

FAA Navigation Programs Update

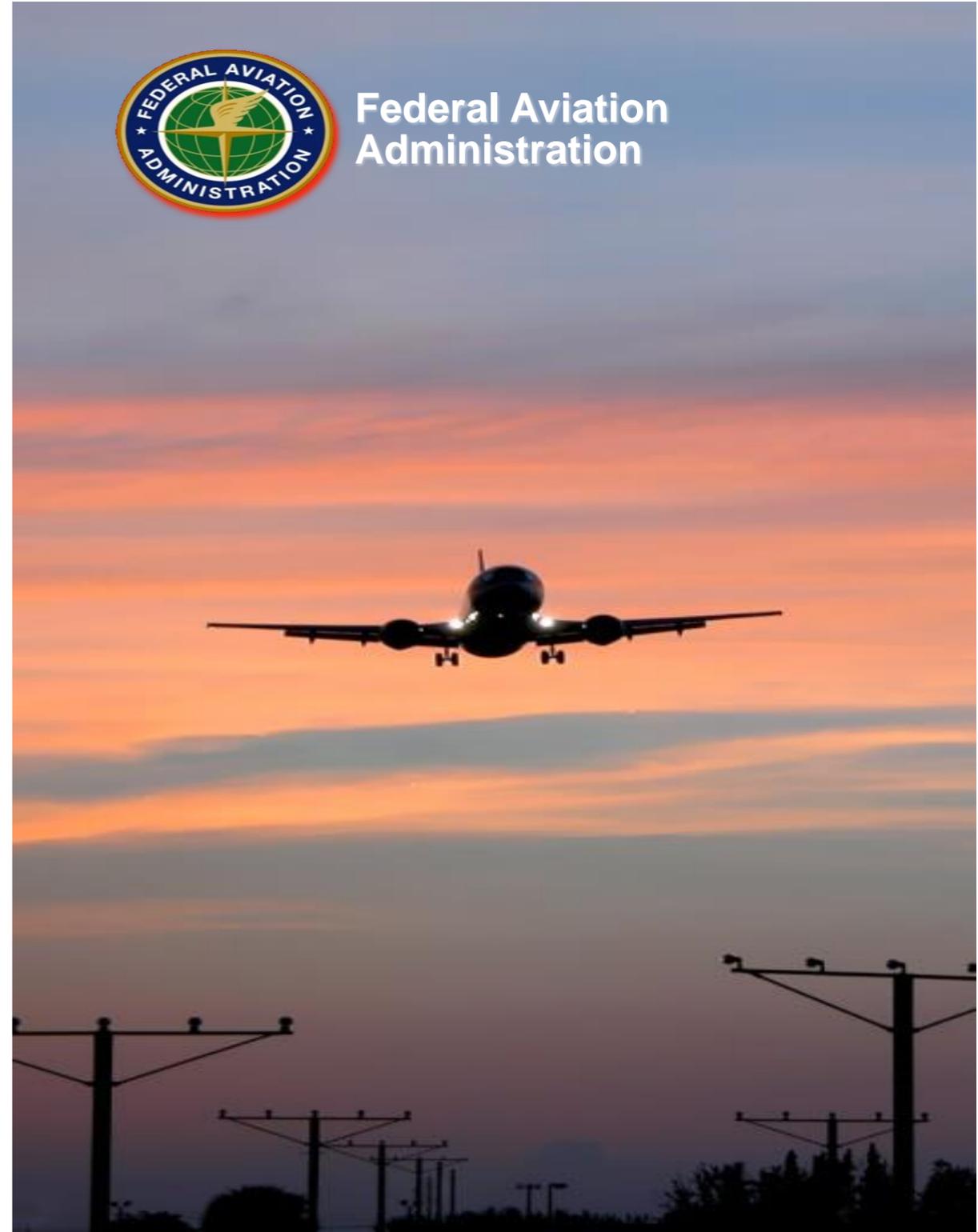
Presented by: Deborah Lawrence

**Presented to: Civil GPS Service Interface
Committee**

Date: September 2018



Federal Aviation
Administration



Agenda

- **FAA Navigation Strategy**
- **WAAS Update**
- **Ground Based Augmentation System (GBAS) Update**
- **Position, Navigation and Timing (PNT) Update**
- **Navigation Resiliency**
 - DME/VOR/TACAN Sustainment
 - NextGen DME Program Update
 - VHF Omni-directional Range (VOR) Minimum Operational Network (MON) Program Update
 - ILS Rationalization Status
- **Summary**

Navigation Strategy 2018

- **Provide resilient navigation services for the PBN NAS Strategy–2016**
 - GPS and WAAS enable all PBN operations and ADS-B
 - A nominal population of legacy conventional NavAids must be sustained to provide a resilient NAS infrastructure while the FAA transitions to PBN
 - NextGen DME Program will provide an RNAV backup to mitigate for the loss of GNSS
 - VOR Minimum Operational Network (MON) Program will repurpose VORs to provide a backup for non-RNAV aircraft
- **Rationalize the legacy NavAid infrastructure**
 - Discontinue redundant VORs to establish the MON
- **Innovate navigation services to enable new capabilities**
 - Multi-Constellation GNSS
 - LED technology, etc.

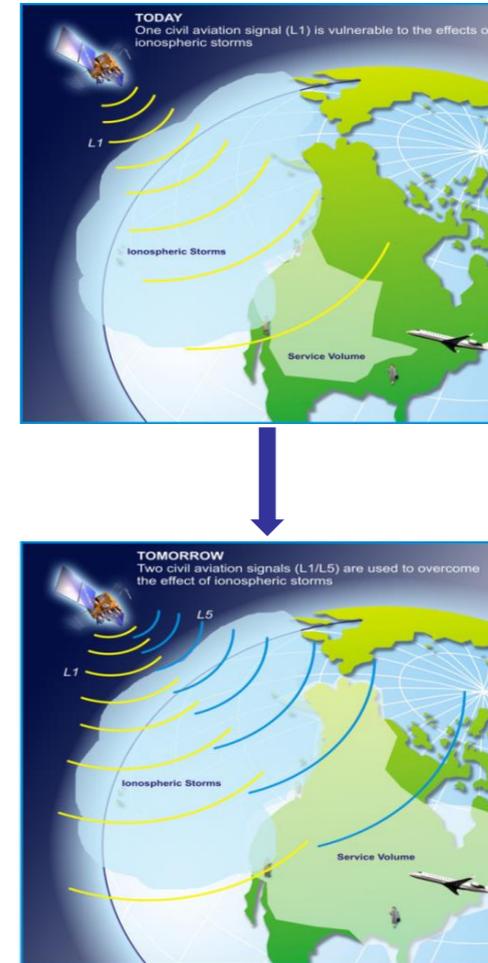


WAAS UPDATE



WAAS Phase IV Dual Frequency Operations Status

- **Phase IV-A**
 - Combination of infrastructure improvements and tech refresh in support of operational system and future incorporation of dual frequency
- **Five (5) Releases**
 - Release 1 (Processor Upgrades) completed April 2017
 - Release 2 (GEO 5 Integration) completed March 2018
 - Release 3 (GIII Multicast Structure) completed January 2018
 - Release 4 (C&V Safety Computer [SC] Validation and Deployment) on schedule to complete cutover by the end of CY2018
 - Release 5 (GPT SC Validation and GEO 6 Integration) Software release scheduled cutover complete by 2nd Quarter CY2019. GEO 6 on schedule for cutover by 2nd Quarter CY2019
- **Dual-Frequency Multi-constellation Capability (DFMC)**
 - MOPS and SARPs development underway
 - WAAS assisting IWG with providing SBAS perspective on DFMC capability
- **Advanced RAIM (ARAIM)**
 - ARAIM subgroup developing more detailed concept definition in Milestone 3 report to look into avionics centric approach for use of multi-constellation GNSS
 - FAA focusing on development of initial requirements for horizontal navigation (H-ARAIM)

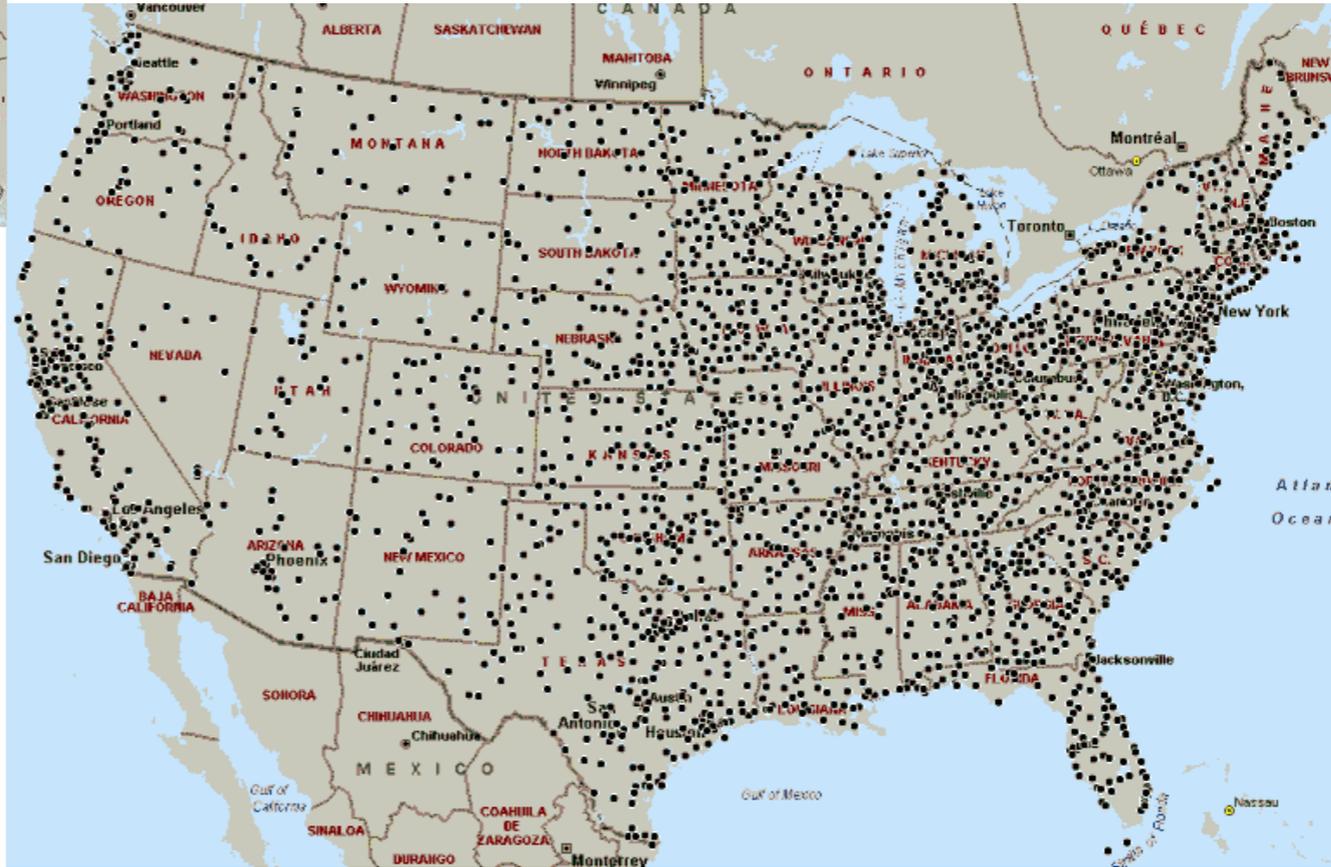


Airports with WAAS LPV/LP Instrument Approaches



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

- As of September 2018 there are currently 1,549 ILS procedures while WAAS has 4,639 LPV/LP procedures published



WAAS Avionics Equipage Status

- **Over 117,000 WAAS equipped aircraft in the NAS**
 - WAAS receivers provided by companies such as:
 - Garmin, Universal, Rockwell Collins, Honeywell, Avidyne, Innovative Solutions & Support (IS&S), Thales and Genesys Aerosystem (Chelton)
- **Since 2006, aircraft equipage rates has increased each year**
- **All classes of aircraft are served in all phases of flight**
- **Only Primary GNSS service enabling NextGen programs**
 - Automatic Dependent Surveillance Broadcast (ADS-B)
 - Performance Based Navigation (PBN)



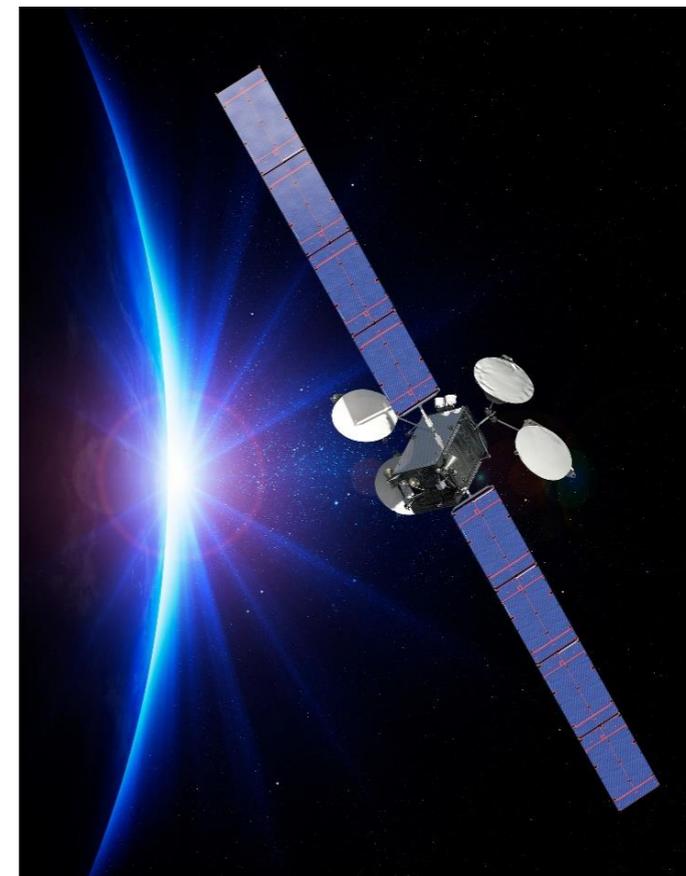
GEO Sustainment (GEOs 5/6/7)

- **GEO 5/6 Satellite Acquisition**

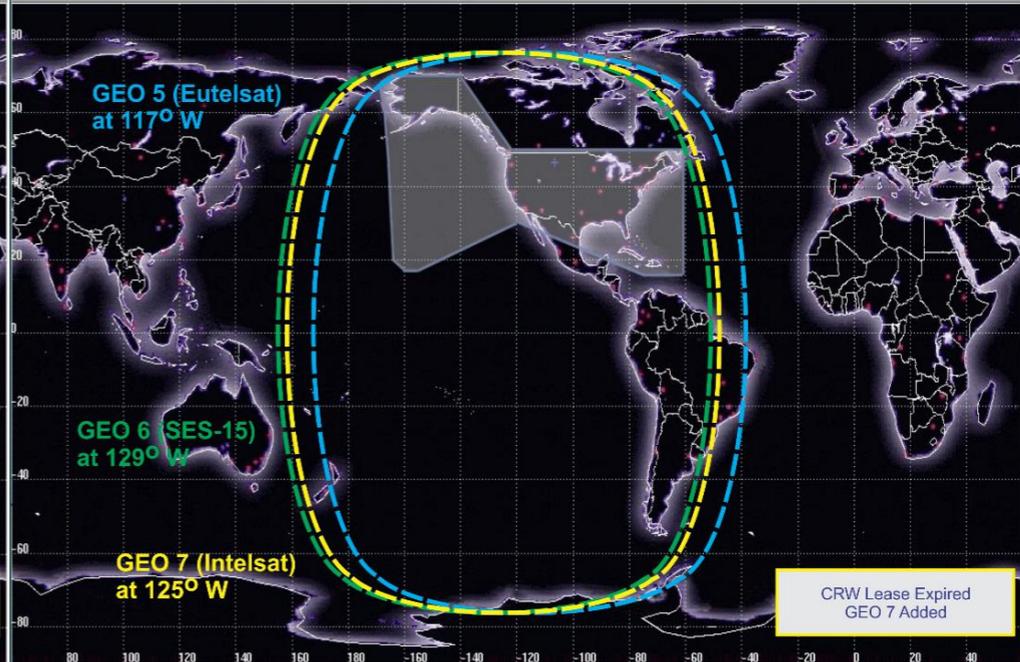
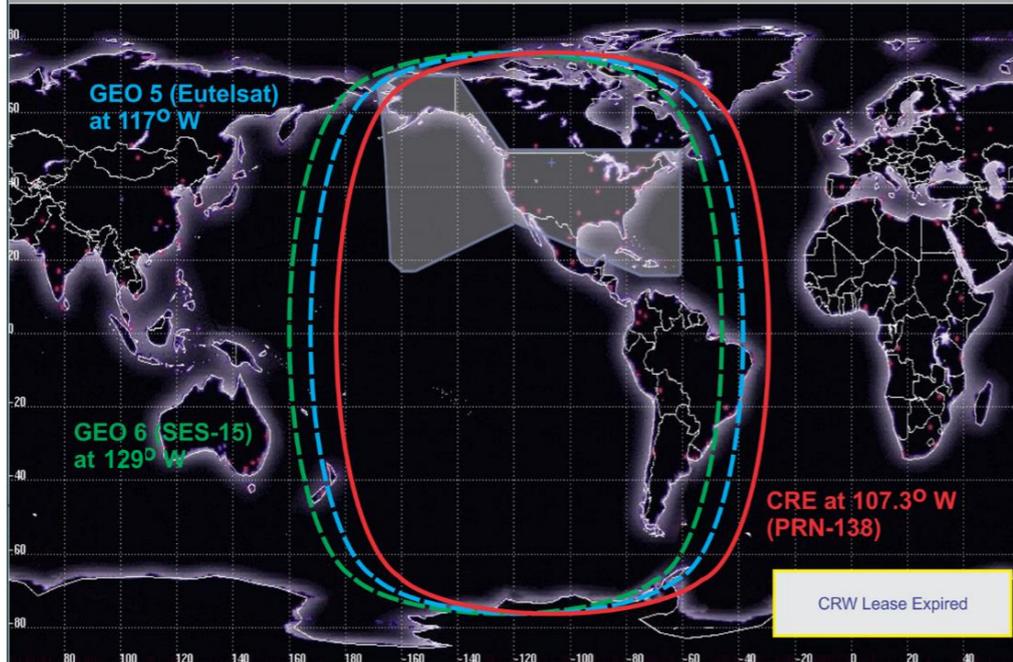
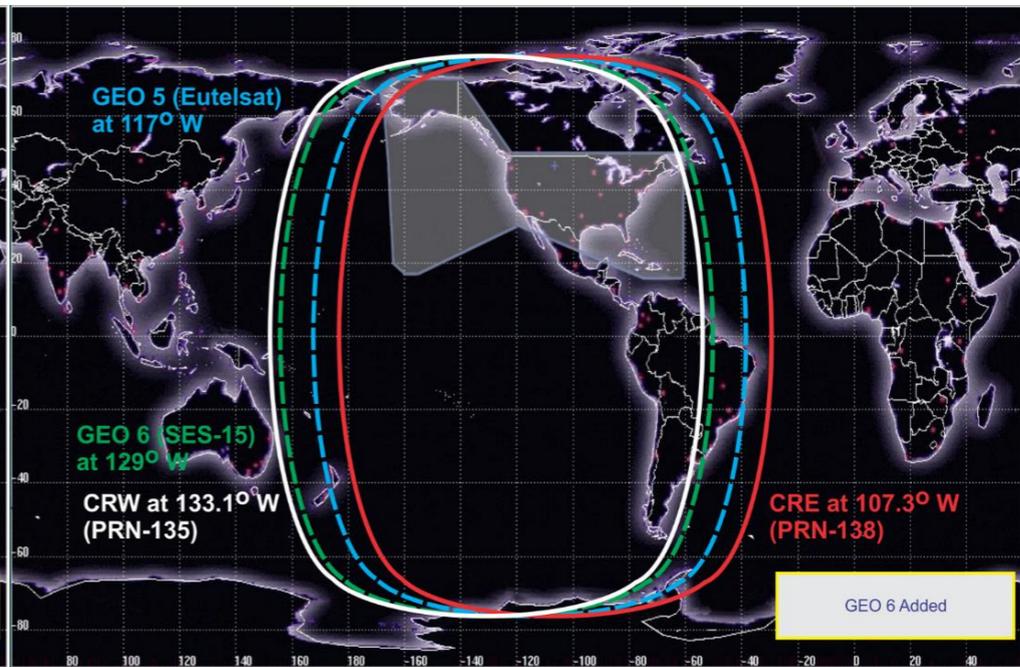
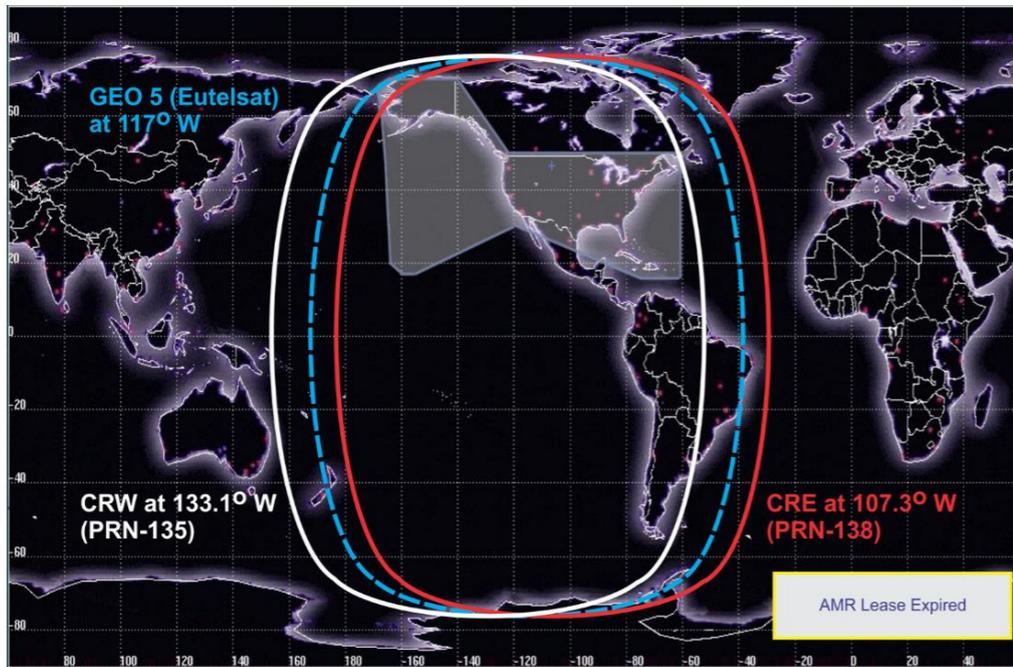
- GEO 5
 - Operational March 2018.
- GEO 6
 - Host satellite is SES-15, planned for 129 West
 - Provides full coverage of CONUS and Alaska
 - Successful launch on 18 May 2017
 - Expected operational capability June 2019.
 - Concluded Phase 1 development in May 2018 with completion of Signal Generator Sub-system (SGS), Radio Frequency Uplink (RFU), and satellite integration.
 - Phase 2 will cutover in 2nd quarter CY2019.

- **GEO 7 Satellite Acquisition**

- Contract awarded in March 2018. Completed Integrated Baseline Review (IBR) in September 2018.



Eutelsat 117WB



GBAS UPDATE



GBAS Overview

- **NextGen Program Closeout**
 - Activities
 - Open issues from GAST-D Workgroup
- **Ongoing FAA Activities**
 - Support thru Non-Federal Policy & Oversight Office (AJW-1X)
 - Honeywell SLS-4000 Block II Updates
 - VDB Compatibility work for ICAO/RTCA
 - Updates to Non-Fed OMM Template
- **Ongoing Industry Activities**
 - PANYNJ – JFK & LGA GBAS planning
 - SEATAC GBAS Planning
 - SFO GBAS Planning
 - Request for GAST-D (CAT-III) SDA Information from Indra Navia
- **Operational Data & Equipage**
 - 5508 approaches conducted at Newark, NJ and Houston, TX
 - Houston GBAS Operational Status

Position, Navigation and Timing (PNT) Update

Innovation Initiatives

- **Support Multi-Constellation GNSS and ARAIM standards development and program coordination through ICAO, RTCA, EU, and ANSP organizations**
- **Explore the feasibility of achieving WAAS CAT-II precision approach service (w/ single & dual frequency GPS)**
- **Develop a Low-Level Helicopter IFR flight route based on Point in Space (PinS) locations**

Navigation Resiliency

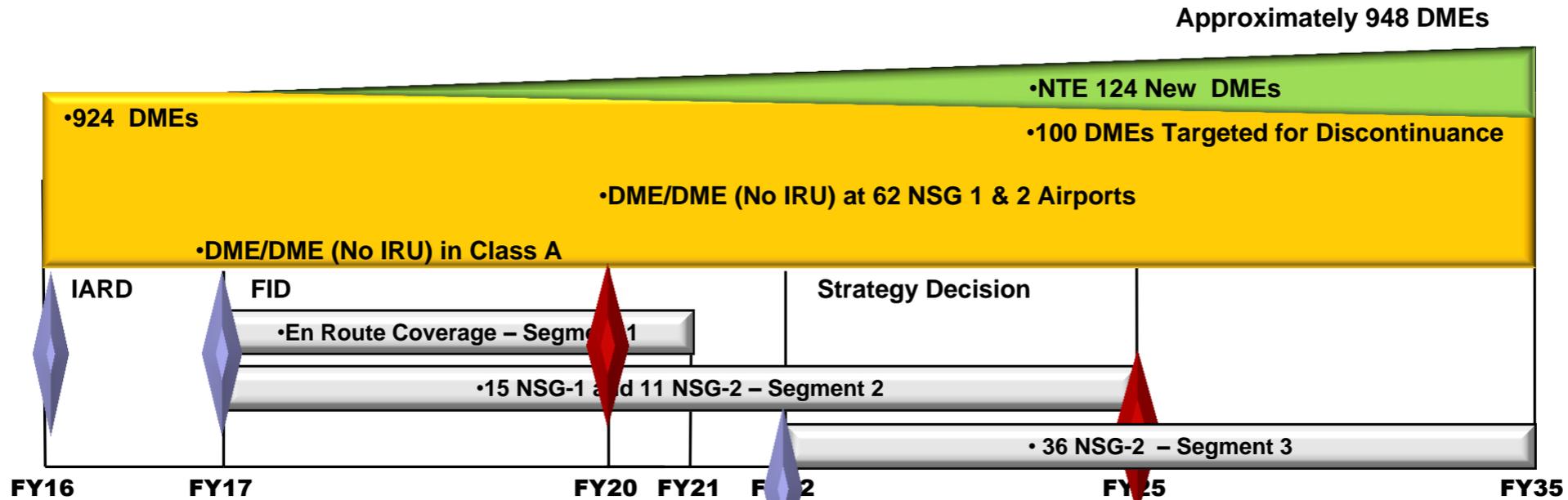
Navigation Resiliency

- **DME/VOR/TACAN service is required for the foreseeable future as part of a resilient navigation infrastructure**
- **DME infrastructure supports PBN operations in the event of GNSS service disruptions**
 - NextGen DME Program being implemented
 - Established interim siting criteria
 - 100 DME targeted for discontinuance
 - New DMEs not-to-exceed 124
- **VOR MON has discontinued 34 VORs to date; 74 planned for Phase 1 ending in 2020.**
 - Next phase strategy decision anticipated in 2020; current plan for next phase is to discontinue 237 VORs
- **ILS Rationalization placed on hold in 2017; initiative has been reinitiated and will commence in 2019**

DME/VOR/TACAN Sustainment

- **Supportability Study**
 - Evaluated all FAA-owned systems to determine supportability through 2045
 - Completed Final Report in July 2018
 - Summary of results:
 - Infrastructure not supportable through 2045 without modernization investment strategy
 - Engineering modifications and improved integrated logistics support approaches required to sustain existing infrastructure in the near term until full system replacement is implemented
- **Next Steps**
 - Address Near-Term Operational Needs (antennae and oscillators)
 - Proceeding with DME/VOR/TACAN Acquisition Strategy

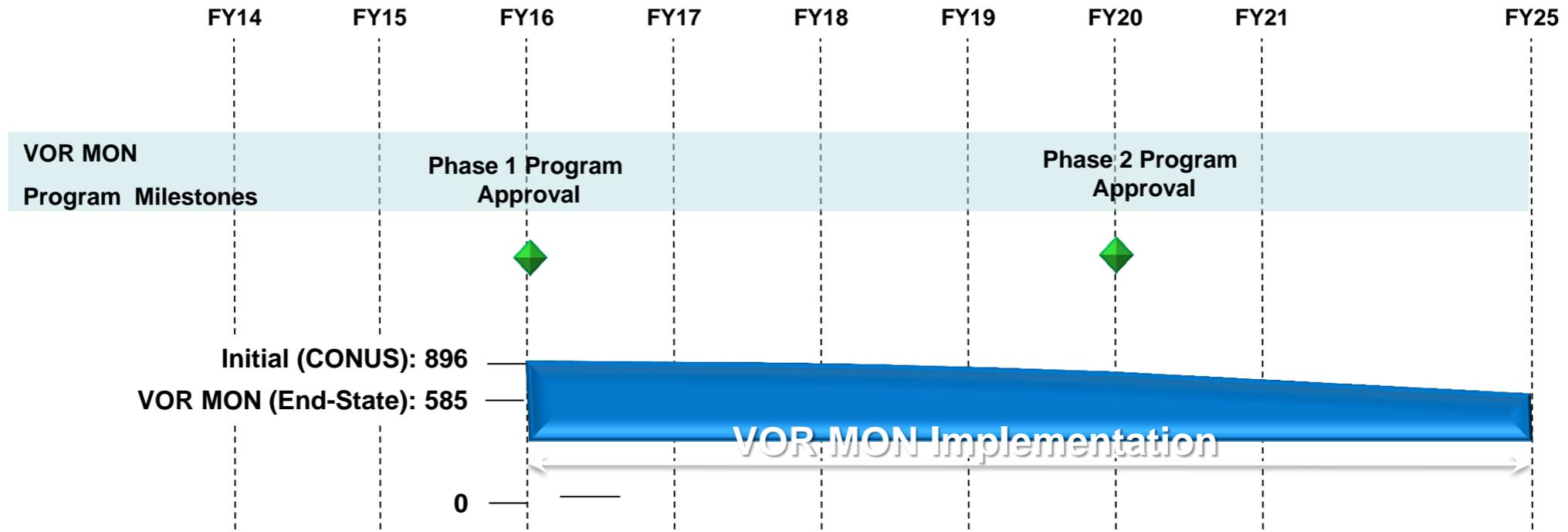
NextGen DME Program Timeline



- Airports grouped into clusters to maximize benefits
- Clusters grouped into discrete segments
 - Segment 1: En Route Coverage
 - Segment 2: Terminal Coverage for 15 NSG-1 and 11 NSG-2 Airports
 - Segment 3: Terminal Coverage for 36 NSG-2 Airports

◆ PBN NAS Navigation Goals
◆ Acquisition Decision Milestones

VOR MON Program Timeline



The VOR MON Program will be completed in 2 phases:

Phase 1: FY16 – FY20

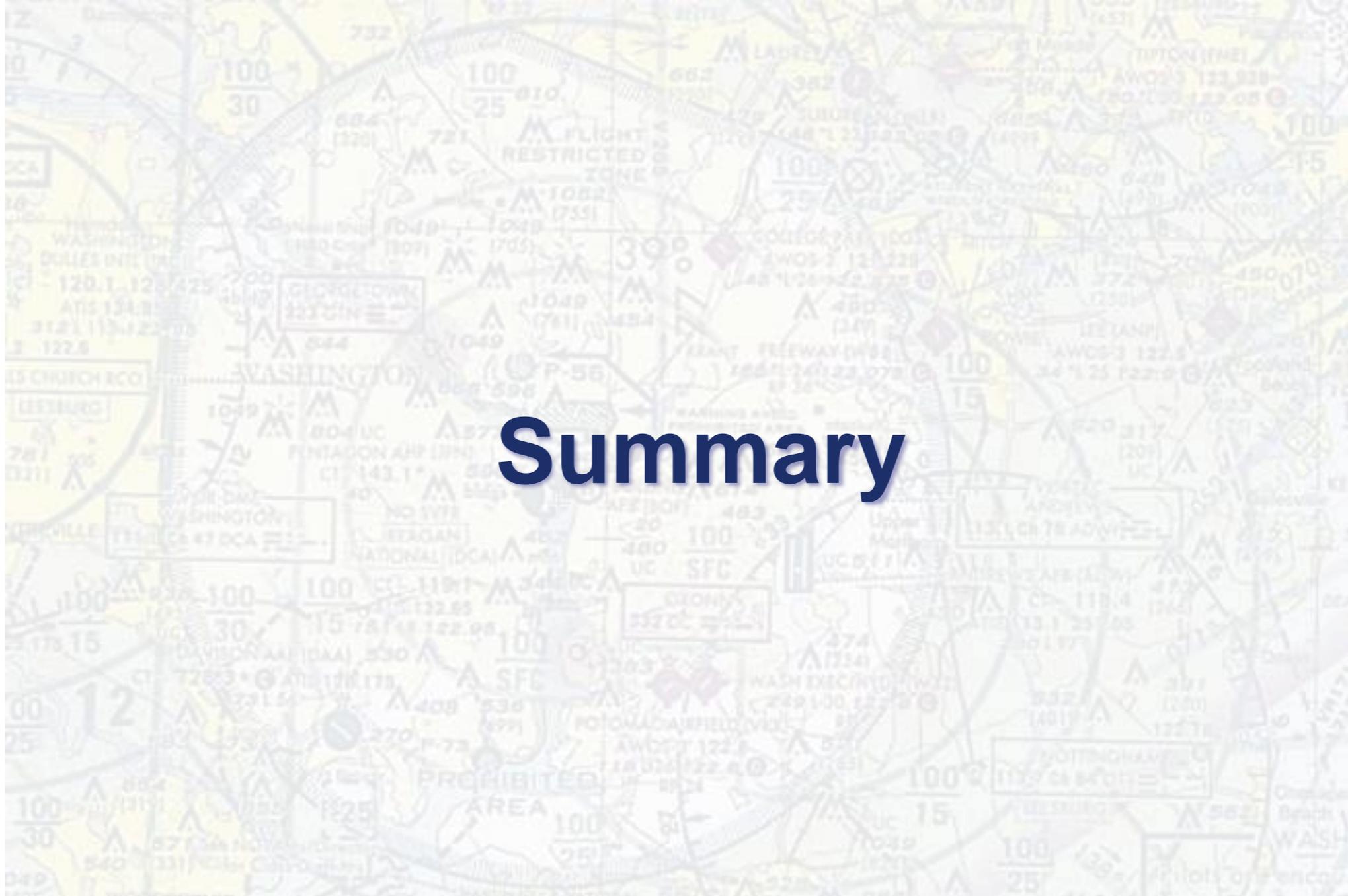
Phase 2: FY21 – FY25



- Publish Final Policy FRN: *“Provision of Navigation Services for the Next Generation Air Transportation System (NextGen) Transition to Performance Based Navigation (PBN)”*
- Remove, Replace, Amend affected Instrument Flight Procedures (IFPs)
- Discontinue Phase 1 VORs (74)
- Plan for Phase 2 Final Investment Decision (FID)

- Continue IFP work
- Discontinue Phase 2 VORs (237)

•As of September 7, 2018



Summary

Summary

- **WAAS is replenishing GEOs, Performing Tech Refresh, and preparing for Phase IVB**
- **FAA continues to support Cat I GBAS operations**
- **GBAS GAST-D safety documentation completed, but not SDA**
- **PNT**
 - Supporting Multi-Constellation GNSS and ARAIM
 - Exploring the feasibility of achieving WAAS CAT-II
- **Resiliency**
 - DME/VOR/TACAN Supportability study completed in 2018
 - NextGen DME Program implementation underway
 - VOR MON implementation – 34 VORs discontinued
 - ILS Rationalization initiative reinitiated

Questions?

Houston GBAS Operational Status

- **Houston GBAS was upgraded to SLS-4000 Block II w/ SBAS in May 2018**
 - Upgrade error: no approaches were enabled
 - Procedural error during upgrade
 - All approaches have been re-enabled and Honeywell process has been reworked to strengthen return-to-service checks for upgrades
 - FAA ground inspection checklist also being updated to ensure that approach statuses are correct
 - GBAS monitors indicated the system was operating normally
 - HAS personnel were not trained to observe approach status
 - ICMS only shows 'green' or 'red' at a system level; no approach by approach status shown
 - Issue was not identified for over two weeks, ~16 approaches cleared
- **Due to failures in communication of PIREPs and questions about monitoring, the GBAS has been NOTAM'ed OTS since**
 - OMM, LOA between ATC and HAS being updated
 - ICMS changes may be deemed necessary
 - Local SMS panel will be held before the system is returned to operation