New Civil Signals

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- CNAV Message

A major focus of the GPS modernization program is the addition of new navigati to the satellite constellation.

The government is in the process of fielding three new signals designed for civili L2C, L5, and L1C. The legacy civil signal, called L1 C/A or C/A at L1, will continu broadcasting, for a total of four civil GPS signals. Users must upgrade their equip benefit from the new signals.

The new civil signals are phasing in incrementally as the Air Force launches new satellites to replace older ones. Most of the new signals will be of limited use ur are broadcast from 18 to 24 satellites.

Second Civil Signal: L2C

Status

- **Pre-operational** signal with message set "healthy"
- Broadcasting from 19 GPS satellites (as of October 17, 2017)
- Began launching in 2005 with GPS Block IIR-M
- Available on 24 GPS satellites ~2021 (as of May 2017)

Features

- Radio Navigation Satellite Services (RNSS) radio band
- Modern signal design (CNAV), including multiple message types and forward error correction
- Bi-Phase Shift Key (BPSK) modulation
- Includes dedicated channel for codeless tracking

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L2C is the second civilian GPS signal, designed specifically to meet commercial n

Its name refers to the radio frequency used by the signal (1227 MHz, or L2) and t that it is for civilian use. There are also two military signals at the L2 frequency.

When combined with L1 C/A in a dual-frequency receiver, L2C enables ionospher correction, a technique that boosts accuracy. Civilians with dual-frequency GPS enjoy the same accuracy as the military (or better).

For professional users with existing dual-frequency operatio enables faster signal acquisition, enhanced reliability, and g operating range.

L2C broadcasts at a higher effective power than the legacy signal, making it easier to receive under trees and even indo

The Commerce Department estimates L2C could generate $5 in economic productivity benefits through 2030.

The first GPS satellite featuring L2C launched in 2005. Every satellite fielded since then has included an L2C transmitter.

In April 2014, the Air Force began broadcasting civil navigation (CNAV) messages L2C signal. However, L2C remains pre-operational and should be employed at th own risk until it is declared operational.

Related Links:

- CNAV Message
- Jul 2006: Article on Economic Benefits of L2C (commerce.gov)

- Broadcasting from 12 GPS satellites (as of October 17, 2017)
- Began launching in 2010 with GPS Block IIF
- Available on 24 GPS satellites ~2024 (as of May 2017)

Features

1176.45 MHz

- Highly protected Aeronautical Radio Navigation Services (ARNS) radio band
- Higher transmitted power than L1 C/A or L2C
- Greater bandwidth for improved jam resistance
- Modern signal design (CNAV), including multiple message types and forward error correction
- Bi-Phase Shift Key (BPSK) modulation
- Includes dedicated channel for codeless tracking

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L5 is the third civilian GPS signal, designed to meet demanding requirements for of-life transportation and other high-performance applications.

Its name refers to the U.S. designation for the radio frequency used by the signa MHz).

L5 is broadcast in a radio band reserved exclusively for aviation safety services. features higher power, greater bandwidth, and an advanced signal design.

Future aircraft will use L5 in combination with L1 C/A to improve accuracy (via ionospheric correction) and robustness (via signal redundancy).

In addition to enhancing safety, L5 use will increase capacity and fuel efficiency

augmentations.

In 2009, the Air Force successfully broadcast an experim signal on the GPS IIR-20(M) satellite. The first GPS IIF sa with a full L5 transmitter launched in May 2010.

In April 2014, the Air Force began broadcasting civil navigation (CNAV) messages signal. However, L5 remains pre-operational and should be employed at the user risk until it is declared operational.

Related Links:

- CNAV Message
- Jun 2010: News Release on First L5 Transmission from GPS IIF Satellite (af.mi
- Apr 2009: News Release on L5 Demo Signal from GPS IIR-20(M) Satellite (af.m

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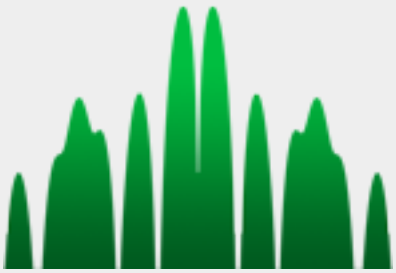
Fourth Civil Signal: L1C

Status

- Begins launching in 2018 with GPS III (as of May 2017)
- Available on 24 GPS satellites in late 2020s

Features



1575.42 MHz

- Aeronautical Radio Navigation Services (ARNS) radio band
- Designed for international GNSS interoperability
- Modern signal design (CNAV-2), including forward error correction

C/A signal. L1C should not be confused with L1 C/A.

L1C features a Multiplexed Binary Offset Carrier (M modulation scheme that enables international coo while protecting U.S. national security interests. T will improve mobile GPS reception in cities and ot challenging environments.

The United States and Europe originally developed common civil signal for GPS and Galileo. Japan's Q Zenith Satellite System (QZSS) and China's BeiDou are also adopting L1C-like signals.

The United States will launch its first L1C signal with GPS III. L1C will broadcast same frequency as the original L1 C/A signal, which will be retained for backwar compatibility.

Related Links:

- **Jan 2013: Joint UK-U.S. Statement Regarding GPS Intellectual Property**
- **Jul 2010: U.S.-EU Joint Statement on Combined GPS-Galileo Performance**
- **Jul 2007: U.S., EU Announce Final Design for GPS-Galileo Civil Signal**
- **International Cooperation**

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Codeless/Semi-Codeless Transition Plan

Once L2C and L5 are fully operational, their features will obviate the need for c semi-codeless GPS receivers, which many GPS professionals use today to attain v accuracy. Such receivers work by exploiting characteristics of the encrypted mil signal at the L2 frequency to achieve dual-frequency capability.

The U.S. government encourages all users of codeless/semi-codeless GPS techno start their planning for transition to the modernized civil signals.
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