

PBN Route Structure Concept of Operations

Overview

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Federal Aviation
Administration



PBN Route Structure CONOPs (PBN-RS)

- **Background**

- PBN is envisioned to be the primary means of navigation across the NAS. The PBN-RS is a component of a foundational PBN network and can optimize the use of airspace in specified areas with PBN ATS route structure while providing point to point flexibility elsewhere.

- **CONOPs Scope**

- Describes a NAS wide end-state route structure concept consisting of both PBN Air Traffic Service (ATS) routes (i.e., Q-routes, T-routes & Y routes) and point-to-point navigation.

- **Guiding principle**

- *“Structure where structure is necessary and, point-to-point where it is not.”*
- Route structure requirements will be based on factors such as traffic demand, airspace utilization, ATC task complexity, airspace access and user operational efficiencies.

Why Establish Q and T Routes

- **High Altitude (Q's)**

- Publish high altitude PBN ATS routes precisely where needed to...
 - Increase airspace capacity and reduce complexity in high volume corridors
 - Procedurally deconflict and segregate flows onto more numerous route options.
 - Improve flight path predictability in congested airspace via optimized routes
 - Retain flexibility via point to point flight path options in less congested airspace.

- **Low altitude (T's)**

- Publish low altitude PBN ATS routes precisely where needed to...
 - Access rather than circumvent Class B/C airspace
 - Lower minimum altitudes in areas of high terrain to improve access and avoid icing
 - Circumvent Special Use Airspace in safe and optimal manner

Why establish Q and T routes

- **Rightsizing - Obsolescence of ground based navigation**
 - VHF VOR facilities support the over 1000 conventional ATS routes that crisscross the NAS today
 - Retaining a full VOR-based route structure in addition to a more optimal and dynamic PBN structure is counter-productive and wasteful due to recapitalization and maintenance costs to support the aging ground infrastructure
 - Due to reliance on ground-based structure, these routes are limited in where they can be located and contribute to system inefficiencies
 - Minimal usage and in many cases near zero usage of low altitude victor airways validate obsolescence
 - EXCEPTION: For safety purposes, legacy victors airways may be retained to provide all users navigational guidance in areas of high terrain.

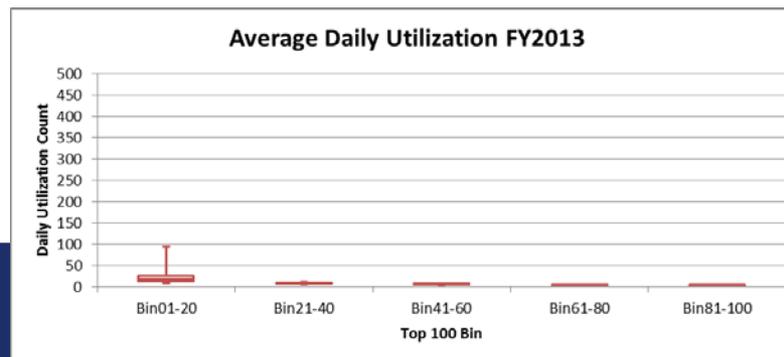


Top 100 Most Used V-Routes

Top 81-100

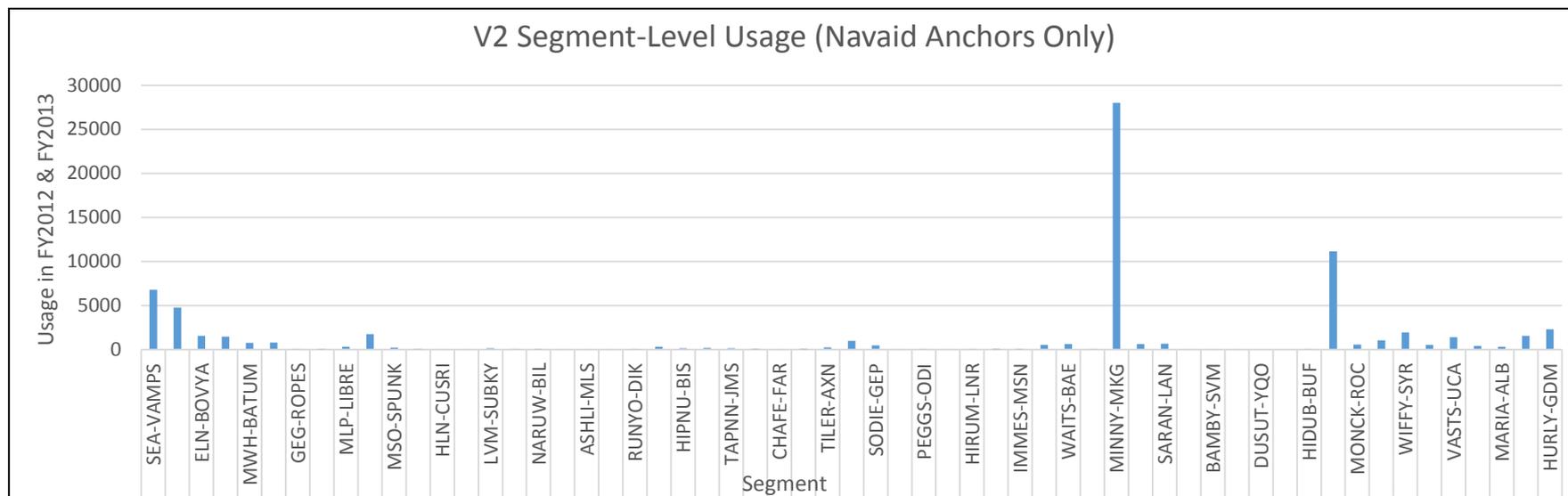
Average Daily Utilization: 3

Airway	FY 2013
V46	3.8
V267	3.7
V54	3.6
V312	3.6
V257	3.5
V37	3.5
V17	3.5
V292	3.3
V266	3.3
V144	3.3
V70	3.2
V187	3.2
V475	3.2
V146	3.1
V581	3.0
V68	3.0
V394	2.9
V431	2.9
V55	2.9
V317	2.8



Example of high usage victor airway “V2”

Anchored by 30 VOR’s, little use along most segments



Today – 301 Jet Routes

Class A airspace at and above FL180



Q Routes Implemented – 114

Clusters of short routes show low usage

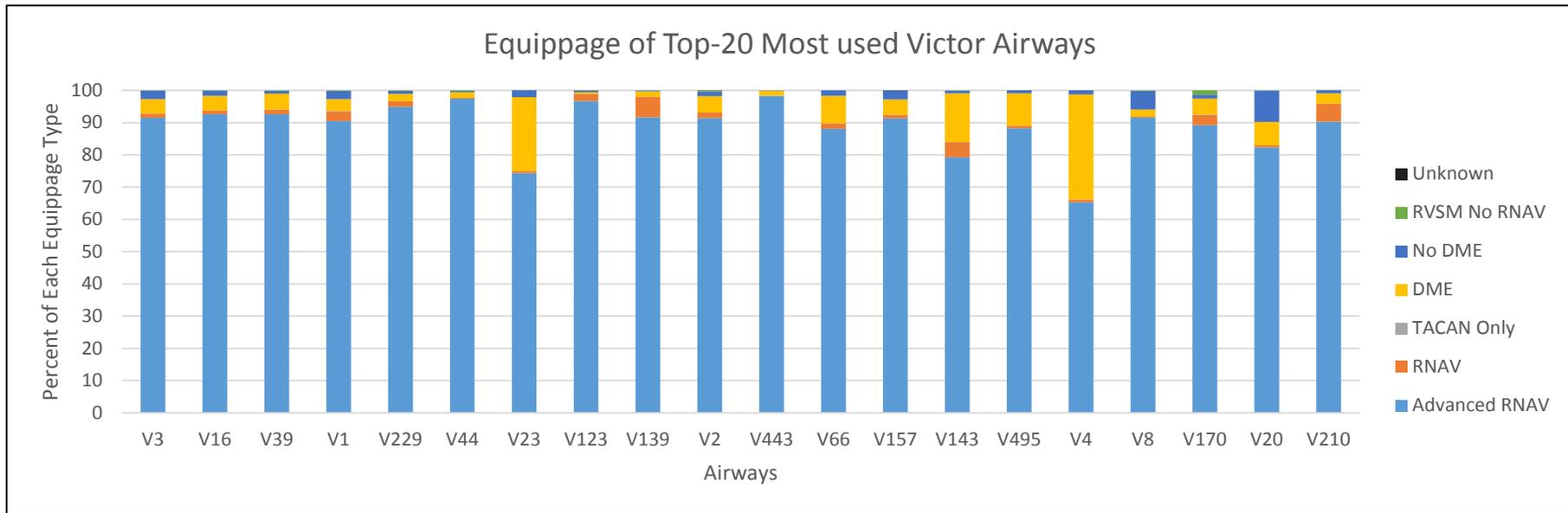


T Routes Implemented - 99



High Equipage Rate Estimate for T routes

Equipage for top 20 victor airways shows 80-90% of victor airway users are equipped to fly T routes



Point to Point Navigation

- **Legacy programs have become less relevant**
 - North American Route Program (NRP)
 - Initiated 200nm from origin, terminates 200nm from dest
 - Non-restrictive routing (NRR)
 - Established or traditional “pitch” and “catch” points
 - Navigation Reference System (NRS)
 - Grid of waypoints across NAS
- **Today**
 - Users file any combination of route segments, NAVAIDs, & waypoints when not route restricted by ATC and automation
- **PBN-RS CONOPs**
 - Retire NRP and NRR
 - Work with stakeholders to place network of optimally placed waypoints
 - ATC IFR preferred routes will be primary method of communicating where route structure utilization is required. Point to point available elsewhere



Benefits of strategically placed PBN ATS Routes

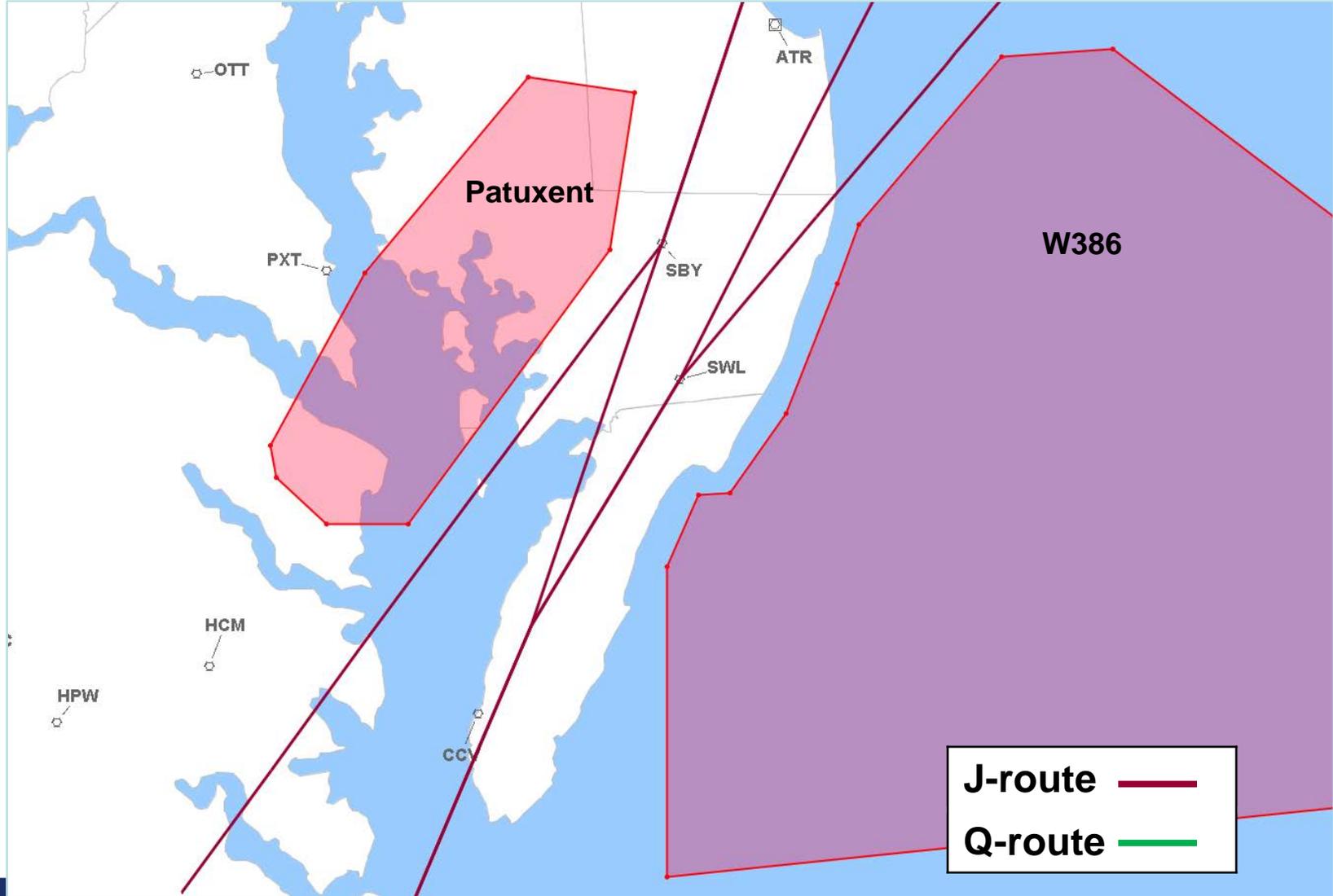
- Increased # of parallel route options through high density airspace
- Reduced separation between centerlines of published routes (8nm)
- Reduction in the number of chokepoints in the system
- Establishing operational independence between air traffic flows
- Enhanced sector throughput
- Reduced propagation of delay caused by high-density airspace constraints
- Reduces controller and pilot/crew task complexity
- More optimal climbs to, descents from, and transitions through the established route structure by segregating traffic across multiple flows
- Circumnavigate Special Activity Airspace (SAAs)
- Optimally define playbook routes, CDRs, and preferred IFR routes
- Greater predictability (less variability) with block times

Case Study Examples around the NAS

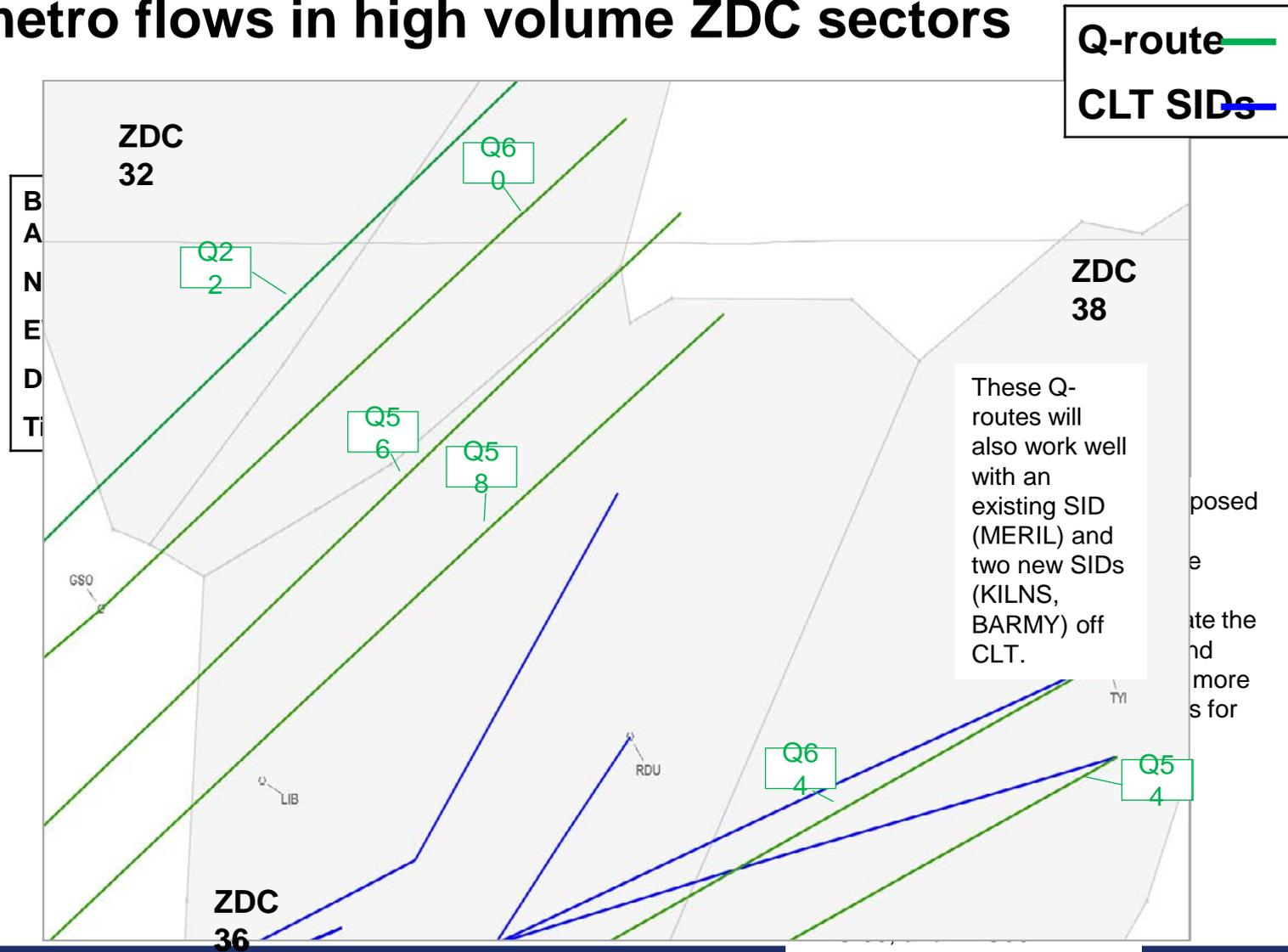


Eastern Seaboard Case Study (High Altitude)

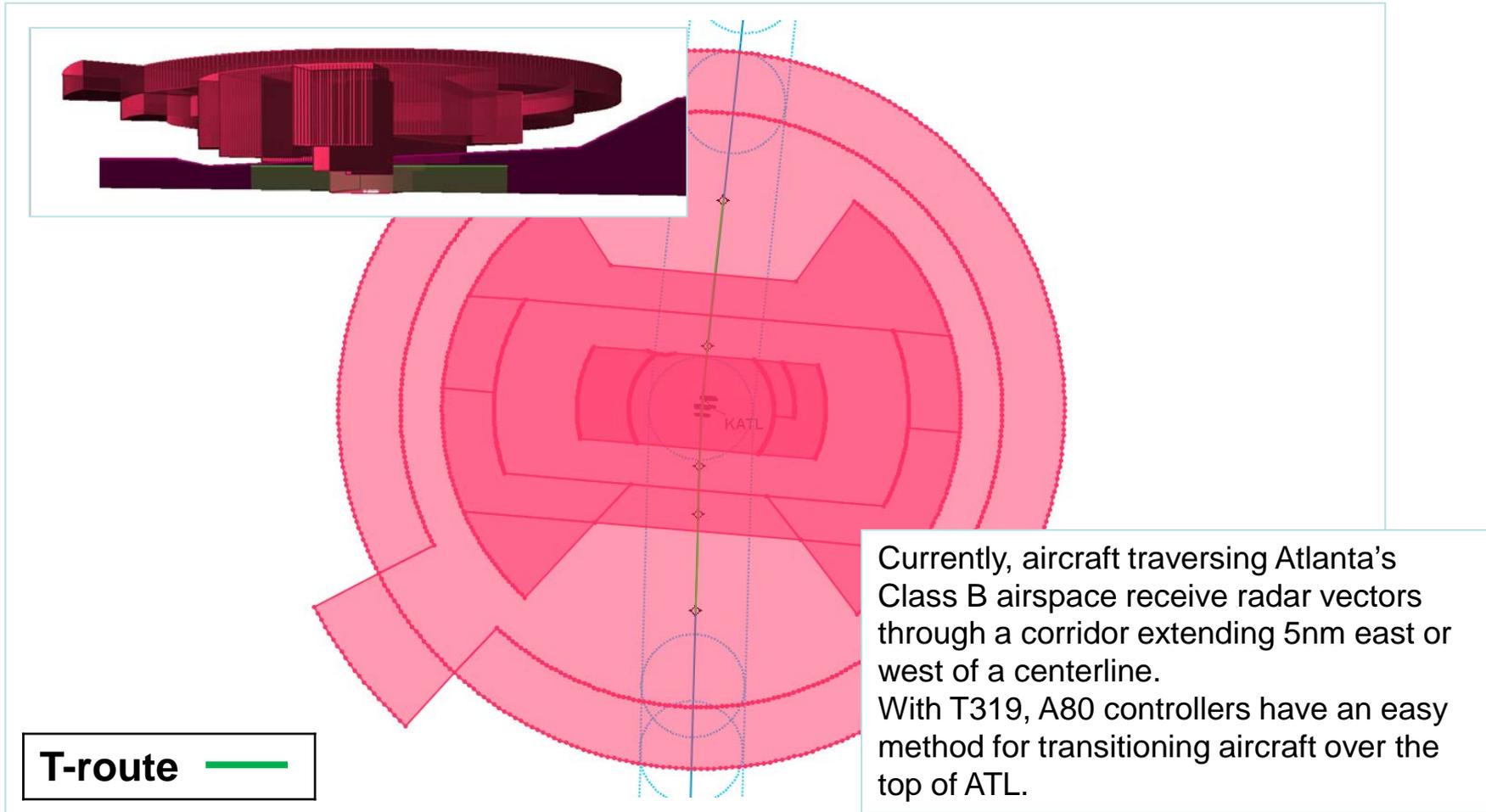
Airspace utilization, ATC complexity, operational efficiency



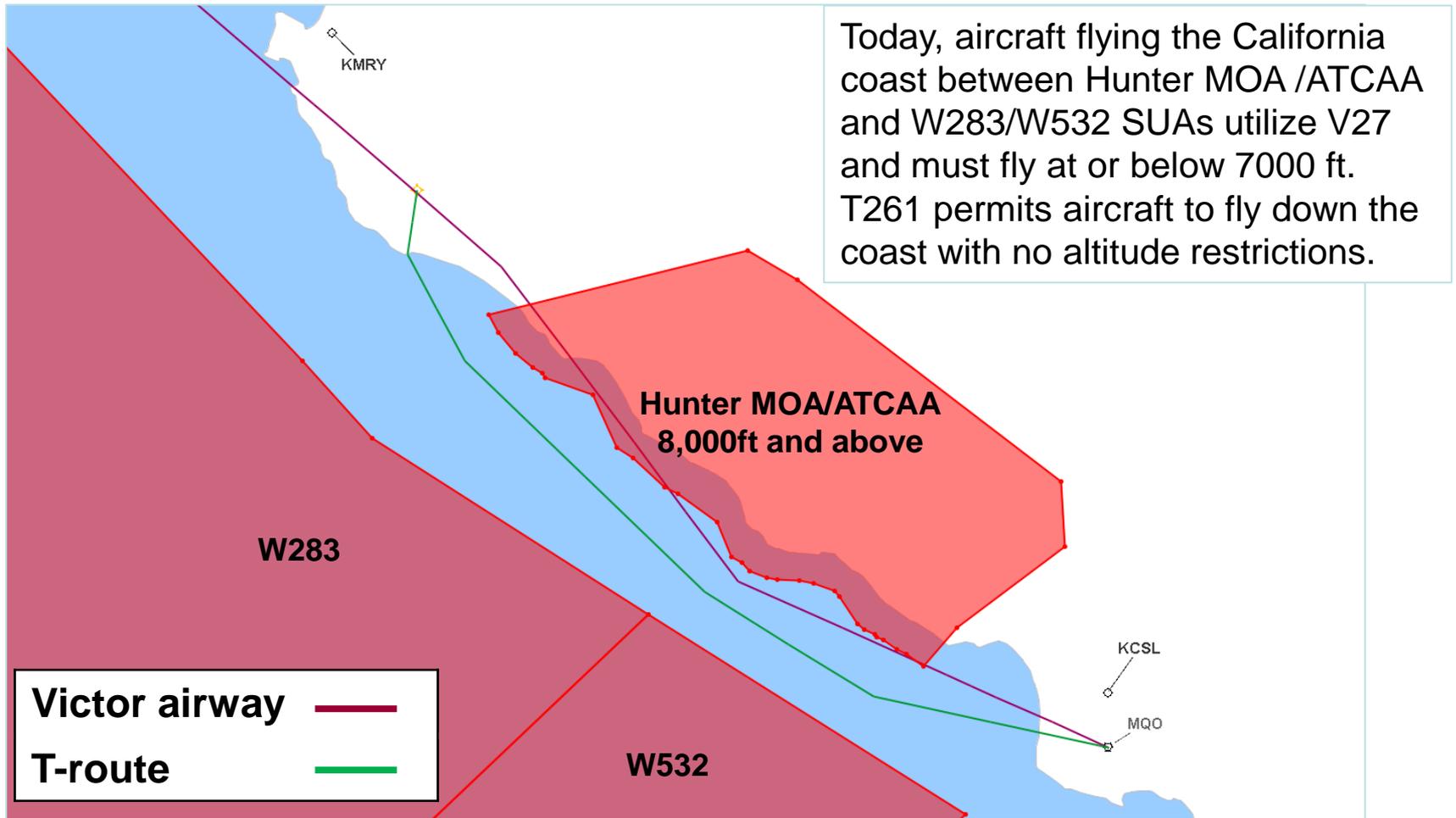
Notional: Segregation of CLT, DC & NY metro flows in high volume ZDC sectors



T Route traversing center of Atlanta Class B

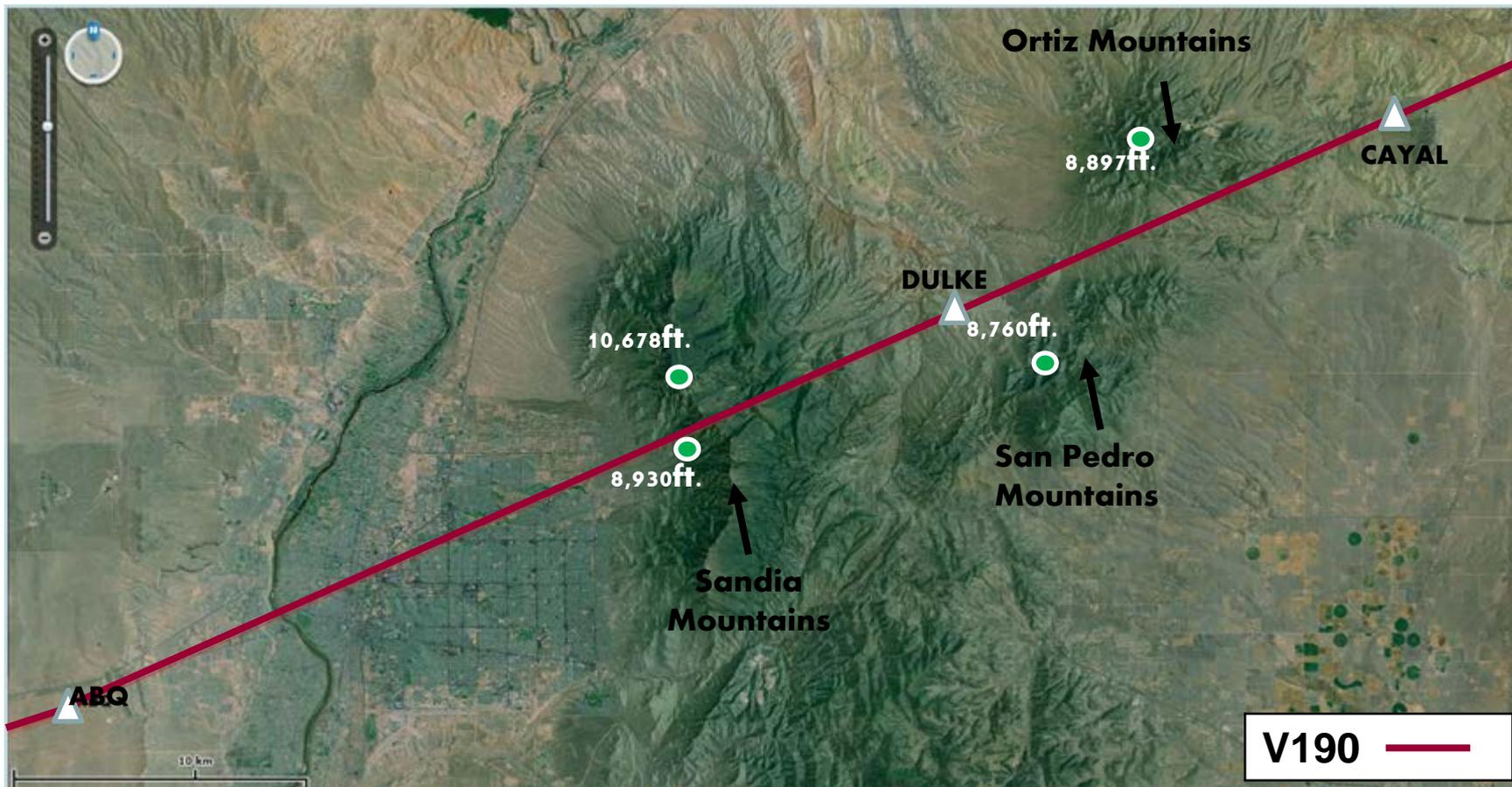


Traversing California Coast below FL230

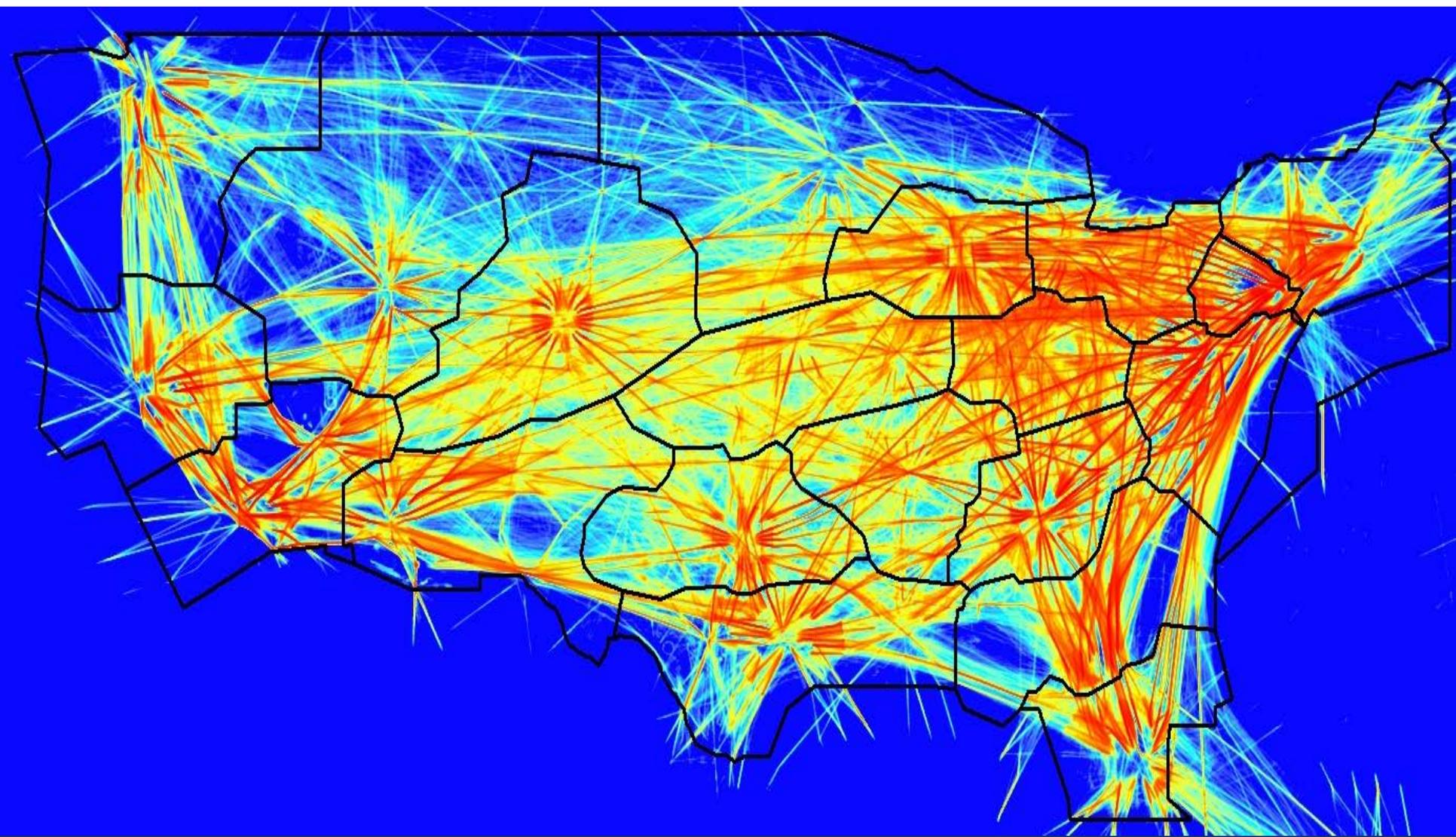


Victor Airway Retention in High Terrain

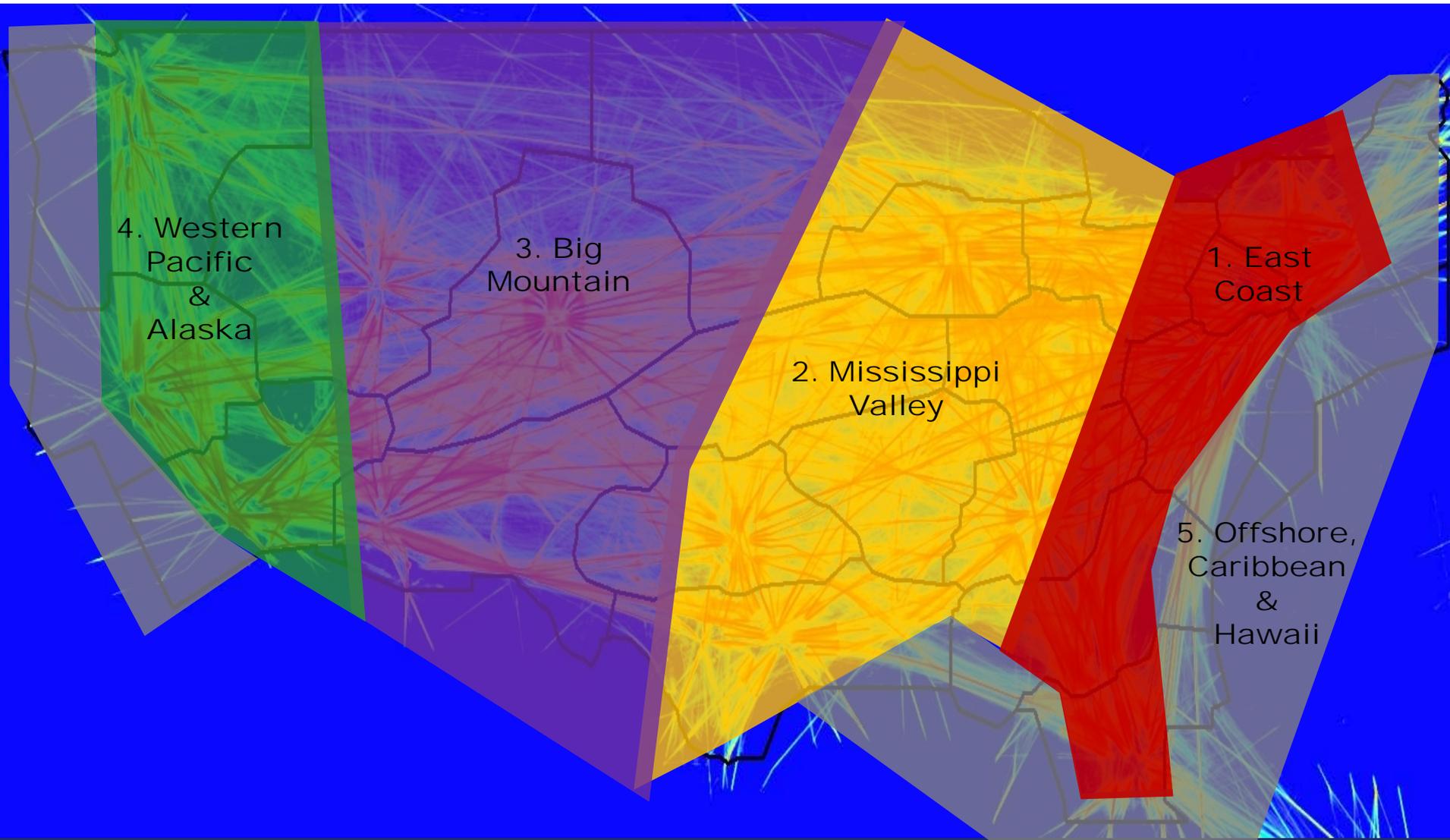
V190 across New Mexico between ABQ and Sante Fe



Heat Map of High Altitude Tracks



CONOPs Proposes 5 Regional Q Route Workgroups



CONOPs Proposes 3 T-Route Workgroups

One per Service Area



Strategic Alignment of PBN ATS Routes Development

- Central clearinghouse for establishing decision criteria and ensuring strategic alignment
- Ensures integration of NAS-wide initiatives and addresses disjointed route structure
 - Integrates Metroplex & non-Metroplex initiatives with route structure in adjacent airspace
- Removal of obsolete infrastructure
 - Supports divestment of VORs and Minimum Operation Network
 - Removal of unnecessary conventional route structure (right-sizing)
- Enabling FAA and operators to leverage investments in modern avionics

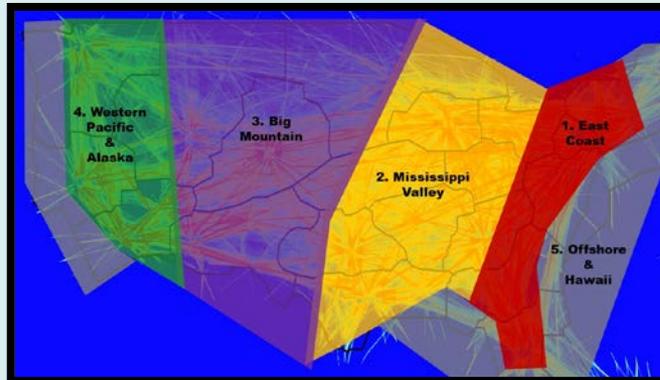


CONOPs Proposes National Workgroup

Ensures strategic alignment between 8 regional Q & T workgroups

National Workgroup Ensures Integration

5 Regional Q-Route
Development Workgroups



3 T-Route Development
Workgroups



Considerations for GNSS Outages

- **High user equipage with DME/DME/IRU and near seamless DME/DME coverage above FL240 will support continued PBN route operations**
- **Network of VOR's assumed at MON end-state will be sufficient for limited operations and provide a safe means for aircraft to land anywhere in the NAS**
- **Ground based airways will be retained in areas of non-radar and mountainous terrain**
- **Looking ahead...NextGen Alternative Positioning, Navigation, and Timing (APNT) will enable PBN operations to continue in the event of a GNSS outage**

DME/DME Coverage Map FL240 & Above

Coverage per AC 90-100A (RNAV 2)

The coverage map reflects coverage as seen by a DME/DME RNAV system that minimally conforms with AC 90-100A (RNAV 2).

