Global Positioning System Status and Modernization

Civil GPS Service Interface Committee (GSIC)

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GPS Overview

Space Segment

Broadcasting since 1978

Control Segment

20 monitoring and
control stations worldwide

User Segment

Reaching over 4 billion
users every second

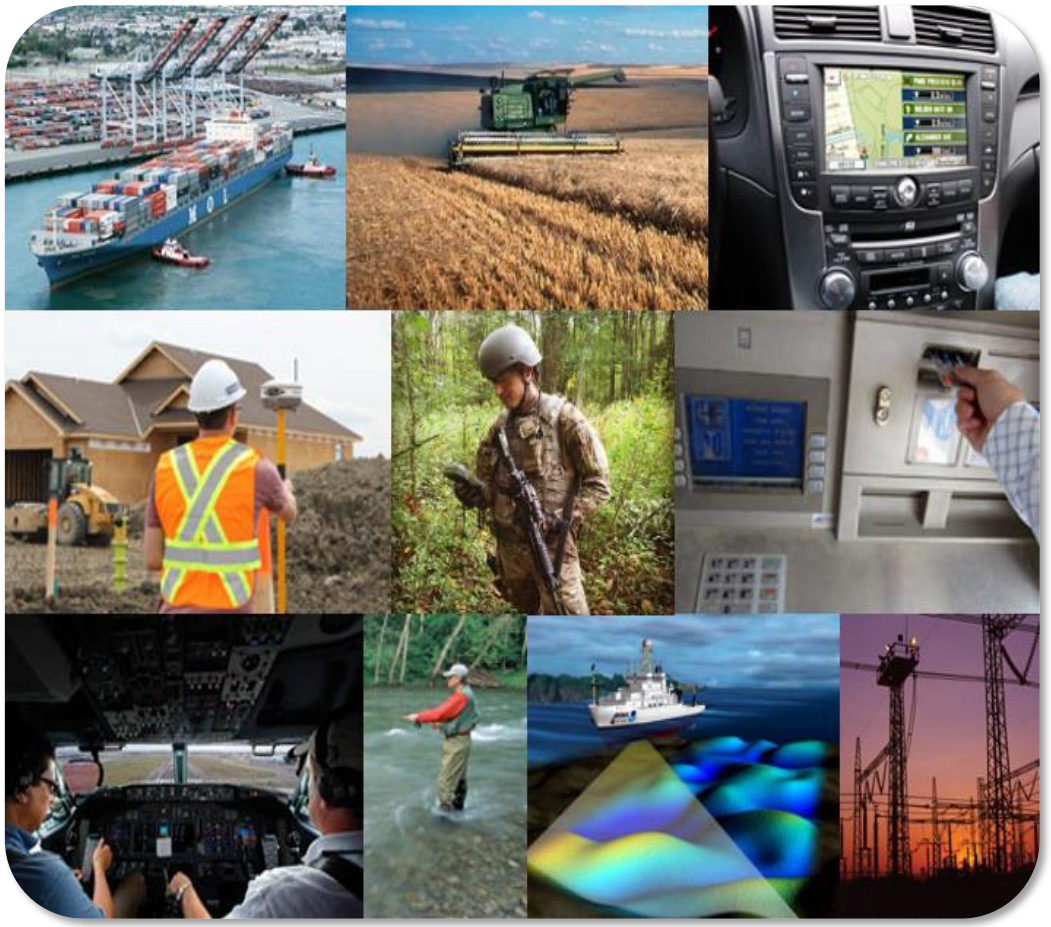
Committed to Cooperation

Department of Defense • Army • Navy • Air Force • Space Force • USMC • NGA • DISA • USNO • NSA • PNT EXCOM
National Nuclear Security Administration (NNSA) • Department of Transportation • Federal Aviation Administration
Department of Homeland Security • U.S. Coast Guard • International Civil Aviation Organization
Global Navigation Satellite Systems • Galileo • Beidou • GLONASS • QZSS • NAVIC
International Committee on GNSS • International Telecommunication Union

Global Impact of GPS

*https://www.gps.gov/governance/advisory/meetings/2019-11/gallaher.pdf

- GPS is utilized across the world with +4B users!
- GPS impacts almost every industry. Some of these industries include:
  - Agriculture
  - Maritime
  - Public Safety
  - Recreation
  - Space
  - Aviation
  - Finance
  - Telecommunications
  - Telematics
  - Oil/Gas
- GPS economic benefit ~$1.4 Trillion*



GPS consistently met all technical performance commitments: Accuracy, Integrity, Availability and Continuity

GPS Constellation Status

35 Satellites • 31 Set Healthy
Baseline Constellation: 24 Satellites

Satellite Block	Quantity	Average Age (yrs)	Oldest
GPS IIR	10 (2*)	18.6	23.1
GPS IIR-M	7 (1*)	12.9	14.9
GPS IIF	12	6.6	10.2
GPS III	2 (1*)	0.9	1.7

*Ops capable; not set healthy

As of 22 Aug 20

GPS Signal in Space (SIS) Performance

From 18 Aug 19 to 15 Aug 20

Average URE*	Best Day URE	Worst Day URE
52.2 cm	38.5 cm (1 Jun 20)	90.2 cm (26 Jul 20)

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

GPS Modernization

SPACE AND MISSILE SYSTEMS CENTER

Space Segment

SV families provide L-Band broadcast to User Segment

GPS IIA/IIR
- Basic GPS
- Nuclear Detonation Detection System (NDS)

GPS IIR-M
- 2nd Civil Signal (L2C)
- New Military Signal
- Increased Anti-Jam Power

GPS IIF
- 3rd Civil Signal (L5)
- Longer Life
- Better Clocks

GPS III (SV01-10)
- Accuracy & Power
- Increased Anti-Jam Power
- Inherent Signal Integrity
- 4th Civil Signal (L1C)
- Longer Life
- Better Clocks

GPS IIIF (SV11-32)
- 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)
- Mainframe System
- Command & Control
- Signal Monitoring

Architecture Evolution Plan (AEP)
- Distributed Architecture
- Increased Signal Monitoring Coverage
- Security
- Accuracy

OCX Block 0
- GPS III Launch & Checkout System

GPS III Contingency Ops (COps)
- GPS III Mission on AEP

M-Code Early Use (MCEU)
- Update OCS to operationalize Core M-Code

OCX Block 1/2
- Fly Constellation & GPS III
- Begin New Signal Control
- Upgraded Information Assurance

OCX Block 2+
- Control all signals
- Capability On-Ramps
- GPS IIIF Evolution

User Segment

Applies Space and Control Segment data for PNT applications

Continued support to an ever-growing number of applications
- 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
- L2C (Various commercial applications)
- L5 (Safety-of-life, frequency band protected)
- L1C (Multi-GNSS interoperability)

GPS III

- SV01 Set healthy and available for use on 13 Jan 20
- SV02 Set healthy and available for use on 1 Apr 20
- SV03 Operationally accepted 27 Jul 20
- SV04 Launch scheduled for 29 Sep 20
  - Second NSSL mission on a recoverable Falcon 9
- SV05 Declared Available for Launch 7 May 20
- SV06 Available for Launch Spring 2021
- SV07 TVAC forecast completion Sep 2020
- SV08 Core Mate completed 15 Apr 20
- SV09-10 Component deliveries in progress

Fourth GPS III satellite launch scheduled 29 Sep

GPS III Follow-On (GPS IIIF)

- GPS IIIF additional features
  - Regional Military Protection (RMP) and redesigned Nuclear Detonation Detection System (NDS)
  - Search-and-Rescue (SAR) payload – faster detection and location of distress signals
  - Laser Retroreflector Array (LRA) – provides more precise ranging data
- Partnering with Air Force Research Laboratory (AFRL) for future technology opportunities
  - Digital Reprogrammable Payloads
  - Demo on Navigation Technology Satellite (NTS-3)
  - Near Real-Time Commanding/Crosslinks
- Status: Design Phase Completed 13 Jul 20; SV11 launch forecasted for 2026

Ensuring the Gold Standard today and into the future

Next Generation Operational Control System (OCX)

- Next-generation command, control and cyber-defense for GPS
  - Enhanced command and control capability
  - Modernized architecture
  - Robust information assurance and cyber security
- Incremental Development
  - OCX Block 0: Launch and Checkout System (LCS) for GPS III
  - OCX Blocks 1 and 2: Controls and manages all GPS IIR, GPS IIR-M, GPS IIF, and GPS III spacecraft; and controls all legacy and new GPS signals
- Current Status
  - LCS successfully supported GPS III SV01, SV02, and SV03 Launch and Checkout
    - Exceeding operational requirements for availability and dependability
  - OCX Block 1 software coding complete – 12 Aug 19
  - System integration and verification ongoing
  - Ready to Transition to Operations: 4QCY22

OCX program continues to execute and meet schedule


global utility
uninterrupted service
strength through partnership
gold standard
GPS