

Space & Missile Systems Center



GPS Program Status

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GPS Overview

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Civil Cooperation

- 3+ Billion civil & commercial users worldwide
- Search and Rescue
- Civil Signals
 - L1 C/A (Original Signal)
 - L2C (2nd Civil Signal)
 - L5 (Aviation Safety of Life)
 - L1C (International)



Spectrum

- World Radio Conference
- International Telecommunication Union
- Bilateral Agreements
- Adjacent Band Interference



Department of Transportation

- Federal Aviation Administration

Department of Homeland Security

- U.S. Coast Guard

34 Satellites / 31 Set Healthy Baseline Constellation: 24 Satellites

Satellite Block	Quantity	Average Age	Oldest
GPS IIA	1	25.4	25.4
GPS IIR	11	17.1	21.6
GPS IIR-M	7	11.6	13.4
GPS IIF	12	5.1	8.8
Constellation	31	11.5	25.4

AS OF 6 MAR 19



Department of Defense

- Services (Army, Navy, AF, USMC)
- Agencies (NGA & DISA)
- US Naval Observatory
- PNT EXCOM
- GPS Partnership Council

Maintenance

- Develop & Publish ICDs Annually
 - Public ICWG: Worldwide Involvement
 - Materials Available at: gps.gov/technical/icwg
- Update GPS.gov Webpage
- Distribute PRNs for the World
 - 120 for US and 90 for GNSS

International Cooperation

- 57 Authorized Allied Users
 - 25+ Years of Cooperation
- GNSS
 - Europe - Galileo
 - China - Beidou
 - Russia - GLONASS
 - Japan - QZSS
 - India - NAVIC



GPS Modernization

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Space Segment

SV families provide L-Band broadcast to User Segment

Legacy (GPS IIA/IIR)

- Basic GPS
- NUDET (Nuclear Detonation) Detection System (NDS)



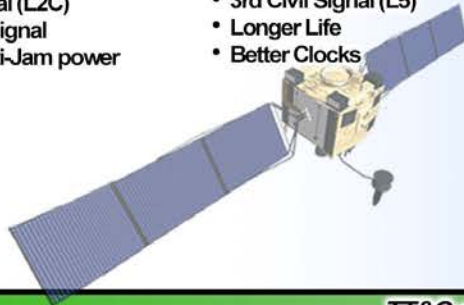
GPS IIR-M

- 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
- Common L1C Signal
- Longer Life



GPS III (SV11+)

- Unified S-Band Telemetry, Tracking & Commanding
- Search & Rescue (SAR) Payload
- Laser Retroreflector Array
- Redesigned NDS Payload



Ground Segment

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

Legacy (OCS)

- Mainframe System
- Command & Control
- Signal Monitoring

AEP

- Distributed Architecture
- Increased Signal Monitoring Coverage
- Security
- Accuracy
- Launch And Disposal Operations



OCX Block 1

- Fly Constellation & GPS III
- Begin New Signal Control
- Upgraded Information Assurance

OCX Block 2+

- Control all signals
- Capability On-Ramps
- GPS III Evolution

OCX Block 0

- GPS III Launch & Checkout

GPS III Contingency Ops (COPs)

- GPS III Mission on AEP

User Segment

Applies Space and Control Segment data for PNT applications

Modernized Civil Signals

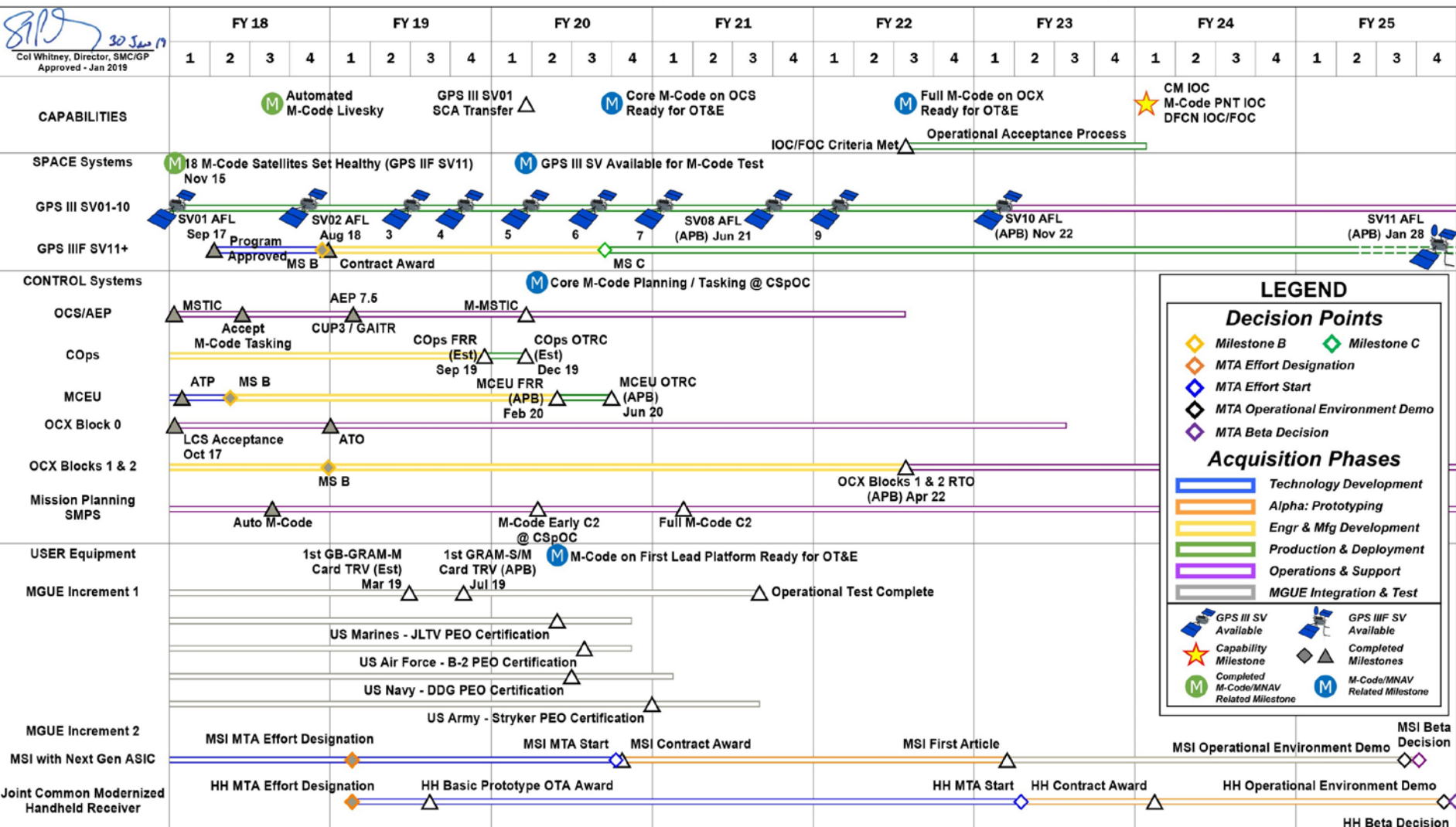
- L1C
- L2C
- L5



Continued support to an ever-growing number of applications

- Annual Public Interface Control Working Group
- Imminent update of SPS Performance Standard
- Sustained commitment to transparency, renew focus on agility

GPS Enterprise Roadmap



AEP	Architecture Evolution Plan	CSpOC	Combined Space Operations Center	GB-GRAM-M	Ground Based GPS Receiver	MGUE	Military GPS User Equipment	OT&E	Operational Test and Evaluation
AFL	Available for Launch	CUP	COTS Upgrade Project	GRAM-S/M	Application Module - Modernized GPS Receiver Application Module - Standard Elec Module/Modernized Handheld	M-MSTIC	Modernized-Monitor Station Tech Improvement & Capability	OTRC	Ops Test Readiness Certification
APB	Acquisition Program Baseline	DDG	Arleigh Burke Guided Missile Destroyer	HH	Initial Operating Capability	MS	Milestone	PEO	Program Executive Officer
ASIC	Application-Specific Integrated Circuit	DFCN	Dual-Frequency Civil Navigation	IOC	Joint Light Tactical Vehicle	MSI	Miniature Serial Interface	PNT	Positioning, Navigation & Timing
ATO	Authority to Operate	Est	Forecast Estimate	JLTV	GPS III Launch & Checkout System	MTA	Middle Tier Acquisition	RTO	Ready for Transition to Ops
ATP	Authority to Proceed	FOC	Full Operational Capability	LCS	M-Code Early Use	OCS	Operational Control System	SCA	Spacecraft Control Authority
C2	Command & Control	FRR	Fielding Readiness Review	MCEU		OCX	Next Gen Operational Control System	SMPS	SAASM Mission Planning System
CM	Constellation Management	GAITR	Ground Antenna Interface Technical Refresh			OTA	Other Transaction Agreement	SV	Space Vehicle
COps	GPS III Contingency Operations							TRV	Technical Requirements Verification



GPS III Space Vehicles (SVs)

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GPS III

- Modernized civil signals
- Longer design life
- Increased accuracy
- Improved anti-jam

SV02 Launch 2019

Gold Standard Since 1993

SV08

SV07

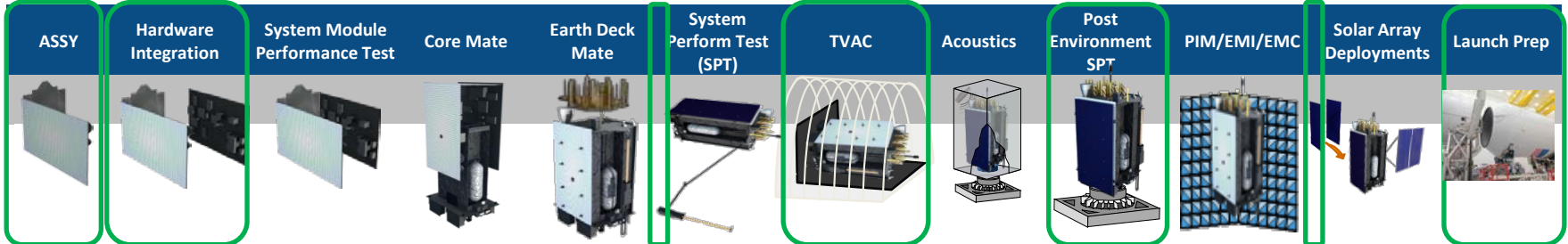
SV06

SV05

SV04

SV03

SV02





GPS IIIF Space Vehicles (SVs)

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- Follow-on production of GPS III satellites
 - ☐ Modernization
 - ☐ Recapitalization
 - ☐ Resiliency
- Contract awarded to Lockheed Martin in Sep 2018
- Strategic on-ramps technology insertion
 - ☐ Digital Payloads
 - ☐ High Power Amplifiers
 - ☐ Advanced Clocks
 - ☐ Near Real-Time Commanding/Crosslinks

Ensuring the Gold Standard today and into the future

Space Starts Here



Next Generation Operational Control System (OCX)

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- Incremental Development
 - Block 0 Launch and Checkout System (LCS)
 - Block 1/2 Operational Control System
- Current Status
 - LCS supported GPS III SV01 launch on 23 Dec 18
 - Continues to function nominally during SV01 on-orbit checkout and testing (OOCT)
 - Preparing to support SV02 launch in 4QFY19
 - Block 1/2 development continues to meet milestones
 - Ready to Transition to Operations: 2Q 2022
- Enhanced command and control capability
- Modernized, agile architecture



OCX program continues to execute and meet schedule



GPS III Contingency Operations (COps)

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- Limited operations for GPS III SVs until OCX Block 1/2 delivery
 - Provides legacy and modernized civil signal operations
 - Uses OCX Block 0 for GPS III launch, major anomaly, & disposal capabilities
- Software Development
 - Risk reduction modification to current control system
 - Four incremental software builds
- Current Status
 - Software development completed Jun 2018
 - Operational Acceptance: Apr 2020

COps is a critical bridge, enabling sustainment of legacy signals for GPS III



GPS Director's Perspectives

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- GPS is the Global Utility
 - Committed to maintaining uninterrupted service
 - “The Gold Standard”
- Continue to enhance GPS resiliency by:
 - Addressing near-term needs with current efforts
 - Identifying opportunities for resiliency improvements
 - Maturing technical needs for future use
- Appreciate the need for alternative PNT sources, and challenge the community (labs, industry, others) to propose & explore solutions
- Exploring & expanding multi-GNSS potential



GPS Firsts!

GPS III SV01 successful launch
on a Falcon 9 on Dec 23, 2018

Next Generation Operational Control
System (OCX) Block 0 performed
nominally during the successful
launch of GPS III SV01

THE GOLD STANDARD FOR PNT



the men and women of the
GLOBAL POSITIONING SYSTEMS DIRECTORATE
home of the gps green monsters

Acquisition professionals delivering the Gold Standard in Space-Based PNT & NDS Services