

# FAA Navigation Programs Update

Presented to: Civil GPS Service Interface Committee

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Federal Aviation  
Administration



# Agenda

- **FAA Navigation Programs Strategy**
- **GPS Civil Update**
- **Wide Area Augmentation System (WAAS) Update**
- **Navigation Resiliency**
  - NextGen DME Program Update
  - VHF Omni-directional Range (VOR) Minimum Operational Network (MON) Program Update
  - Tactical Air Navigation (TACAN) Rationalization to a Minimum Operational Network (MON)
  - Instrument Approach Strategy and ILS Rationalization
- **Sustainment**
  - DME/VOR/TACAN Sustainment
- **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 at the busiest airports for aircraft (air carrier and commercial) equipped for DME navigation
  - Very High Frequency Omnidirectional Radio Range (VOR) Minimum Operational Network (MON) provides a backup for aircraft not equipped for DME navigation
  - Instrument Landing System (ILS) retained to provide vertically guided approach service at airports with air carrier operations and at VOR MON airports
- **Rationalize conventional navigation systems**
  - Discontinue unneeded VOR systems to establish the MON
  - Reduce Tactical Air Navigation (TACAN) to a MON to support military needs
  - Reduce ILS at smaller GA airports where most aircraft are equipped with WAAS
- **Sustainment**
  - DME/VOR/TACAN (DVT) Sustainment Program will replace legacy systems retained for resiliency

# GPS Civil Update

# Support to National Space Policy

- **Space Policy Directive 7 (SPD-7)**
  - Establishes requirements and strategy to implement data and signal authentication for GPS and WAAS
- **Executive Order 13905 “Responsible Use of PNT/GPS”**
  - FAA implementing VOR MON and NextGen DME Programs to provide resilient navigation services during potential GPS outages and disruptions
  - FAA retaining primary and secondary radars to provide resilient surveillance services during Automated Dependent Surveillance Broadcast (ADS-B) outages during GPS outages and disruptions
  - Backup timing services to be provided through telecommunications services

# 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 investigating ability potential to monitor and detect jamming and spoofing by leveraging data available through the ADS-B system
  - FAA conducted investigation on COTS portable electronic devices to alert potential GPS spoofing; GNSS receivers, telephony signals (e.g., 5G), and SDRs
  - FAA purchased next generation receivers to validate new standards and test potential mitigations for spoofing

# GPS Modernization Support

- **FAA Co-Chair of the National Space-based PNT Systems Engineering Forum (NPEF)**
- **FAA Co-Chair of GPS Program Management Reviews**
- **Civil Signal Operational Capability Integrated Product Team (CSOC IPT)**
  - Enterprise – preparing for joint use declaration of L2C and L5
  - Requirements – investigating the feasibility ARAIM and Authentication
  - Civil Signal Monitoring – implementing Civil Monitoring Performance Specification
  - Test – Supporting OCX integrated systems test and planning for 4 SV test
- **Support implementation of OCX**
  - Supporting development of GPS  $P_{\text{const}}$  failure mitigations
    - Signal monitoring to detect anomalies in a timely manner
    - Pre-check to verify satellite uploads prior to implementation
- **Conduct Position Signal Integrity Continuity Assurance (PSICA) activities with DOD to assure safety**

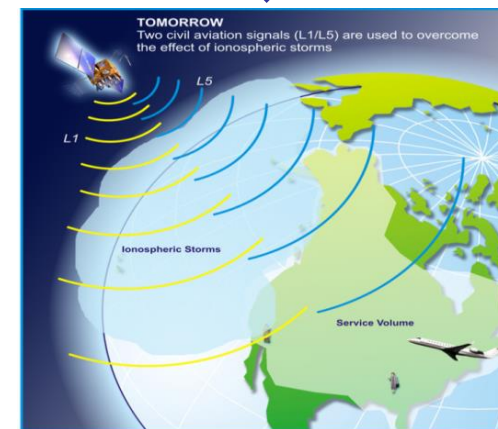
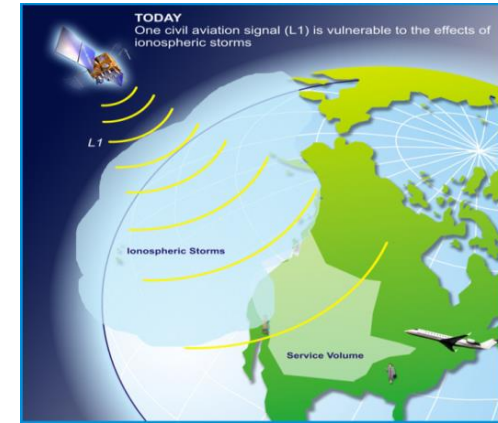
# WAAS UPDATE



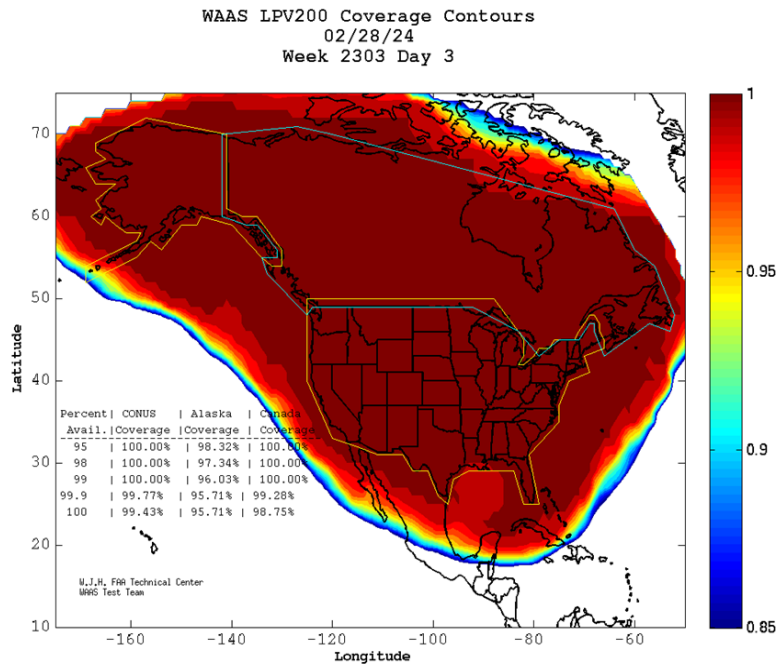
# WAAS Phase 4 Dual Frequency Operations (DFO) Status

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

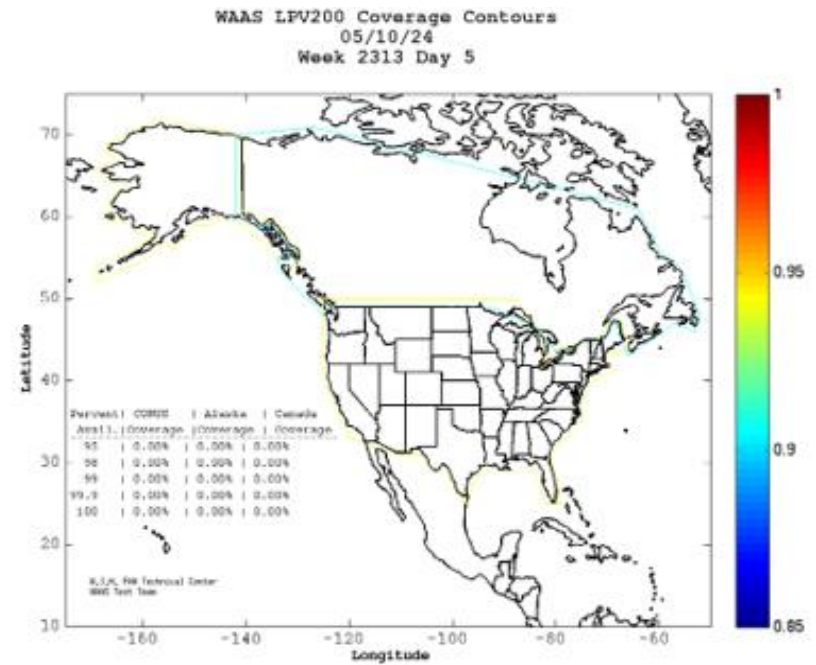
- Introduces WAAS Dual Frequency service using L1 & L5
  - WAAS DF Limited Operational Capability (DF LOC) ~ 2026
  - WAAS DF Initial Operational Capability (DF IOC) ~ 2027
  - WAAS DF Final Operational Capability (DF FOC) ~ 2028
- WAAS Technical Refresh (2022 – 2028)
  - Processor replacement coupled 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)



# The Need for Dual Frequency – Ionospheric Impacts



Nominal Day

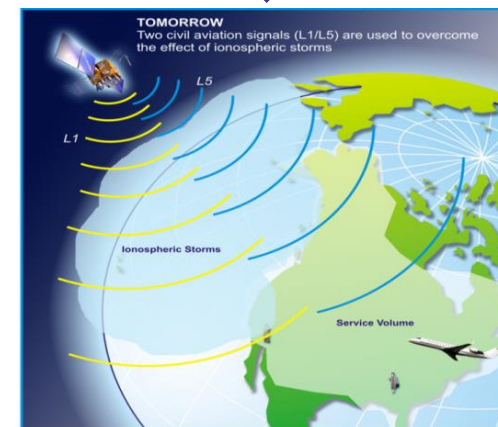
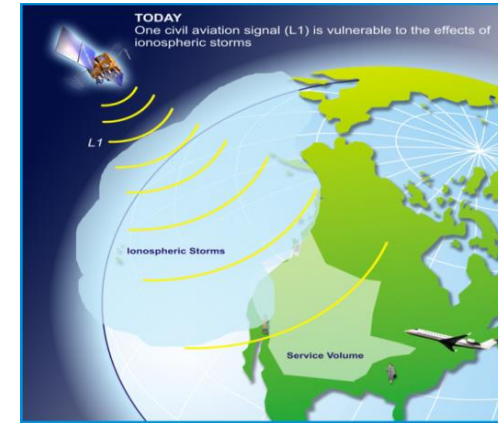


May 10, 2024

- **May 2024 was the first time the WAAS Extreme Storm Detector Tripped**
  - Shuts down WAAS vertical service for 8 hours during periods of extreme volatility

# 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 2025
  - 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

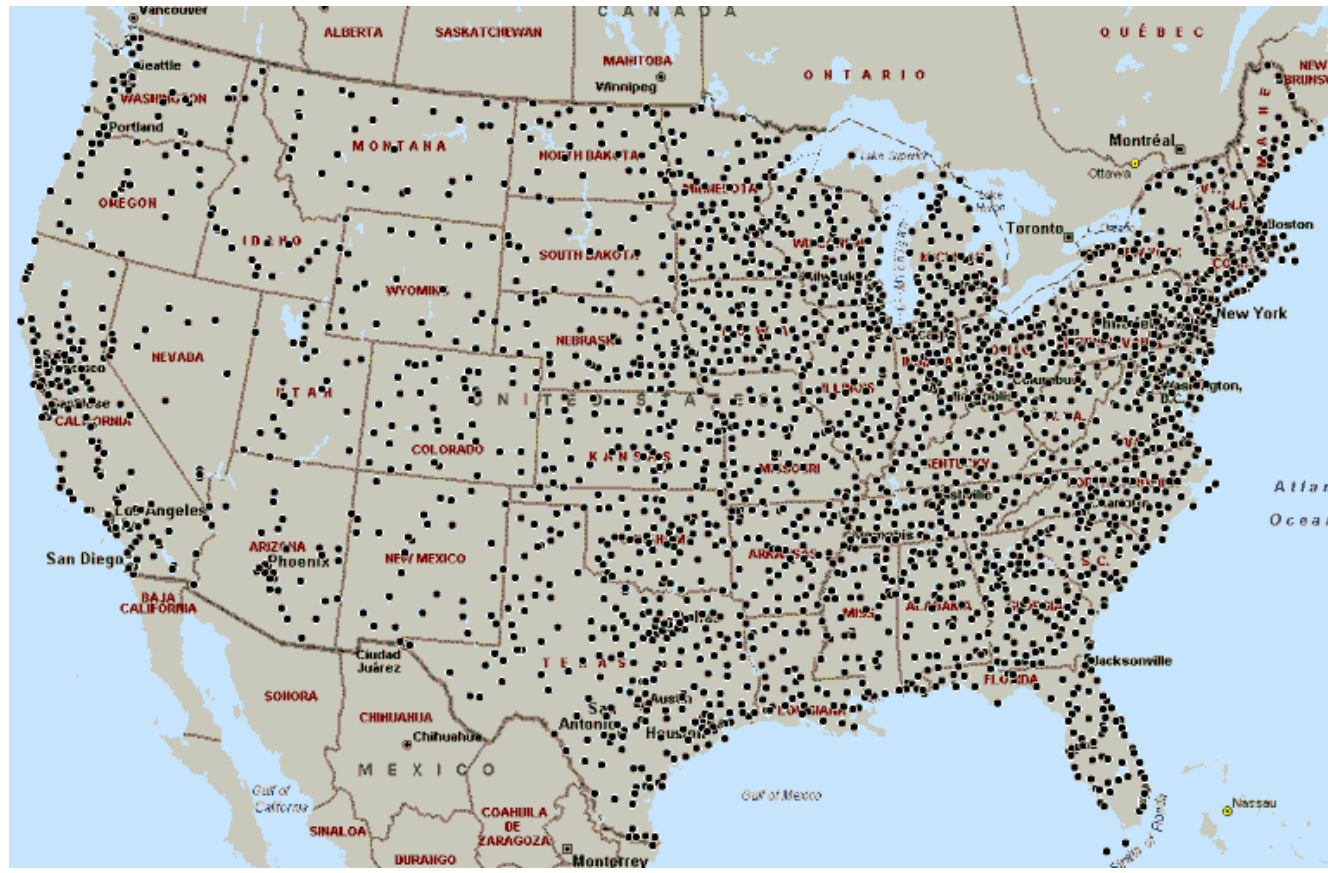


# Airports with WAAS LPV/LP Instrument Approaches



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

- As of July 11, 2024 there are currently 1,612 ILS procedures while WAAS has 4,898 LPV/LP procedures published

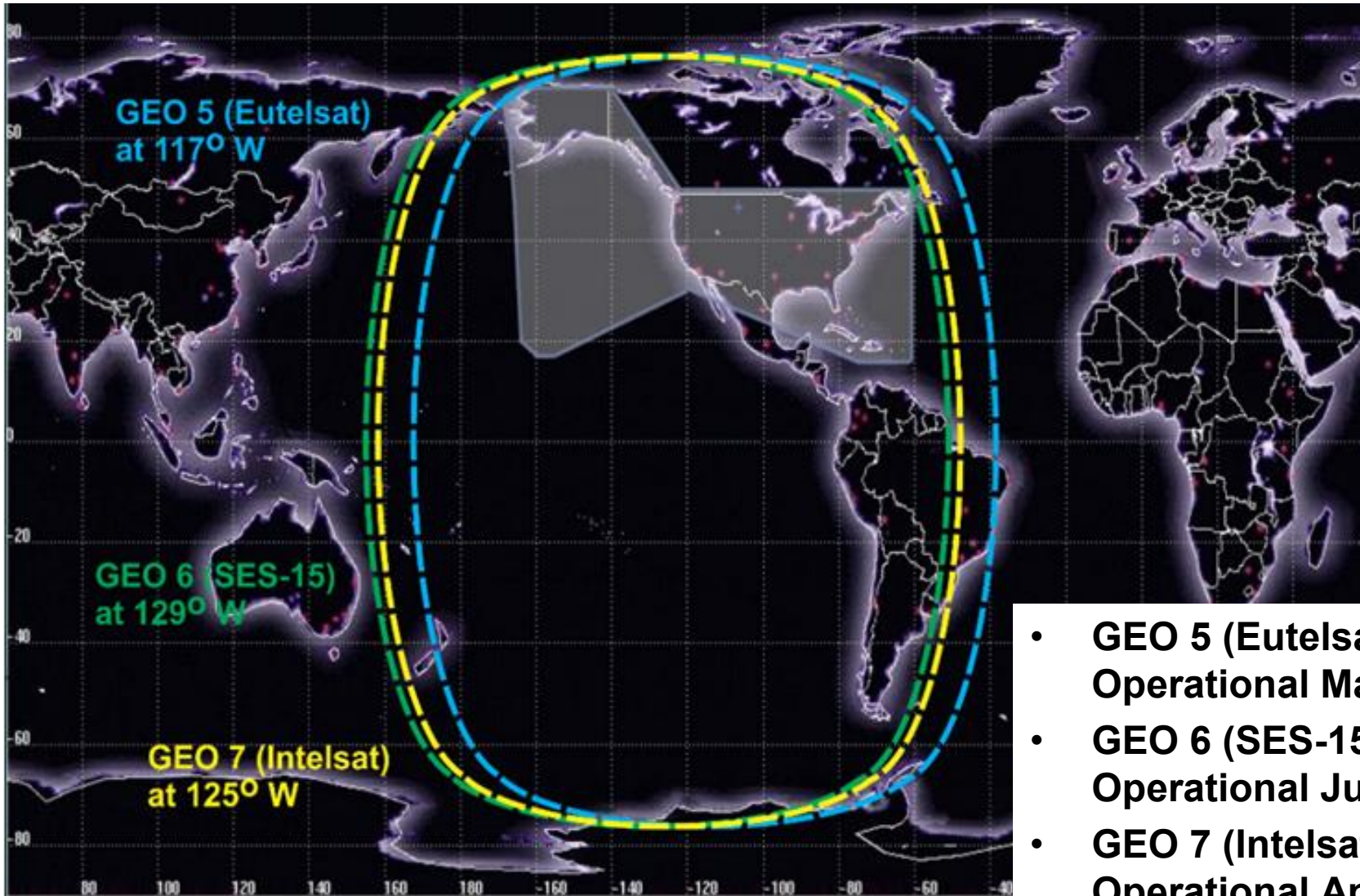


# WAAS Avionics Equipage Status

- **Over 154,952 WAAS equipped aircraft**
  - 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
    - 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 NextGen programs**
  - Automatic Dependent Surveillance Broadcast (ADS-B)
  - Performance Based Navigation (PBN)



# 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

# Navigation Resiliency

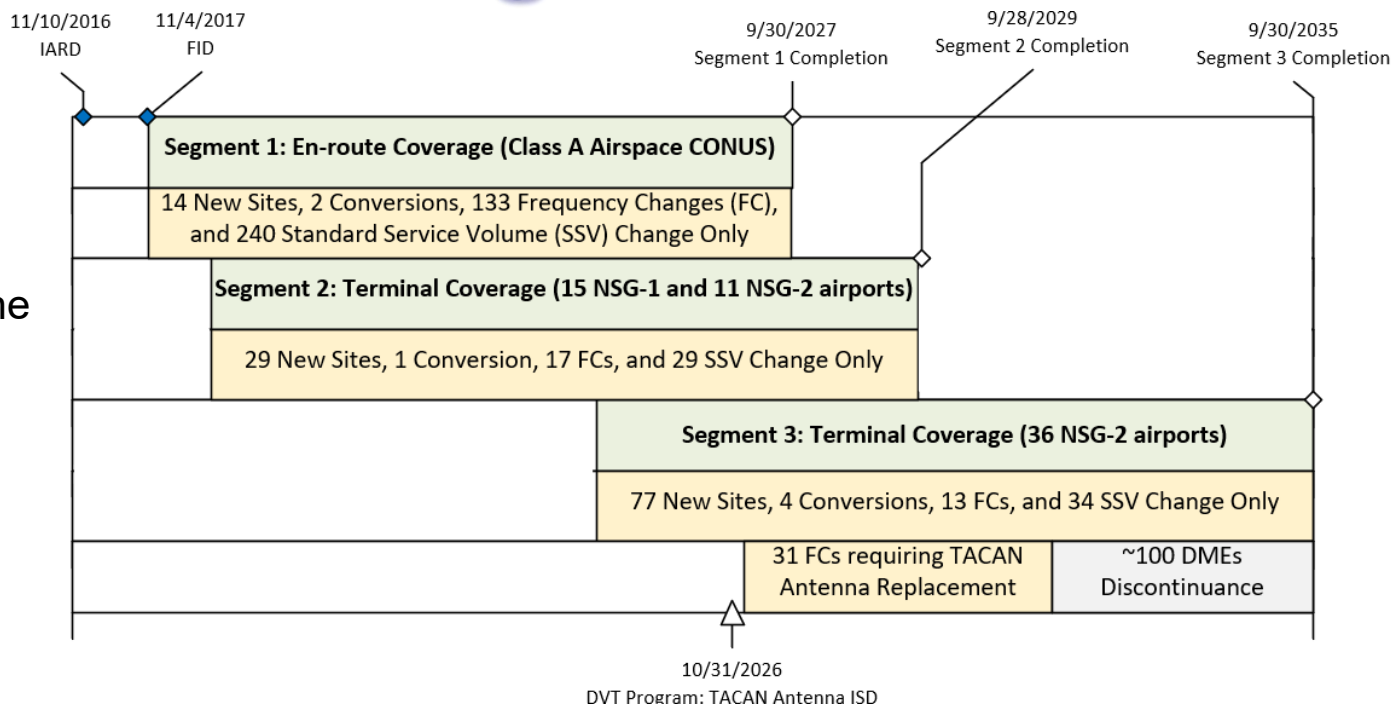
# Navigation Resiliency

- **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**
  - NextGen DME Program 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) are implemented to expand coverage at 5,000' Above Ground Level (AGL) to enable VOR-to-VOR navigation
    - 379 out of the planned 500 facilities completed
  - MON airports host a conventional ILS or VOR approach within 100 nautical miles
  - VORs that do not meet criteria are being discontinued
    - 186 out of the planned 303 VORs have been discontinued



# NextGen DME Program Timeline

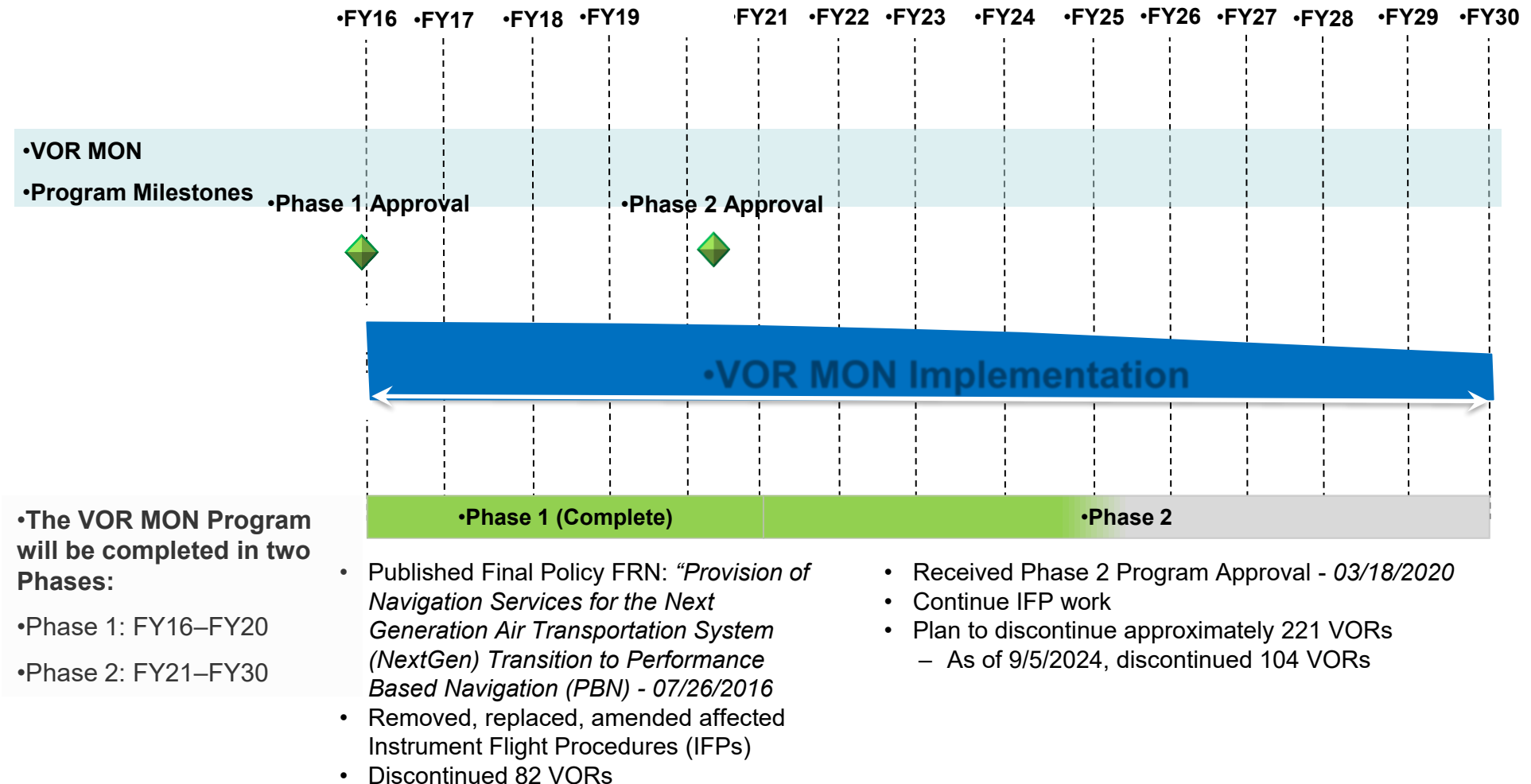
- Executing the Solution Implementation Phase through a segmented approach, delivering the Program benefits incrementally



## Project Status

Program Segment	HP Dual DME Installations			Frequency Changes			SSV Change Only		
	Target	Completion	%	Target	Completion	%	Target	Completion	%
Segment 1 (En Route)	16	15	93.75%	133	76	57.14%	240	81	33.75%
Segment 2	30	1	3.33%	16	3	18.75%	29	4	13.79%
Segment 3	81	0	0.00%	13	4	30.77%	34	8	23.53%
<b>Program Totals</b>	<b>127</b>	<b>16</b>	<b>12.60%</b>	<b>162</b>	<b>83</b>	<b>51.23%</b>	<b>303</b>	<b>93</b>	<b>30.69%</b>

# •VOR MON Program Timeline



# 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)**
  - Final plan being coordinated through signature process
- **Perform Acquisition Planning for Joint Resource Council (JRC) Decision**
  - Investment Analysis Readiness Decision (IARD)
  - Final Investment Decision (FID)
- **Developing artifacts required for investment decision**

# 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
- **ILS, LOC, or VOR approaches will be retained at MON airports to support recovery during GPS outages**
- **Rationalize Category-I ILSs at small airports where most aircraft are equipped to fly LPV**
- **Redundant NDB and VOR approaches will be cancelled**

# ILS Strategy

- **Retain existing Category 1, 2, & 3 ILSs at airports with air carrier operations**
- **Retain ILS or Localizer (LOC) approaches at VOR MON airports to support recovery during GPS outages and disruptions**
- **Rationalize Category-1 ILS at small airports where most aircraft are equipped with WAAS to fly LPV approaches**
- **Coordinate Proposed Policy Federal Register Notice (FRN) for internal coordination and public comment**
  - Assess stakeholder readiness based on internal and public comments
- **Program Planning and Outreach**
  - Conducting outreach with airport managers and industry groups to solicit feedback on strategy
  - Briefed FAA Airport District Offices (ADOs) – to establish the ILS Rationalization policy and address concerns
- **Based on stakeholder input, seek FAA Joint Resource Council (JRC) approval to initiate a program**
  - Implementation will follow JO 7400.2, Procedures for Handling Airspace Matters

# Sustainment

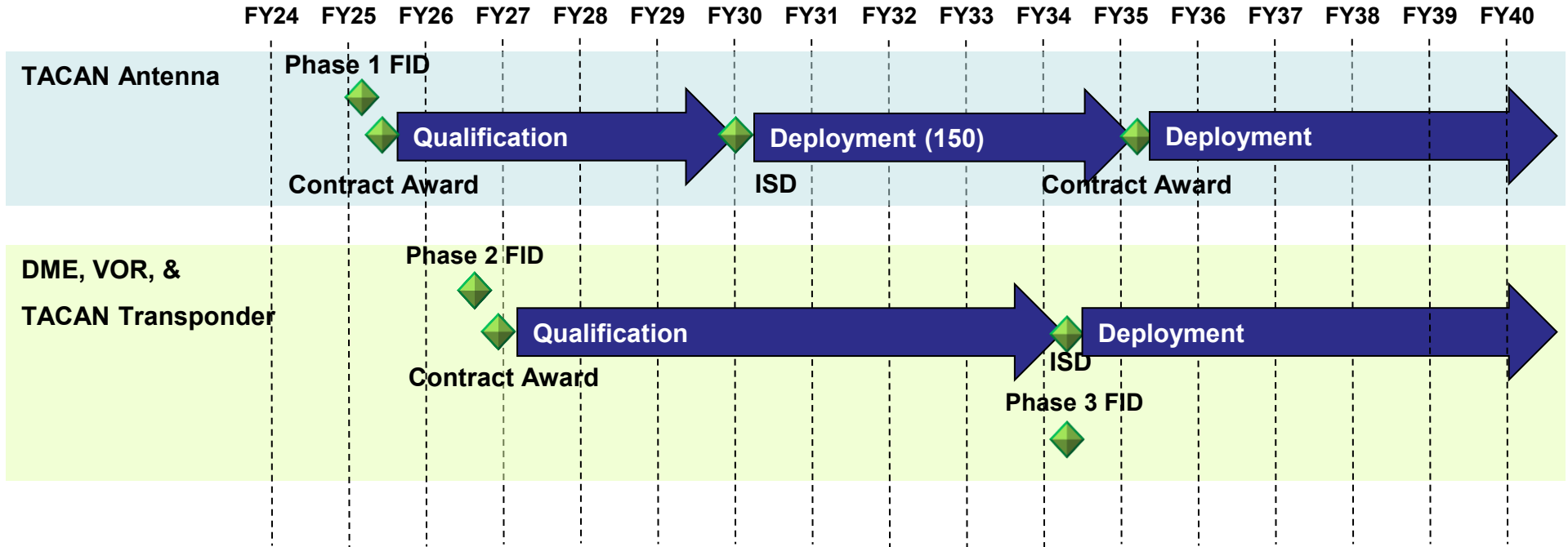
# DVT Sustainment Program

- Most DVT systems are 30+ years old and becoming unsustainable
- VOR MON and NextGen DME Programs do not sustain DVT systems
- Procurement contracts are not available to replace VORs or TACANs
- A TACAN Antenna procurement planning is underway to address urgent, short-term needs
- DVT Sustainment completed Investment Analysis Readiness Decision in September 2020
- Anticipated DVT system inventory:

VOR Single System	VOR/DME	DME Single System	VORTAC	TACAN Single System	LPDME Systems	TOTAL
21	404	96	407	14	677	1619

- **Next Steps**
  - Continue procurement activities for the TACAN Antenna
  - Reach Final Investment Decision

# DVT Roadmap



## Phase 1 (TACAN Antenna)

- Small-business set-aside
- 10-year IDIQ contract (8-year base plus two 1-year options)
- Phase 1 will replace up to 150 TACAN Antennas, about 1/3 of the NAS.
- The remaining antennas will be replaced in Phase 3 and beyond

## Phase 2 (DME, VOR, & TACAN Transponder Qualification)

- Competitive award
- 20-year IDIQ contract (5-year base plus three 5-year options) – covers Phases 2, 3, and most of 4

## Phase 3+ (Deployment of Combined DVT Systems)

- Exact sites and number of systems to be replaced each year will be based on operational priorities and available funding
- Tech refresh / product improvement



# Summary

# Summary

- **FAA is supporting National Policy and GPS Modernization initiatives**
- **WAAS is implementing dual frequency service and addressing obsolescence of components**
- **Strategy planning for ARAIM in support of the Interagency Forum for Operational Requirements (IFOR) process as a new GPS requirement is underway**
- **Resiliency**
  - NextGen DME Program implementation is underway
  - VOR MON program – 379 out of 500 new VOR SSVs have been published and 186 out of 303 planned VORs have been discontinued
  - TACAN MON Program Planning underway in coordination with PBFA
  - ILS Rationalization strategy is being coordinated with internal and external stakeholders to establish rationalization criteria
- **Sustainment**
  - DME/VOR/TACAN (DVT) Sustainment Program is planning for Final Investment Decision in December 2023

# Questions?

# BACKUP

# TACAN MON Notional Timeline



Formulate response to DoD on FAA CoA 1 Decision (Completed)

Continue study of new TACAN service volume definitions and database integration

Flight check and data analysis of TACANs retained by the TACAN RON that need new SSVs, synced with VOR MON and NextGen DME waterfall schedules

Coordination and vetting between FAA and DoD of individual TACAN candidates for divestment

Decommissioning or conversion of TACANs not retained by TACAN RON



# ILS Rationalization Communication & Outreach

- **Internal Stakeholder Coordination**

- Aviation Safety (AVS), AFS-400, AIR-100
- Airports (ARP)
  - Airport District Offices and Regional Managers
- Aviation Policy Office (APO)
- Air Traffic Organization (ATO)
  - Mission Support Services (AJV) Operations Support Groups (OSGs),
  - Flight Procedure Team (FPT), Aeronautical Information Services (AIS)
  - Flight Operations (AJF), Technical Operations (AJW)
- DoD Policy Board for Federal Aviation (PBFA)

- **External Outreach**

- NBAA, A4A, RAA, AOPA, NAC, ACI-NA, NASAO, AAAE, ACC, etc.
- Congress, DoD, and the OEMs