



Modernizing PNT for a Resilient Future

Assured PNT Summit

May 29, 2024

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Agenda

- **Great Power Competition: A Case for Change**
- **Enterprise Modernization: Sustainment and Resilience**
- **Architecture Investments / Focus Areas**
- **Supporting the Warfighter: Military Code**
- **Resilient GPS (R-GPS)**

Great Power Competition (GPC)

“Great Power Competition involves rival nations with global interests, reach, and influence vying to be the preeminent actor in international politics. This means that great power competition occurs on a global scale.”

The Case for Change, Gen Saltzman, CSO USSF
12 February 2024

THE CASE FOR CHANGE

Optimizing for Great Power Competition





Civil Sustainment and Military Resilience

Architecture operationally ready for Great Power Conflict

Legacy Capabilities



Civil Signals (L1-L5)

- Legacy (OCS)
- Mainframe System
 - Command & Control
 - Signal Monitoring



Legacy (PLGR/GAS-1/MAGR)

- First Generation System

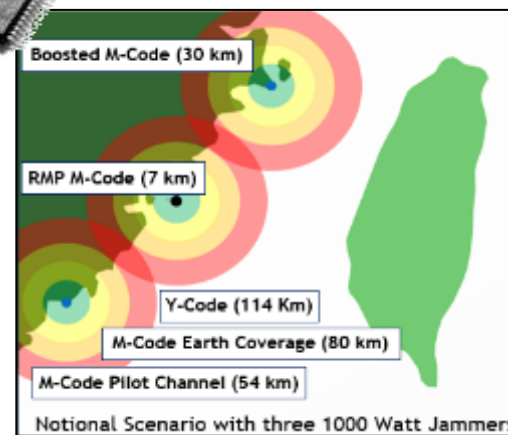
Great Power Conflict-Ready Capabilities



Military GPS User Equipment (MGUE) Inc 1 & 2



OCX



M-Code and RMP





Space: Essential to the Joint Fight



“Space had become integral to virtually every combat operation whether it is on land, sea, undersea, or in the air”
- Gen (Ret) Kevin Chilton, former Air Force Space Command Commander (2007)



“Our space capabilities are central to our ability to project power anywhere on the globe...they contribute to every aspect of the Joint multi-dimensional battle networks we assemble to fight and prevail over any opponent.”
- Mr. Bob Work, Former Dep. Secretary of Defense (2016)



“If we lose our access and ability to operate freely in space...we all lose.”
- Gen (Ret) Jay Raymond, Inaugural Chief of Space Operations (2022)

“If space is off plan, then I’m off plan.”
- Admiral Samuel Paparo, USINDOPACOM Commander (2023)



“The joint force will not succeed without the support provided from space and that joint force will not survive if our adversaries are allowed to operate in space with impunity.”
- Mr. Frank Kendall, Secretary of the Air Force (2024)



Commercial Space Strategy

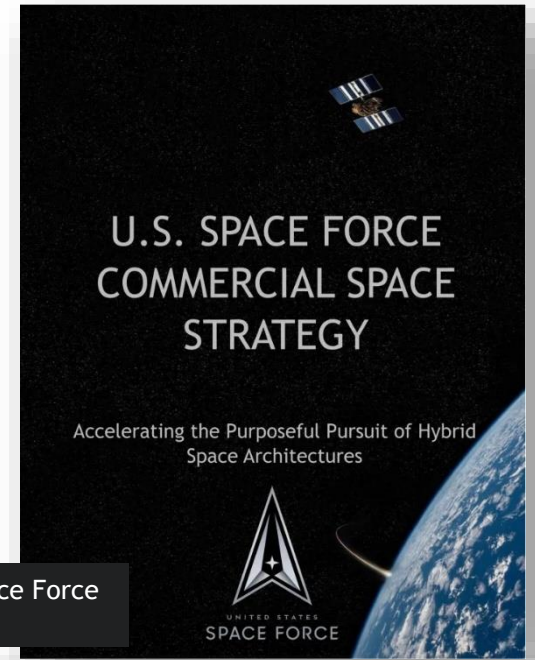
Institutionalize and operationalize commercial capabilities by integrating space goods, services, and activities

Priority mission areas for new commercial integration:

- Tactical Surveillance, Reconnaissance, and Tracking
 - Space-Based Environmental Monitoring
 - **Positioning, Navigation, and Timing**
 - Space Access, Mobility and Logistics
-

Decision-making criteria to leverage commercial space solutions

1. Operational Utility
2. Feasibility
3. Resilience by Design
4. Speed to Fielding





Commercial Space Strategy Implementation

Lines of Effort

- Collaborative Transparency
 - Capabilities and limitations (government and partners)
- Operational and Technical Integration
 - Integrate commercial space solutions into a hybrid space architecture
- Risk Management
 - Collective effort
- Securing our Future
 - Prioritize science and technology; continually assess the operating environment



Commercial Integration: Capability Development Initiatives



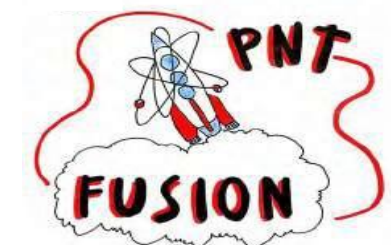
SpaceWERX Tactical Finance Opportunities

SpaceWERX/AFWERX Alt PNT Challenge

- 122 responses from industry
- Awards: 20 x \$1.9 Million

AltPNT Challenge Solicitation Focus Areas

- Non-Radio Frequency (RF) PNT: Develop PNT that is not based on electromagnetic signals.
- Alternative Space-Based PNT: Develop space-based PNT from other non-Global Navigation Satellite System sources.
- PNT Fusion: Develop techniques and algorithms for fusing multiple independent sources of PNT.
- PNT Assurance and Integrity: Develop and mature GPS and GNSS signal integrity and PNT assurance techniques to validate signals broadcast in a multi-GNSS environment.
- PNT Situational Awareness (SA), Monitoring: Enhanced capabilities to monitor the global GNSS spectrum environment.
- PNT Innovation Center: Define, develop, and equip a government-funded Alternative PNT Innovation Center.





GPS Enterprise Modernization

SPACE SEGMENT (SATELLITES)

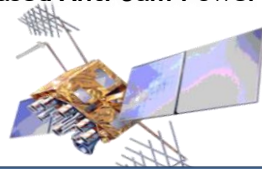
Legacy (GPS IIA/IIR)

- 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
- 4th Civil Signal (L1C)
- Longer Life
- Improved Clocks

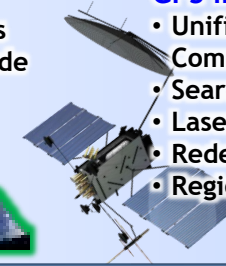
R-GPS

- pMEO satellites
- Legacy & M-Code



GPS IIIIF (SV11-32)

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



CONTROL SEGMENT (GROUND)

Legacy (OCS)

- Mainframe System
- Command & Control
- Signal Monitoring

Architecture Evolution Plan (AEP)

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



OCX Block 0

- GPS III Launch & Checkout

GPS III Contingency Ops (COps)

- GPS III Mission on AEP

M-Code Early Use (MCEU)

- Update OCS to operationalize Core M-Code on AEP

OCX Block 1

- Fly Constellation & GPS III
- Control New Signals
- Upgrade Cyber Security

OCX Block 2

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

OCX Block 3F

- Incorporates GPS IIIIF Command & Control
- Tasks RMP and new NavWar capabilities



USER SEGMENT (RECEIVERS)

Legacy (PLGR/GAS-1/MAGR)

- First Generation System



SAASM-era User Equipment

- Anti-Jam capability
- Electronic Protection



Military GPS User Equipment

- M-Code Receivers
- Common GPS Modules
- Increased Access Power w/ M-Code
- Increased Accuracy
- Increased Availability
- Increased Anti-Tamper Anti-Spoof
- Increased Acquisition in Jamming



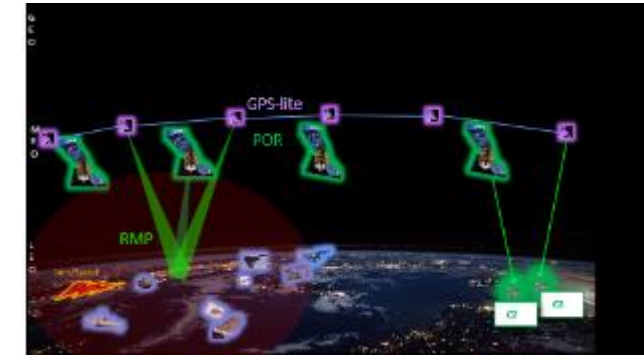
Visit GPS.gov for more info



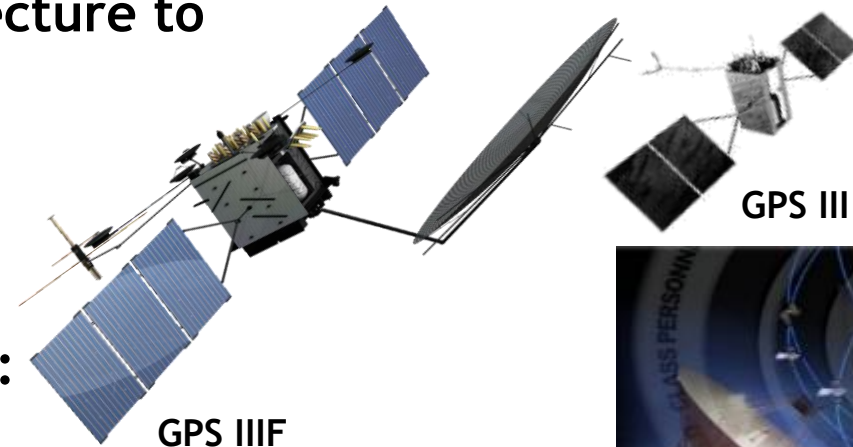
Architecture Modernization Focus Areas

Objectives:

- Sustain GPS as a worldwide civil utility while modernizing it to counter current and emerging military PNT threats.
- Pursue complementary solutions in a flexible architecture to lead-turn the threat.
- Strategic drivers: threats, dependence on GPS
- Architecture attributes: resiliency, flexibility
- FY24 Presidential Budget supported PNT capabilities:
 - ✓ GPS sustained for military and civil users
 - ✓ High power regional signal to improve resiliency
 - ✓ Builds GPS resiliency capabilities within Proliferated Space Warfighting Architecture
 - ✓ Smaller form-factor GPS chips compatible with selected other satellite navigation signals



GPS-Lite



GPS III F

GPS III

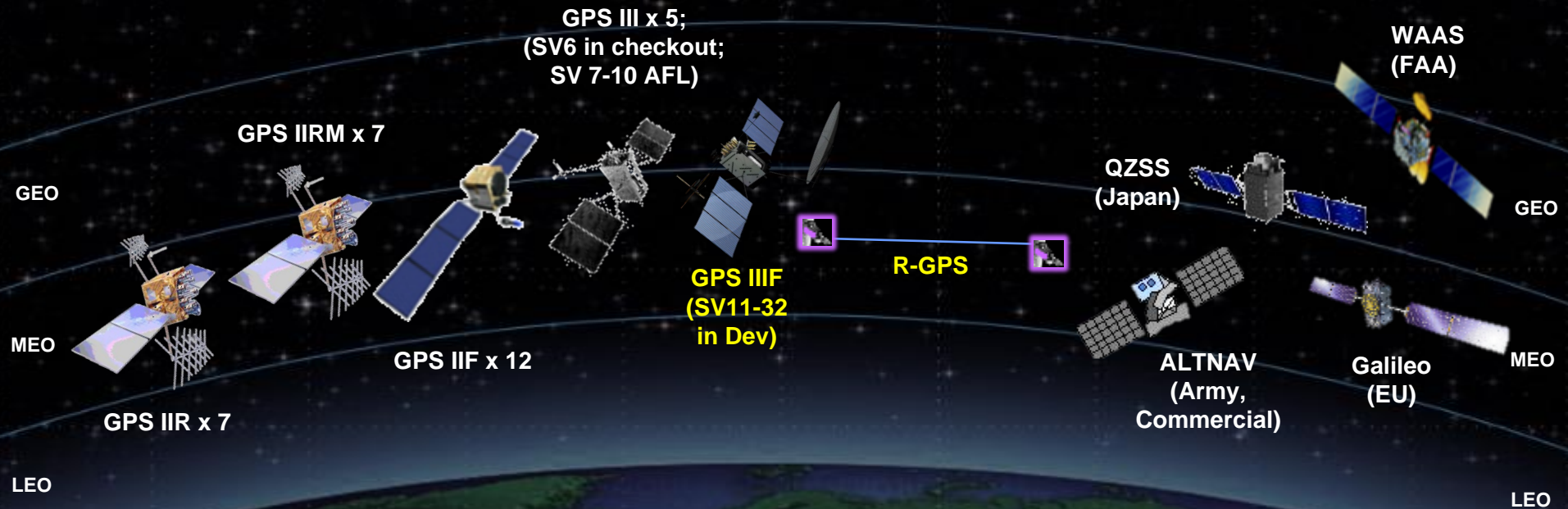


OCX

Military GPS User
Equipment (MGUE)
Increment 2



FY2025 PNT Architecture Investments



GPS OCX
GPS OCX 3F

DoD PNT User Equipment (UE)

Legacy GPS UE

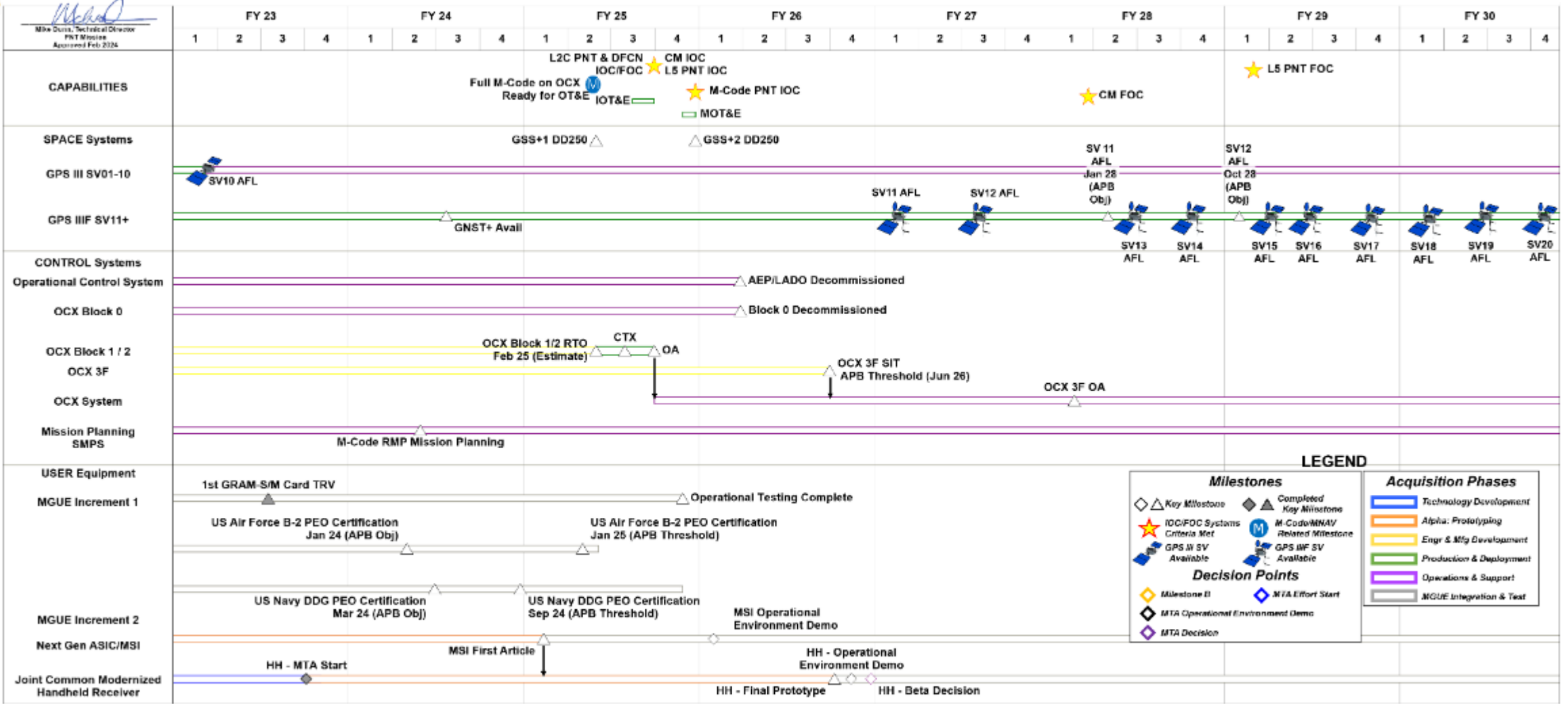
Military GPS User Equipment (MGUE) Increment 1

MGUE Increment 2 (Compatible with ALTNAV, MGNSS, RMP)

Yellow = FY25 PB Investments



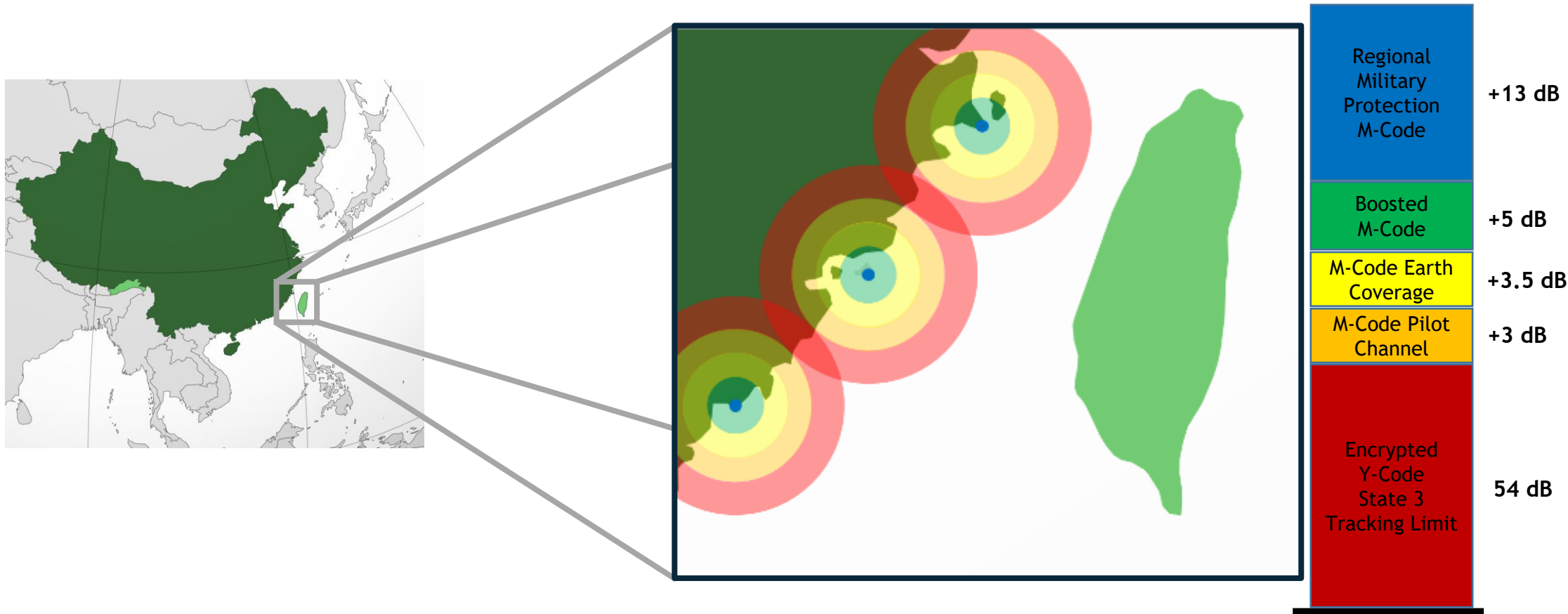
GPS Enterprise Roadmap



APB	Architecture Evolution Plan	DFCN	Dual-Frequency Civil Navigation	HH	Handheld	MOT&E	Multi-Service Operational Test & Evaluation	PNT	Positioning, Navigation & Timing
AFL	Available for Launch	FOC	Full Operational Capability	IOC	Initial Operating Capability	MSI	Miniature Serial Interface	RMP	Regional Military Protection
APB	Acquisition Program Baseline	GRAM-SM	GPS Receiver Application Module - Standard Elec Module/Modernized	IOT&E	Initial Operational Test & Evaluation	MTA	Middle Tier Acquisition	RTO	Ready for Transition to Ops
ASIC	Application-Specific Integrated Circuit	G3SS	GPS III Satellite Simulator	JLTV	Joint Light Tactical Vehicle	OA	Operational Acceptance	SMPS	SAASM Mission Planning System
CM	Constellation Management	GNST+	GPS IIF Non-Fight Satellite Testbed	LADO	Launch, Anomaly, and Disposal Operations	OCX	Next Gen Operational Control System	SIT	System Integration Test
CTX	Constellation Transfer	GSS	GPS Satellite Simulator	M-Code	Military Code	OT&E	Operational Test and Evaluation	SV	Space Vehicle
DDG	Alegh Burke Guided Missile Destroyer			MGUE	Military GPS User Equipment	PEO	Program Executive Officer	TRV	Technical Requirements Verification



Military-Code Anti-Jam Capability



Military-Code (M-Code) capable receivers provide the Warfighter a more robust solution for ensuring access to jammed and hostile environments.

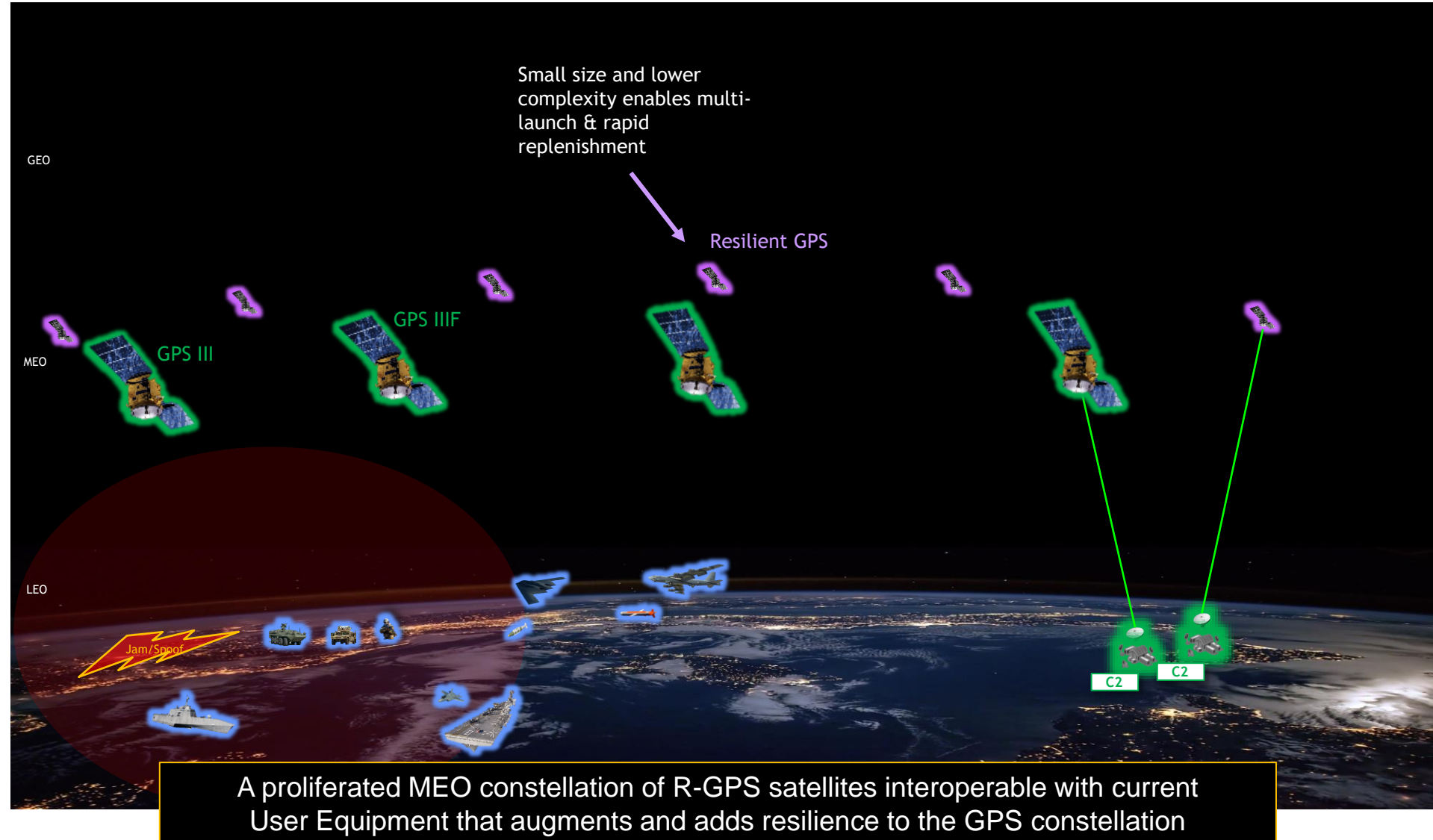
Modernized GPS improves operation in contested environments

M-Code is now globally broadcast



Resilient GPS (R-GPS)

- **Description:** Rapid, low-cost production of new GPS satellites in tranches; multi-manifested launch; compatible with existing user equipment in accordance with DSB and SWAC recommendations
- **Requirement:** Deliver low cost, lightweight pMEO vehicles serving both legacy and M-code users
- **Objective:** Initiate rapid prototype build and demo with non-traditional industry partners, leading to R-GPS with enhanced capabilities over multiple tranches





Questions?