

VOR Minimum Operational Network (MON) Implementation

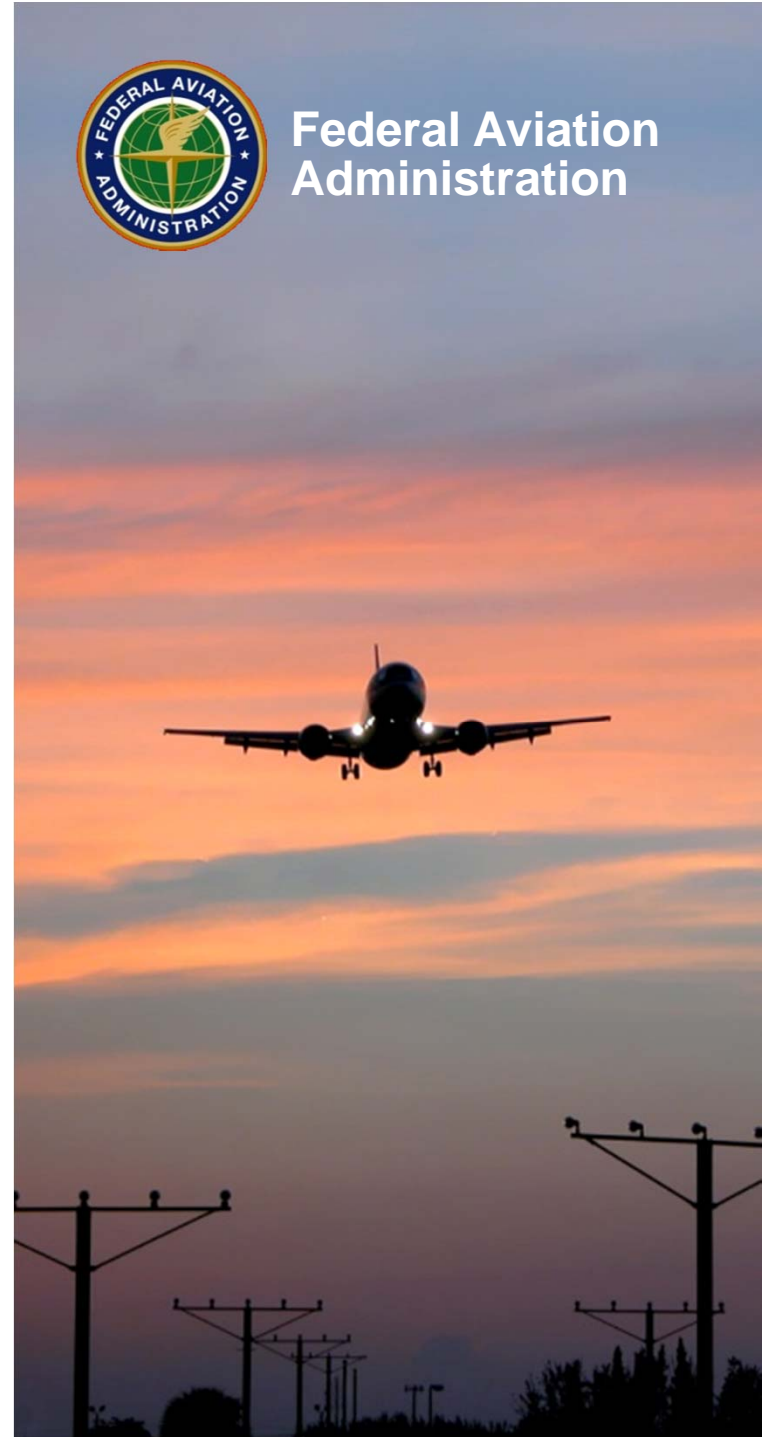
**Presented to: Aeronautical Charting Forum,
ACF 12-02**

**Presented by: Navigation Program
Engineering**

Date: October 24, 2012



**Federal Aviation
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Background

- **The FAA will transition from VOR-defined route structures as the primary means of navigation to Performance-Based Navigation (PBN)**
 - PBN uses Area Navigation (RNAV) and Required Navigation Performance (RNP)
- **VORs must give way to a safer, more reliable, and efficient means of air navigation**
 - Objective is to provide improved accuracy, availability, integrity, and continuity to support PBN

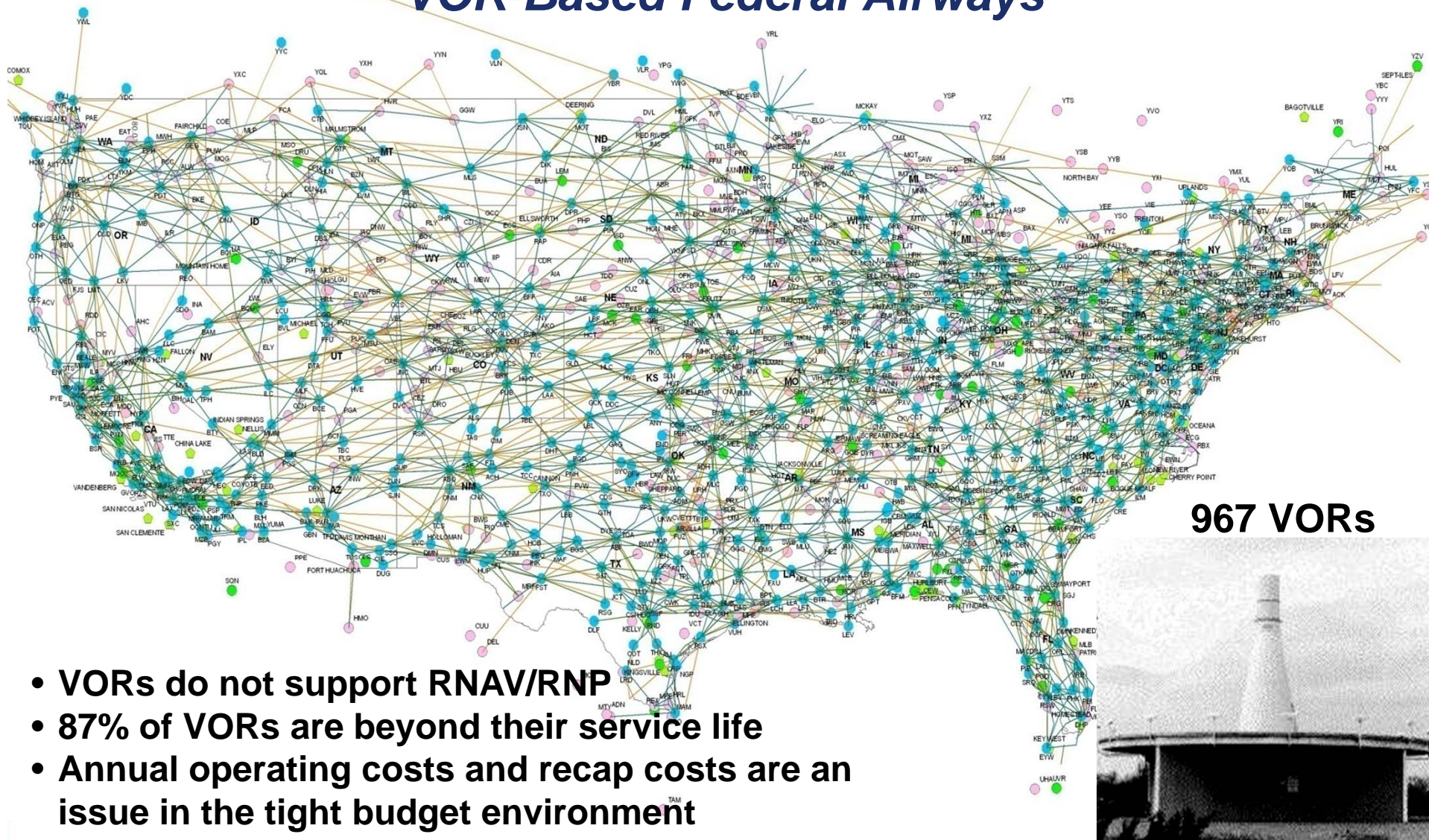


Objectives

- **The VOR Minimum Operational Network (MON) Implementation Program is a collaborative effort to provide management oversight, and tactical and strategic implementation guidance**
 - Focuses on safety and coordination across organizational lines of business (LOBs)
 - Transitions from a legacy network of 967 VORs to a MON of approximately 500 VORs by a target date of January 1, 2020
 - This is one of a myriad of complex activities required to shift resources from the legacy NAS into NextGen
- **A Business Case is being developed for FAA approval**

Current Operating Environment

VOR-Based Federal Airways



967 VORs

- VORs do not support RNAV/RNP
- 87% of VORs are beyond their service life
- Annual operating costs and recap costs are an issue in the tight budget environment

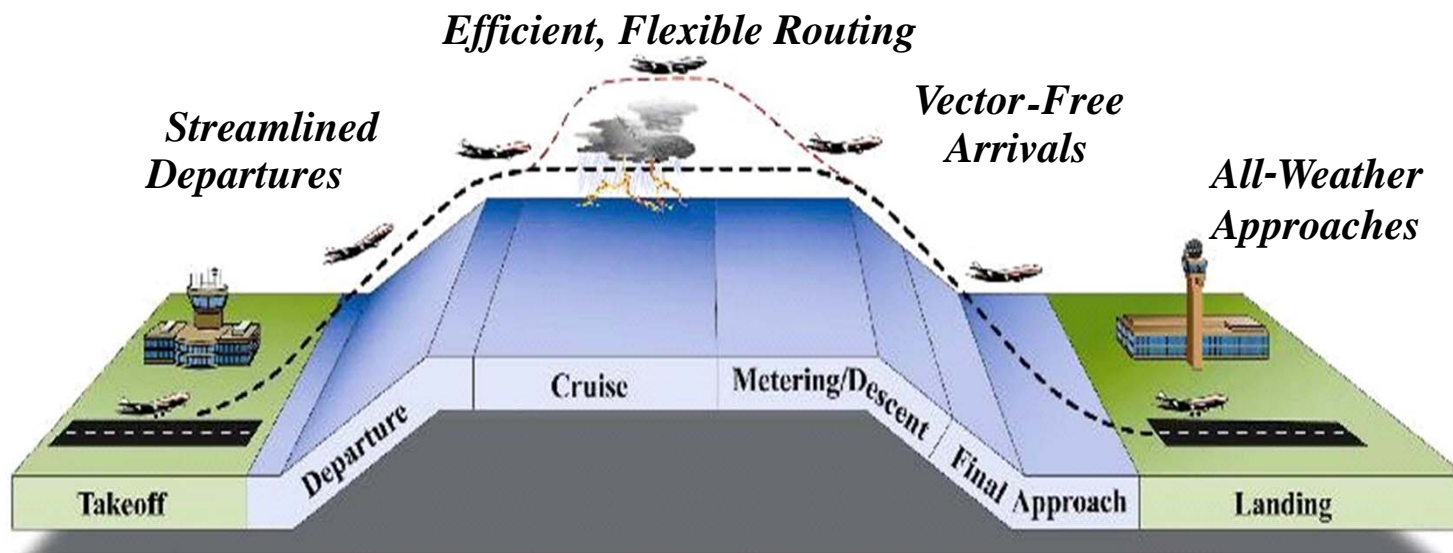
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Changing Environment

- **Most Aircraft will have Performance Based Navigation (PBN) capability by 2020:**
 - Majority of Aircraft will have GPS/WAAS capability
 - In compliance with 2020 ADS-B Mandate
 - Air Carrier/Cargo/High-end GA will have DME/DME/Inertial Capability
 - Low-end GA may need VOR for backup when GPS is unavailable



Reducing Dependencies on VORs

- **As the FAA transitions to RNAV and PBN, aircraft reliance on VORs will decrease significantly**
- **This will allow the FAA to transition to a VOR MON, which will provide backup coverage, if needed, during a GPS outage**
 - A majority of the Part 121/135 carriers will have GPS and Distance Measuring Equipment/Inertial Reference Unit (DME/DME/IRU) or DME/DME and Instrument Landing System (ILS)
 - For all other aircraft, the MON will provide sufficient back-up coverage to enable aircraft to proceed safely VOR-to-VOR and/or to a suitable landing destination with a GPS-independent approach within approximately 77 nm of any location in CONUS



Attributes of VOR MON Capability

- **The VOR Minimal Operational Network (MON) will provide:**
 - **A backup capability for lower end GA IFR aircraft in the event of a widespread GPS outage**
 - **An operational contingency, and not the robust network of current VORs**
 - **A transitional network of VORs to allow users time to equip with new avionics to transition to RNAV and RNP**



Steps Taken to Date

- **Federal Register Notice (FRN) published on proposed navigation strategy to inform external stakeholders of FAA intent**
- **Second notice published to provide FAA feedback to 330 comments received in response to the initial notice**
- **Notional VOR MON list developed for initial coordination**
- **Preliminary Operational Safety Assessment developed**
- **Strategy meetings with Service Areas and Service Centers conducted**
- **Separate briefings provided to external stakeholders:**
 - AOPA, DOD, A4A

Concurrent Strategy Moving Forward

Methodology

- **Program Activities**
 - Business Plan
 - In development
 - MON Cost /Benefits analysis
 - Service Volume Engineering Analysis
 - Service Area Working Group
 - AJV – Airspace and Procedures
 - AJE/ AJT/AJR – Involved
 - Full Coordination of Candidate prioritization in Working Group
 - National Discontinuance Strategy
 - MON Implementation Plan
 - Waterfall Schedule
 - Safety Management / Risk Management
 - OSA
 - PSP

Investment Planning

- **Major Milestones**
 - Investment Analysis Review Decision (IARD) JRC June 2013
 - Initial Business Case
 - CONOPS
 - Shortfall Analysis
 - Requirements Documentation
 - OSA
 - Final Investment Decision (FID) JRC June 2014
 - MON Achieved by January 2020

Next Steps

1) VOR MON list is being vetted in the FAA (HQ and Service Areas)

- FAA Working Group (WG) will modify list, as appropriate (WG composition: PMO, AJV, AJE, AJT, AJW, AFN, and ANG membership, others will be added as identified.)
- Once the list is finalized in the FAA, results will be shared with external stakeholders

2) External stakeholder working group (including AOPA, A4A, DoD, others) will further scrub list

- List will be modified, as appropriate
- Fully coordinated list will be finalized

Next Steps (cont.)

3) Develop implementation plan and waterfall schedule

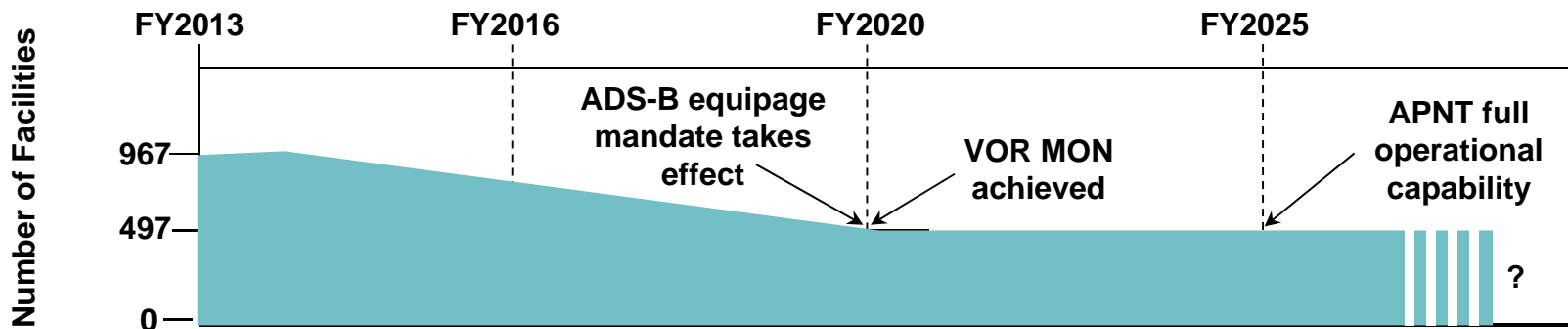
- VOR MON implementation plan will take all other PBN transition plans into account:
 - Instrument Flight Procedures Cancellation Plans;
 - Optimization of Airspace and Procedures in the Metroplexes; and
 - Development of high and low altitude RNAV Routes
- Development of VOR MON waterfall schedule will correlate with removal and/or replacement of Instrument Flight Procedures

4) Achieve FAA approval of Business Case (JRC FID)

5) Discontinue VORs according to the plan

- Starting in FY-14, VORs will be discontinued according to the waterfall schedule
- Each VOR identified to be discontinued will go through formal rule-making that will result in new procedures as appropriate
- Achieve the VOR MON by January 1, 2020

MON Implementation



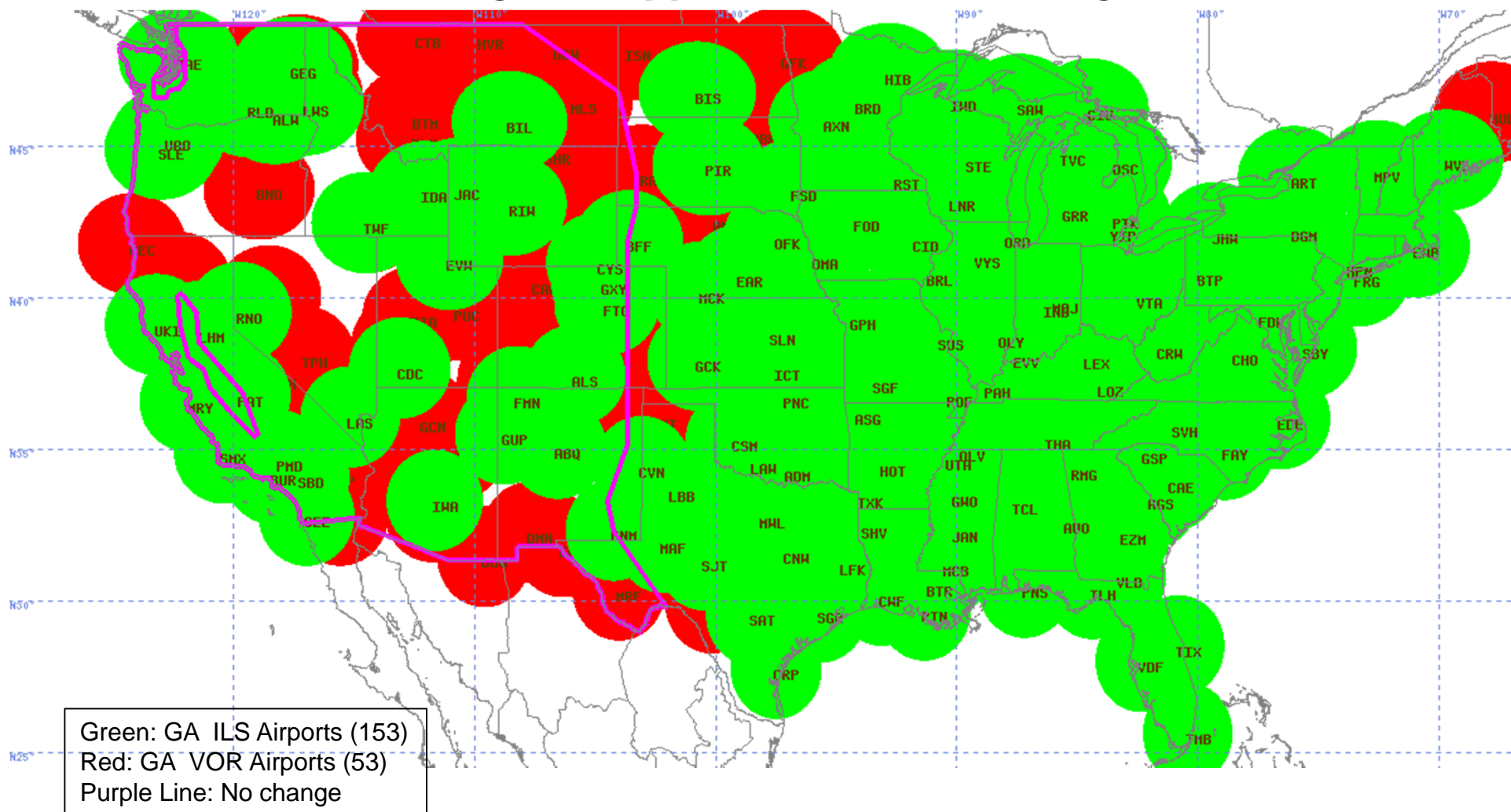
- **Objective: Reduce dependence on VORs**
 - Near-term: Discontinue approximately half of the VORs to a Minimum Operational Network (MON) by 2020
 - Longer-term: Re-evaluate MON once full operational capability has been achieved for Alternate Positioning Navigation and Timing (APNT) service

Back-up Materials



Notional MON Airports

Coverage for Approaches and Landings



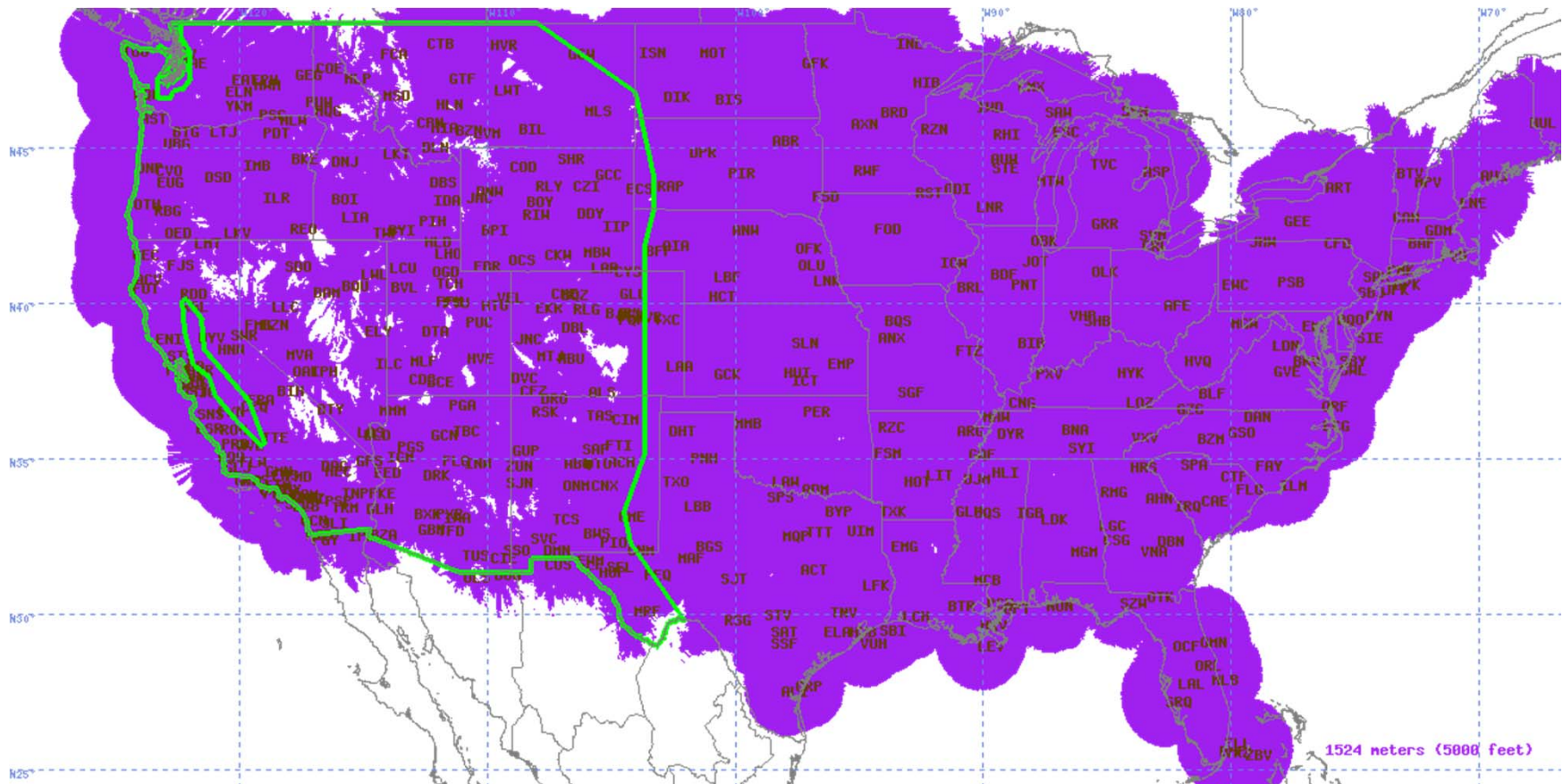
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Notional VOR MON at 5000 ft. AGL

En route Coverage



Past and Current DME Coverage

