GLOBAL POSITIONING SYSTEM - HISTORY

History

The design of GPS is based partly on similar ground-based radio navigation systems, such as LORAN and the Decca Navigator developed in the early 1940s, and used during World War II. In 1956 Friedwardt Winterberg proposed a test of General Relativity using accurate atomic clocks placed in orbit in artificial satellites. To achieve accuracy requirements, GPS uses principles of general relativity to correct the satellites' atomic clocks. Additional inspiration for the GPS came when the Soviet Union launched the first man-made satellite, Sputnik in 1957. A team of U.S. scientists led by Dr. Richard B. Kershner were monitoring Sputnik's radio transmissions. They discovered that, because of the Doppler effect, the frequency of the signal being transmitted by Sputnik was higher as the satellite approached, and lower as it continued away from them. They realized that since they knew their exact location on the globe, they could pinpoint where the satellite was along its orbit by measuring the Doppler distortion (see Transit (satellite)).

The first satellite navigation system, Transit, used by the United States Navy, was first successfully tested in 1960. It used a constellation of five satellites and could provide a navigational fix approximately once per hour. In 1967, the U.S. Navy

developed the Timation satellite which proved the ability to place accurate clocks in space, a technology that GPS relies upon. In the 1970s, the ground-based Omega Navigation System, based on phase comparison of signal transmission from pairs of stations, became the first worldwide radio navigation system. However, limitations of these systems drove the need for a more universal navigation solution with greater accuracy.

While there were wide needs for accurate navigation in military and civilian sectors, almost none of those were seen as justification for the billions of dollars it would cost in research, development, deployment and operation for a complex constellation of navigation satellites. However during the Cold War arms race, the nuclear threat to the very existence of the United States was the one need that did justify this cost in the view of the US Congress. And this deterrent effect is why GPS was funded. The nuclear triad consisted of the US Navy's Submarine Launched Ballistic Missiles (SLBMs) along with the US Air Force's strategic bombers and Intercontinental Ballistic Missiles (ICBMs). Considered vital to the nuclear deterrence posture, accurate determination of the SLBM launch position was a force multiplier. Precise navigation would enable US submarines to get an accurate fix of their positions prior to launching their SLBMs.

The US Air Force with two-thirds of the nuclear triad also had requirements for a

more accurate and reliable navigation system. The Navy and Air Force were developing their own technologies in parallel to solve what was essentially the same problem. To increase the survivability of ICBMs, there was a proposal to use mobile launch platforms so the need to fix the launch position had similarity to the SLBM situation. In 1960, the Air Force proposed a radio-navigation system called MOSAIC (Mobile System for Accurate ICBM Control) that was essentially a 3-D LORAN. A follow-on study called Project 57 was worked in 1963 and it was "in this study that the GPS concept was born." That same year the concept was pursued as Project 621B, which had "many of the attributes that you now see in GPS" and promised increased accuracy for Air Force bombers as well as ICBMs. Updates from the Navy Transit system were too slow for the high speeds that the Air Force operated at. The Navy Research Laboratory continued advancements with their Timation (Time Navigation) satellites, first launched in 1967, and with the third one in 1974 carrying the first atomic clock put into orbit.

With these parallel developments out of the 1960s, it was realized that a superior system could be developed by synthesizing the best technologies from 621B, Transit, Timation and SECOR in a multi-service program. Over the Labor Day weekend in 1973, a meeting of about 12 military officers at the Pentagon discussed the creation of a Defense Navigation Satellite System (DNSS).

It was at this meeting that "the real synthesis that became GPS was created." Later that year, the DNSS program was named Navstar. With the individual satellites being associated with the name Navstar (as with the predecessors Transit and Timation), a more fully encompassing name was used to identify the constellation of Navstar satellites. This more complete name was Navstar-GPS which was later shortened simply to GPS.

After Korean Air Lines Flight 007 was shot down in 1983 after straying into the USSR's prohibited airspace, President Ronald Reagan issued a directive making GPS freely available for civilian use, once it was sufficiently developed, as a common good. The first satellite was launched in 1989, and the 24th and last satellite was launched in 1994.

Initially, the highest quality signal was reserved for military use, and the signal available for civilian use intentionally degraded ("Selective Availability", SA). This changed in 2000, with U.S. President Bill Clinton ordering Selective Availability (SA) turned off at midnight May 1, 2000, improving the precision of civilian GPS from about 1000 feet to about 65 feet.

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