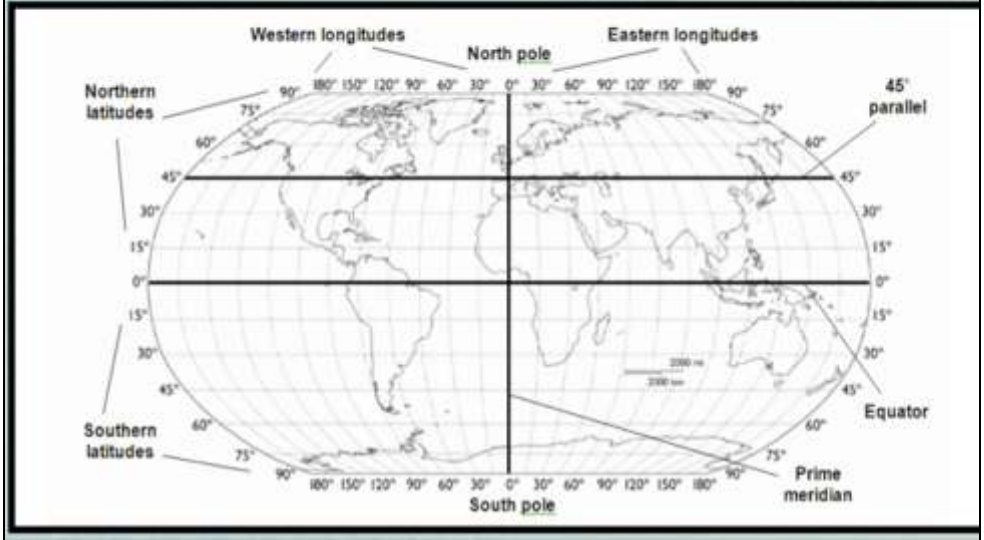
Tropics of Cancer and Capricorn: Located at 23.5 degrees *North* and 23.5 degrees *South* of the Equator, this area of Planet Earth (*between those two lines*) is known as the **"Tropics,"** and is indicated with a **lighter blue color** on the above globe. This area experiences no dramatic change in season because the sun is consistently high in the sky throughout the year.

People living *North* of the Tropic of Cancer and *South* of the Tropic of Capricorn experience dramatic seasonal climate changes, based on the earth's tilt, and the subsequent angle of the sun. When it's summer *North* of the Tropic of Cancer, it's winter *South* of the Tropic of Capricorn. (*The reverse is also true*).

Prime Meridian: Located at zero degrees longitude (*East or West*), it divides the Planet Earth into the Eastern and Western Hemispheres, and is the line from which all other lines of longitude are measured.

Latitude and Longitude

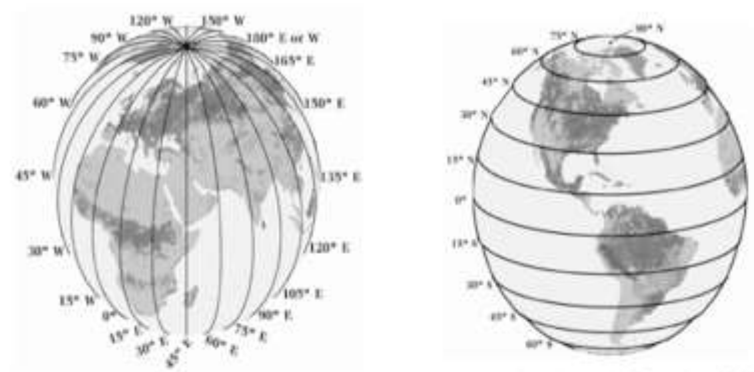
As shown in the figure below, geographic **latitude** represents global location in North/South direction while **longitude** indicates position with respect to East/West.



Meridians and Parallels

An imaginary line that has the same longitude is called a meridian. The Prime Meridian has zero longitude. All meridians merge in two points called **poles**. The meridian opposite the Prime Meridian has 180° longitude.

An imaginary line that has the same latitude is called a **parallel**. The Equator is the longest parallel, and it has zero latitude. The North and South poles are the shortest parallels with 90° latitude and are actually just two points.



Source: University of Texas Institute for Geophysics

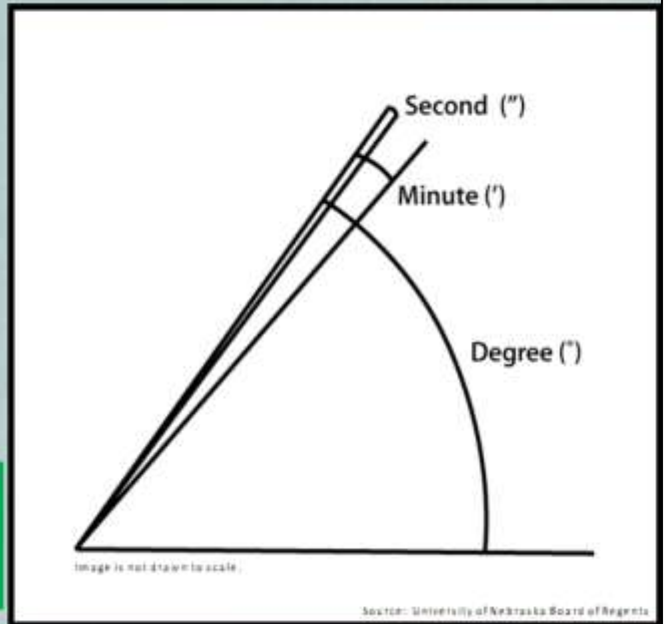
Degrees, Minutes and Seconds

As with any angle, these geographic coordinates can be expressed in degrees (˚). One degree consists of 60 minutes ('), and one minute consists of 60 seconds (").

Some examples:

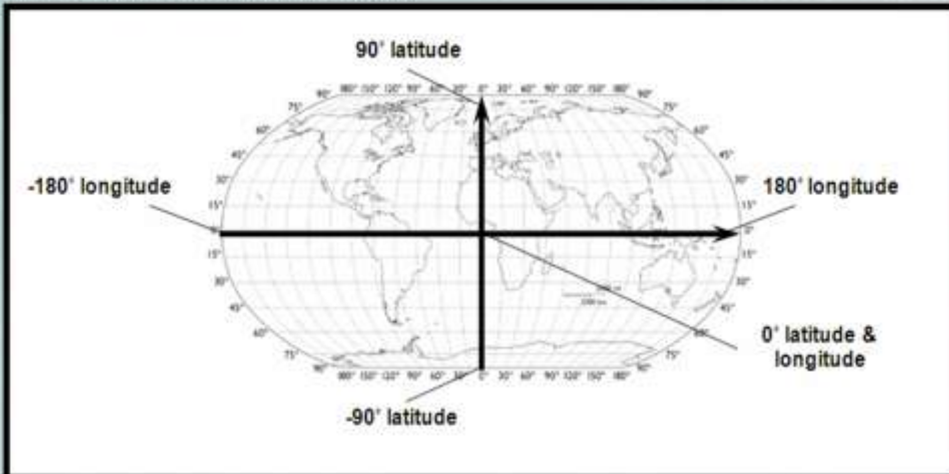
N 40˚48'27.34" W 96˚40'22.24"
N 51˚03'18.54" W 114˚03'44.78"
N 33˚53'19.06" E 35˚29'43.72"
S 31˚57'19.44" E 115˚51'30.92"
S 23˚32'56.19" W 46˚38'19.75"
S 4˚19'15.01" E 15˚17'55.18"

With parallels 69 miles apart, one minute equals 1.15 miles (69 ÷ 60 = 1.15) and one second equals 0.01967 miles or 101.19 feet (1.15 ÷ 60 = 0.01967 • 5280 = 101.19).



Positive and Negative Spaces

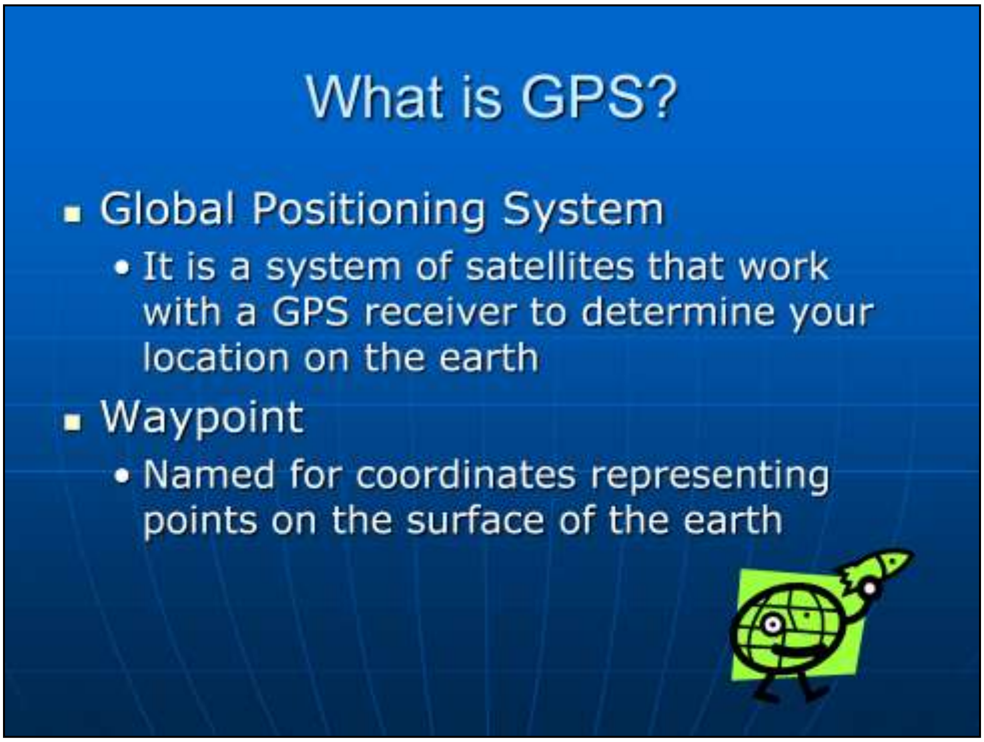
To make it easier dealing with geographic coordinates when creating maps, it is assumed that western longitudes and southern latitudes have negative values. Therefore, while in Nebraska or other continental states of the US, latitude should be positive and longitude negative.



Application…

- Locate the approximate location of these continents, countries or cities on the balloon..
  - Australia – South 25, East 135
  - South America – South 0 West 60
  - China – North 30 East 30
  - Ames, IA - North 42 West 93


Where are you going or have gone for vacation?



The Global Positioning System (GPS) is a worldwide radio-navigation system formed from a constellation of 24 satellites and their ground stations.

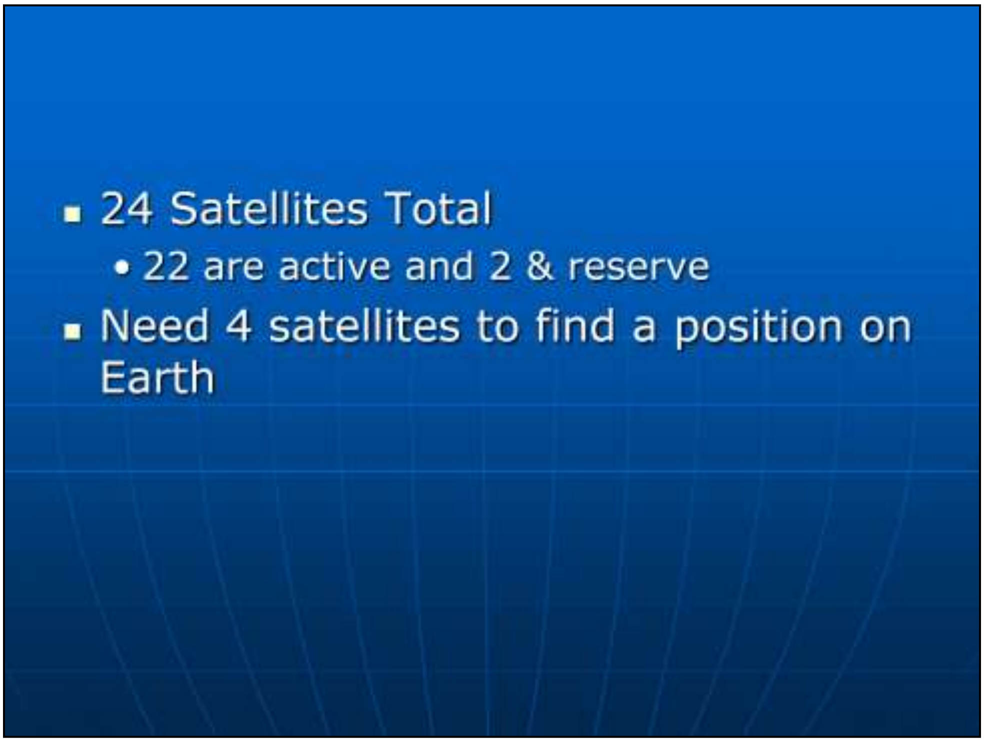
GPS uses these "man-made stars" as reference points to calculate positions accurate to a matter of meters. In fact, with advanced forms of GPS you can make measurements to better than a centimeter!

In a sense it's like giving every square meter on the planet a unique address.

GPS receivers have been miniaturized to just a few integrated circuits and so are becoming very economical. And that makes the technology accessible to virtually everyone.

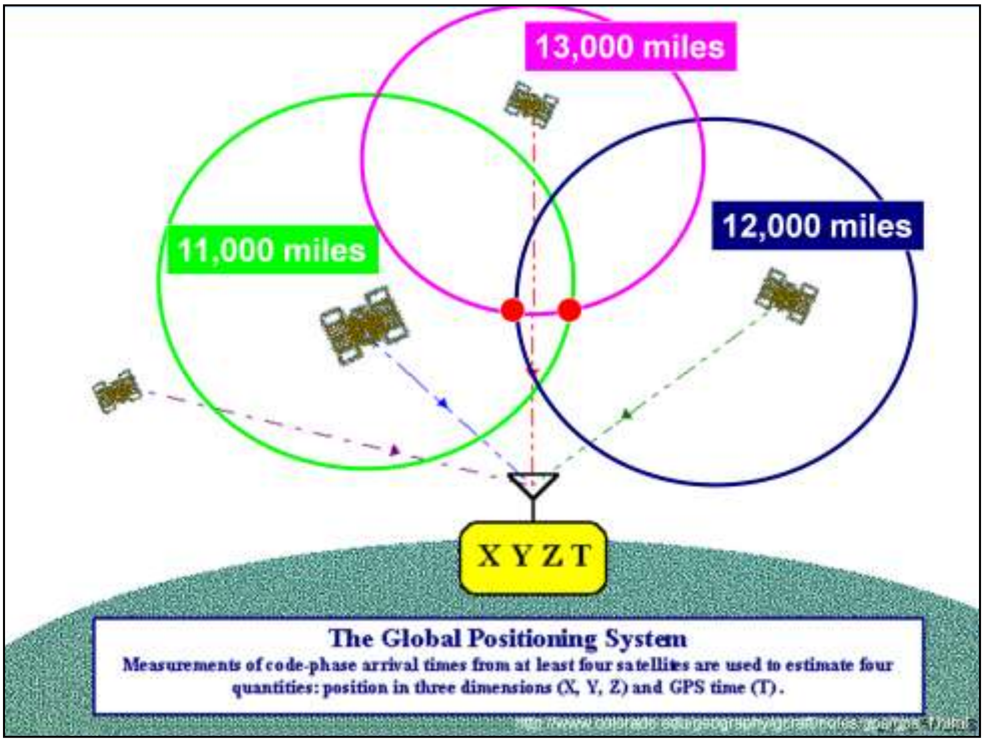
These days GPS is finding its way into cars, boats, planes, construction equipment, movie making gear, farm machinery, even laptop computers.

Soon GPS will become almost as basic as the telephone. Indeed, at Trimble, we think it just may become a universal utility. (degrees, minutes and fractions of minutes)



What do the satellites do?
Each satellite is broadcasting the time. But not just any time...atomically accurate time. Your GPS receiver listens to this broadcast. It has an atomically-accurate clock in it, too. By comparing the difference between the time given by the satellite and the time in your GPS receiver, the GPS can calculate the distance between you and the satellite.

How is time turned into distance?
Well, say you are travelling in a car at precisely 60 miles per hour. You travel for 1 hour. How far have you gone? 60 miles! Now, imagine you are riding a radio wave transmitted from a GPS satellite. Radio waves travel at the speed of light, 186,000 miles per second. If it takes you .06 seconds to get from the satellite to the GPS, how far have you gone? 11600 miles. The GPS receiver in the hand of the human on the surface of the earth is 11600 miles from the satellite.



GPS is funded by and controlled by the U. S. Department of Defense (DOD). While there are many thousands of civil users of GPS world-wide, the system was designed for and is operated by the U. S. military.

GPS provides specially coded satellite signals that can be processed in a GPS receiver, enabling the receiver to compute position, velocity and time.

Four GPS satellite signals are used to compute positions in three dimensions and the time offset in the receiver clock. The GPS User Segment consists of the GPS receivers and the user community. GPS receivers convert SV signals into position, velocity, and time estimates. Four satellites are required to compute the four dimensions of X, Y, Z (position) and Time. GPS receivers are used for navigation, positioning, time dissemination, and other research.

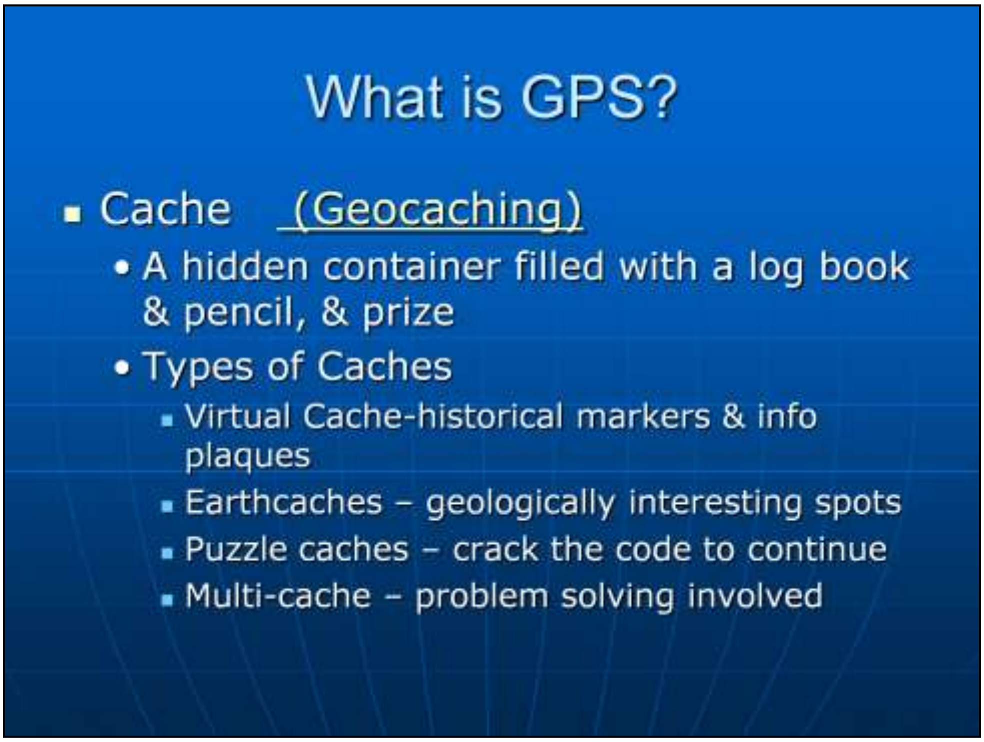
Navigation in three dimensions is the primary function of GPS. Navigation receivers are made for aircraft, ships, ground vehicles, and for hand carrying by individuals.

GPS Navigation

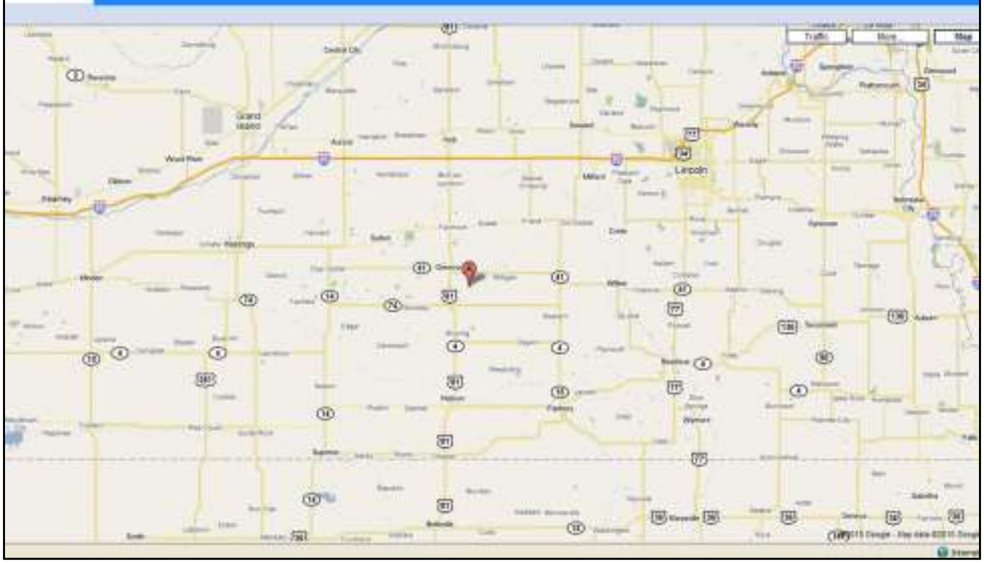
Precise positioning is possible using GPS receivers at reference locations providing corrections and relative positioning data for remote receivers. Surveying, geodetic control, and plate tectonic studies are examples.

Time and frequency dissemination, based on the precise clocks on board the SVs and controlled by the monitor stations, is another use for GPS. Astronomical observatories, telecommunications facilities, and laboratory standards can be set to precise time signals or controlled to accurate frequencies by special purpose GPS receivers.

Research projects have used GPS signals to measure atmospheric parameters.


What is GPS?
Cache (Geocaching)
A hidden container filled with a log book & pencil, & prize
Types of Caches
Virtual Cache-historical markers & info plaques
Earthcaches – geologically interesting spots
Puzzle caches – crack the code to continue
Multi-cache – problem solving involved

- Over 35 geocaches within 50 miles of Geneva!



Putting GPS to work

GPS technology has matured into a resource that goes far beyond its original design goals. These days scientists, sportsmen, farmers, soldiers, pilots, surveyors, hikers, delivery drivers, sailors, dispatchers, lumberjacks, fire-fighters, and people from many other walks of life are using GPS in ways that make their work more productive, safer, and sometimes even easier.

In this section you will see a few examples of real-world applications of GPS. These applications fall into five broad categories.

Click below to learn more about each application:

Location - determining a basic position

Navigation - getting from one location to another

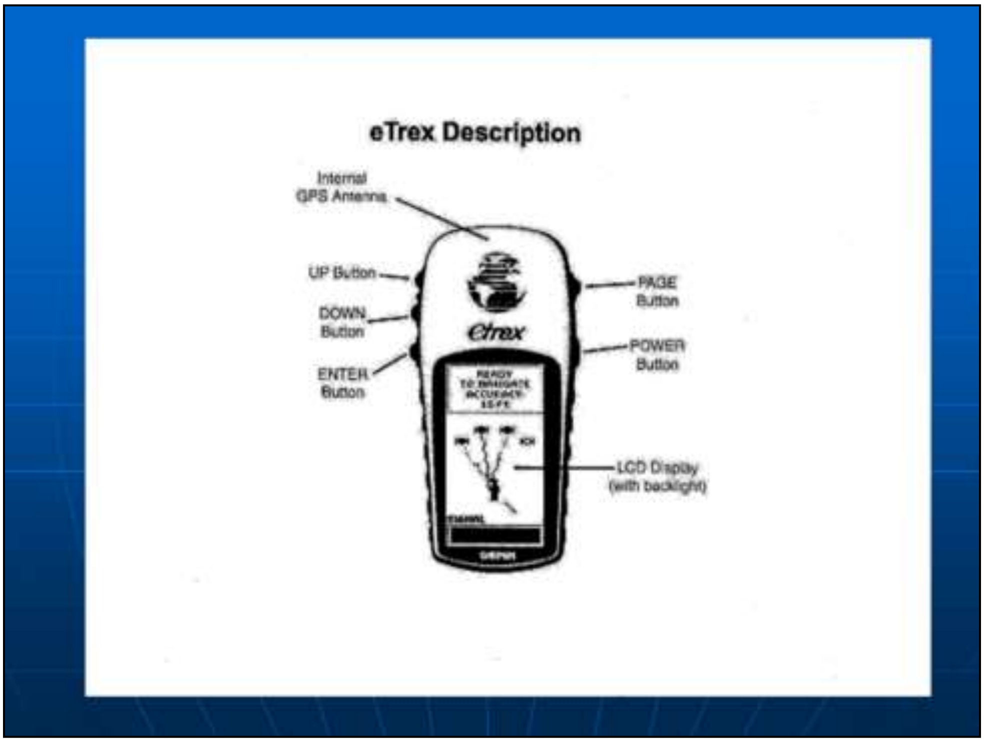
Tracking - monitoring the movement of people and things

Mapping - creating maps of the world

Timing - bringing precise timing to the world

Your turn..

- eTrex GPS Receivers
  - Power button
  - Page button
  - Up button
  - Down button
  - Enter
  - LCD Display

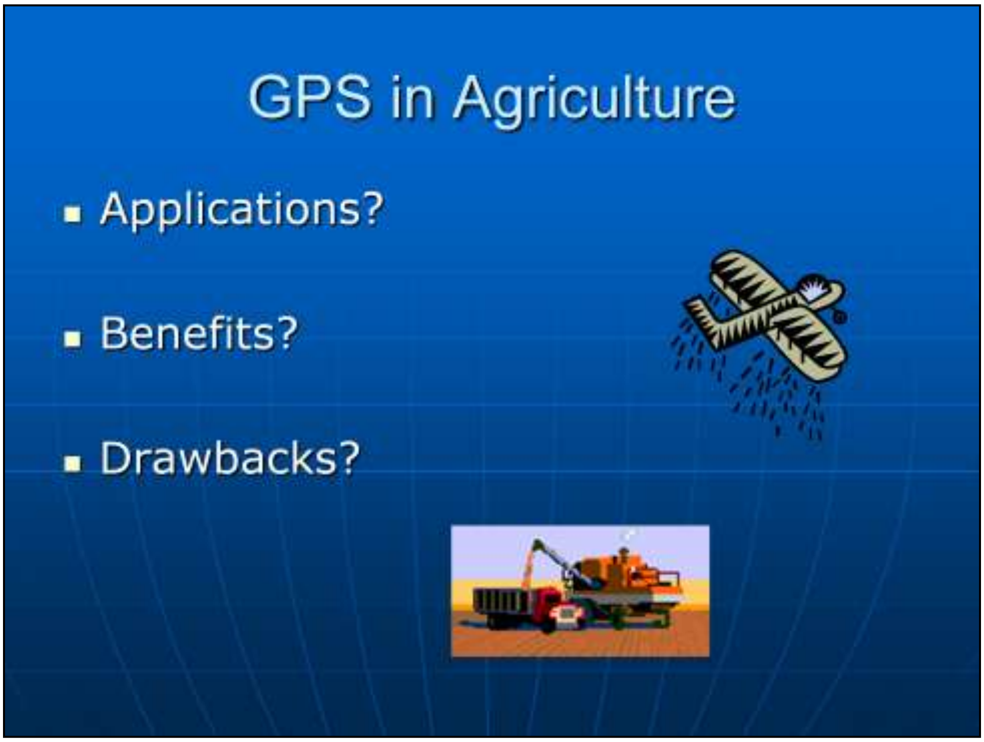

eTrex Description
Internal GPS Antenna
UP Button
DOWN Button
ENTER Button
eTrex
PAGE Button
POWER Button
LCD Display (with backlight)

Your turn…

- With a partner, make a waypoint, switch to see if you can find the spot
  - Make a waypoint
  - Locate a waypoint
  - Make tracks

GPS in Agriculture

- Precision Agriculture
  - sometimes called site-specific farming, allows a farmer to identify variability within a field and manage that variability to increase crop production & profits
  - merging of computers, GPS, GIS (geographic information systems), variable rate controllers (or VRT), in-field & remote sensing, & telecommunications



What are the benefits of precision ag?

Are there any drawbacks?

What do you think is the future of precision agriculture?

Review & Wrap-Up

- What did you find interesting about the GPS unit?
- How could GPS be used in your daily life?
- What could GPS be used for in today's world?
  - Measuring glacier speeds, keeping track of animal populations, boating, biking, hiking, airplanes, agriculture, tracking stolen vehicles, locating a cell phone of someone who is lost or injured, surveying land, guiding the blind, anything that uses positioning, time or navigation anywhere on Earth and in any type of weather.

Review & Wrap-Up

- What is geocaching?
- What is precision agriculture?
  - Examples of how GPS is used in agriculture

Where we went…

- Latitude & Longitude
- GPS
- You do the navigating
- Impact on Agriculture

Where Exactly Are We?

Nebraska Lincoln EXTENSION