



Department of Transportation

Office of the Secretary

Office of the Assistant Secretary for Research and Technology (OST-R)

# **DOT Role in Implementation of SPD-7**

## **CGSIC Plenary**

**September 21, 2021**

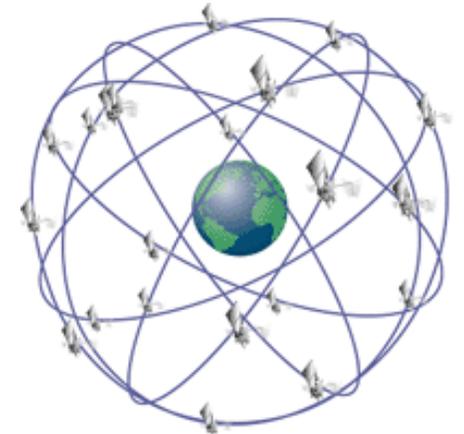
# SPD-7 Implementation Plan - DOT Responsibilities

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**DOT is the lead department for civil PNT, and is responsible for coordinating, defining, and validating requirements for civil applications. DOT represents all civil departments and agencies in GPS development, acquisition, management, and operations.**

**To implement SPD-7, DOT responsibilities are grouped under the following categories:**

- Space-Based PNT Requirements for Civil Applications
- Space-Based PNT Management and Modernization for Civil Applications
- Performance Monitoring and Interference Detection for Civil Space-Based PNT Services
- PNT Resiliency
- Space-Based PNT Data and Signal Authentication
- International Engagement



# 2021 National Space-Based PNT Policy (SPD-7): Key DOT Roles and Responsibilities – January 15, 2021

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- Have lead responsibility for the **development of requirements** for civil applications from all United States Government civil agencies
- Represent the civil agencies in the **development, acquisition, management, and operations of GPS and its augmentations**
- Ensure the **earliest operational availability for modernized civil signals and services**
- Ensure, in coordination with the Secretary of Defense and the Secretary of Homeland Security, the **performance monitoring** of United States civil space-based PNT services
- Implement capabilities to **monitor, identify, locate, and attribute space-based PNT service disruption and manipulations** within the United States that adversely affect use of space-based PNT for transportation safety, homeland security, etc.
- Develop and validate requirements and a funding strategy to **implement data and signal authentication of civil GPS and wide area augmentations** for homeland security and public safety purposes



# 2021 National Space-Based PNT Policy (SPD-7): Key DOT Roles and Responsibilities (Cont.)

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- Promote the **responsible use** of United States and foreign civil space-based PNT services and capabilities for **transportation safety as directed in EO 13905**.
- Facilitate **international participation** in the development of **civil transportation applications** using United States space-based PNT services.
- Ensure that public safety service applications based on United States space-based PNT services **meet or exceed internationally recognized standards**
- Facilitate **international coordination for the development of monitoring standards** for space-based PNT services.
- Maintain **awareness of the risks and potential benefits** associated with the use of **foreign space-based PNT** services.
- Ensure that **international transportation initiatives consider the dual-use nature of space-based PNT services**, particularly including services that are openly available and can be readily used by adversaries or terrorists to threaten the security of the U.S.



# DOT GPS Liaison Activities

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61<sup>st</sup> CGSIC (St Louis, MO)  
20-21 September 2021



U.S. Department of Transportation

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# Overview

- Monitoring the GPS Legacy and Modernized Signals
  - SPD-7 directs DOT to monitor GPS (and GNSS) for performance and interference
  - DOT performance monitoring function both internal & external to GPS Enterprise for L1 C/A, L2C, L5, and L1C
  - Federal-wide coordination on interference monitoring
- GNSS Integrity Support Message (ISM) for Advanced RAIM
  - Broadcast message type definitions for CNAV and CNAV-2 (IS-GPS-200M/705H/800H)
  - FAA leading on ISM parameter generation, validation, and packaging
  - Coordinated interface between FAA and GPS Control Segment
- DOT Liaison Positions to USSF Space Operations Command (SpOC) and Space Systems Command (SSC)
  - Of note, upcoming [GPS PICWG](#), 29-30 September 2021, see [gps.gov](#) home page for more

# GNSS Interference Detection, Monitoring, Location, and Attribution

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## Planned Activities:

- a. Development of formal interference specifications and monitoring capabilities, derived from the regulatory and operating documentation on the GPS radiofrequency (RF) spectrum.
- b. DOT, in coordination with DHS and DoD, will establish a multi-layer interference detection and monitoring (IDM) capability to include: space layer, airborne layer, and a terrestrial layer.
  - The terrestrial layer needs to include high-value assets (e.g., key airfields, maritime ports, etc.), and close-in location capability (e.g., UAV and personal device applications).
  - This IDM process will identify any State, local and commercial capabilities that can be leveraged and will build upon existing event recording capabilities to receive reports of disruption, conduct analysis and interagency coordination and notify Federal Radio Emission Compliance Regulators of significant disruptions or manipulations of space-based PNT services.
  - Near-term requirements involve a spectrum monitoring capability and equipment in response to the FCC O&A granting Ligado Networks the ability to broadcast in the GPS adjacent radiofrequency band.

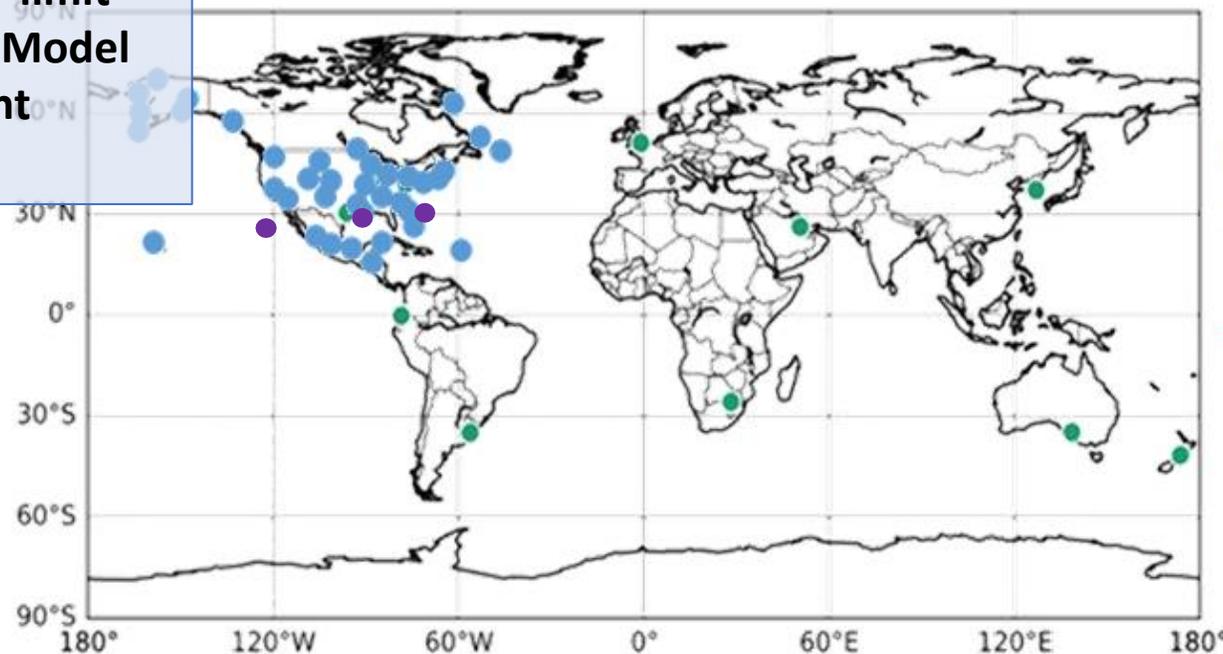
# RFI Monitoring Overview and Planning

## Active Functions

- In-band Interference
- Phase Jump/Jitter
- Cross Ambiguity Function Inconsistency

## Future RFI Functions

- Adjacent Band Over-limit
- Adjacent Band PNT Model
- Adjacent Band Errant Modulation



## Possible Early Path-finders

- NGA Monitor Stations
- Volpe Wake Vortex Installations
- FAA WAAS/NSTB Network
- ADS-B Ground Base Transceiver (GBT) Network
- PIRT OLSON Network
- Airport Facilities, e.g. Glide Slope/Localizers
- Mobile/Dispatch Platform
- CISA National Critical Function Sites

# GNSS Performance Monitoring

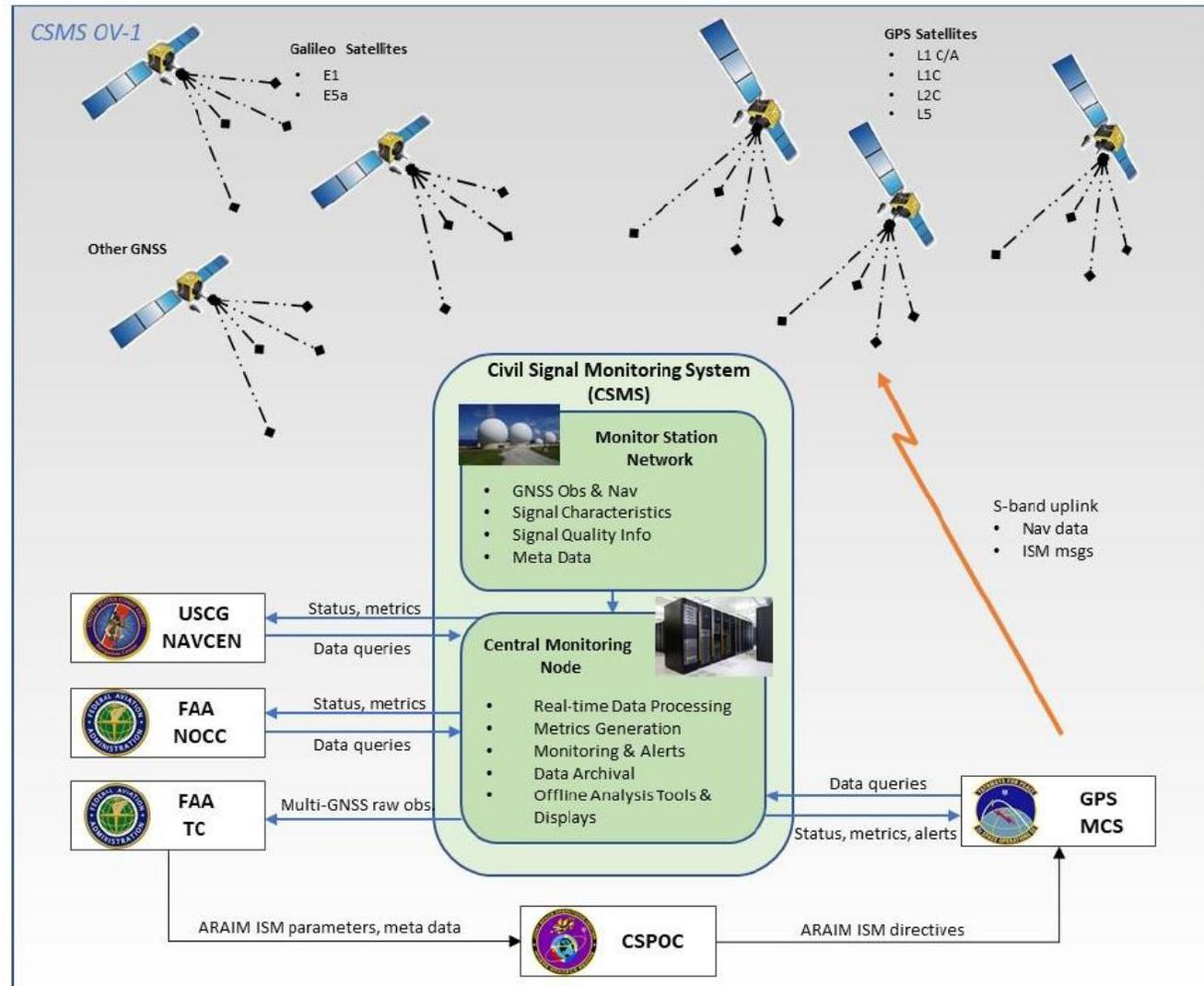
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## Planned Activities:

Implementation of civil GNSS signal performance monitoring capabilities in partnership with the National Geospatial Intelligence Agency (NGA) to support civil use of the modernized GPS/GNSS open signal broadcast.

- This effort will assure the GPS Standard Positioning Service Performance Standard requirements are met for all civil users
- Focus on Multi-GNSS to support activities within the International Committee on GNSS (ICG) Monitoring and Assessment Task Force

# CSMS Performance Monitoring ConOp



# ARAIM Current CNAV/CNAV-2 ISM Parameters

## IS-GPS-200M/705H/800H Define Message Type 40 (ISM for ARAIM)

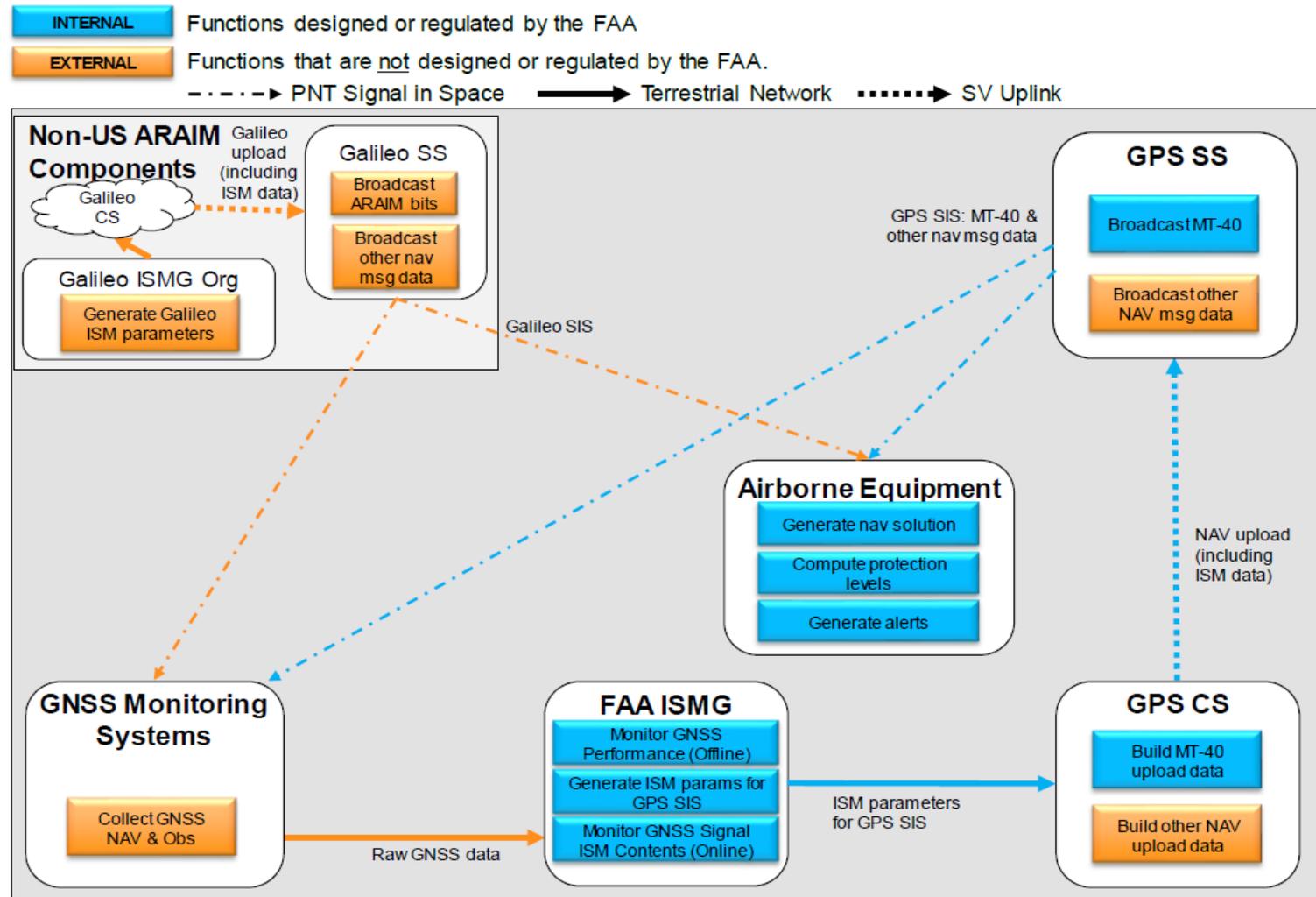
Content	Field	Bits	Cum.
GNSS ID	1	4	4
WN <sub>ISM</sub>	2	13	17
TOW <sub>ISM</sub>	3	6	23
t_correl	4	4	27
b_nom	5	4	31
γ_nom	6	4	35

Content	Field	Bits	Cum.
R_sat	7	4	39
P_const	8	4	43
MFD	9	4	47
Service Level	10	3	50
Mask	11	63	113
ISM CRC	12	32	145

These three parameters being addressed by SARPS/MOPS work on ARAIM.



# CSMS Off-line ISM Monitoring for ARAIM



# GPS Signal and Data Authentication

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## Planned Activities:

- a. Requirements development / validation
- b. Research on a very low bandwidth key/signature mechanism
- b. Research on ranging and data authentication schemes, both in-band and out-of-band

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**Questions?**