

Physics Presentation Outline

I. History of Global Positioning:

- a. What is it? It is a navigational system using satellite signals to fix the location of a radio receiver on or above the earth's surface.
- b. GPS was first made possible by the invention of accurate atomic clocks (originally developed for the study of Physics), satellite launching technology, microwave communication and radio navigation.
- c. The first GPS system, TRANSIT, was used by the U.S. navy to track nuclear submarines.
- d. With the success of this program, the Department of Defense gave approval for a Global Positioning system. With that order 24 satellites were designed, and launched between 1989 and 1993.

II. Physics Component:

- a. Department of Defense subsidizes and runs the GPS system at Schriever Air Force Base in Colorado.
- b. In order to know the position of a GPS receiver on earth, there must be 4 satellites acting on it (X, Y, Z, t)
- c. Relativistic Effects:
 - i. Clock drift due to the high speed of the satellite is corrected through continuous monitoring by the Dept. of Defense and by using an atomic clock in the satellite.
 - ii. Sagnac effect due to Earth's rotation is corrected using a gyroscope.

III. Uses of GPS:

- a. GPS data loggers record the position of the device at timed intervals and store locations in memory.
- b. With these data points, one can calculate distance, duration of a trip.
- c. GPS systems are used in a variety of domestic uses such as OnStar and Google Earth.

IV. Political Ramifications

- a. Issue of Big Brother syndrome.
 - i. A benefit of GPS is E911, which speed up emergency services that can save many lives. Has led to privacy concerns.
 - ii. Court does not allow third parties access to GPS tracking without consent of phone user. Government officials not allowed to access track records of a suspect without evidence of wrongdoing.
 - iii. There are privacy issues of GPS in the workforce.
- b. Precision-guided munitions, guided by GPS, can lead to foreign conflicts. GPS is very important tool for the US and has assisted the military in various foreign conflicts. Other nations are quickly developing the technology and will soon have GPS capabilities comparable to the US.
- c. Scientists must learn how to protect GPS technology from environmental factors, such as solar radio flares. Solar radio flares have affect GPS technology by reducing their accuracy and even destroying some receivers' ability to determine position.

V. The Future of GPS:

- a. Future use of GPS in the army.
- b. Big Brother syndrome.
- c. Improvement for accuracy and signal.