GPS Enterprise Modernization Briefing

PNT Advisory Board
9 Dec 2021

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Approved for Public Release

GPS Overview

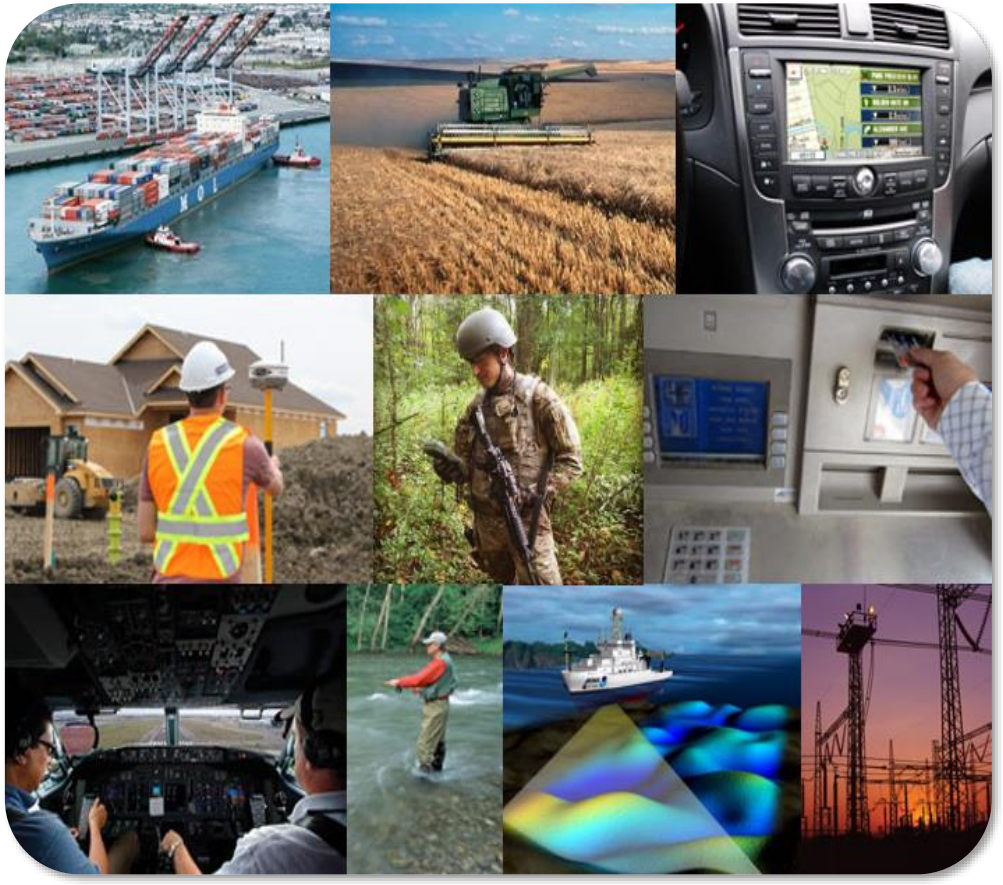
Committed to Cooperation

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 over 4 billion 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

37 Satellites • 30 Set Healthy
Baseline Constellation: 24 Satellites

Satellite Block	Quantity	Average Age (yrs)	Oldest
GPS IIR	7 (5*)	19.9	24.3
GPS IIR-M	7 (1*)	14.1	16.2
GPS IIF	12	7.8	11.5
GPS III	4 (1*)	1.6	2.9

*Not set healthy

As of 20 Nov 21

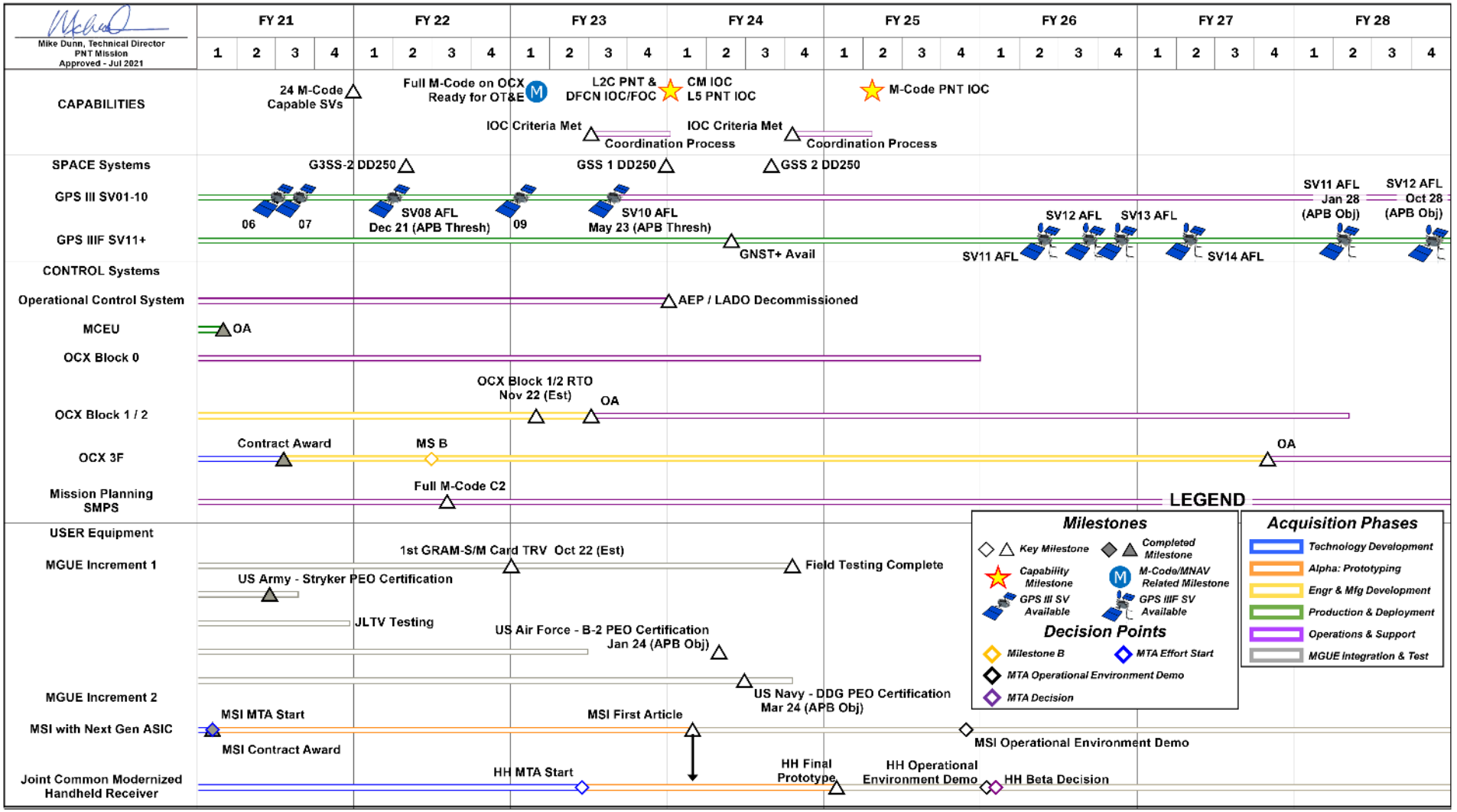
GPS Signal in Space (SIS) Performance

From 20 Nov 20 to 20 Nov 21

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

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

GPS Enterprise Roadmap



AEP	Architecture Evolution Plan	DFCN	Dual-Frequency Civil Navigation	GSS	GPS Satellite Simulator	MNAV	Military Navigation	OT&E	Operational Test and Evaluation
AFL	Available for Launch	Est	Forecast Estimate	HH	Handheld	MS	Milestone	PEO	Program Executive Officer
APB	Acquisition Program Baseline	FOC	Full Operational Capability	IOC	Initial Operating Capability	MSI	Miniature Serial Interface	PNT	Positioning, Navigation & Timing
ASIC	Application-Specific Integrated Circuit	GRAM-S/M	GPS Receiver Application Module – Standard Elec Module/Modernized	JLTV	Joint Light Tactical Vehicle	MTA	Middle Tier Acquisition	RTO	Ready for Transition to Ops
C2	Command & Control			LADO	Launch, Anomaly, and Disposal Operations	OA	Operational Acceptance	SMPS	SAASM Mission Planning System
CM	Constellation Management	G3SS	GPS III Satellite Simulator	MCEU	M-Code Early Use	Obj	Objective Date	SV	Space Vehicle
DDG	Arleigh Burke Guided Missile Destroyer	GNST+	GPS IIIF Non-Flight Satellite Testbed	MGUE	Military GPS User Equipment	OCX	Next Gen Operational Control System	TRV	Technical Requirements Verification

Global Positioning System (GPS) III

- Current Status
  - SV01 Operationally accepted on 2 Jan 20
  - SV02 Operationally accepted on 27 Mar 20
  - SV03 Operationally accepted on 27 Jul 20
  - SV04 Operationally accepted on 1 Dec 20
  - SV05 launched 17 Jun 21, Operationally accepted 29 Jun 21 and currently in test
  - SV06 Declared Available for Launch 5 Apr 21
  - SV07 Declared Available for Launch 20 May 21
  - SV08 Declared Available for Launch 10 Jun 21
  - SV09 System-level testing in progress
  - SV10 Component deliveries and installations in progress
- Upcoming Milestones
  - SV09 Thermal Vacuum testing planned for Fall 2021
  - SV10 Thermal Vacuum testing planned for Spring 2022

GPS III Follow-On (GPS IIIF)

- Current Status
  - Contract Awarded 26 Sep 18
  - Critical Design Review (CDR) 2 Mar 20
  - Milestone C 13 Jul 20
  - GPS IIIF SV13 & SV14 purchased Oct 2020
  - Implementation Design Review (IDR) 10 Dec 20
  - Planned use of evolved/common bus on SV13+
  - Integrated Baseline Review (IBR) 6 May 21
  - GPS IIIF SV11 Available for Launch (AFL) 2QFY26
  - GPS IIIF SV12 AFL 3QFY26
- Upcoming Milestones
  - GPS IIIF Non-Flight Satellite Testbed (GNST+) completion planned for Winter 2024
  - GPS IIIF SV11 Thermal Vacuum testing planned for Winter 2024

Next Generation Operational Control System (OCX)

- Current Status
  - GPS III Launch & Checkout System (LCS) successfully supported launch of GPS III SV01-05 and transfer to 2SOPS
  - Addressed IBM obsolescence issue by awarding a modification to accelerate incorporation of Hewlett Packard Enterprise (HPE) replacement
  - Completed 17 of 17 Monitor Station installations (Jul 2021)
  - System integration and verification ongoing

- Upcoming Milestones
  - Next Generation Operational Control System (OCX) Certificate of Conformance Complete (Dec 2021)
  - Ready to Transition to Operations projected 4QCY22

OCX program continues to execute within baseline

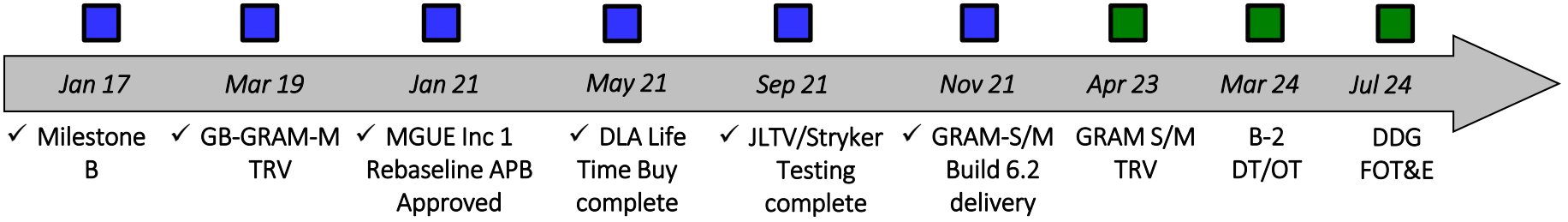
Next Generation Operational Control System (OCX) 3F

- Current Status
  - Awarded Next Generation Operational Control System (OCX) 3F Contract Award ($283M, Apr 2021)
  - Startup Activities ongoing; program will modify adaptive architecture of OCX Blocks 1 and 2 software baseline to launch and control enhanced GPS IIIF satellite capabilities
- Upcoming Milestones
  - Milestone B (1QCY22)
  - Handover to Sustainment (3QCY25)
  - Operational Acceptance (3QCY27)

OCX 3F program continues to execute and meet schedule

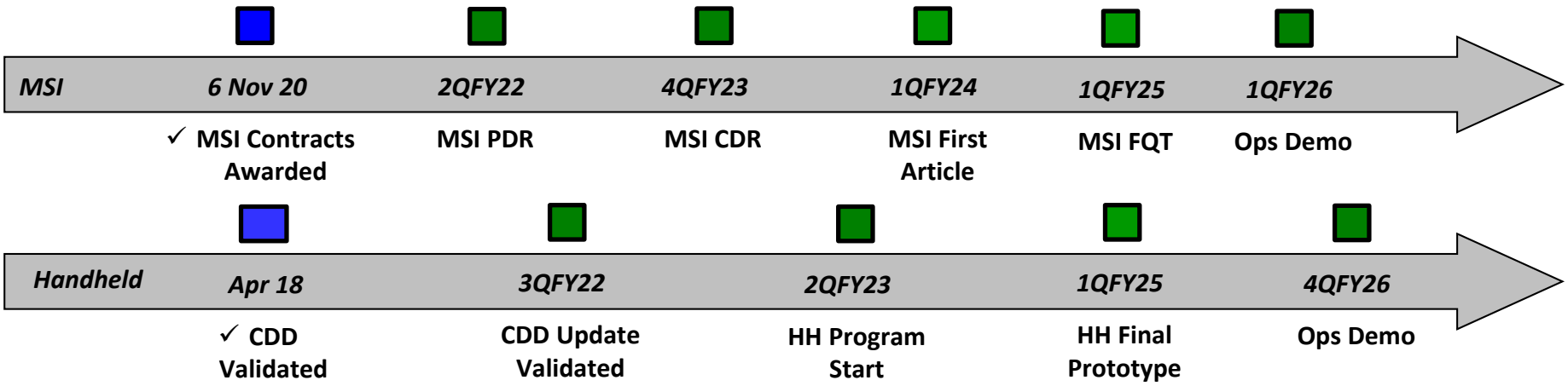
Military GPS User Equipment (MGUE) Increment (Inc) 1

- Current Status
  - MGUE Inc 1 provides warfighters with the M-Code capable GPS receivers required to access Modernized GPS improvements, primarily enhanced anti-jam and spoofing resistance
  - MGUE Inc 1 develops and field-tests M-Code receiver-cards for Ground and Aviation/Maritime Lead Platforms. Services responsible for all receiver procurement
  - Defense Logistics Agency (DLA) awarded ASIC Life Time Buy contracts to preserve $1.2B investment in MGUE Inc 1 receivers—enables M-Code receiver production for next 8-9 years
  - USMC Joint Light Tactical Vehicle (JLTV) Field Utility Evaluation (FUE) is scheduled to conclude on 14 Sep 21. US Army will leverage data from the JLTV FUE in lieu of a separate field test for their Mounted and Dismounted Assured PNT solutions
  - USAF B-2 and USN Guided Missile Destroyer (DDG) testing currently scheduled to conclude by Fall 2024, completing MGUE Inc 1 field testing on all Lead Platforms
- Upcoming Milestones



Military GPS User Equipment (MGUE) Increment (Inc) 2

- Current Status
  - MGUE Inc 2 matures the Next-Gen ASIC (NGA) technology required for all weapon system platforms to provide functionality & backwards compatibility
  - MGUE Inc 2 will deliver a production-ready Miniature Serial Interface (MSI) Receiver Card in 1QFY26 to support Handheld (HH) and ground applications
  - MGUE Inc 2 will deliver a Joint Common Handheld to replace the Defense Advanced GPS Receiver (DAGR)
- Upcoming Milestones:



Back-Ups

Acronyms

AFL	Available for Launch
ASIC	Application Specific Integrated Circuit
CDD	Capability Development Document
CDR	Critical Design Review
DAGR	Defense Advanced GPS Receiver
DDG	Arleigh Burke Guided Missile Destroyer
DT	Developmental Testing
FOT&E	Follow-on Operational Test and Evaluation
FQT	Formal Qualification Testing
FUE	Field User Evaluation
GNST+	GPS IIIF Non-flight Satellite Test Bed
GRAM–S/M	GPS Receiver Application Module – Standard Elec Module/Modernized
HH	Handheld
HPE	Hewlett Packard Enterprise
IBM	International Business Machines
IBR	Integrated Baseline Review
IDR	Implementation Design Review
JTLV	Joint Light Tactical Vehicle
LCS	Launch and Checkout System
MGUE	Military GPS User Equipment
MSI	Miniature Serial Interface
OCX	Operational Control System
OT	Operational Testing
PDR	Preliminary Design Review
PNT	Positioning, Navigation, and Timing
SIS	Signal-in-Space
TRV	Technical Requirements Verification
URE	User Range Error
USAF	United States Air Force
USMC	United States Marine Corps
USN	United States Navy