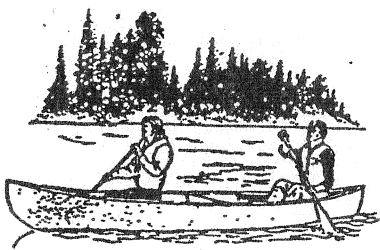
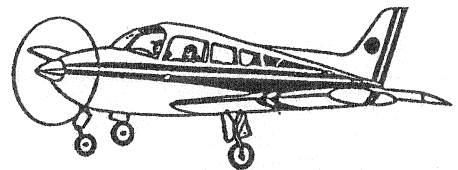


# Lost ?



## G P S



Global Positioning System

*A. Raeth*  
Technology Education  
Amery Middle School



# Introduction

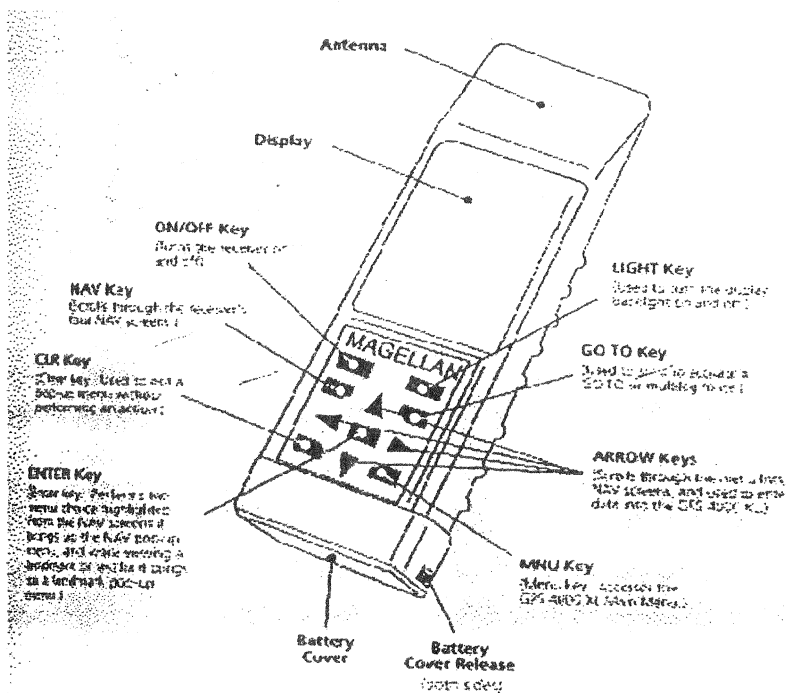
Welcome to being able to find where ON the world you are. This activity will allow you to experiment with a Global Positioning System. (GPS) By reading and looking over the material provided, and your use of a GPS you should start you on your way to navigating the land, lakes, and air around us.

## Suggested Procedure

- Step 1*      Read "Lost- Staying on Track" and the activity.
- Step 2*      Complete worksheet on "3 Dimensional Location".
- Step 3*      Do the Activity using the GPS, following all the directions and safety rules.

## Objectives

1. The students will understand how a GPS device gets the information needed to give latitude, longitude, altitude, date.
2. The student will use the GPS to locate five landmarks on our campus
3. The students will be able to read direction, speed , time & distance between landmarks.

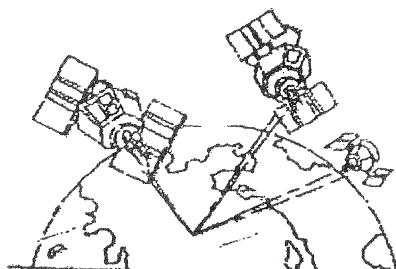


## LOST - STAYING ON TASK

Ever been fishing on a large lake and want to find the same spot the next trip out? How about hiking in a forest and want to get back to camp or car easily? Global Positioning System ( GPS ) could be the device that could pinpoint your location on the lake, in the woods or even your friends house in the middle of a city.

GPS is a hand held or vehicle held device used to determine location, speed, and precise time in any weather and anywhere on earth. A satellite-base system, GPS, or " Navigation Satellite Timing and Ranging Global Positioning System " ( NAVSTAR ) is controlled and operated by the United States Department of Defense. It was originally developed under the U. S. Air Force as a guidance system for military troops, vehicles, and weaponry. During the Desert Storm Conflict, troops used GPS to help navigate the desert. The GPS is available for civilian and commercial uses as well, another example technology transfer from military to civil applications. The system uses 24 satellites and three orbiting spares. These satellites travel around the earth in such a way that up to six satellites orbit in the same

horizontal plane. It takes three satellites to locate latitude and longitude (triangulation), and by adding a fourth satellite will give you altitude.



The satellites weights 84 kilograms and have a design life of about 7.5 years. Each satellite contains four atomic clocks, two cesium clocks and two rubidium clocks. These clocks are very precise and are used to measure the signal travel time between the visible satellites and the GPS Device. This is similar to counting the time between the flash of lighting and hearing the thunder ( approximately 3 seconds per mile ) to tell how far away the lighting strike was. Atomic clocks are accurate to within one second every 70,000 years. The satellites are in orbit about 11,000 miles above the earth and travel around the earth twice a day in the same line.

### GPS Accuracy

Selective Availability ( S/A ). Because GPS was designed as a military navigational system, the Department of Defense created two transmission codes; the “P” code (Precise Code) for military use, and the “C/A” code (Civilian Access Code) for civilian use. The highest accuracy levels were to reserved for the military so as to prevent hostile enemy attacks against the U. S. using our own system. However, once in operation, the civilian code proved to be more accurate than the D. O. D. had intended. The military has since intentionally degraded the accuracy, this is named “selective availability” or “S/A”.

The government has stated that with S/A turned on , civilian GPS accuracy levels increase will be 100 meters or less, 95% of the time. The other 5% of the time, the accuracy will 300 meters or less. However, typical accuracy for most users averages 20 and 50 meters the majority of the time. There is a strong possibility that S/A will be turned off in the near future.

## GPS Applications

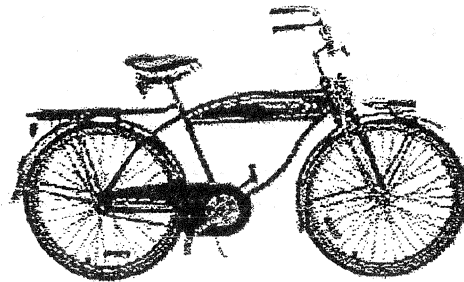
GPS applications in the civilian sectors are just beginning, here are uses.

### Search and Rescue

Injured? Lock your coordinates and have a friend go for help. The GPS can guide him back to the trailhead and provide your exact location to rescuers. Like wise if you have a radio or cellular phone and your boat or car is disabled, you can call and tell help where to find you.

### Mountain and Road Biking

*What Around Graphic*



Hitting the trail or road on bike? GPS can be used for periodic status reports of your progress. Plan your next leg and log in your positions to get an accurate report of where you have been and where you are going. This is especially useful for the long haul, competitive racing, or off road trips.

### Traveling by Car or RV

Plan your vacation route and note waysides and points of interest. There is even mapping software and GPS receivers that hook up to portable computers, that show you your position as you travel. This is great for vacationers in strange places, or traveling salespersons.

### Hunting, Fishing, Prospecting, Bird watching, Outdoor Photography

Use a GPS receiver to memorize those spots you knew you'd never forget how to get to, but somehow can't seem to find in "different light." Surprise fishing spots, wildlife refuges, and vistas never be lost again.

### Other possibilities

Hiking, Back packing, Climbing, Ballooning, Sail Planes, Small Aircraft, Snowmobiling, Cross - Country Skiing, and Dogsledding.

The GPS has six different screens. These screens will give information on the direction in degrees you are moving, speed, feet above sea level, time, and date. It allows you to set up landmarks, will plot the distance between landmarks, time, and route. Different screens give you different information and combination of information.

### Review Questions

1. What is GPS?

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2. How many satellites are used in this system?

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3. What is the accuracy of an atomic clock?

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4. List five different applications of the GPS.

A. \_\_\_\_\_

B. \_\_\_\_\_

C. \_\_\_\_\_

D. \_\_\_\_\_

E. \_\_\_\_\_

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At the heart of a GPS is *triangulation*, the determination of an unknown position using distances from known positions.

A GPS receiver uses signal transmission times from orbiting satellites to calculate distances from those satellites which in turn are used to determine receiver position.

### Activity #1

Your team is to locate three objects in the technology lab. You will use X, Y, Z coordinates for the location of the objects. The point 0, 0, 0, is marked on the floor.

**Assignment:** You are to locate three objects in the room using the three dimensional layout.(X, Y, Z) You should be within plus or minus 3inches. The X coordinates are on the red line. The Y coordinates are on the yellow line and the Z coordinates are along the green line. Each block is equal to 1 foot. To find the exact measurement count the number of blocks then measure the last part with a ruler.

**EXAMPLE:**

Location #? (X) 6 foot 2inches, (Y) 4 foot 6inches, (Z) 1 foot 9inches

Location #1 (X) (Y) (Z)

Location #2 (X) (Y) (Z)

Location #3 (X) (Y) (Z)



## Activity 2

Now you get to use the GPS unit to find landmarks already stored in the GPS unit. These landmarks are on school property.

Assignment: Your team is to find the 5 landmarks already stored in the GPS while following the rules.

### *Rules for this activity*

- 1) There is no need to climb over any fences or walk through where you are not wanted. Walk around these places.
- 2) You only have to cross the road by the school twice. Once by the middle school and once by the high school.
- 3) You have 30-45 minutes to complete this activity. Time taken after this will cost you points.
- 4) Remember that you are in class, act as if you were in the class room.
- 5) Always pay close attention to safety.

STEP 1 Go to the top of the key of the last basketball hoop outside.

Hold down the ON/OFF button until the screen turns on.

STEP 2 Now press the GO TO button. Select Landmark 1 (LMK 1) and press enter.

STEP 3 Press the NAV button three times. This screen should have an arrow and a half circle on it.

STEP 4 Follow the arrow on the screen, while watching the distance. Once the distance reads 0.0 you are at the landmark. Remember the GPS unit does not give the exact location, but it gets you to about within 100 yard of the landmark.

STEP 5 Write down what the landmark is, and the time it took you to travel. Be general about the landmark.

STEP 6 Follow steps 2-5 for the rest of the landmarks.

STEP 7 When done press the ON / OFF button.

LANDMARK 1 is:

LANDMARK 2 is:

LANDMARK 3 is:

LANDMARK 4 is:

LANDMARK 5 is: