PNT Advisory Board
GPS Update

4 December 2024

Mr. Cordell DeLaPena, Jr, SES, DAF
Program Executive Officer
MilComm & Positioning, Navigation, and Timing

Agenda

- MCPNT Overview
- Enterprise Modernization
- Architecture Investments / Focus Areas
- Supporting the Warfighter: Military Code
- Resilient GPS (R-GPS)
- FMS
- Commercial Integration

MilComm & PNT Mission & Vision

Mission

Rapidly deliver premier MilComm and PNT capabilities resilient to the threat by the relentless pursuit of warfighter needs and acquisition excellence

Vision

World-class space professionals connecting people and systems, any time any place, to enable unity of effort across all warfighting domains

MILITARY COMMUNICATION & PNT

1,800+
active duty, civilian, and contractor employees

4 GPS Ground Stations
17 GPS Monitoring Stations
2 GPS Control Stations

GPS satellites in sustainment

- 6-GPS IIR
- 7-GPS IIR-M
- 12-GPS IIF
- 6-GPS III

SATCOM satellites in sustainment

- 6-AEHF
- 6-DSCS
- 2-EPS
- 5-MILSTAR
- 5-MUOS
- 10-WGS
- 4-UHF

28 satellites/payloads in production or development

WGS 11(1)	WGS 12(1)	GPS III(4)	GPS IIIF(10)	R-GPS(8)	MUOS (2)	EPS-R(2)
1	1	4	10	8	2	2

MCPNT BY THE NUMBERS

FY25-29 total budget $23.3 billion

32 Active Programs
9 Systems in Sustainment

- 9 *ACAT I Programs*
- 1 *ACAT II Programs*
- 5 *ACAT III Programs*
- 3 *MTAs*
- 3 *SWPs*
- 10 *AML Exempts*
- 1 *Quick Start*

8 *Ground Systems*

Over **2 Million** Units
of GPS User Equipment (UE) fielded with next-gen Military GPS UE starting to field

Over 400,000
GPS User Equipment (UE) sold through GPS Foreign Military Sales (FMS)

More than 200 GPS FMS cases in work and active engagement with 60 allied nations

17,000+
SATCOM Terminals

as of 1 Dec 24

GPS Constellation Status

36 Satellites • 30 Set Healthy
Baseline Constellation: 24 Satellites

Satellite Block	Quantity	Average Age (yrs.)	Oldest
GPS IIR	6 (4*)	22.8	27.3
GPS IIR-M	7 (1*)	17.1	19.1
GPS IIF	11 (1*)	10.5	14.1
GPS III	6	4.8	5.8

*Not set healthy

As of: 18 Nov 24

GPS Signal in Space (SIS) Performance

As of: 18 Nov 24

Average URE*	Best URE	Worst URE
34 cm	24.5 cm (8 Apr 24)	89.4 cm (25 May 24)

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

GPS Enterprise Modernization

SPACE SEGMENT (SATELLITES)

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

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

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

GPS III (SV01-10)
- Accuracy & Power
- Increased Anti-Jam Power
- Inherent Signal Integrit
- 4th Civil Signal (L1C)

R-GPS
- pMEO satellites
- Legacy & M-Code

GPS IIIF (SV11-32)
- Search & Rescue (SAR) Payload
- Laser Retroreflector Array
- Redesigned NDS Payload
- Regional Military Protect (RMP)

CONTROL SEGMENT (GROUND)

Legacy (OCS)
- Command & Control
- Signal Monitoring

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

OCX Block 0
- GPS III Launch & Checkout
- GPS III Contingency Ops (COps)
- GPS III Mission on AEP
- M-Code Early Use (MCEU)

OCX Block 1
- Fly Constellation & GPS III;Control New Signals

OCX Block 2
- Control all signals
- Capability On-Ramps

OCX Block 3F
- Incorporates GPS IIIF Command & Control

USER SEGMENT (RECEIVERS)

Legacy (PLGR/GAS-1/MAGR)
- First Generation System

SAASM-era User Equipment
- Anti-Jam capability
- Electronic Protection

Military GPS User Equipment
- Common GPS Modules
- Increased Access
- Increased Accuracy, Availability, Anti-Tamper Anti-Spoof
- Increased Acquisition in Jamming

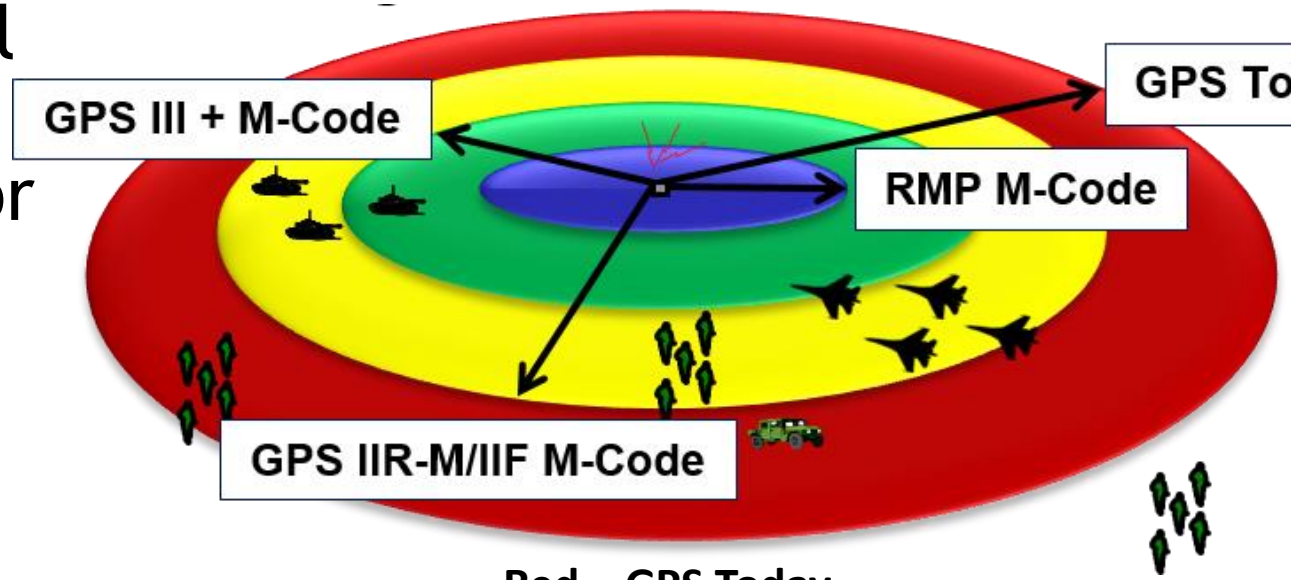
GPS L5: Safety of Life

Capability	L5 PNT IOC	L5 PNT FOC
Forecast	**FY2026**	**FY2029**
Space	18+ L5 SVs • GPS IIF • GPS III	24+ L5 SVs • GPS IIF • GPS III • GPS IIIF
Control	C2 L5 SVs • OCX Blk 1	C2 L5 SVs • OCX 3F
User	Civil Receivers	Civil Receivers

- L5 is designed for safety-of-life applications, offering improved accuracy and reliability
- Today: 17 L5-capable satellites on orbit (11x GPS IIF, 6x GPS III)
- L5 IOC projected for FY2026
- L5 FOC projected for FY2029

Benefits of Military Code (M-Code)

- **GPS M-Code** is a military signal designed to enhance **anti-jamming** and **secure access** for military GPS users
- M-Code includes Security and Anti-spoofing improvements



Red – GPS Today
Yellow – M-Code
Green – M-Code with GPS III
Blue – GPS Regional Military Protection (RMP)

SECAF Perspective

“The Space Force’s $30 billion budget needs to grow — whether that’s through internal Defense Department trades or an increase from Congress”

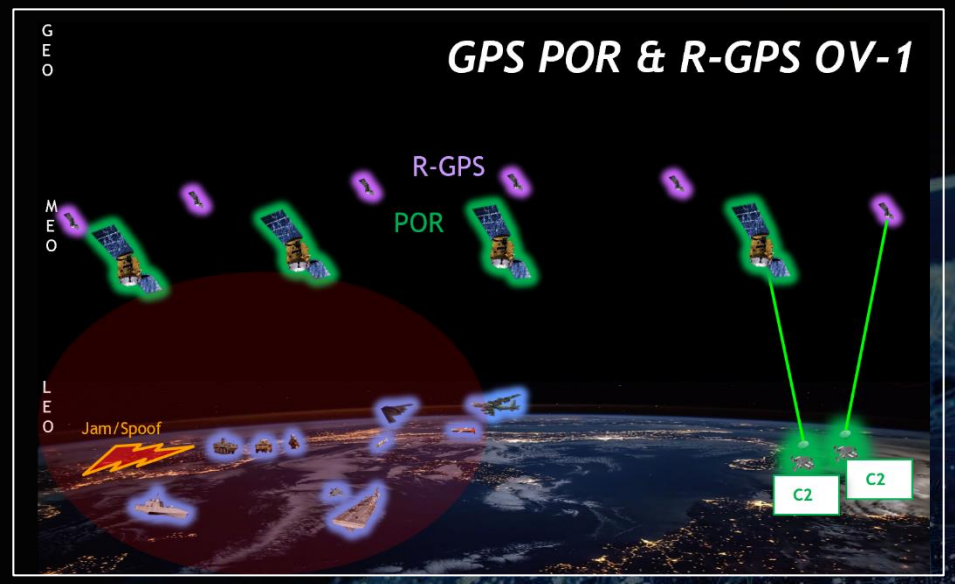
“[The Space Force] budget is going to need to double or triple over time to be able to fund the things we’re actually going to need to have,”

“We have received Quick Start authority to field additional low-cost GPS satellites to increase the resilience of the GPS system and have initiated that program.”

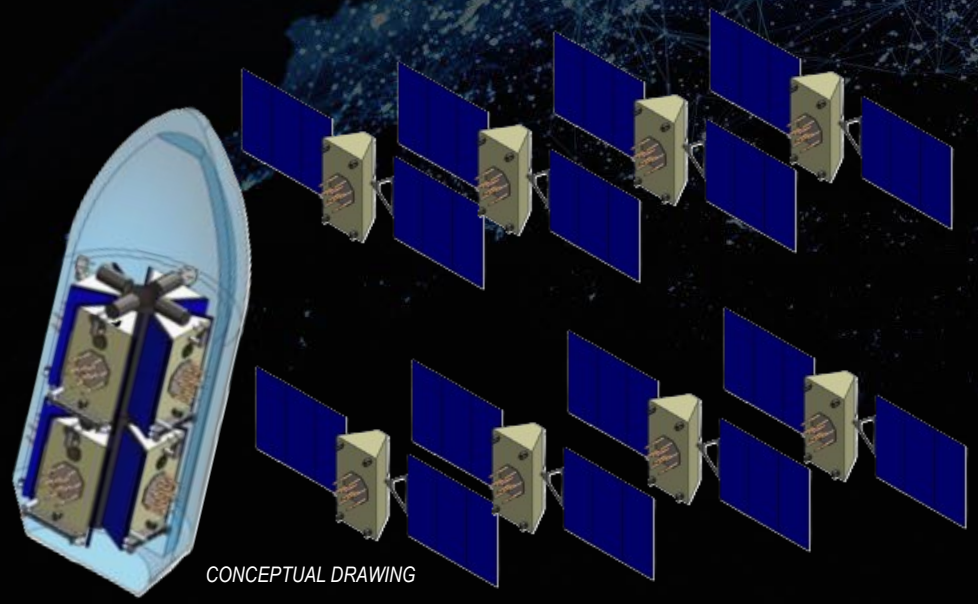
SECAF Frank Kendall at the Air & Space Forces Association’s 2024 Air, Space and Cyber Conference

The Department of the Air Force needs to focus its space-related acquisitions on resilient space missions -- meaning our space-based capabilities can be protected, survive attack, degrade gracefully under attack, and be reconstituted in a reasonable time, if necessary.

Resilient GPS (R-GPS)



- Resilient GPS augments GPS constellation with proliferated small sats
- Transmit core GPS signals worldwide
- Acquired in LEAPs (Lite Evolving Augmented Proliferation)



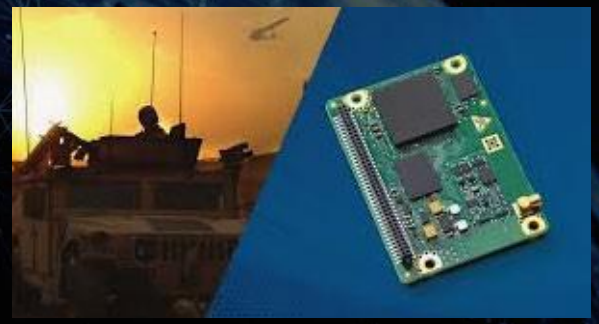
- Leverage both traditional and non-traditional vendors
  - Phase 0: 4 vendors; design concepts in early 2025
  - Phase 1: Up to 2 vendors;Demo in 2026
  - Phase 2: Up to 2 vendors build up to 8 satellites for launch as early as 2028; Goal: $50 - $80M per SV

Resilient GPS LEAP 1 Phase 0 Awarded September 2024 - 6 Months from Approval to Award

Foreign Military Sales (FMS) Program

- **Implement Department of Defense and Department of State GPS PPS UE FMS to dozens of authorized nations**
  - Ensure all sales are compliant with US DoD PNT security and export policies
  - M-Code UE may only be procured through FMS channels
  - PPS UE: PNT Security Devices, GPS receiver cards and systems

- **Executing 400 active FMS cases**
  - 50+ Nations
  - Total active case value ~$70M
  - In receipt of inquiries for over 40k M-code receivers



MPE-M receiver

Force 5M M-code receiver

- **Working with FMS nations to ensure foreign GPS PPS UE development meets security requirements**

PPS: Protected Positioning Service
UE: User Equipment
PNT: Position, Navigation, Timing

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: PNT Development Initiatives

SpaceWERX/AFWERX Alt PNT Challenge

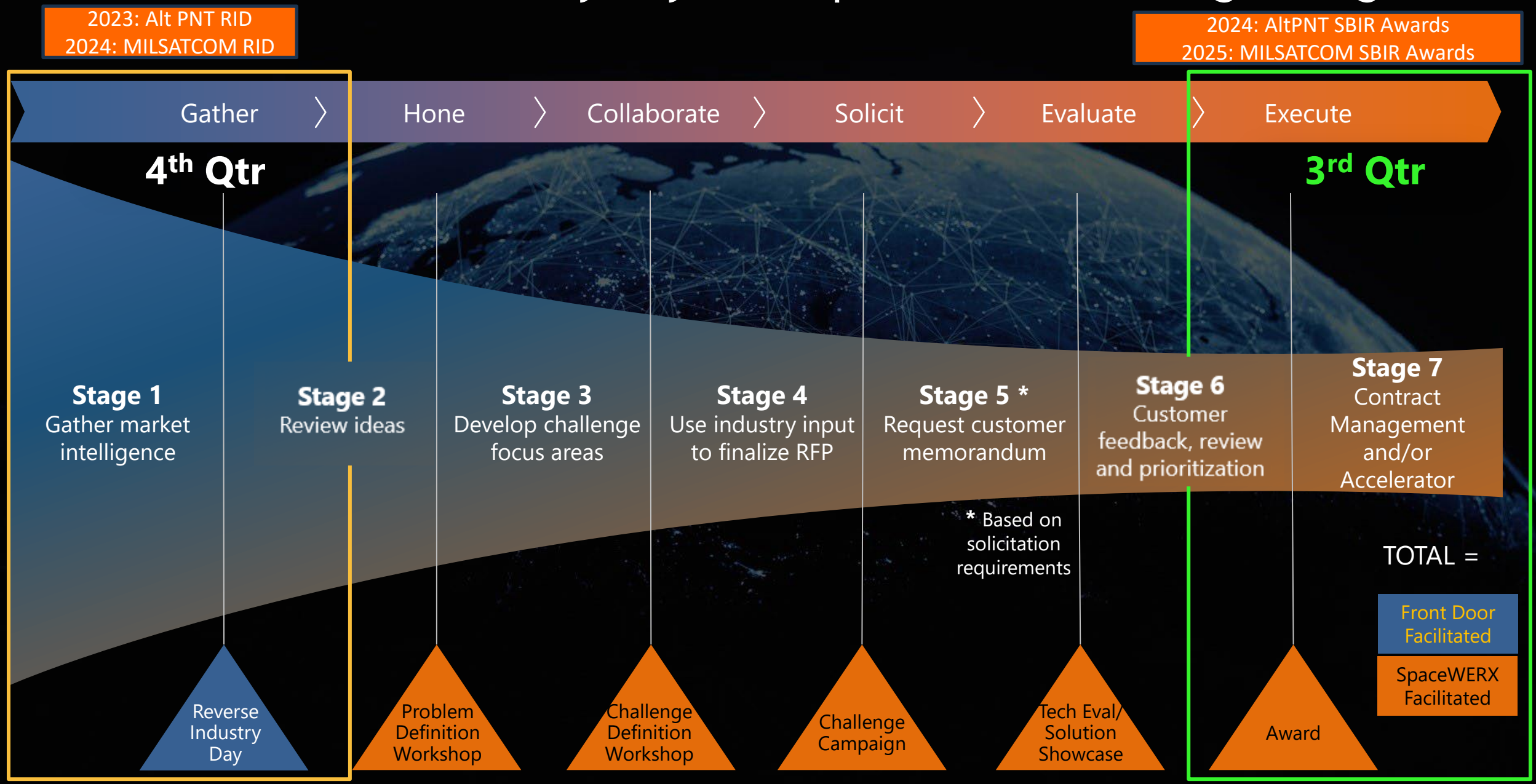
- 122 responses from industry
- Awards: 20 x $1.9 Million

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

* Awards have the potential for follow-on TACFI Funding

Reverse Industry Days and SpaceWERX Challenge Integration



SPACEWERX

Questions