



***U.S. GPS/GNSS
International Activities
Update***

**UN/Mongolia Workshop on the
Applications of GNSS**

*Office of Space Affairs
U.S. Department of State*

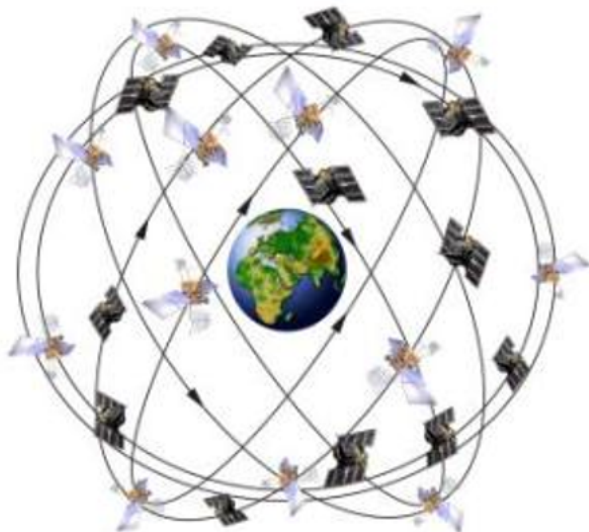
25-29 October 2021



GPS Constellation Status



37 Satellites • 30 Set Healthy
Baseline Constellation: 24 Satellites



Satellite Block	Quantity	Average Age (yrs)	Oldest
GPS IIR	7 (5*)	19.8	24.2
GPS IIR-M	7 (1*)	14.0	16.1
GPS IIF	12	7.8	11.4
GPS III	4 (1*)	1.5	2.8

*Not set healthy

As of 16 Oct 21

GPS Signal in Space (SIS) Performance

From 16 Oct 20 to 16 Oct 21

Average URE*	Best Day URE	Worst Day URE
48.6 cm	31.5 cm (20 Apr 21)	70.4 cm (13 Mar 21)

*All User Range Errors (UREs) are Root Mean Square values



GPS Modernization



Space Segment

SV families provide L-Band broadcast to User Segment

- | | | | | |
|---|---|---|---|---|
| GPS IIA/IIR <ul style="list-style-type: none"> • Basic GPS • Nuclear Detonation Detection System (NDS) | GPS IIR-M <ul style="list-style-type: none"> • 2nd Civil Signal (L2C) • New Military Signal • Increased Anti-Jam Power | GPS IIF <ul style="list-style-type: none"> • 3rd Civil Signal (L5) • Longer Life • Better Clocks | GPS III (SV01-10) <ul style="list-style-type: none"> • Accuracy & Power • Increased Anti-Jam Power • Inherent Signal Integrity • 4th Civil Signal (L1C) • Longer Life • Better Clocks | GPS IIIIF (SV11-32) <ul style="list-style-type: none"> • Unified S-Band Telemetry, Tracking & Commanding • Search & Rescue (SAR) Payload • Laser Retroreflector Array • Redesigned NDS Payload |
|---|---|---|---|---|

Control Segment

TT&C of Space Segment assets & distribution of data to user interfaces

- | | | | | |
|--|---|---|--|---|
| Legacy (OCS) <ul style="list-style-type: none"> • Mainframe System • Command & Control • Signal Monitoring | Architecture Evolution Plan (AEP) <ul style="list-style-type: none"> • Distributed Architecture • Increased Signal Monitoring Coverage • Security • Accuracy | OCX Block 0 <ul style="list-style-type: none"> • GPS III Launch & Checkout System GPS III Contingency Ops (COps) <ul style="list-style-type: none"> • GPS III Mission on AEP M-Code Early Use (MCEU) <ul style="list-style-type: none"> • Update OCS to operationalize Core M-Code for MGUE | OCX Block 1/2 <ul style="list-style-type: none"> • Fly Constellation & GPS III • Begin New Signal Control • Upgraded Information Assurance | OCX Block 2+ <ul style="list-style-type: none"> • Control all signals • Capability On-Ramps • GPS IIIIF Evolution |
|--|---|---|--|---|

User Segment

Applies Space and Control Segment data for PNT applications

- | | |
|---|---|
| Continued support to an ever-growing number of applications <ul style="list-style-type: none"> • Annual Public Interface Control Working Group (ICWG) • Standard Positioning Service (SPS) Performance Standard Updates • Precise Positioning Service (PPS) Enhancements • Sustained commitment to transparency • Visit GPS.gov for more info | Modernized Civil Signals <ul style="list-style-type: none"> • L2C (Various commercial applications) • L5 (Safety-of-life, frequency band protected) • L1C (Multi-GNSS interoperability) |
|---|---|



Wide Area Augmentation System (WAAS) Current Status

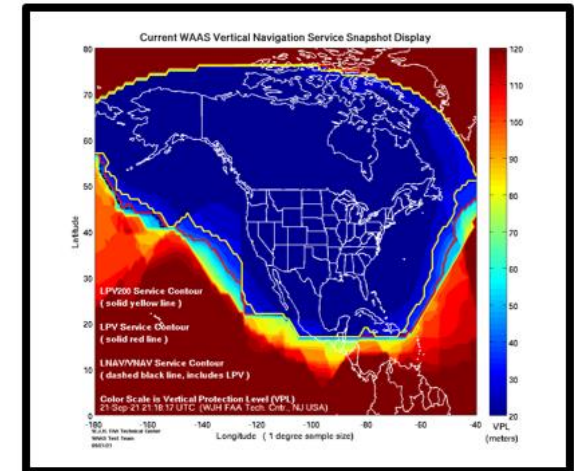


- Current WAAS provides high availability service to aviation user in North America
 - 4,086 Localizer Performance with Vertical Guidance (LPV) approaches in the NAS
 - Over 1050 LPVs are LPV-200's which provides CAT I equivalent instrument approach performance
- Preparing WAAS to take advantage of Dual Frequency service that will be provided by GPS
 - To continue high availability of WAAS vertical service during ionospheric disturbances
- GEO Sustainability
 - Currently maintaining 3 GEO's (Anik F1R [CRE], Eutelsat 117 WB [GEO 5], SES-15 [GEO 6])
 - Intelsat Galaxy 30 (GEO 7), launched August 2020, currently being integrated, expect operational in 2022

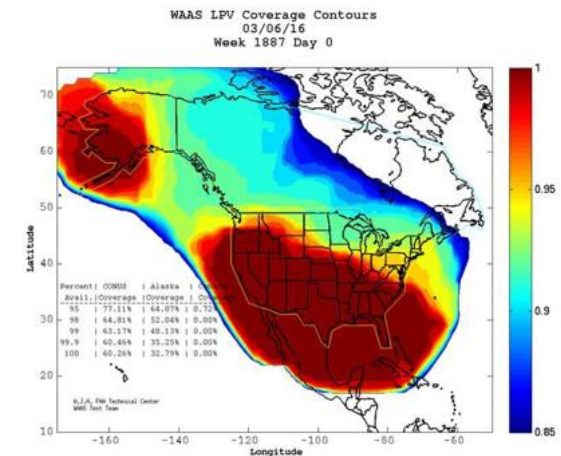
WAAS Modernization Efforts

- Dual Frequency Multi-Constellation (DFMC)
- Advanced Receiver Integrity Monitoring (ARAIM)

Current WAAS LPV Coverage



WAAS LPV Coverage March 6, 2016 Iono event





WAAS Avionics Equipage Status



- Over 144,000 WAAS equipped aircraft in the NAS
 - WAAS receivers provided by companies such as: Garmin, Universal, Rockwell Collins, Honeywell, Avidyne, Innovative Solutions & Support (IS&S), Thales and Genesys Aerosystem (Chelton)
- Since 2006, aircraft equipage rates have increased each year
- All classes of aircraft are served in all phases of Flight
 - Recent STC for Boeing 737-600/700/800 avionics
- Enabling technology for NextGen programs
 - Automatic Dependent Surveillance Broadcast (ADS-B)
 - Performance Based Navigation (PBN)





U.S. Space-based PNT Policy (2020 NSP & SPD-7)

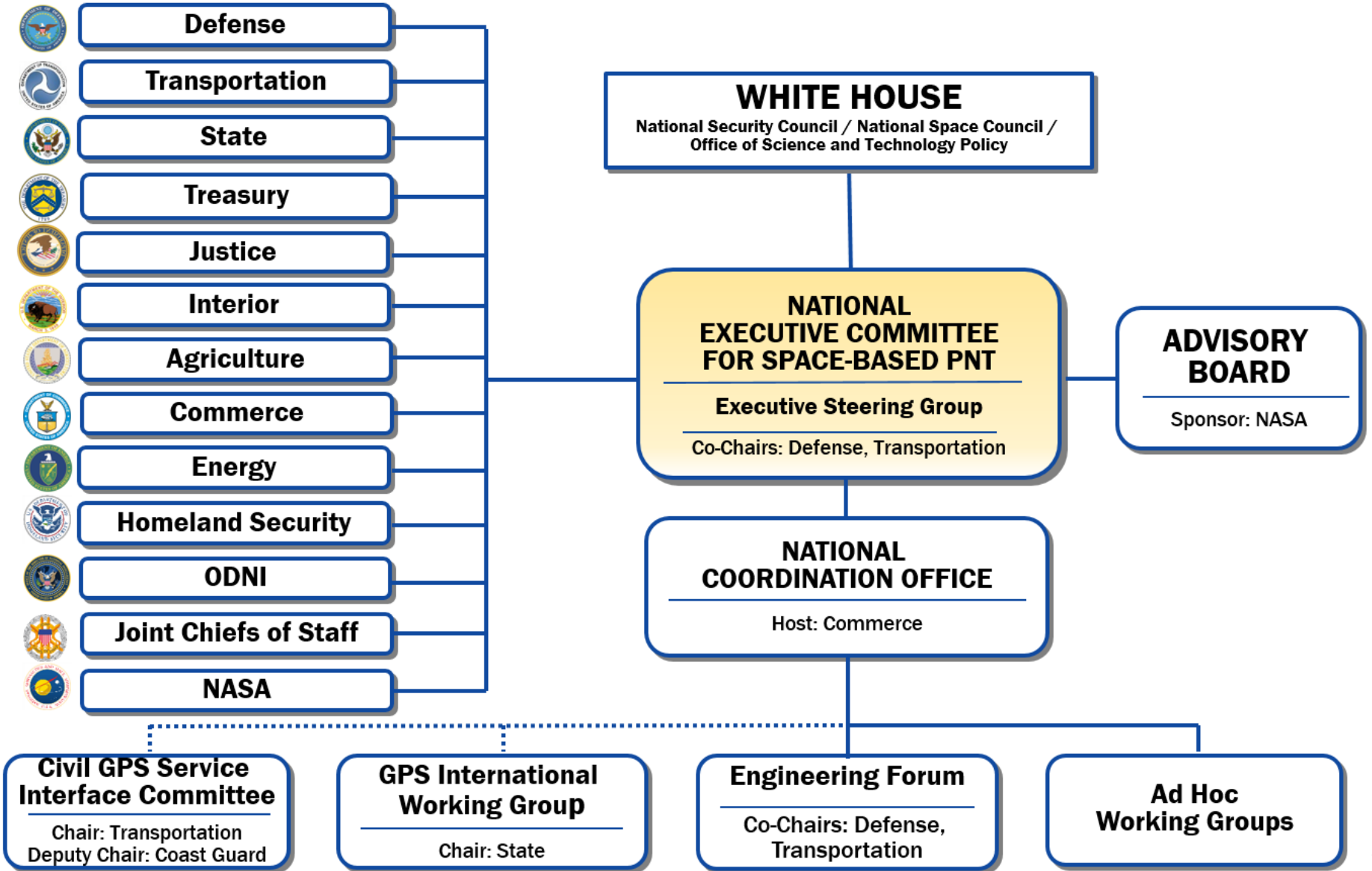


Maintain U.S. leadership in the service provision, and responsible use of GNSS, including GPS and foreign systems

- Ensure **compatibility** – ability of U.S. and non-U.S. space-based PNT services to be used separately or together without interfering with each individual service or signal
- Encourage **interoperability** – ability of civil U.S. and non-U.S. space-based PNT services to be used together to provide the user better capabilities than would be achieved by relying solely on one service
- Promote **transparency** in civil service provision and enable **market access** for U.S. industry
- Promote and support the **responsible use of GPS** as the pre-eminent space-based PNT service
- Foreign space-based PNT services may be used to complement civil GPS service
 - Receiver manufacturers should continue to improve security, integrity, and resilience in the face of growing cyber threats
- Encourage foreign development of PNT services and systems based on GPS
- Support international activities to **detect, mitigate, and increase resilience** to harmful disruption or manipulation of GPS



National Space-Based PNT Organizations





Bilateral International Cooperation



Europe

- GPS-Galileo Cooperation Agreement signed in 2004
- U.S.-EU Space Dialogue and three Working Groups meet regularly

Japan

- Comprehensive Space Dialogue held August 2020
- Technical Working Group discusses GPS and QZSS compatibility and interoperability

India

- U.S.–India Joint statement on GNSS Cooperation – 2007
- Civil Space Joint Working Group (CSJWG) met November 2019

China

- Three Working Groups and GNSS Plenary meeting held May 2018
- Joint Statement of Cooperation on Civil Signal Compatibility and Interoperability – November 2017



Multilateral International Cooperation



International Committee on GNSS (ICG)

- Pursuing a Global Navigation Satellite System-of-Systems to provide civil GNSS services that benefit users worldwide
 - Promote the use of GNSS and its integration into infrastructures, particularly in developing countries
 - Encourage compatibility and interoperability among global and regional systems
- U.S. priorities include spectrum protection, system interoperability and information dissemination
- 15th Meeting held in Vienna, Austria in September 2021
- UAE will host the 16th Meeting in 2022



For Additional Information...



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GPS.GOV

Official U.S. government information about the Global Positioning System (GPS) and related topics

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GPS: The Global Positioning System

A global public service brought to you by the U.S. government

INFORMATION FOR THE GENERAL PUBLIC

How to Correct Your Address in GPS Devices, Apps, & Online Maps



Do GPS devices show your home or business in the wrong place? The problem is not GPS! It's the mapping software.

[Report your issue to the software providers](#)

Common Questions →

- How do I add or correct my address in GPS devices, apps, and maps?
- What can I do about trucks driving through my neighborhood?
- How do I report GPS service outages?

FOR GPS PROFESSIONALS

What's **HOT** for Pros

- CGSIC St. Louis, Sep 20-21
- Technical documentation
 - ICD updates for 2021
 - Public ICWG meeting, Sep 29
 - PRN assignments, Jun 2021
- Ligado Networks and GPS
 - Secretary of Commerce letter to Senator Inhofe (PDF)
 - FCC order denying motion for stay
- U.S. Space-Based PNT Policy of 2021
- Recent presentations
- Funding & legislation
 - FY22 GPS funding & NDAA

News Items →

- Aug 18: Innovation is the game, GPS III-5 is the name
- Jul 1: GPS III SV05 receives operational acceptance

