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
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
The VOR MON Program will be completed in 2 phases:

**Phase 1:** FY16 – FY20
- 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)

**Phase 2:** FY21 – FY25
- 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