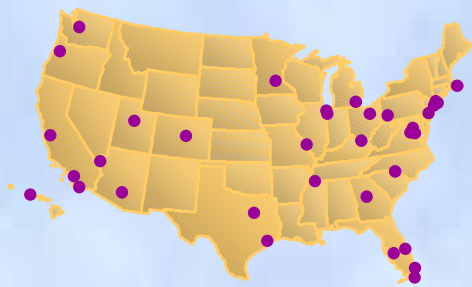
National Airspace Redesign
High Altitude Redesign Briefing
for
NBAA User Forums

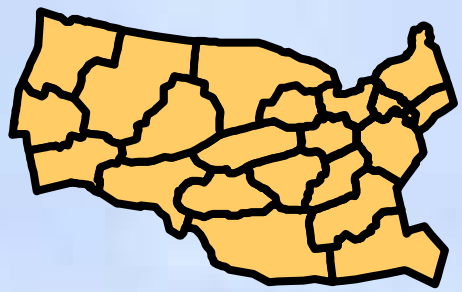
National Airspace Redesign

Primary means of the FAA to modernize US airspace by migrating from constrained ground-based navigation to the freedom of an RNP RNAV satellite-based system

- **Bottom up: Optimize & redesign local airspace targeting congested areas …**
  - **Focused on key airports and associated airspace; changes in arrival and departure routes drive change up into en route airspace**



- **Top down: In parallel, redesign national airspace … High Altitude Redesign (HAR)**
  - **By using new technology and airspace concepts, balance flexibility and structure to obtain maximum system efficiency**



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High Altitude Redesign

- Influenced by the airspace concepts recommended to FAA by RTCA
  - Frequent meetings with user representatives; advice on:
    - Consistency with original concepts
    - Fleet capabilities and limitations
    - Implementation impacts
- Evolutionary implementation based on emerging technology
  - Plan to begin implementing initial functions in initial airspace during 2003
  - Expansion geographically, vertically and functionally planned through 2008 and beyond
- With each increment, benefits will increase consistent with user equipage

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RTCA SC192 High Altitude Concept Summary

"…RTCA SC 192 examined the possibility of defining a high altitude airspace structure where the FAA could begin to implement many of the Free Flight concepts...

The High Altitude Airspace Concept…could provide more... freedoms…while offering an opportunity to deploy new technology and procedures in a controlled environment...

This airspace would allow properly equipped users to begin achieving the economic benefits of flying their preferred routes and altitudes with fewer restrictions…

RTCA SC 192 envisions the initial implementation of this airspace at the higher flight levels…and…at additional levels as technology and procedures allow."

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High Altitude Redesign Vision

Balance flexibility and structure to obtain maximum system efficiency

Performance Objectives

- Improve system efficiency
- Reduce route structure
- Eliminate "airspace" miles-in-trail restrictions
- Increase flexibility for controllers and users

By ...

Design Objectives

- Point-to-point navigation with pilot navigation in lieu of radar vectors
- Non-restrictive routing wherever efficient
- RNAV/parallel RNAV routes in high density corridors
- Efficient routing around active SUA/ATCAA
- Improved knowledge of SUA/ATCAA status

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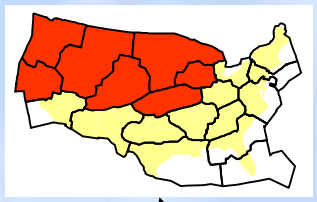
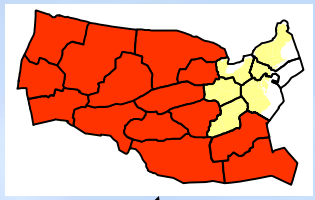
Evolutionary HAR Implementation

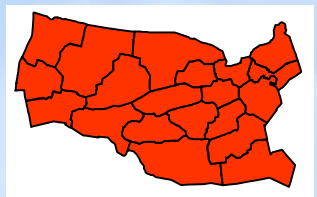
Phase 1 Initial
When: 2003
Where: Seven Northwest enroute centers at FL390 & Above



Phase 1 Expansion
When: 2004
Where: Additional seven enroute centers in the south and southwest



Phase 1 Completion
When: 2005-06
Where: Remaining six CONUS enroute centers in the east and southeast



Phase 2
Provides capabilities achievable with changes to the current automation system and aircraft equipped for RVSM and RNP
When: Beginning in 2005
Where: All CONUS centers

Phase 3
Provides benefits feasible with a new ground automation system and a digital environment
When: Beginning in 2008
Where: All CONUS centers

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Phase 1 Completion includes vertical and geographic expansion. Vertical expansion will be dependent on user equipage. Geographic expansion to the northeast is dependent on completion of the Great Lakes Redesign and NY/NJ/PHL Redesign.

Phase 1 Design

Design Concept:

- RNAV / closely-spaced parallel RNAV routes
  - Using structure where most efficient

- Navigational Reference System
  - Efficiently defining flight paths – tactical and planned

- Non-Restrictive Routing
  - Providing users increased routing flexibility

- ATCAA & SUA waypoints
  - Mitigating SUA effects for civilian aviation

Enabling capability:

- Radar monitoring, RNAV/Advanced RNAV, RNP
- RNAV/Advanced RNAV, URET and Navigation Reference System
- Flight management systems & data bases
- RNAV/Advanced RNAV, access to airspace schedules

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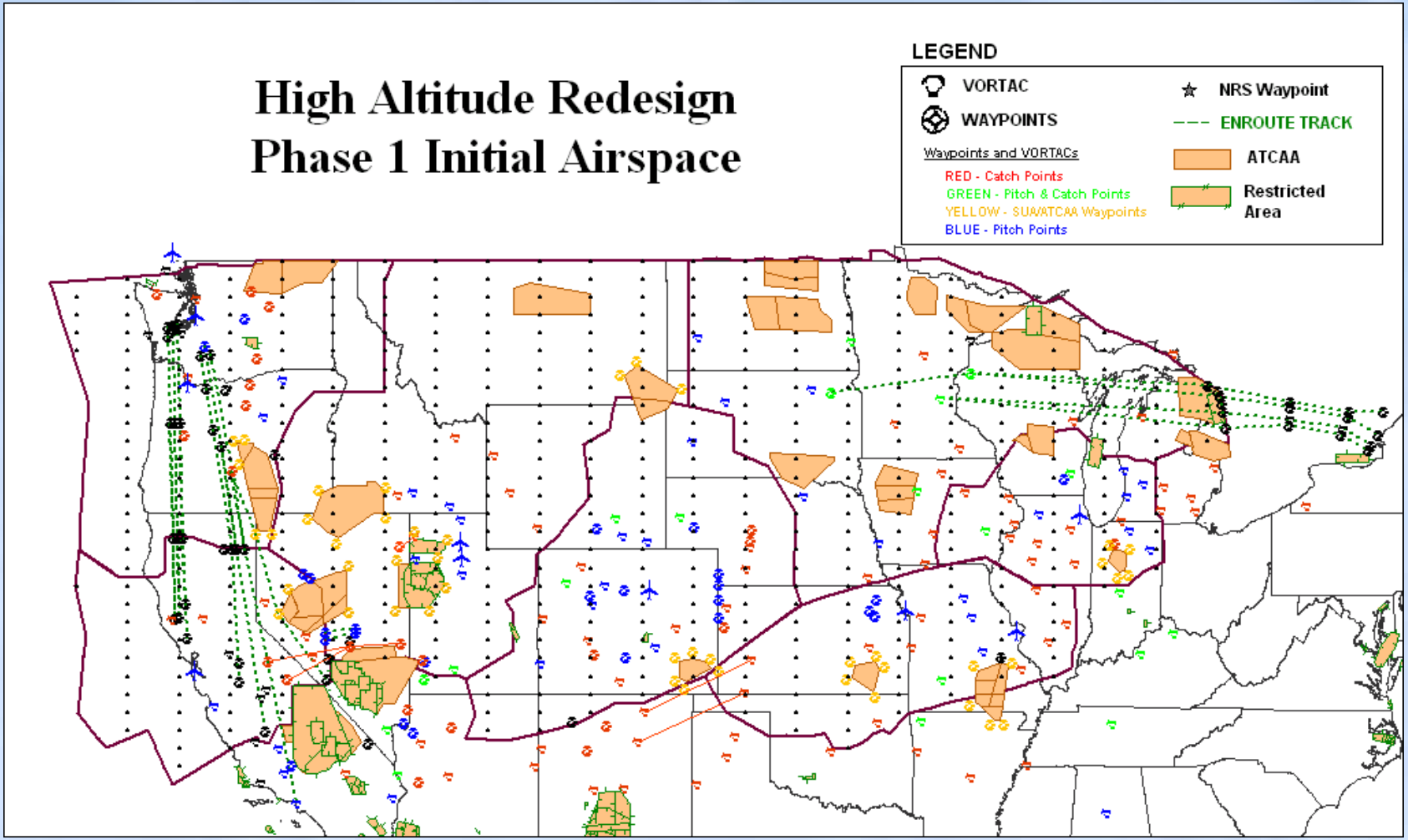
Phase 1 Initial Airspace



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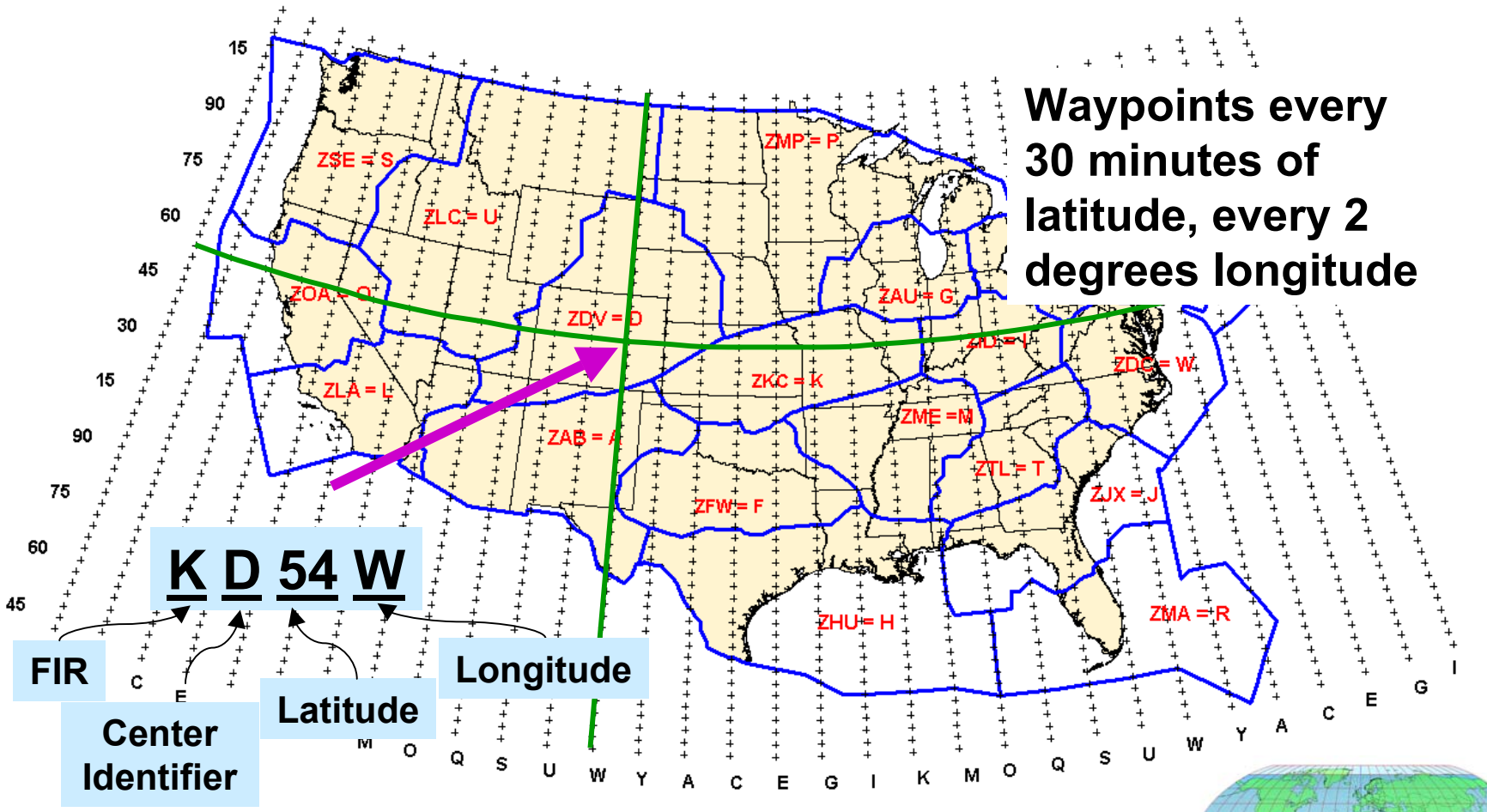
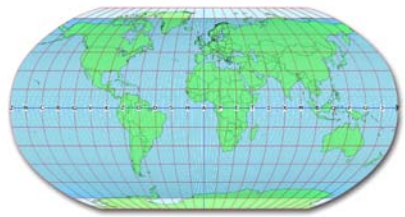
Navigational Reference System





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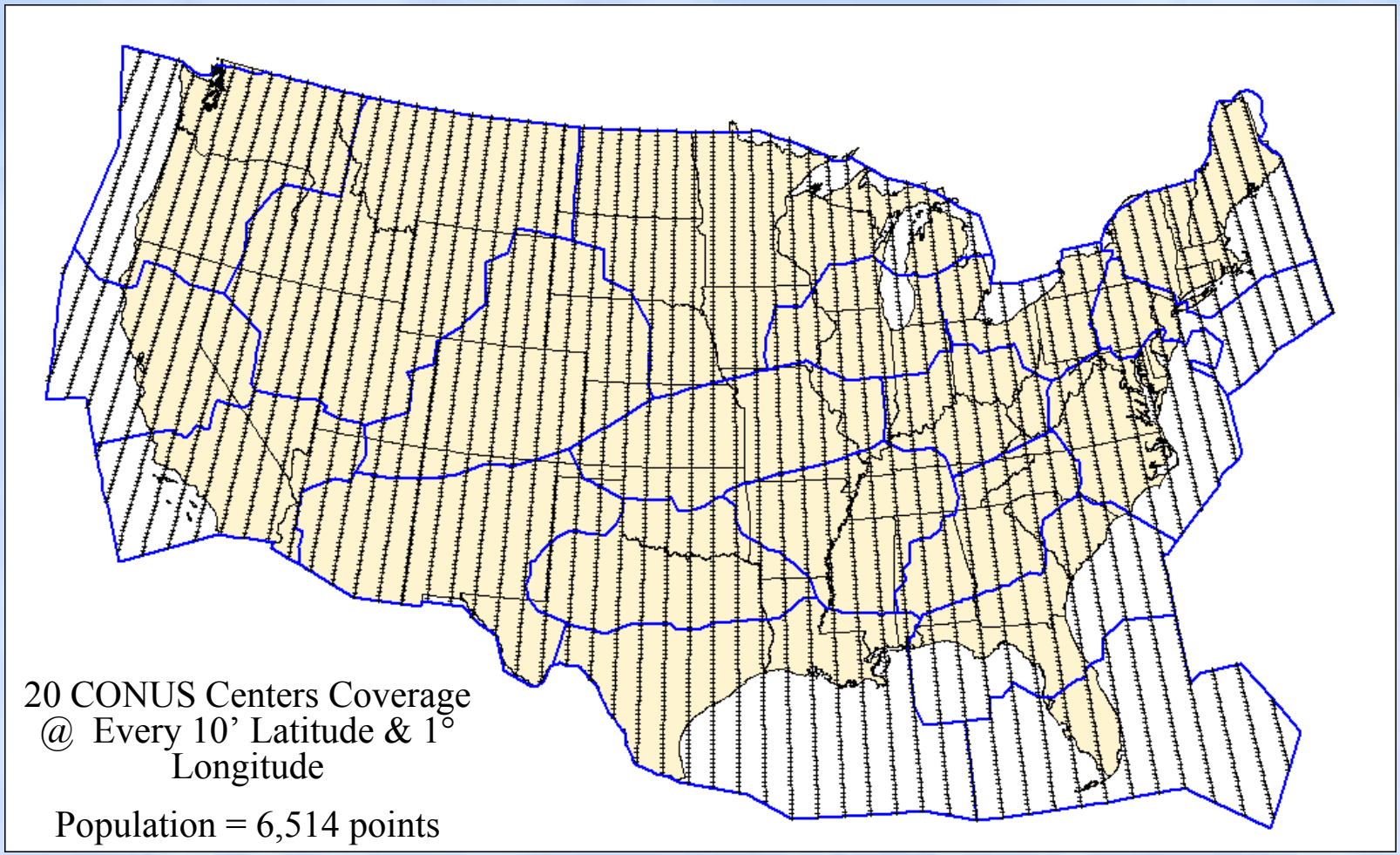
NRS - CONUS Fully Populated Density



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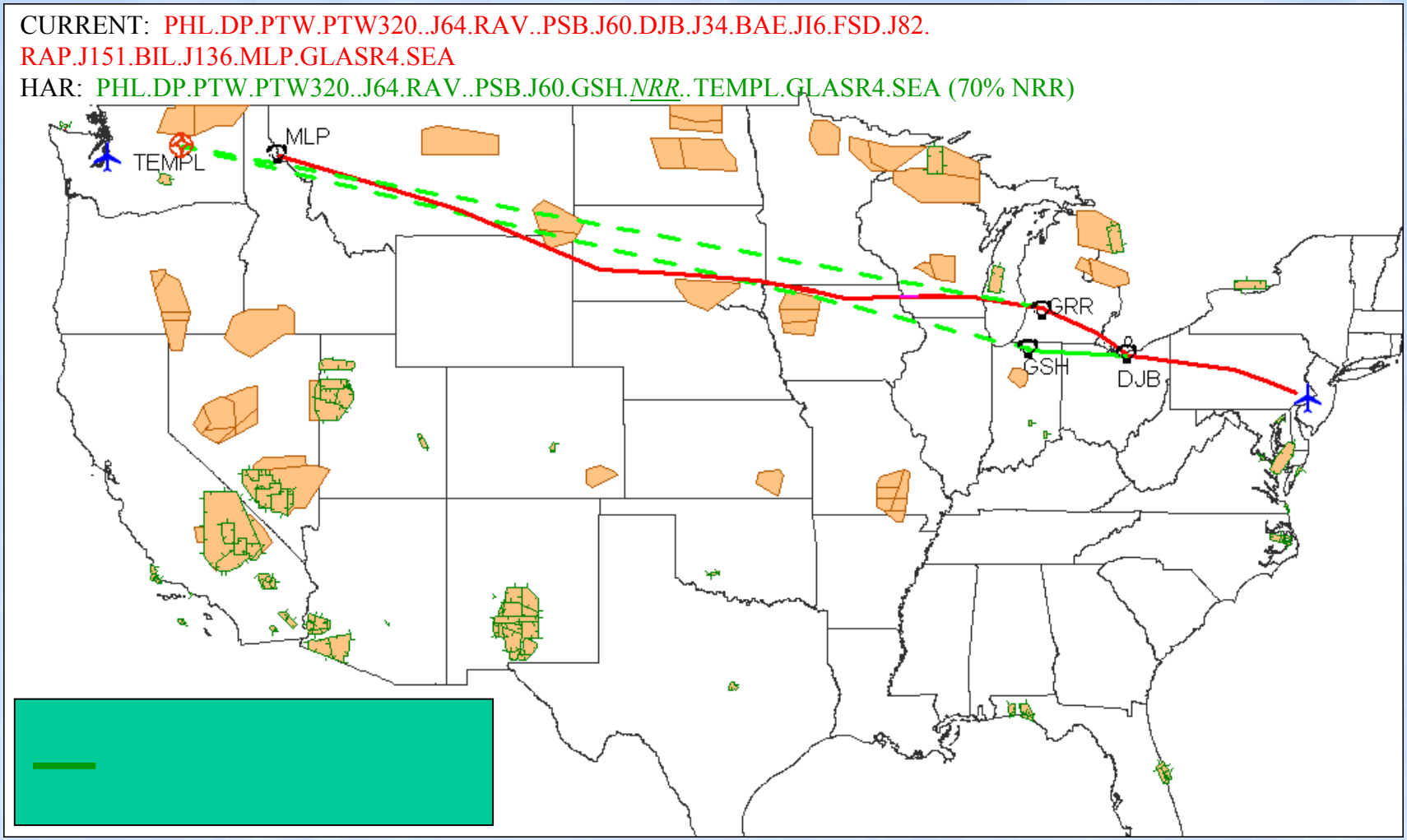
Routing Example: PHL-SEA

CURRENT: PHL.DP.PTW.PTW320..J64.RAV..PSB.J60.DJB.J34.BAE.JI6.FSD.J82.
RAP.J151.BIL.J136.MLP.GLASR4.SEA

HAR: PHL.DP.PTW.PTW320..J64.RAV..PSB.J60.GSH.*NRR*..TEMPL.GLASR4.SEA (70% NRR)



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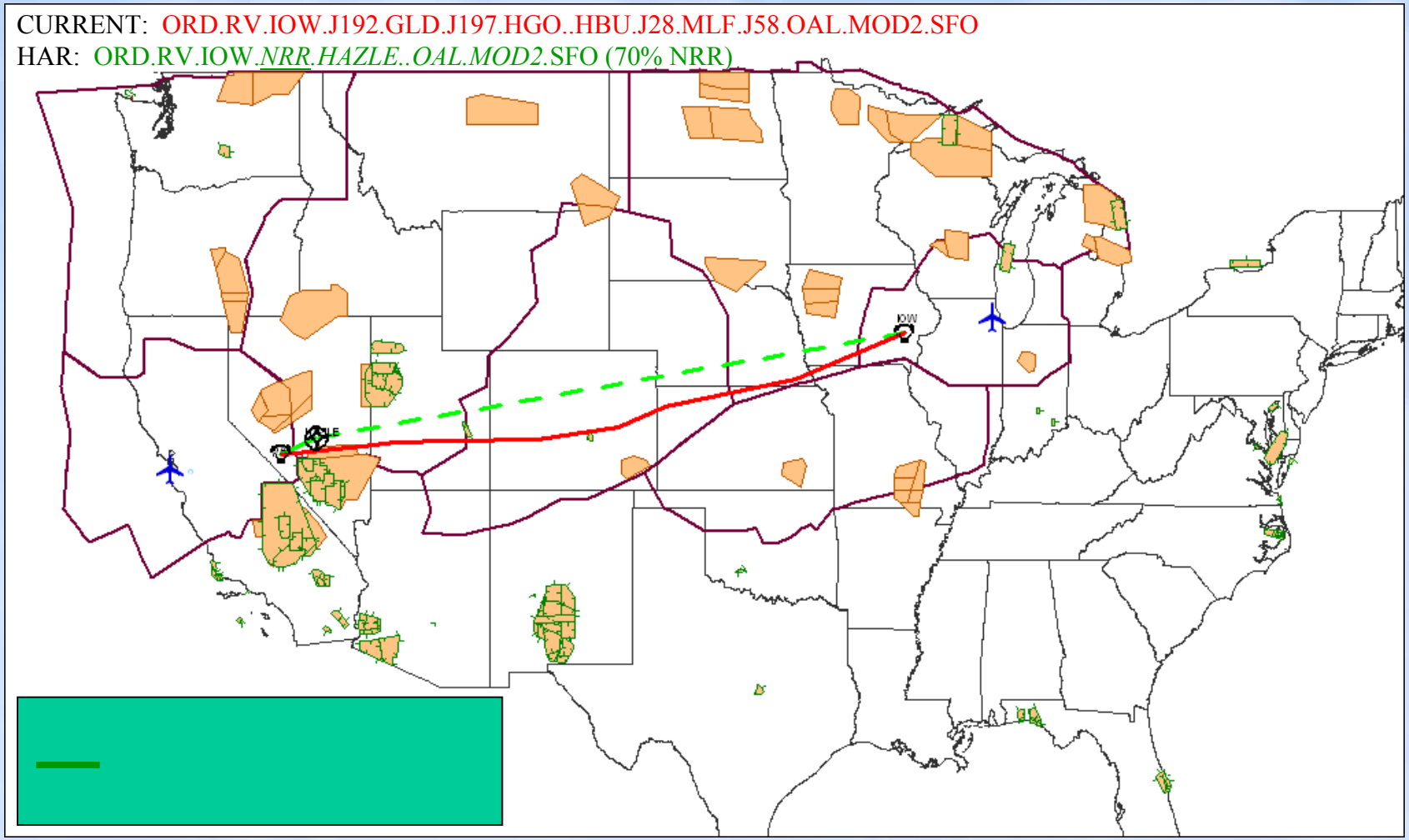
Routing Example: ORD-SFO



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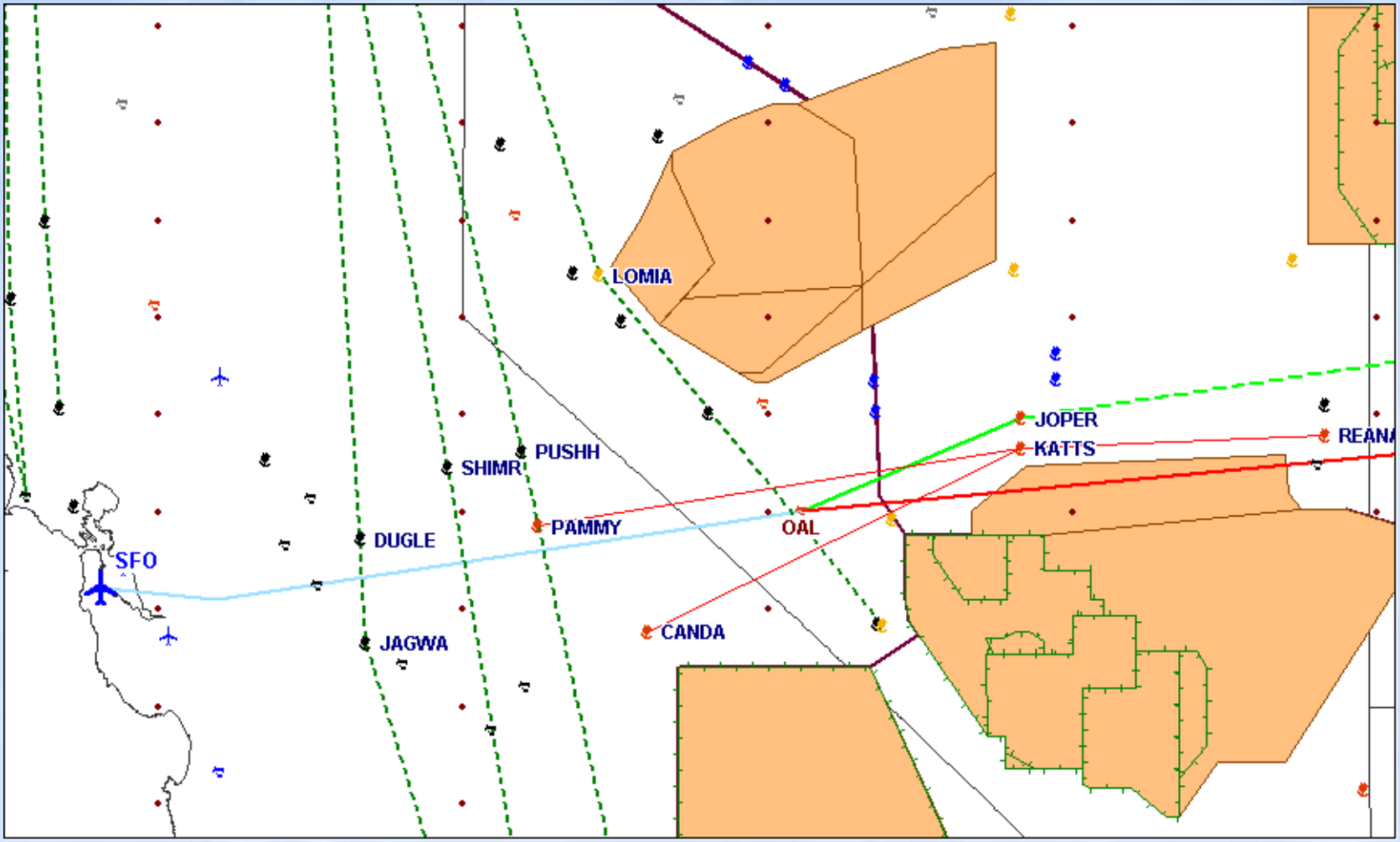
Routing Example: Confined Airspace



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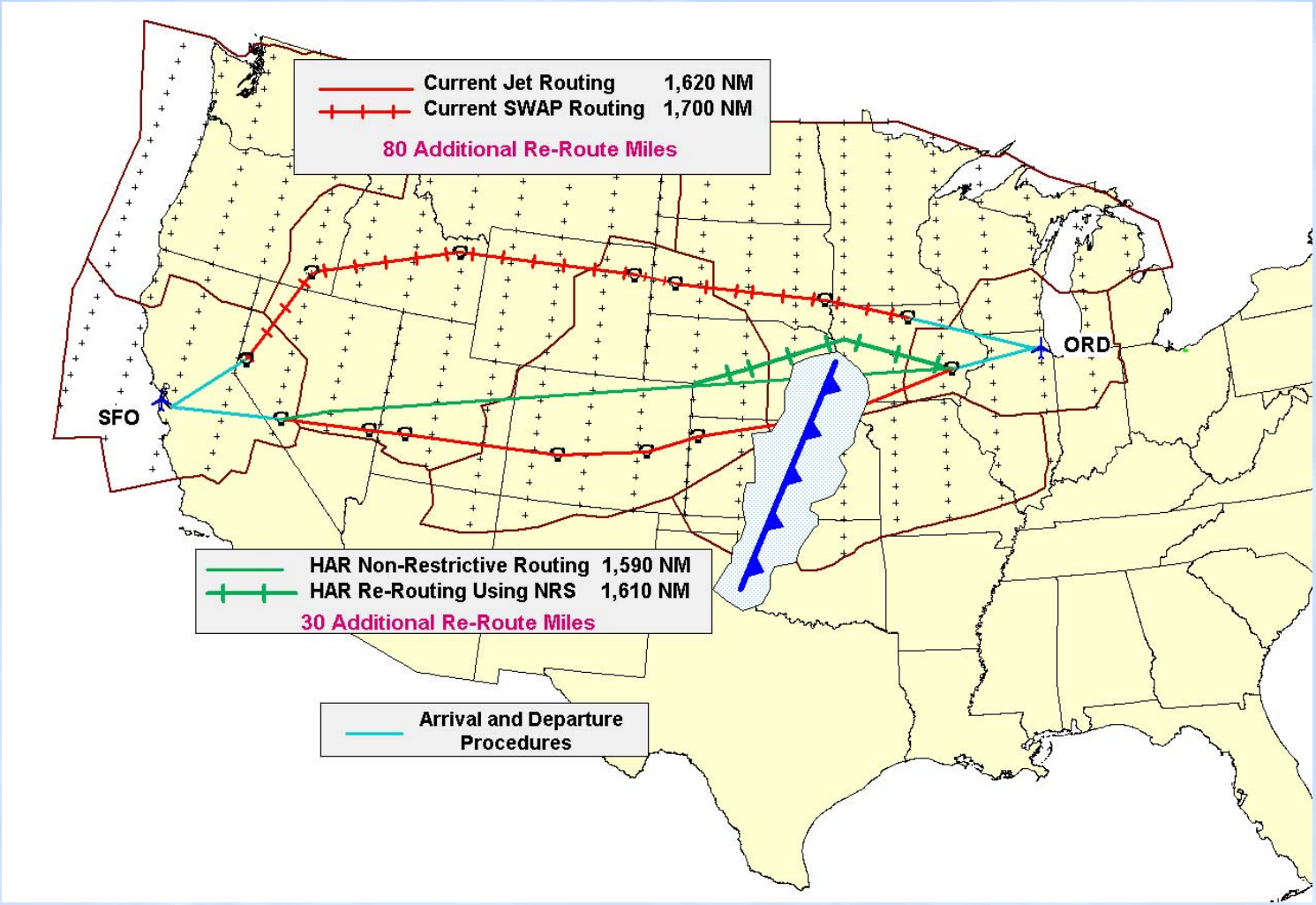
HAR Weather Reroute with NRS



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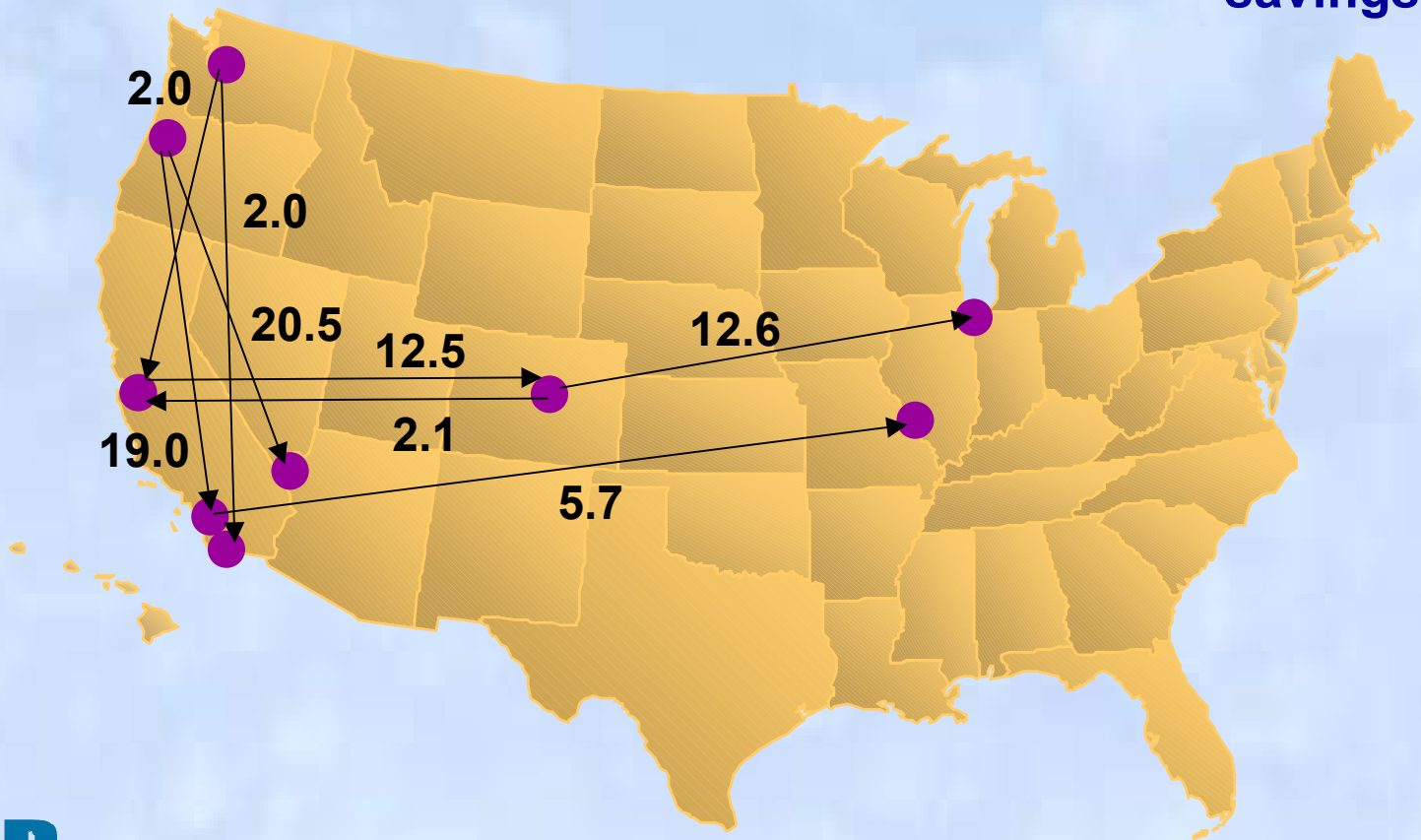
Sample Benefits
(Initial airspace FL390 and above)

Looking at select city pairs, average distance saving of 8 miles per flight

estimated $7M annual savings



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Analytic Foundation for Decisions

- Each phase supported by modeling
  - Proof of concept modeling
  - Designs modeled for benefits and workability
- After implementation of each phase, post-analysis will:
  - Validate concept and design
  - Measure benefit


Picture by Mary Yee

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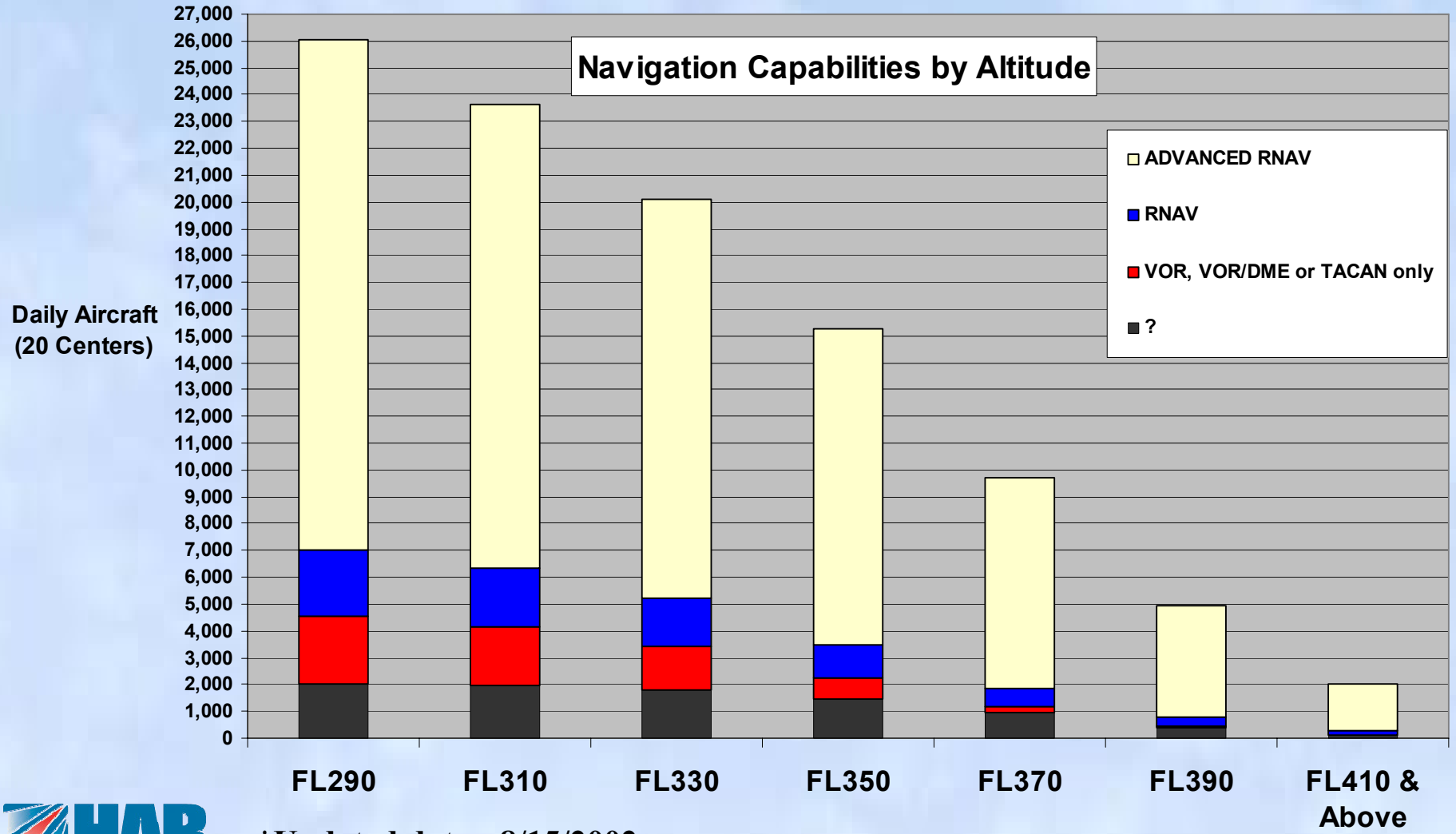
User Environment
Navigation Capabilities by Altitude*



*Updated data - 8/15/2002

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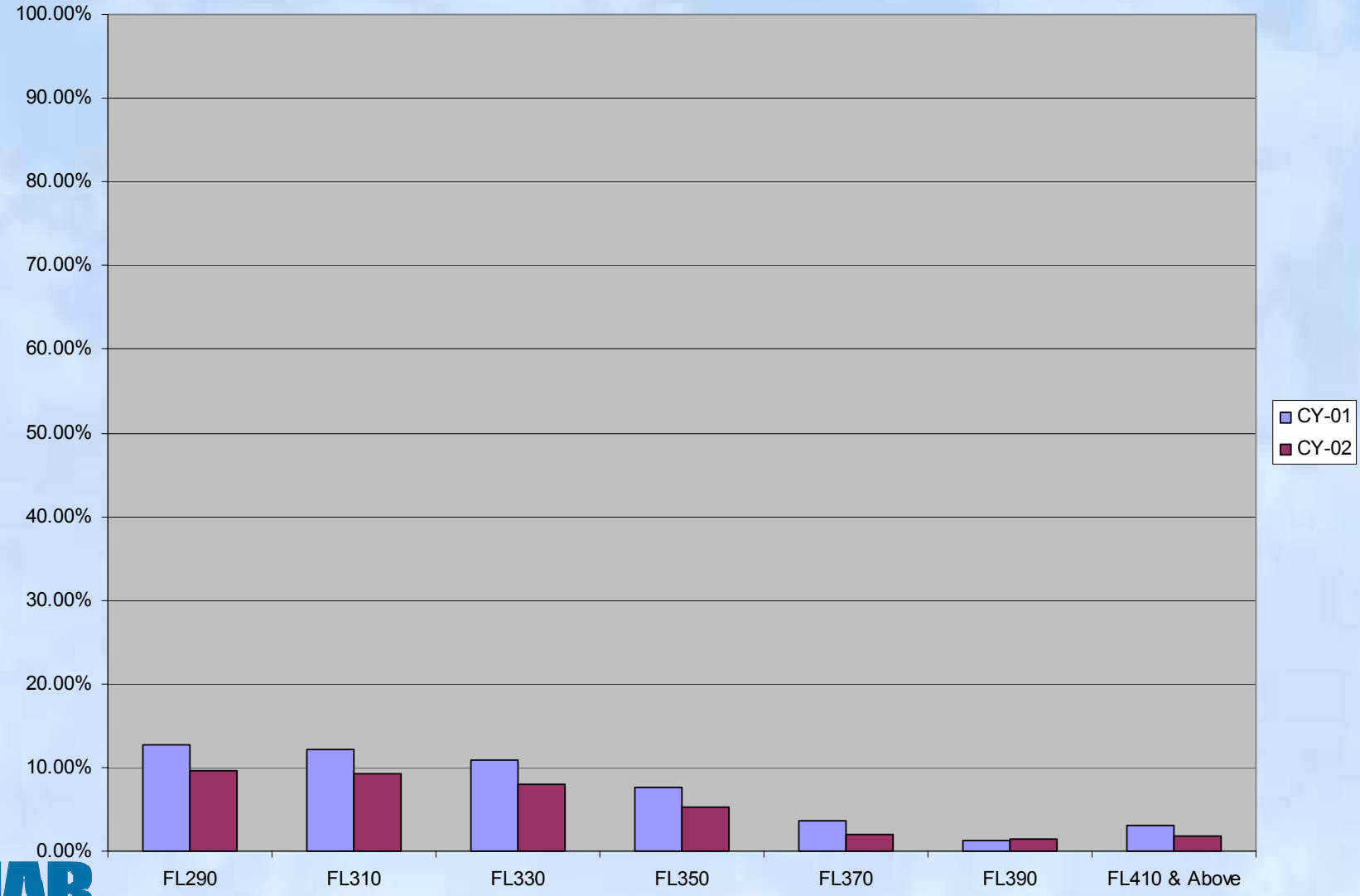
Non-RNAV CY-01 to CY-02



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NAS Infrastructure

- User Request Evaluation Tool (URET) proposed for all 20 Centers by 2005
  - Waterfall adjustments made to accelerate delivery to ZMP and ZDV and provide URET to ZLC

- Number of sectors is currently constrained at some centers because of equipment limitations

- En Route Automation Modernization (ERAM) needed to make significant enhancement or changes to ground based functionality

Initial Implementation Considerations

- Rule making to establish RNAV "Q" routes taking longer than anticipated
- User equipage limitations greater than just small percentage of non-RNAV capable aircraft
  - Significant FMS/avionics database limitations
  - Necessitates functional modification to ensure comparable service level to NRP for database constrained aircraft
- Additional coordination needed to ensure traffic management procedures will be compatible with design
- Flight planning community concerns
  - Ensuring understanding of design
  - Providing time for changes to systems and procedures
  - Operational trials of new routes
- Provide more in depth NRS fix naming "HF" study

Phase 1 Implementation "Roll out"

May 15, 2003

Charting Waypoints

- ATCAA/SUA Avoidance
- Point-to-Point Nav. on "Q" Route Paths

July 10, 2003

Chart "Q" Routes

- Q routes operational
- Initiate limited scope trial of NRR flight planning

Sept. 4, 2003

Chart NRS Waypoints

- Limited scope trial of NRR flight planning using NRS

Fall 2003 (TBD)

- Full HAR with NRR implemented
- Point-to-point for database limited A/C

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Waypoint Estimates - HAR

High Altitude Redesign Waypoints - New (approximate)					
Phase	Timeframe	Centers	Pitch, Catch, SUA / ATCAA, Define Route	NRS	Cummulative Total
1 - Initial	CY-03	ZSE, ZDV, ZLC, ZOA, ZKC, ZMP, ZAU*	127	513	640
1 - Expansion A	CY-04	ZLA, ZAB, ZFW, ZHU, ZME, ZMA*, ZJX*	350	281	1,300
1 - Expansion B	CY-05	ZTL, ZDC, ZNY, ZBW, ZOB, ZID, ZAU**, ZMA**, ZJX**	500	191	2,000
Full U. S. w/NRS Resolution Max.	TBD	All 20 Domestic	1,000	6,500	7,500

Notes:
* Partial
** Remainder

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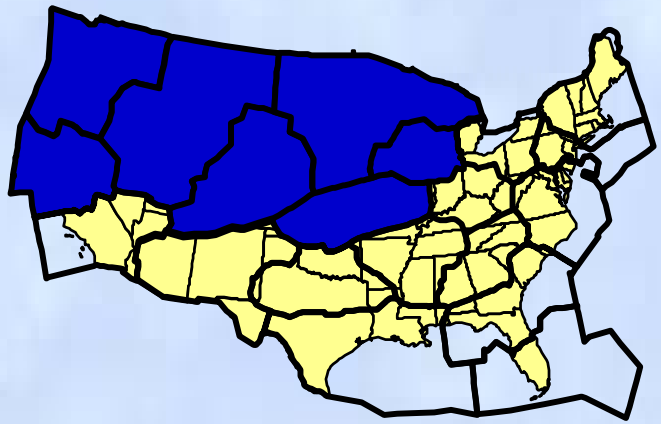
Summary

- In 2003, the initial deployment of High Altitude Redesign will provide benefits through:
  - RNAV/Parallel RNAV routes
  - RNAV waypoint navigation around SUA/ATCAA
  - Flexibility in routing: Non-Restrictive Routing (NRR)
  - Navigation Reference System (NRS) for point-to-point navigation
- Initial affected airspace:
  - ZAU, ZMP, ZLC, ZSE, ZOA, ZDV, ZKC
  - NRR FL390 & above,
    File Jet Routes below FL390



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Discussion