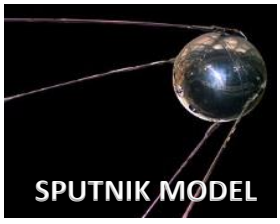
NAVIGATE WITH GPS—PART 1

The compass and the gyroscope were available to science during the same period in history, the magnetic compass being the oldest navigational tool in existence and the gyroscope more recently invented as a toy. These two technologies would eventually be combined but not until electric power became available that provided the energy to continuously spin a wheel suspended in a set of pivotal rings called a gimbal that would become known as the gyroscope.

The navigational device called a gyrocompass was formed from these new innovations by Elmer Ambrose Sperry, Sr. Sperry's first compass was tested in 1910 on the Navy's USS Delaware (BB-28). Other innovations to the gyrocompass would follow making navigation safer and reduce the complicated mathematics required in earlier navigation and supported other fields such as aviation, guided missiles, auto-steering, and graphic course recording. Innovations in navigation are continues from the very first travelers search for food or water. The modern navigator continues to seek release from the work of navigation so predictions in the 1960s stated that new innovations would need to come through automation.

DOPPLER EFFECT-DISCOVERIES IN SOUND & LIGHT

The Doppler Effect was named after an Austrian physicist Christian Doppler based on proposals made in 1842 regarding the color of light emitted from distant stars. Doppler's proposal relates the frequency of a sound generated from a source that varies with the speed of the source and that all stars emitted white light but the color of some stars are owing to their motion toward or away from the earth. The Doppler Effect has advanced the science of Astronomy, Radar, Medical imaging and blood flow measurement, velocity measurement, Underwater Acoustics, Audio, Vibration measurement, and Satellite communication.



The Soviet Union launched the first man-made satellite, named Sputnik, in 1957.

Two American physicists, William Guier and George Weiffenbach, decided to monitor Sputnik's radio signals. Because of the Doppler Effect, the physicists could track where Sputnik was in its orbit as it circled earth. This experiment gave rise to the innovations of GPS (Global Positioning System).

PREDECESSORS TO GPS

Navigation by early means was difficult and hazardous. By the 1940s the United States developed *Long Range Navigation LORAN,* using low frequency radio signals transmitted from land based towers located throughout the Pacific and Atlantic Ocean rim, each with a range of 1,200 miles. To navigate using LORAN a navigator would receive signals from at least three transmitters and by using the speed of sound in air of 1,126 ft/s (768 mph) as a reference would measure the time each signal would take to reach the receiver. Mapping lines were then drawn representing the time it took for each signal to arrive from the known transmitter locations. The plotting of these diverging lines would give an accurate location of the navigator's receiver. As of February 8, 2010 the U.S. Coast Guard terminated transmission of U.S. LORAN-C signals due to declining use as GPS was developed as the primary navigational system.

Decca Navigator System was first deployed by the Royal Navy during World War ll and was similar to the U.S. LORAN-C system with a maximum range of 400 mile. This system was in use until being shut down in the spring of 2000.

In 1960 the first satellite navigation system, Transit, used by the U.S. Navy was successfully tested. In 1962 the Telstar satellite provided the first trans-Atlantic television signals.

The design of GPS is based partly on ground-based radio navigation systems similar to LORAN and Decca. These monitoring stations are located in Hawaii, Kwajalenin Atoll in the Pacific Ocean, Ascension Island in the South Atlantic, Diego Garcia in the Indian Ocean, Colorado Springs Colorado, England, Australia, Argentina, Ecuador, Barain, Washington DC, and Cape Canaveral.