

# FAA Navigation Programs Update



Presented to: Civil GPS Service Interface Committee

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# Agenda

- **FAA Navigation Programs Strategy**
- **GPS Civil Update**
- **Wide Area Augmentation System (WAAS) Update**
- **Navigation Resiliency**
- **Sustainment**
- **Divestment**
- **Summary**



# FAA Navigation Programs Strategy

- **Provide safe, efficient, and resilient navigation services for the NAS**
  - Global positioning System (GPS) and Wide Area Augmentation System (WAAS) provide navigation for all Performance-Based Navigation (PBN) and Automated Dependent Surveillance-Broadcast (ADS-B)
- **Resiliency**
  - Distance Measuring Equipment (DME) provides an Area Navigation (RNAV) backup for high altitude enroute, departures, and arrivals for air carrier and commercial aircraft at the 62 busiest airports
  - Very High Frequency Omnidirectional Radio Range (VOR) Minimum Operational Network (MON) provides a conventional navigation backup for aircraft not equipped for DME navigation
  - Instrument Landing System (ILS) retained to provide vertically guided approach service at air carrier and VOR MON airports
- **Sustainment**
  - Sustaining VOR, TACAN, DME, and ILS for resiliency
  - Procuring TACAN Antennas to meet most urgent needs
- **Rationalize conventional navigation systems**
  - The VOR MON Program will close in July 2026
  - Reduce Tactical Air Navigation (TACAN) to a MON while supporting military needs
  - Reduce ILS at smaller GA airports where most aircraft are equipped to fly WAAS LPV approaches



# GPS CIVIL UPDATE



# Support to National Space Policy

- **Space Policy Directive 7 (SPD-7)**

- Directs development of requirements and strategy to implement data and signal authentication for GPS and WAAS
- Coordination with international partners for use of GPS and augmentations

- **Executive Order 13905 “Responsible Use of PNT/GPS”**

- FAA enhancing the DME network to provide navigation resiliency during potential GPS outages and disruptions
- FAA retaining primary and secondary radars to provide resilient surveillance services during potential GPS disruptions and outages to Automated Dependent Surveillance Broadcast (ADS-B)
- Timing services to be provided through telecommunications services per FAA order 1770.68



# Support to National Policy

- **GPS Jamming and Spoofing is a Risk to Aviation**

- DOT/FAA establishing government and industry partnership to mitigate impacts at systems and applications levels

- FAA published a GNSS Interference Resource Guide

[https://www.faa.gov/about/office\\_org/headquarters\\_offices/avs/offices/afx/afs/afs400/afs410/GNSS](https://www.faa.gov/about/office_org/headquarters_offices/avs/offices/afx/afs/afs400/afs410/GNSS)

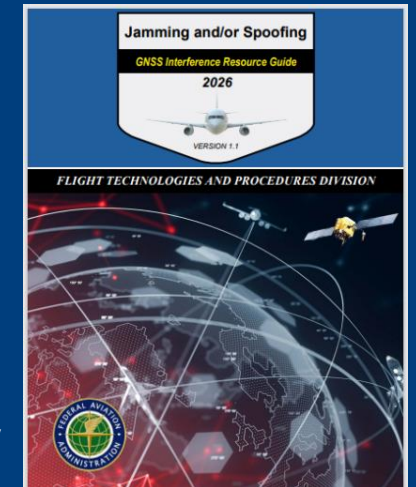
- Participating in development of RTCA and EUROCAE standards

- Support DFMC SBAS equipment with inherent spoofing awareness and mitigation capability

- Support standards for Controlled Reception Pattern Antenna (CRPA) for civil use with existing GPS L1 signal and future DFMC equipment

- Working with DoD and DOT to develop technical approach and plan for data and signal authentication for GPS civil signals

- Continue to validate requirements for SBAS navigation message authentication



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# GPS Modernization Support

- **FAA Co-Chair of the National Space-based PNT Systems Engineering Forum (NPEF) with USSF**
- **FAA Co-Chair of GPS Program Management Reviews with USSF**
- **Civil Signal Operational Capability Integrated Product Team (CSOC IPT)**
  - Enterprise – Path to set GPS L5 signal healthy
  - Requirements – Review Request For Changes (RFCs) for GPS and public documents ( e.g. RFC-519/RFC-544 for ARAIM messages and clarity of service)
  - Civil Signal Monitoring – Path to monitor GPS L5
  - Test – Supporting anomaly resolution during upper PRN testing and support for Navigation Technology Satellite 3 experiments
- **Support extension of Ground Control Segment for GPS L5 monitoring**
  - Path to set GPS L5 signal healthy
  - Path forward for ground segment
- **Conduct Position Signal Integrity Continuity Assurance (PSICA) activities with DoD to assure safety**



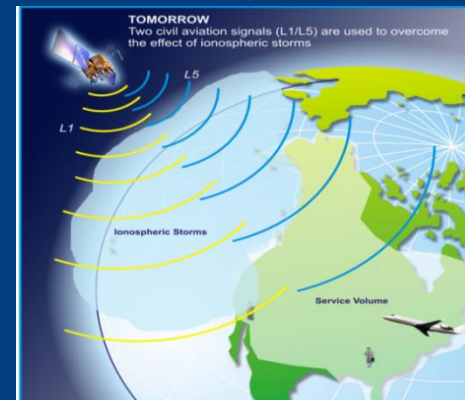
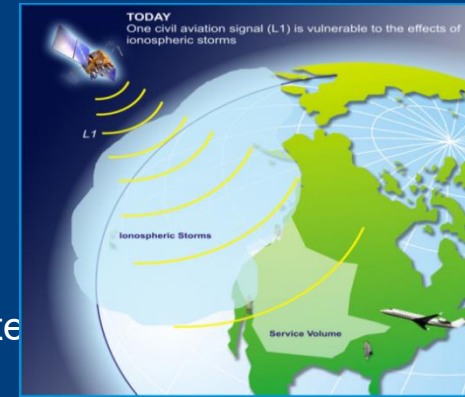
# WAAS UPDATE



# WAAS Phase 4 Dual Frequency Operations (DFO) Status

- **Phase 4B (FY22-32)**

- Introduces WAAS Dual Frequency service using L1 & L5
  - WAAS DF Limited Operational Capability (DF LOC) ~ 2026
  - WAAS DF Initial Operational Capability (DF IOC) ~ 2027
  - WAAS DF Final Operational Capability (DF FOC) ~ 2028
- WAAS Technical Refresh (2022 – 2028)
  - Processor replacement coupled with transition to Linux-based operating system
  - GUS receiver refresh
  - New WAAS Safety Computer Development
  - Security Updates
  - Start transition to IP based communications networks
- Future
  - Complete IP migration
  - Data Authentication
  - GEO 8 Acquisition
  - Reference Receiver Replacement (G-IV)

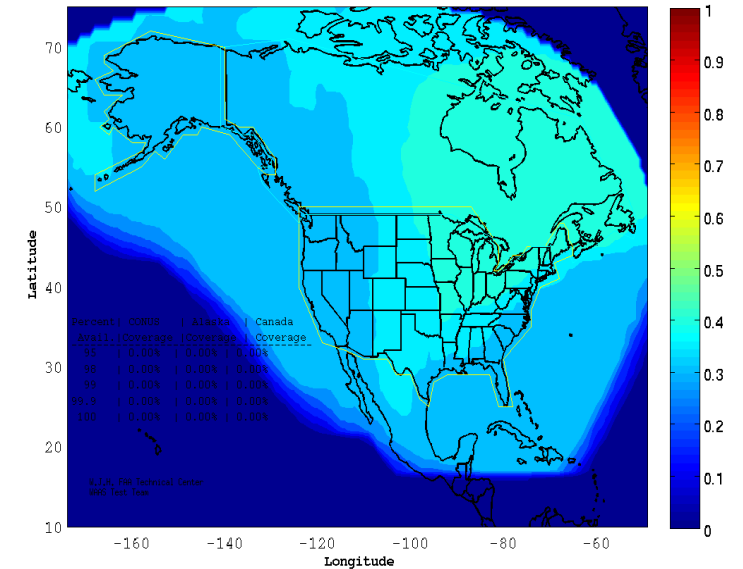
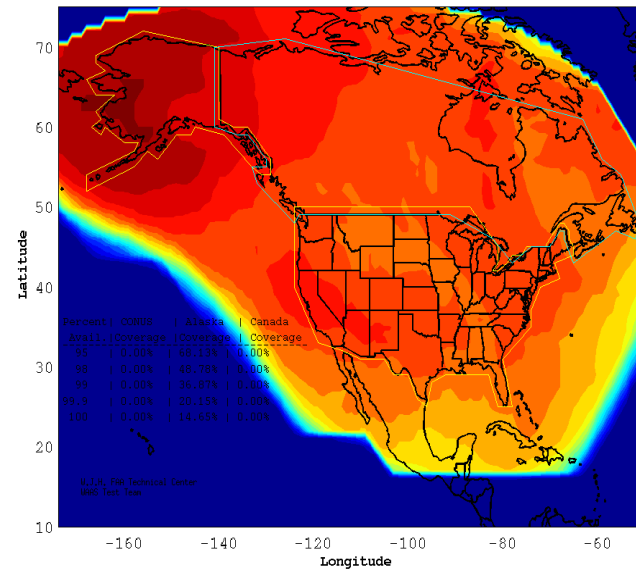
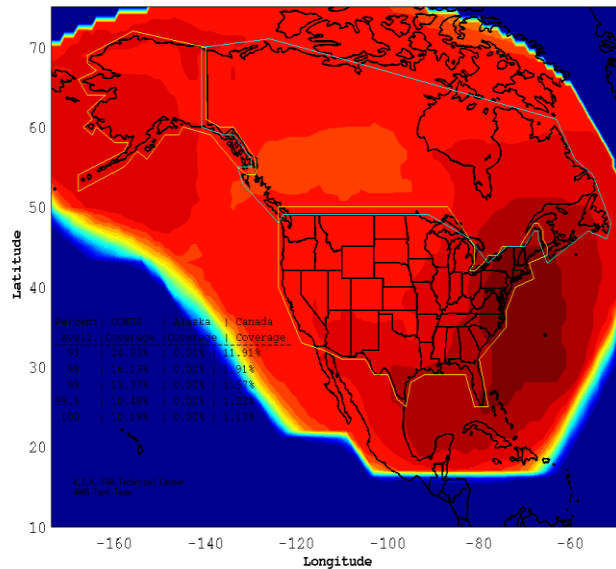


# Need for Dual Frequency – Ionospheric Impacts

WAAS LPV Coverage Contours  
1/19/26  
Week 2402 Day 1

WAAS LPV Coverage Contours  
1/20/26  
Week 2402 Day 2

WAAS LPV Coverage Contours  
1/21/26  
Week 2402 Day 3



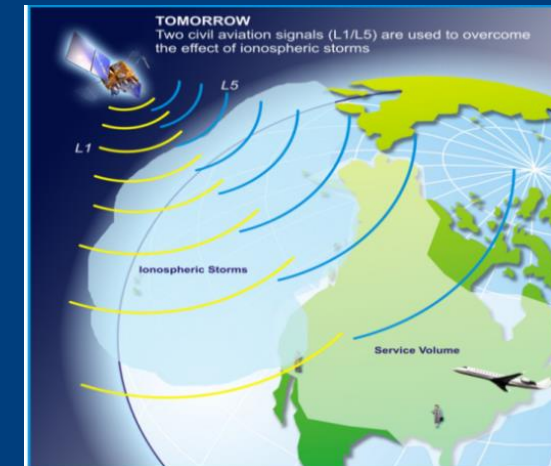
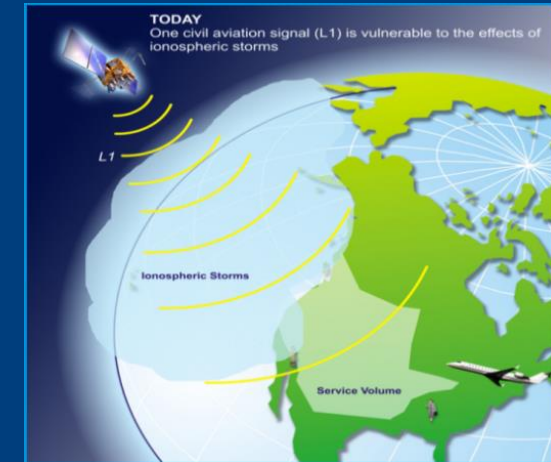
- Beginning on January 19 and continuing into January 21, 2026 there was a loss of precision approach WAAS service in CONUS and Alaska
- The WAAS Extreme Storm Detector (ESD) tripped on January 21 and there was an extended loss of vertical service from WAAS over the entire WAAS service volume
- Non-precision approach guidance was not impacted



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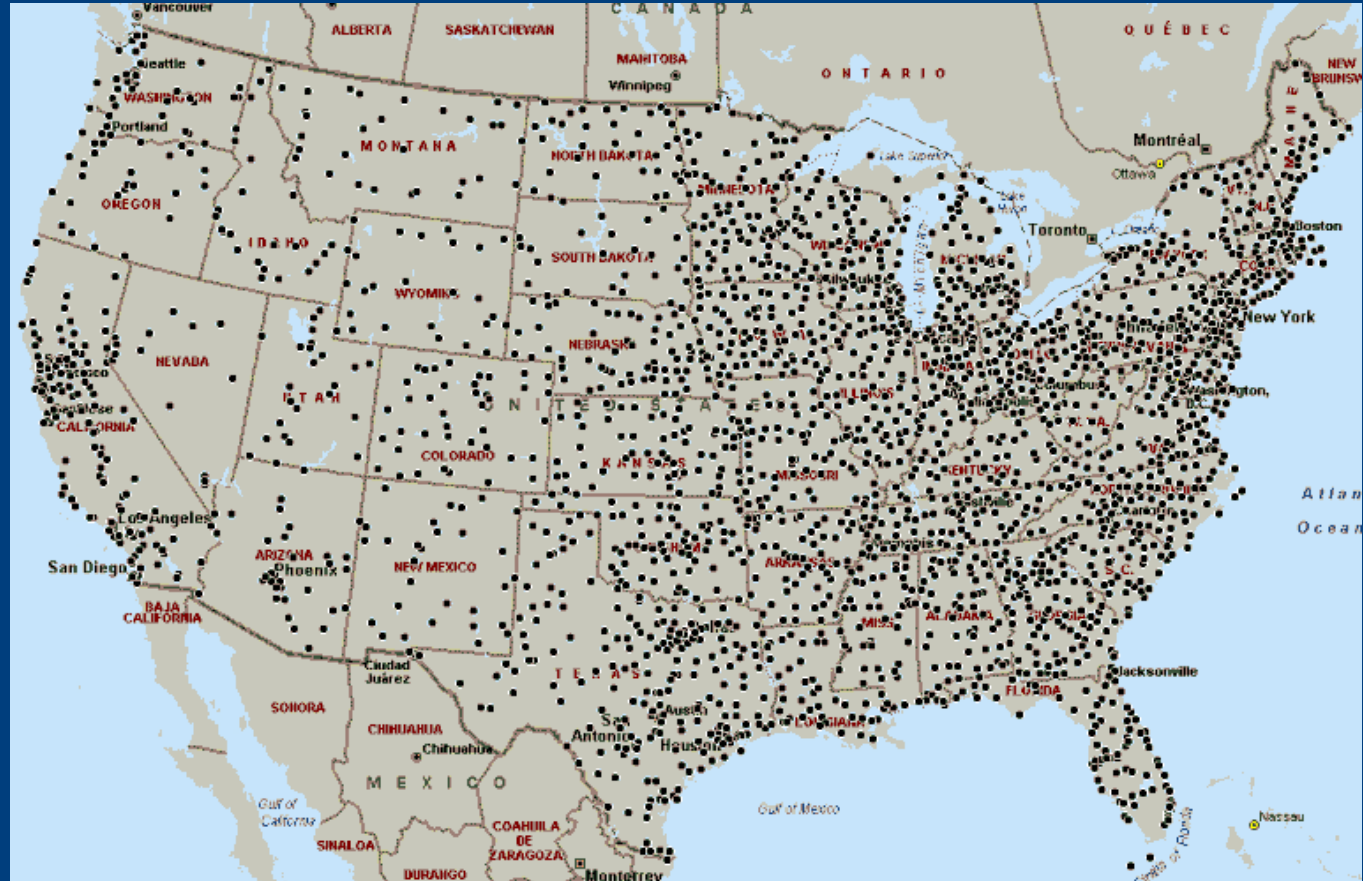
# SBAS Evolution

- **Dual-Frequency Multi-constellation Capability (DFMC)**
  - Standards development progressing
    - GPS L5 and DFMC SBAS SARPs published in Amendment 93
    - RTCA and EUROCAE working a joint DFMC SBAS MOPS, expect to complete in 2026
  - WAAS assisting IWG with providing SBAS perspective on DFMC capability
- **Advanced RAIM (ARAIM)**
  - ARAIM algorithm development continuing in standards group for multi-constellation GNSS capability
  - Integrity Support Message for GPS broadcast working through the GPS change process
  - ICAO Navigations Systems Panel produced initial requirements for horizontal navigation (H-ARAIM) in January
  - RTCA and EUROCAE working a joint DFMC SBAS MOPS, expect to complete in 2025



# Airports with WAAS LPV/LP Instrument Approaches

- Most of the airports throughout the National Airspace System contain WAAS Procedures



- As of Mar 19, 2026, there are currently 1,290 ILS (CAT I) procedures while WAAS has 4,985 LPV/LP procedures published

# WAAS Avionics Equipage Status

- **Over 179,574 WAAS equipped aircraft worldwide**
  - WAAS receivers provided by companies such as:
    - Garmin, Universal, Rockwell Collins, Honeywell, Avidyne, Innovative Solutions & Support (IS&S), Thales and Genesys Aerosystem (Chelton), CMC
  - General Aviation:
    - All classes of aircraft are served in all phases of flight
  - Air Carriers
    - Main aircraft with SBAS capability in the US - Airbus A220 (Delta and JetBlue)
    - Partnership with Delta Airlines to measure benefits of A220 equipage in the NAS and to equip B-717 fleet with WAAS capable avionics
- **Enabler for Airspace Modernization**
  - Automatic Dependent Surveillance Broadcast (ADS-B)
  - Performance Based Navigation (PBN)
  - Enhanced Navigation & Safety: Provides better accuracy, reliability, and availability over standard GPS
  - Surface Surveillance: Allows ATC to track aircraft on airport taxiways and runways



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# NAVIGATION RESILIENCY



# Navigation Resiliency

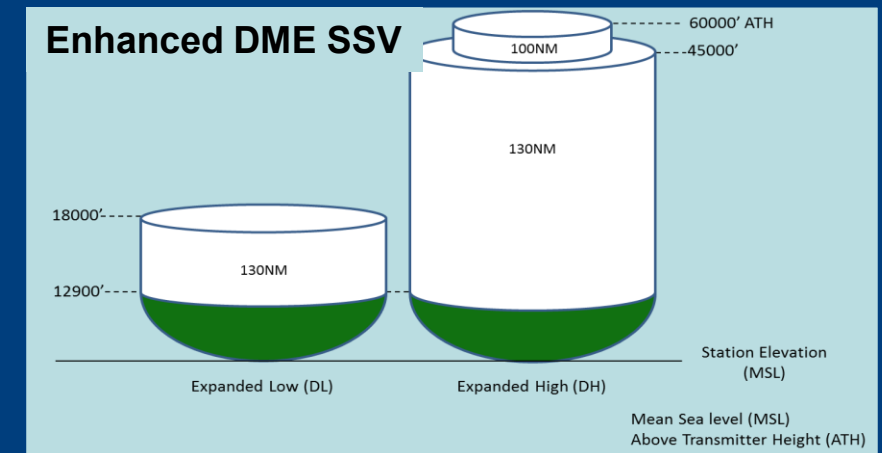
- **VOR, DME, TACAN, and ILS systems provide a backup capability aircraft revert to during GPS outages and disruptions**
- **DME navigation provides an Area Navigation (RNAV) service suitably equipped aircraft can revert to during GPS outages and disruptions**
  - DME Support to PBN Strategy is adding approximately 123 new DMEs to expand RNAV coverage at the busiest airports hosting air carrier operations
  - ILS retained at the busiest airports to provide vertically guided approach operations during GPS outages and disruptions
- **The VOR MON provides a conventional navigation capability for aircraft not equipped for DME navigation over CONUS**
  - Enhanced VOR Standard Service Volume (SSV) provide coverage at 5,000' Above Ground Level (AGL) to enable VOR-to-VOR navigation
    - 451 new SSV were published
  - VORs that do not meet criteria are being discontinued
    - 215 out of the planned 303 VORs were discontinued
  - MON airports host a conventional ILS or VOR approach within 100 nautical miles



# DME Support for PBN Strategy: Purpose and Scope

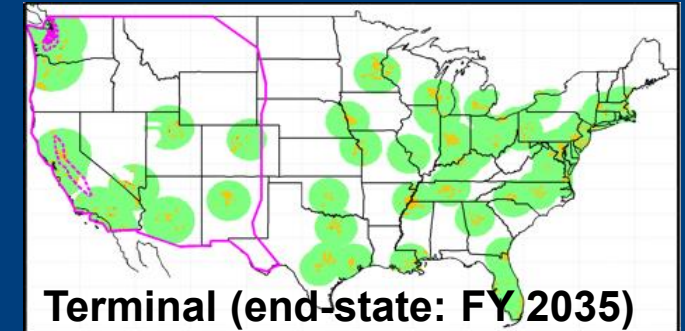
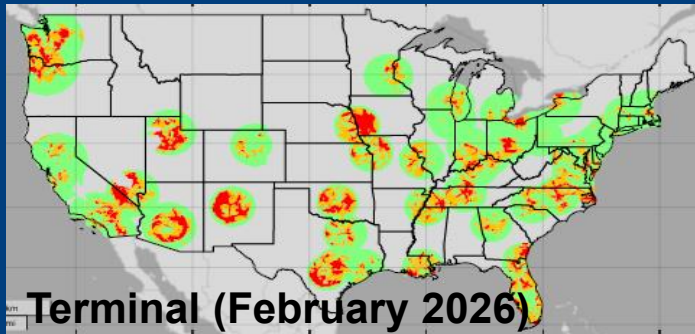
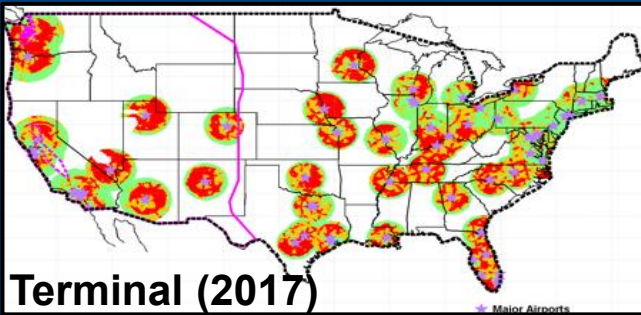
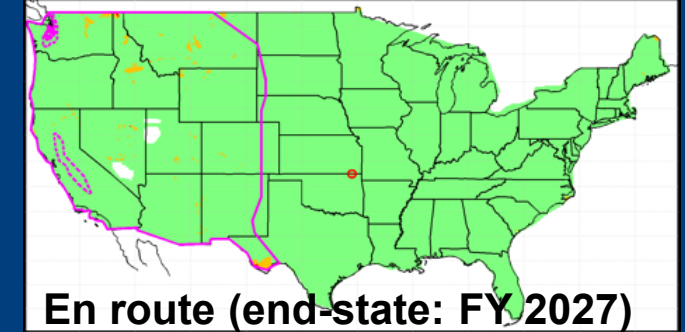
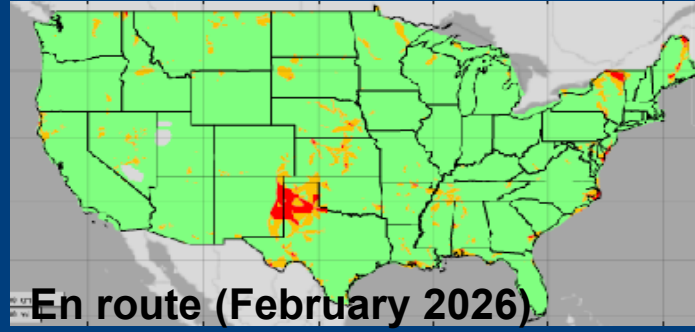
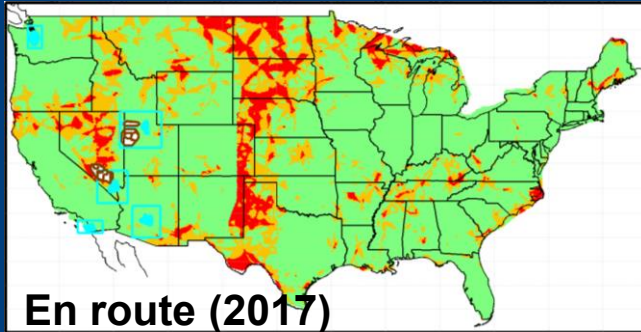
- **Optimize DME network to allow aircraft equipped for DME navigation to continue PBN operations to ILS approaches during GPS disruptions.**
  - Provide redundant Area Navigation (RNAV) 2.0 services above FL180 (Class A Airspace).
  - Provide RNAV-1.0 services on NSG-1 and NSG-2 airports.
- **Scope**
  - Expand existing DME Frequency Protection Standard Service Volumes (SSV) to DME-L (DL) or DH.
    - Some facilities will require a frequency change to mitigate adjacent/co-channeling interference.
  - Install new high-power dual DME to fill coverage gaps.
  - Replace some DMEs to increase interrogation capacity.

Procedure	RNAV Off The Ground (ROTG)	RNAV-1.0 SID	RNAV-2.0 Q/T Routes En Route Cruise	RNAV-1.0 STAR	RNP 0.3-1 LNAV LP LNAV/VNAV LPV
	Takeoff	Departure		Arrival	Approach
System	GNSS	GNSS / HPDME			GNSS



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# DME Support for PBN: Progress Toward End-State



	Coverage Statistics Summary			
	DME/DME RNAV Coverage	Redundant	Critical	None
<b>Enroute</b>	<b>98.93%</b>	<b>93.86%</b>	<b>5.07%</b>	<b>1.07%</b>
<b>Terminal Areas</b>	<b>86.91%</b>	<b>58.41%</b>	<b>28.55%</b>	<b>13.04%</b>

LEGEND	
	DME/DME RNAV coverage
	Redundant DME/DME RNAV coverage
	Single DME/DME RNAV coverage
	No DME/DME RNAV coverage



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# VOR MON Program Closeout

- **Due to funding constraints and agency prioritization, the work on the VOR MON Program is being closed out in 2026**
  - Discontinuances funded by the program will end on July 9
  - Additional VORs will be retained to provide near-to-seamless VOR signal coverage at and above 5,000' Above Ground Level
    - VOR MON (retention) list is being re-baselined.
      - VORs that are not included in the retention list will continue the discontinuance processes as determined by the Service Centers.
  - Frequency changes will continue as funding allows



# VOR MON Program Summary

- **Program in closeout phase**
  - VOR retention and discontinuance lists being re-baselined
  - Final baseline will be published on the internal KSN and public websites
  - Safety Risk Management document is being reviewed
- **451 of 489 new VOR SSVs published**
- **215 of 219 VORs discontinued**
  - FY26 goal to discontinue 10 VORs was completed March 19



# Instrument Landing System (ILS) Approach Strategy

- **Retain existing Category I, II, and III ILSs at airports where commercial aircraft operate**
- **Publish RNAV(GPS) charts with Localizer Performance with Vertical guidance (LPV) minimums to satisfy new requirements for Category-I vertically guided approach service**
  - 4,885 LPVs currently published
  - Design criteria changes add additional qualifying runways for LPV
- **Retain ILS, LOC, or VOR approaches at MON airports to support recovery during GPS outages**
- **Rationalize Category-I ILSs at small airports where most aircraft are equipped to fly LPV**
- **Cancel redundant NDB and VOR approaches**



# SUSTAINMENT



# DME, VOR, TACAN and ILS Sustainment

- **Most DME, VOR, and TACAN systems are 30+ years old and becoming unsustainable**
- **VOR MON and NextGen DME Programs do not sustain systems**
- **Procurement contracts are not available to replace VORs or TACANs**
- **TACAN Antenna procurement is underway to address urgent, short-term needs**
- **ILS Sustainment strategy is to remove older systems and reduce number of configurations**



# TACAN Antenna Procurement

- **FAA awarded a contract in July 2025 to procure, test, ship, and install COTS 900E TACAN antennas**
  - First delivery was made in December 2025
  - Replacing legacy RTA-2, low-power TACAN Antenna (LPTA), and Rantec TACAN Antennas
  - Site installations are focused on Operationally Critical (OpCrit) and Frequency Change sites to support Navigation Resiliency
    - First installation completed at Corona, NM (CNX) on Jan. 30; flight Inspection is scheduled for April 2026



# VOR Sustainment

- **VOR Sustainment is an operational challenge**
- **Currently developing a VOR Sustainment Strategy**
  - Full-scale development is not affordable at this time
  - Conducted a VOR Market Survey in 2025
    - Two Vendors with viable products, with varying degrees of compliance with the VOR spec (FAA-E-37012).
  - Working with stakeholders to identify Minimum Viable Product (MVP) requirements
  - Prioritize and disposition VORs as candidates for sustainment
  - This is a large-scale task that requires a multifaceted approach (700+ VORs):
    - Cannibalization
    - Dopplerize, as needed
    - Modernize select parts – Service Life Extension Program (SLEP)
    - Replace with commercially available VOR system
    - Revisit feasibility of service-based options, on a smaller scale



# DIVESTMENT



# TACAN MON

- **Retain TACANs to support military aircraft for en route, terminal, and approach operations during GPS outages and disruptions**
  - 122 of 407 TACAN sites are being assessed for removal
- **Implement enhanced SSV so fewer TACANs can provide the required service coverage**
  - Integrate with VOR MON and NextGen DME program schedules for flight check and implementation of new SSV
  - Review problematic TACAN sites as candidates for discontinuance
- **Coordinate Program Plan with Policy Board on Federal Aviation (PBFA)**
  - Draft updated and coordinated in early 2025
  - Renewing coordination through signature process
- **Received approval for initial funding in FY28**
- **Developing artifacts required for investment decision**
  - FAA instituted new investment decision process and designated authority to a Chief Administrative Officer (CAO)



# Instrument Landing System (ILS) Rationalization

- **Previously developed rationalization criteria based on ILS Approach Strategy**
- **Conducted outreach to some industry groups (2024-2025), but activity was paused**
- **Received approval for initial funding in FY28**
- **Developing artifacts required for investment decision**
  - Will follow new process with Chief Administrative Officer (CAO)
- **Coordinate Proposed Policy Federal Register Notice (FRN) for internal coordination and public comment**
  - Assess stakeholder readiness based on internal and public comments
- **Based on stakeholder input, seek approval to initiate a program**
  - Implementation will follow JO 7400.2, Procedures for Handling Airspace Matters



# SUMMARY



# Summary

- **FAA is supporting National Policy and GPS Modernization initiatives**
- **WAAS is implementing dual frequency service and addressing obsolescence of components**
- **Working on ARAIM standards with EUROCAE and RTCA**
- **Resiliency**
  - NextGen DME Program implementation continues
  - VOR MON program will close out in July 2026
- **Sustainment**
  - TACAN Antenna procurement and installations at critical sites
  - Developing VOR Sustainment Strategy and looking for innovative alternatives
  - Procuring ILS to remove older systems and reduce number of configurations
  - Procuring DMEs to support PBN Strategy, as needed
- **Divestment**
  - TACAN MON to proceed with Program Plan finalization and investment decision process
  - ILS Rationalization activity to resume with investment decision process



# QUESTIONS?



# BACKUP



# WAAS GEO Constellation

- GEO 5 (Eutelsat 117WB) – Operational March 2018
- GEO 6 (SES-15) – Operational July 2019
- GEO 7 (Intelsat G-30) – Operational April 2022

