FAA NAVAID Rationalization / Resiliency Overview

Presented to:  AACA

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Date:  Feb 23, 2017
Navigation Programs Goals

To develop, acquire, implement, and sustain navigation systems that support current NAS operations, the transition to a PBN centric NAS, and the delivery of new capabilities that enable NextGen operational improvements.
NAS Transition to Performance Based Navigation (PBN)

• PBN NAS Strategy – 2016
  – Implementation of Area Navigation (RNAV) and Required Navigation Performance (RNP)
  – Retention of conventional NavAids necessary for a resilient navigation infrastructure
**Resilient Navigation Services**

- **GNSS** is the primary enabler for all PBN (RNAV and RNP) and ADS-B accuracy & integrity for all separation levels
- **DME/DME** provides an RNAV alternative
- **VOR MON** can be used by aircraft that are not DME/DME RNAV equipped
- **CAT-I ILSs** will support safe recovery in the event of a GNSS outage
Navigation Strategy Goals

• Enable the PBN NAS Strategy–2016
  – Provide GNSS (GPS and WAAS) to enable all PBN operations and ADS-B (accuracy & integrity for all separation levels)
  – Provide resilient navigation services to ensure safety, capacity, and efficiency
  – Implement the NextGen Distance Measuring Equipment (DME) Program to provide an RNAV backup for Class A airspace and the Navigation Service Group (NSG) 1-2 airports, during GNSS outages

• NavAid Rationalization
  – VOR Minimum Operational Network (VOR MON)
  – Distance Measuring Equipment (DME)
  – Tactical Air Navigation (TACAN)
  – Non-Directional Beacon (NDB)

• Procure systems to fill gaps or sustain the retained infrastructure
## NAVAIDs Sustainment Strategy

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**SA** – Sustainment Analysis  **ISD** – In-Service Decision  **CA** – Contract Award
VOR MON Program Goals

• Support the NAS transition from VOR based routes to a more efficient Performance Based Navigation (PBN) structure consistent with Next Gen goals and the NAS Efficient Streamlined Services Initiative (NESS).

• Enable pilots to:
  – Revert from PBN to conventional navigation in the event of a Global Positioning System (GPS) outage;
  – Tune and identify a VOR at an altitude of 5,000 feet or higher;
  – Navigate using VOR procedures through a GPS outage area;
  – Navigate to a MON airport within 100 nautical miles to fly an Instrument Landing System (ILS) or VOR instrument approach without Distance Measuring Equipment (DME), Automatic Direction Finder (ADF), surveillance, or GPS; and
  – Navigate along VOR Airways especially in mountainous terrain where surveillance services are not available and Minimum En Route Altitudes (MEAs) offer lower altitude selection for options in icing conditions.

• Discontinue approximately 30% (308) of VORs by 2025, in accordance with JO 7400.2 and established policies.
VOR MON Lessons Learned

• Safety must not be compromised during the transition

• External and internal communication and coordination is critical
  – Internal dependencies exist within the VOR infrastructure
  – External needs vary
  – All practical means of communication should be utilized

• Instrument procedures work is the key to success

• Spectrum requirements may need to change

• Business case realities should be balanced with expectations
  – Balancing resources between implementation and sustainment
Criteria for Establishing the VOR MON
Airline Operations during a GPS Outage

- Nearly all airliners are equipped with Distance Measuring Equipment (DME/DME) equipment and are RNAV capable.
- The FAA assumes that most airliners will use DME/DME navigation and Instrument Landing System (ILSs) in case of a GPS outage.
- This presentation does not discuss DME navigation, but the FAA has a separate program to maintain DME/DME navigation.
MON Airports and VOR MON Selection Criteria

• General Criteria
  – Retain sufficient ILSs, LOCs, and VORs to support safe landings at a suitable destination with a GPS-independent approach (ILS, LOC or VOR) within 100 NM of any location within CONUS
  – Retain almost all VORs in western designated mountainous area and outside of CONUS
  – Retain VORs to support international arrival airways from the Atlantic, Pacific, the Caribbean, and at the Core 30 airports
  – Provide near-seamless coverage at and above 5000ft AGL
    • Note: Substantial coverage will exist below 5000 ft AGL
  – Retain sufficient VOR ground stations to enable aircraft to proceed safely to another VOR and/or to a suitable destination with a GPS-independent approach (ILS, LOC or VOR) within 100 NM of any location within CONUS
MON Airport and VOR MON Selection Criteria - Continued

• **Other considerations**
  – Only FAA owned/operated VORs are being considered
  – DMEs and TACANS are generally being retained
    • DME/TACAN service would, in general, be retained if VOR service is removed
    • Radios at VOR sites will generally be maintained
  – Support for VOR-to-VOR navigation capability
    • VOR signal coverage at 5000 ft above ground level to FL 450 will be provided
    • Generally navigate VOR-to-VOR direct without airways
    • Existing airways and VORs would generally be used in the western mountain area and where necessary in other places
Reducing Dependencies on VORs

• As the FAA transitions to PBN, aircraft reliance on VORs will decrease significantly

• This will allow the FAA to transition to a VOR MON, which will provide backup coverage during a GPS outage as well as basic navigation capability
  – A majority of operators, operating under rules other than Part 91, will have GPS, DME/DME and ILS
    • Some operators may need VOR to fulfill requirements for independent navigation systems
  – For all other aircraft, the MON will provide sufficient coverage to enable aircraft to proceed safely VOR-to-VOR and/or to a suitable landing destination with a GPS-independent approach within approximately 100 nm of any location in CONUS
VOR MON Equipment Requirements

- There will be no change in current equipage rules:
  - 14 CFR Part 91 (non Subpart K)
    - Aircraft equipped with non-WAAS GPS will continue to be required to carry an alternate form of navigation appropriate to the route to be flown (i.e., a VOR)
    - WAAS-equipped aircraft will continue to not be required to carry an alternate form of navigation
      - If WAAS is out of service, the non-WAAS GPS rules will apply
  - Others (14 CFR part 121, 135, 91 Subpart K, etc.)
    - Must carry an appropriate independent non-GPS-based navigation system (in addition to GPS and/or WAAS)
    - Rules on “independence” can be complex depending on navigation architecture in aircraft
Resiliency - It’s a *Big* Job

- VORs have been central to the U.S. National Airspace System for over 60 years

- Virtually all charts, airways, airspace, and procedures are based on or depict VORs

- The specific VORs and the specific order of removal will be the subject of official announcements, collaboration, and outreach by the FAA
  - A VOR will not be removed from service until all procedures using that VOR have been modified or cancelled
Summary

- PBN NAS Strategy defines the overall requirement
- Navigation Strategy implements the resilient navigation infrastructure
- VOR MON Program currently being implemented
- NextGen DME Program is being planned
- Internal and External coordination is key to success