

The overall system provides:

- Accurate 3D (three-dimensional) determination of position, velocity, and time
- Passive operation
- All-weather operation
- Real-time positioning
- Continuous operation
- Usable in a hostile environment (military uses)

It is important to note that GPS receivers operate passively (no communication with the satellite system), therefore, a limitless number of simultaneous users can exist.

In accordance with the Federal Radionavigation Plan (FRP) jointly prepared by the Department of Defense and Department of Transportation:

... many existing navigation systems are under consideration for replacement by GPS beginning in the mid- to late-1990s. GPS may ultimately supplant less-accurate systems such as LORAN-C, Omega, VOR, DME, TACAN, and Transit, thereby substantially reducing federal maintenance and operating costs associated with these current radionavigation systems.

## National security caveat

In the interest of U.S. national security, the highly accurate and dependable GPS has built-in features which can deny accurate service to unauthorized users, prevent spoofing (passing of incorrect data meant to deceive users), and reduce receiver susceptibility to jamming.

These security measures, designed only with the military in mind, can cause considerable difficulties for unauthorized users. Essentially, an unauthorized user is defined as anyone without a specific military need and/or mission.

## GPS PROGRAM HISTORY

Since the early 1960s the U.S. Air Force (USAF) and U.S. Navy (USN) have operated or studied assorted satellite navigation systems. The navy sponsored two programs, Transit and Timation.

*Transit:* First operational in 1964, Transit is currently providing surface navigation service for ships.

*Timation:* A high-tech research program for a two-dimensional (latitude and longitude) navigation system.

During the same period of time, the air force conducted concept studies assessing a three-dimensional (latitude, longitude, and altitude) navigation system called 621B.

## **GPS program management**

In 1973 the U.S. Deputy Secretary of Defense directed that the air force be the executive service to consolidate the Timation and 621B programs into a single, all-weather navigation system to be called the NAVSTAR Global Positioning System.

The NAVSTAR GPS Joint Program Office (JPO) was established in July 1973 at U.S. Air Force Systems Command/Space and Missile Systems Organization (SAMSO), Los Angeles AFB, California. The JPO is staffed by personnel from the USAF, USN, U.S. Army (USA), U.S. Marine Corps (USMC), U.S. Coast Guard (USCG), U.S. Defense Mapping Agency (DMA), NATO nations, and Australia.

## **Development phases of GPS**

By December of 1973 the JPO had received approval to start the concept validation phase (Phase One) of the GPS program. This phase included concept studies, projected system performance, and feasibility. Phase One was completed in 1979.

Phase Two was subsequently started and included full-scale equipment development (including the development of GPS user equipment) and system testing. That phase ended in 1985.

The third phase (Phase Three) started in 1985, with the production of GPS equipment and further system developments leading to the completed satellite constellation, Master Control Station (MCS), and advanced user equipment.

## **Operational capability**

The term FOC (full operational capability) defines the condition when full and supportable military capability is provided by a system. GPS FOC will be declared by the Secretary of Defense when 24 operational satellites (Block II/IIA types) are in their assigned orbits and when the constellation has successfully completed testing. Three of the 24 satellites will be orbiting spares that can easily be moved to replace a faulty satellite.

An Initial Operational Capability (IOC) was attained when 24 GPS satellites (Block I/II/IIA types) were operating in their assigned orbits, available for navigation use, and providing service. This total included three operational spares in orbit.

Notification of IOC came from the Secretary of Defense following an assessment by the USAF (the system operator) that the constellation could sustain required levels of accuracy and availability throughout the IOC period. IOC occurred on December 8, 1993. Full military FOC is expected in 1995.

Prior to IOC, GPS was considered to be in the process of development for operational purposes, therefore signal availability and accuracy were subject to change.

## **Operation and logistical support**

Starting in 1986, overall operation of the Control and Space Segments of GPS was managed by the USAF 2nd Space Wing at Falcon AFB, Colorado. Prior to that time operation was from a prototype master control station operated from Vandenberg AFB, California.