GNSS Spectrum Issues and New GPS L5

International Civil Aviation Organization
Regional Coordination Meeting
Lima, Peru
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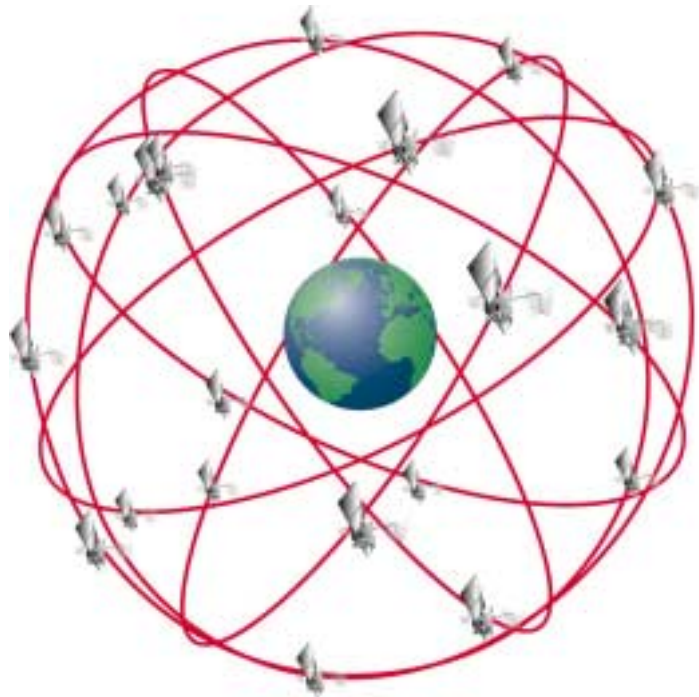
Federal Aviation Administration
Washington, D.C.

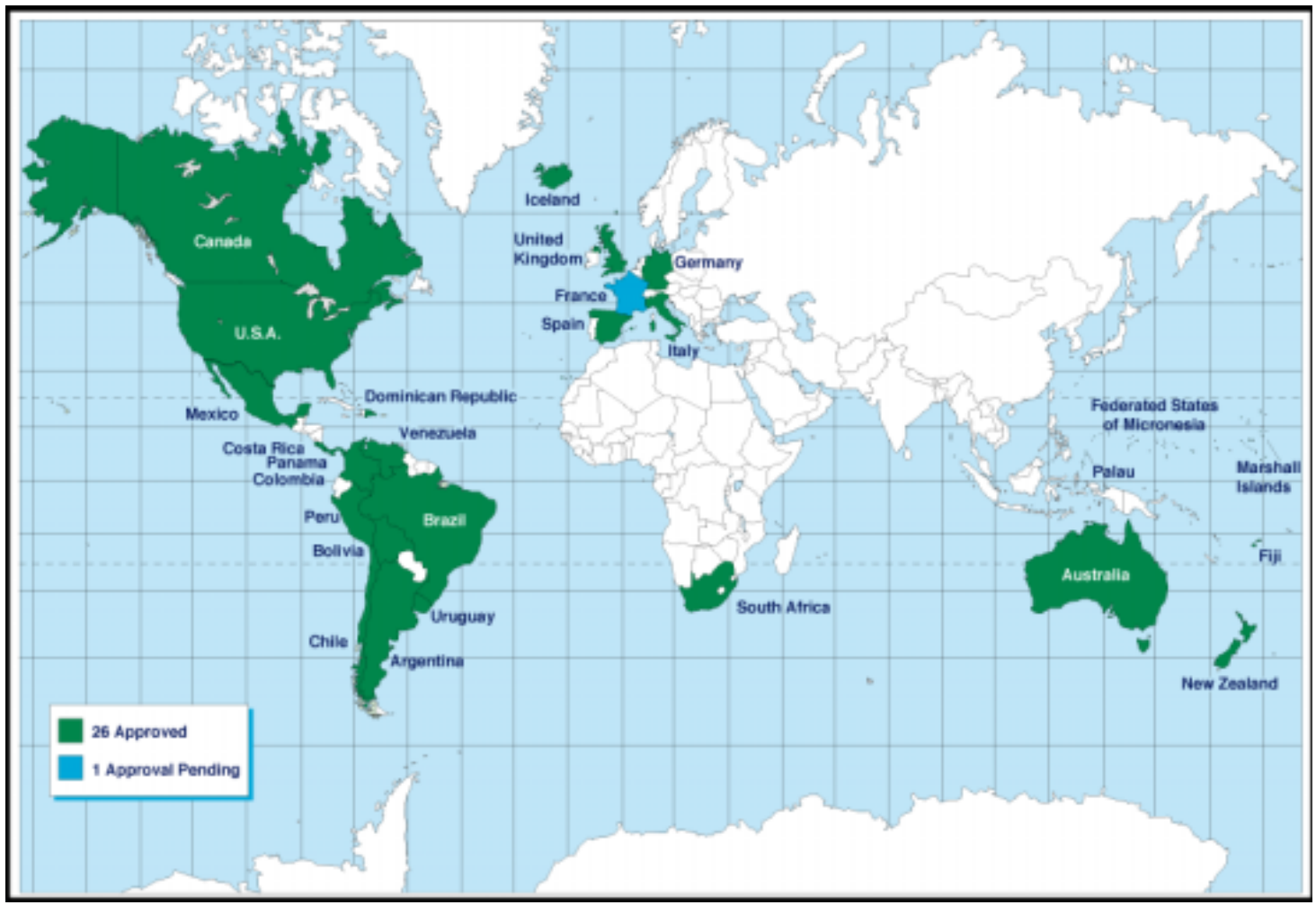
Basic GPS System

- Space Segment
  - 24 Satellites
  - 6 Orbital Planes
  - 4 Satellites per Plane
  - Orbit at Approximately 11,000 Nautical Miles Above the Earth
  - Orbits Every 12 Hours



- Ground Control Segment
  - Master Control Station, Colorado Springs
  - 5 Monitor Stations at Worldwide Locations

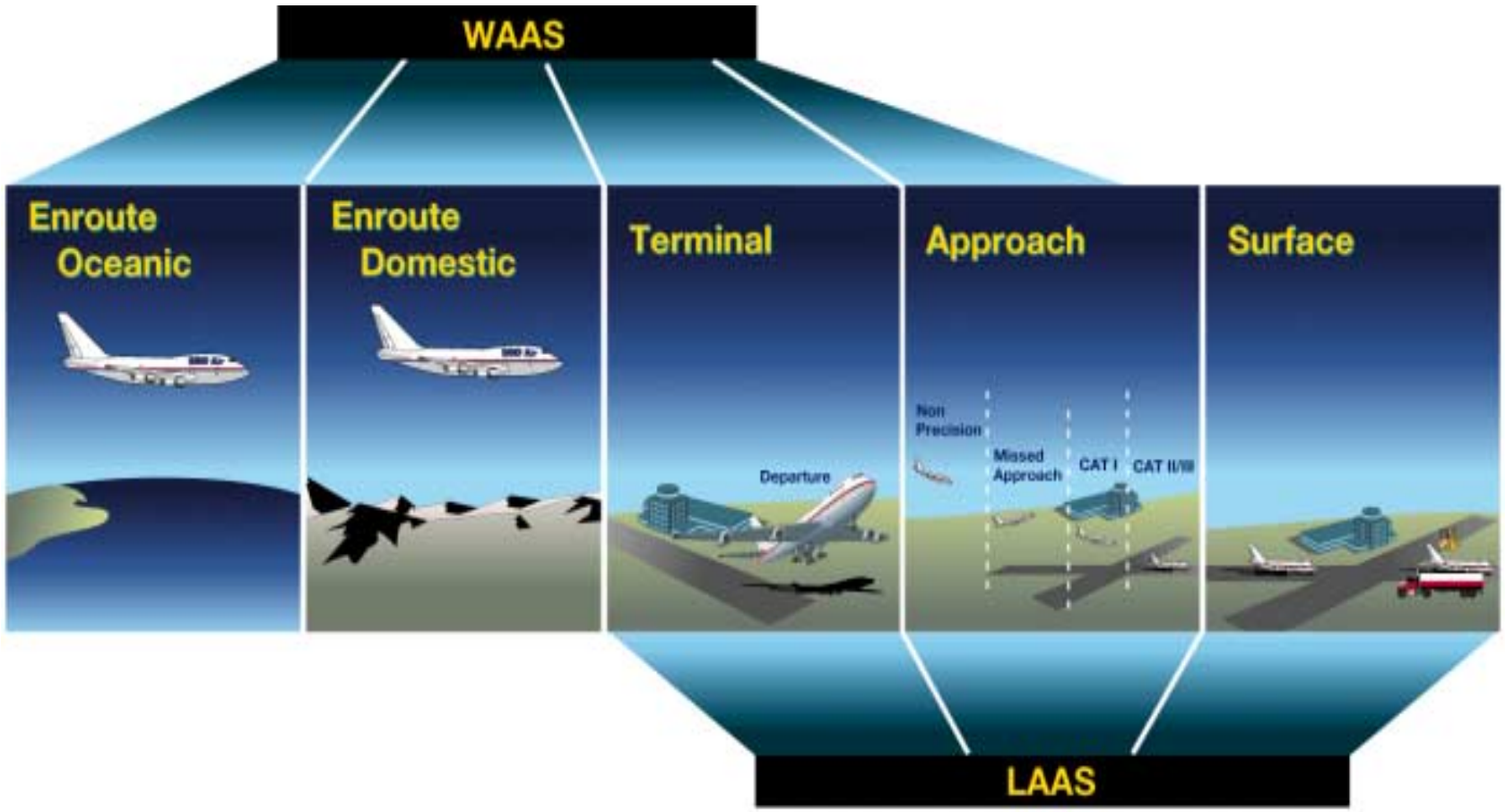
GPS Approved for Supplemental Means of Navigation

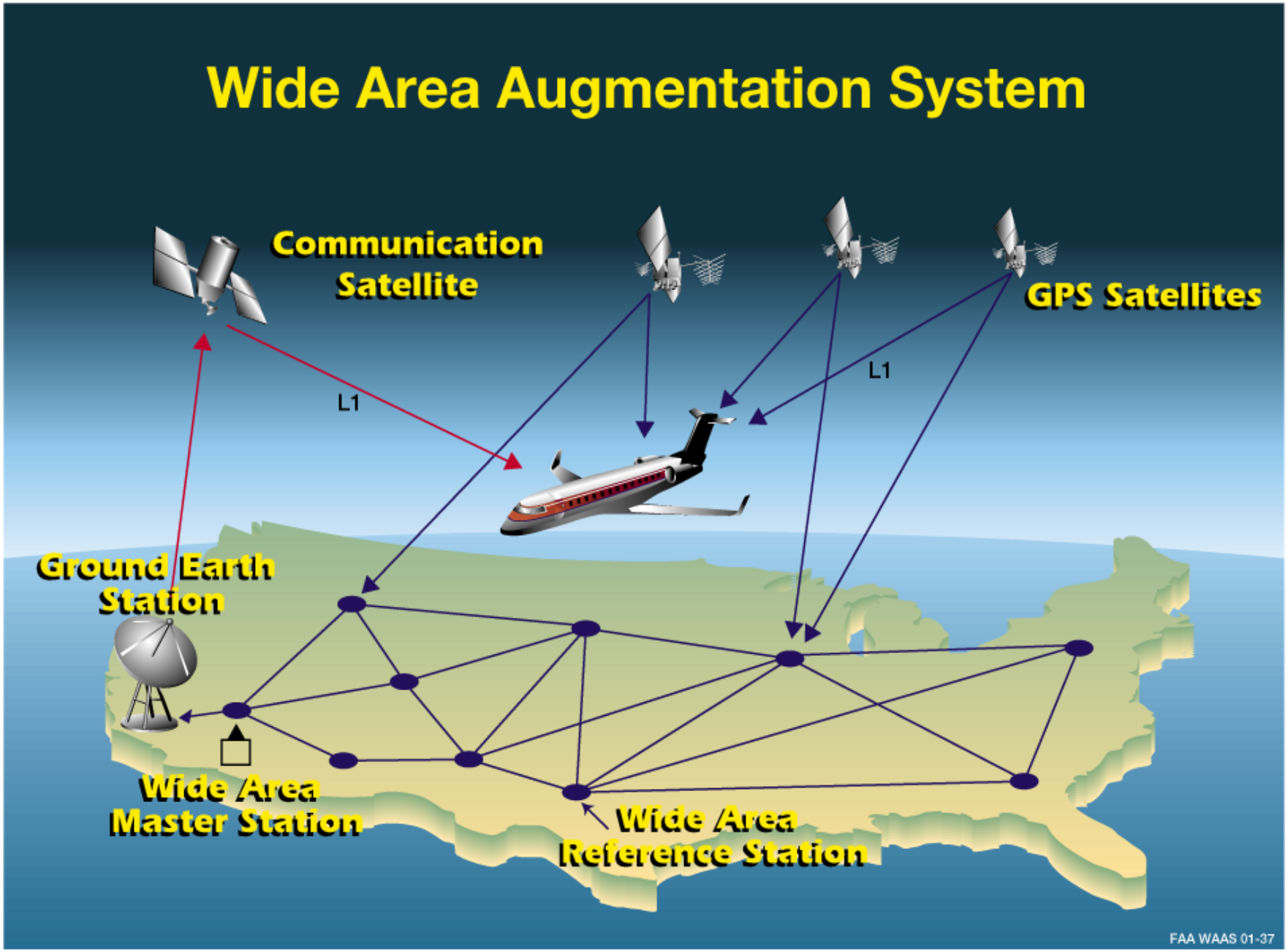


GPS Service

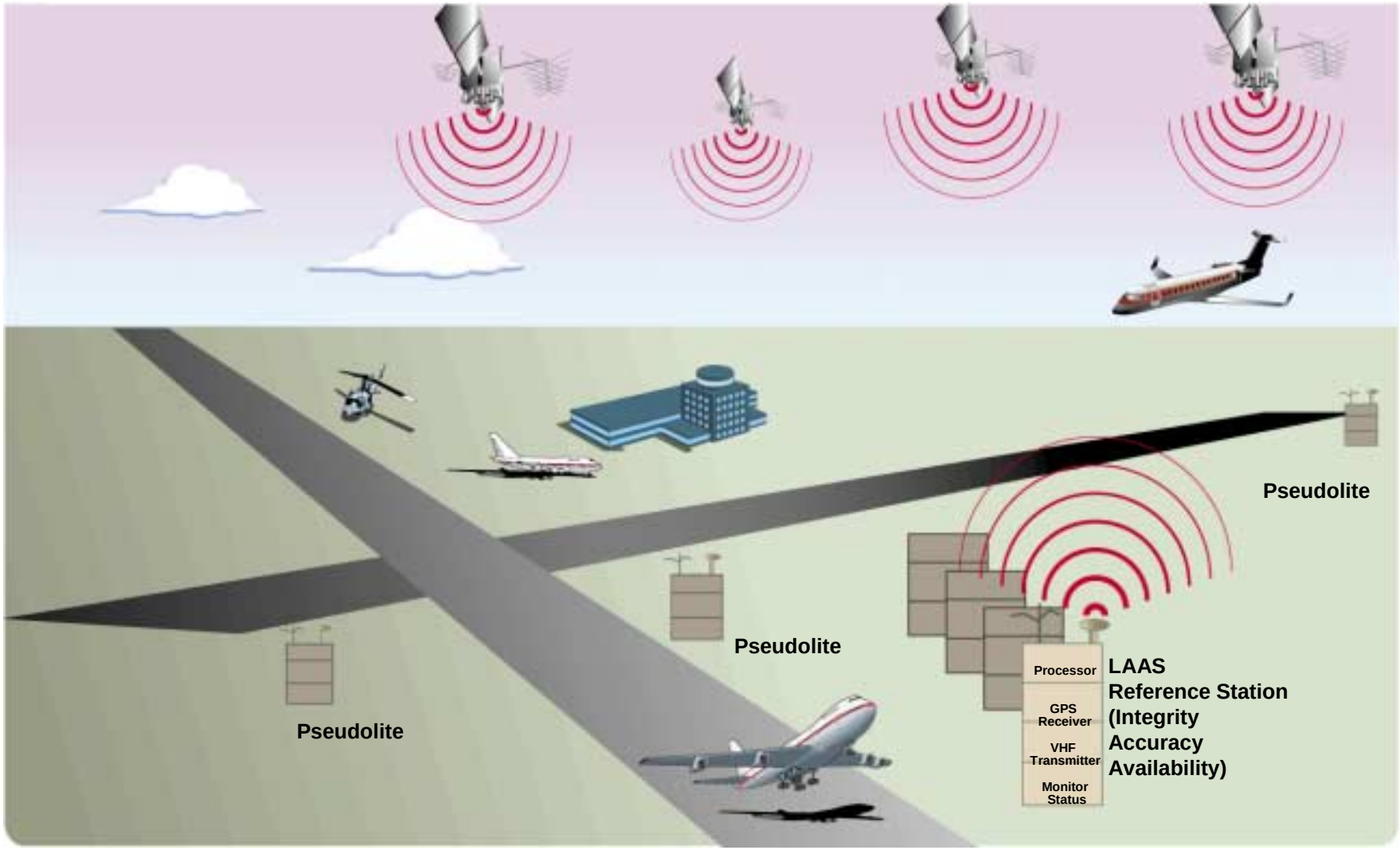
- Standard Positioning Service
  - Worldwide Coverage
  - Civil Use at no charge
  - C/A Code on L1 Frequency (1575.42 MHz)
  - Accuracy - 100 meters horizontal & 156 meters vertical, with 95% Availability
  - Second civil frequency (1227.6 MHz) available 2003
    - Will be available for general use in non-safety-critical applications.
  - Third civil frequency (1176.45 MHz) available 2005
    - Will meet the needs of critical safety-of-life applications such as civil aviation.

Satellite Navigation's Mission
SBAS/GBAS Implementation




Wide Area Augmentation System
Communication Satellite
GPS Satellites
L1
L1
Ground Earth Station
Wide Area Master Station
Wide Area Reference Station
FAA WAAS 01-37

Ground Based Augmentation System (GBAS) Architecture



Potential Benefits of GBAS

Category II & III **- Precision Approach Capability**

Remote Coverage **- Available to Areas Not Covered by SBAS**

Tailored Approaches **- To Avoid Obstacles, Noise Sensitive Areas, or Congested Airspace**

Multiple Runway Coverage **- One GBAS Will Serve the Entire Airport**

Aircraft Surface Navigation **- Aircraft Can Use GBAS as a Guide When Taxiing**

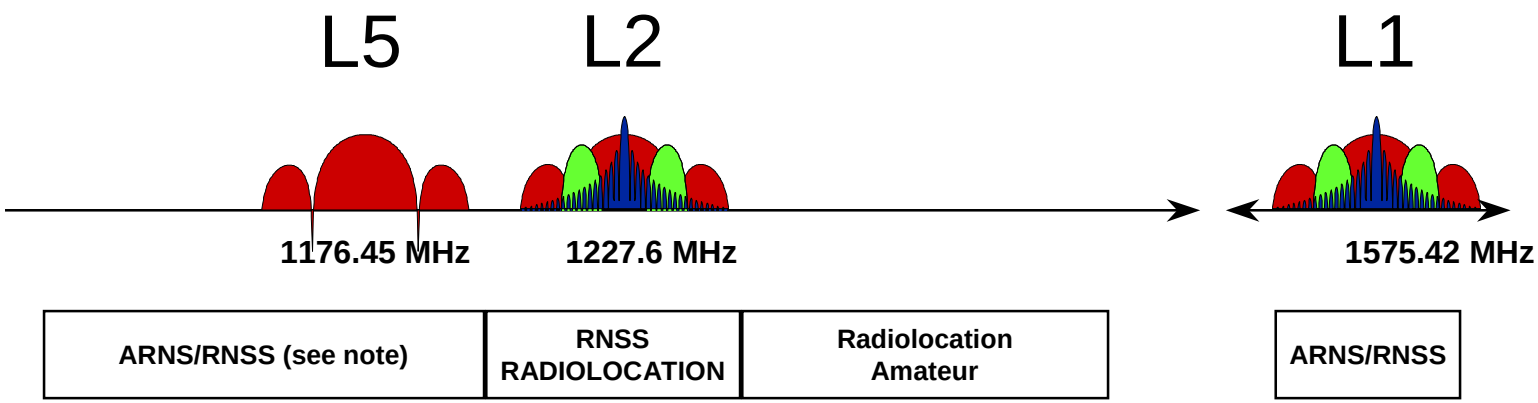
Modernization of GPS Element of GNSS

- GPS L2 signal, at 1227.60 MHz, will be made available for non-safety-critical applications. Available on satellites launching in 2003.

- A new civil GPS (L5) signal, at 1176.45 MHz, will be made available for critical safety-of-life applications. Goal is to implement L5 on satellites launching in 2005.

- Enhances availability and continuity to improve service to users.

Future GPS Frequency Plan



NOTE: At WRC-2000, a new primary allocation for RNSS in the 1164-1215 MHz band was approved. This will accommodate the new L5 frequency and planned Galileo system for safety-of-life applications.

Benefits of a New GNSS Signal

- Improved Safety benefit
  - Reduce the possibility of Controlled Flight into Terrain (CFIT)
  - ***Global Precision Approach capability*** will be the key mitigation for CFIT
  - Improved surface surveillance capability
    - Reduction in Runway Incursions
- Completely redundant satellite navigation service to L1
  - L5 will be implemented on both GPS and WAAS satellites
- Will Increase likelihood that international civil aviation can adopt sole-means and sole-service provider approach with satellite navigation
- Increased efficiency
  - Reductions in en route separations (both lateral and vertical)
- Improved ADS-B capability

Interference

- The addition of another ARNS-protected GPS signal (L5 at 1176.45 MHz) will greatly increase protection against interference

- This critical point was underscored in a GPS Risk Assessment Study performed by Johns Hopkins University Applied Physics Laboratory
  - "… second civil frequency, and the proposed higher signal power, will mitigate interference concerns"
  - Study was co-sponsored by ATA, AOPA, and FAA

- Likelihood that unintentional interference would affect flight operations is significantly reduced (i.e., the probability that both L1 and L5 would be simultaneously interfered with unintentionally is very low)

- FAA is still actively assessing the threat of intentional interference to civil aviation operations

Summary

The ICAO GNSS continues to be modernized and improved to provide added safety benefits and operational enhancements for international civil aviation