



National Airspace Redesign High Altitude Redesign

NRS Background



HAR Design Principles

- **Eliminate current ground based Jet Route structure**
- **Non-restrictive route areas (free flight) wherever feasible considering overall system efficiency**
- **Point-to-point navigation utilizing both pre-defined waypoints and “GRID” reference points**
 - Location of waypoints not constrained by ground based NAVAIDS
- **Pre-defined waypoints placed for maximum system efficiency**
 - Facilitate navigation around Special Use Airspace (SUA) and Air Traffic Control Assigned Airspace (ATCAA)
 - Basis for RNAV/Parallel RNAV routes in high density areas
 - Connection to departure and arrival procedures (pitch and catch)
- **Flexibility for controllers to define route segments tactically**
 - Pilot navigation vs. controllers vectors to gain overall system efficiency

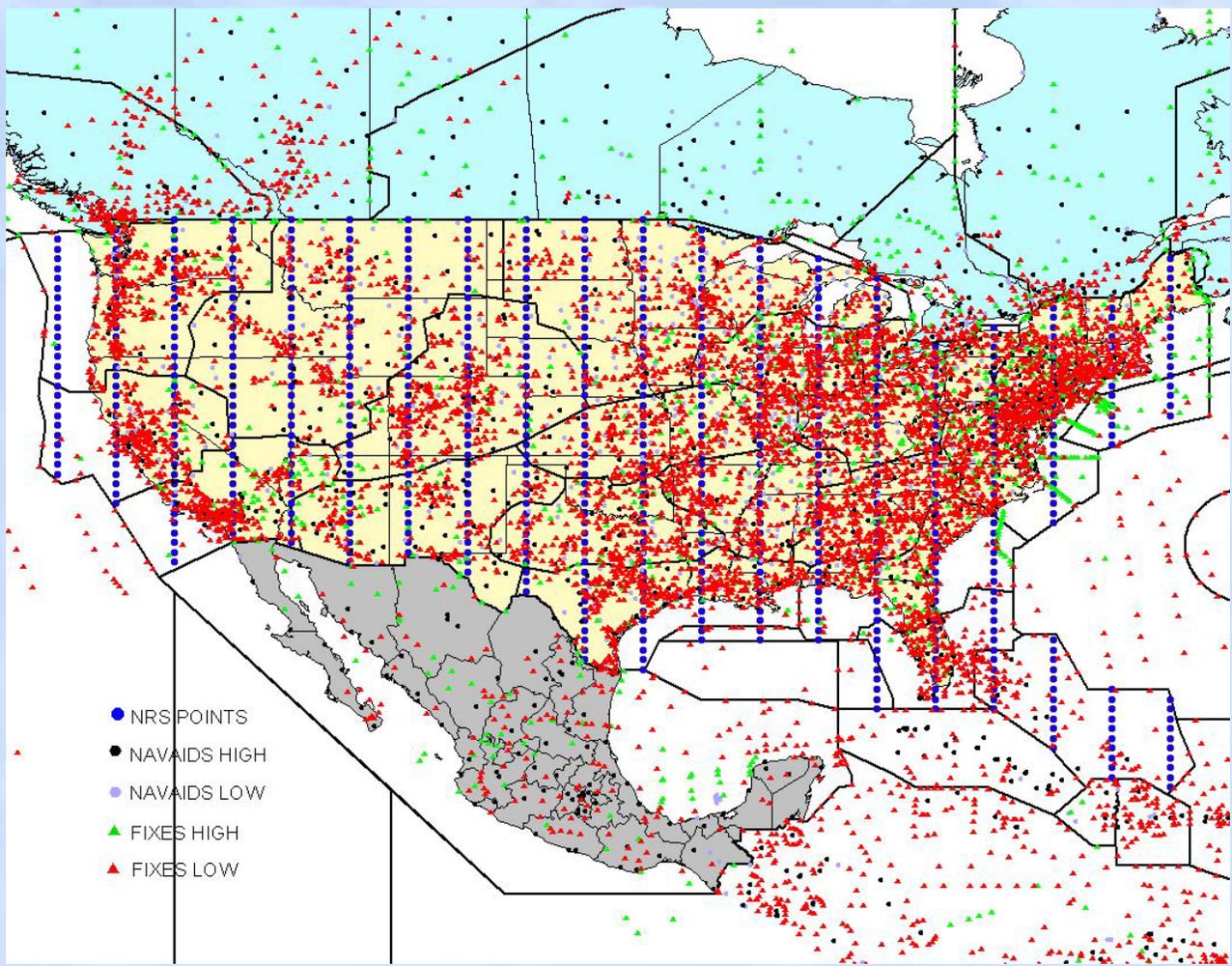
Why a “NRS”?

- **Tactical aid in resolving conflicts between aircraft at non-routine conflict points associated with random routings**
- **Tactical aid in weather avoidance, especially in confined sectors or involving multiple aircraft**
- **Supports weather reroutes closer to desired flight path**
- **Less workload to communicate than Lat./Long.**
- **Lower error potential than Lat./Long.**
- **Facilitate understanding of changes in flight path**
- **Can be used to satisfy current NAS Computer processing requirements for filing at least one fix per center area**
- **Facilitates pilot navigation in lieu of workload intensive radar vectoring**

Desirable Interim NRS Features

- **Easy to communicate**
- **Low error potential**
- **Consistent with fix naming principles**
- **Intuitive as to general location of “fixes”**
- **Minimal impact to airborne equipment – only database changes are realizable in near term**
- **Useable by preponderance of fleet**
- **Minimal changes to ground automation – database only changes**
- **Supports U.S. wide implementation**
- **Resolution of navigation points supports their tactical use without significant added mileage**

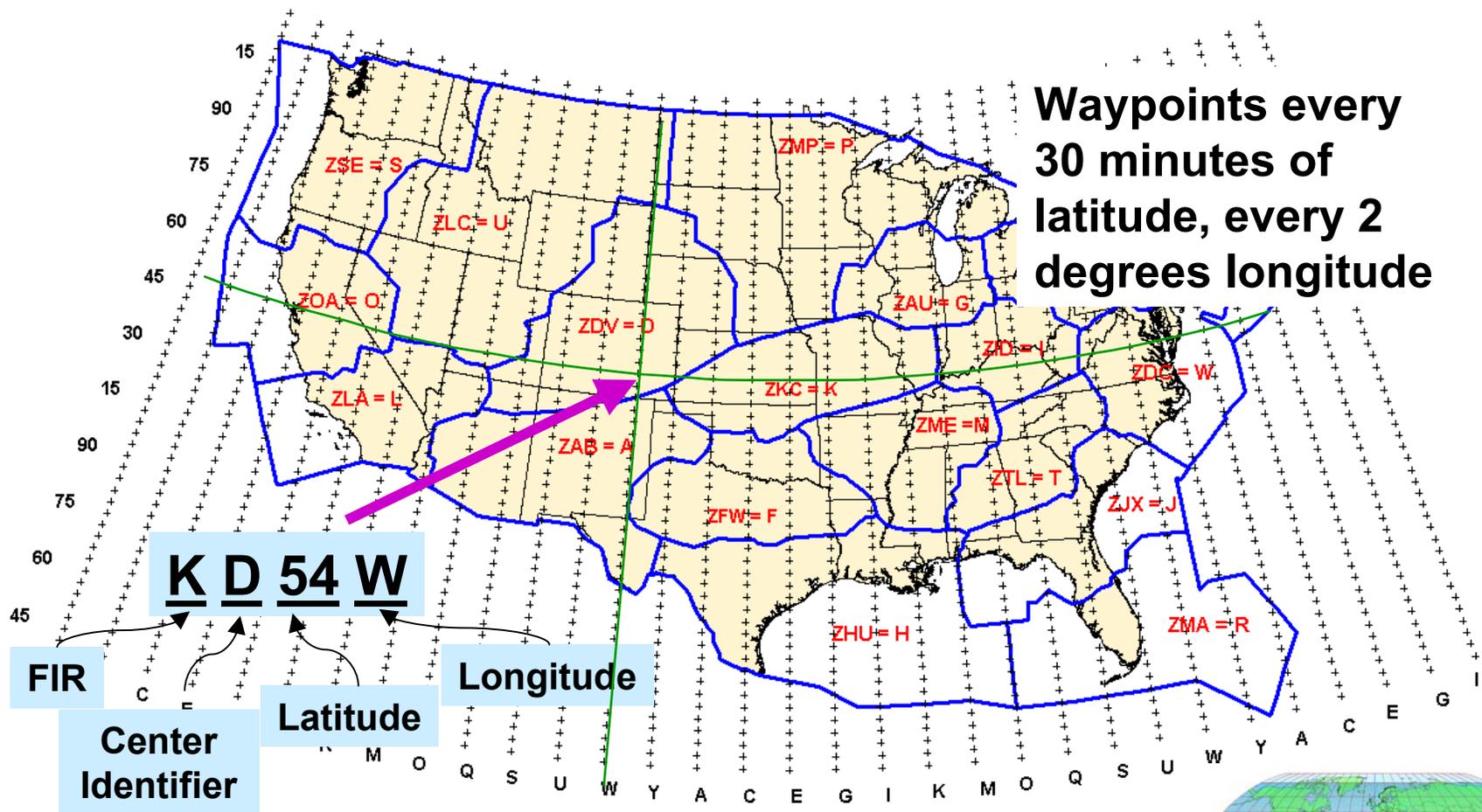
NAVAIDS, FIXES AND NRS



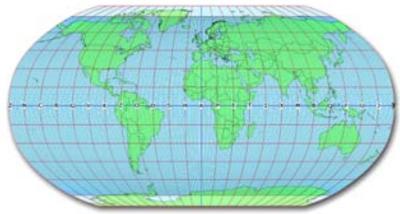
Waypoint “Population”

- **Database sizing constraints by both airborne platforms and Host computer system potentially preclude utilizing full NRS**
 - **Variability by aircraft?**
 - **Publishing/Charting corresponding waypoint Lat/Long potential work around for airborne platforms and flight planning systems**
 - **Confining new Waypoints to specific Center area and 150 NM into adjacent potential work around for Host limitation**
- **Impact to controllers if pilot unable to navigate to specific tactically assigned waypoint?**

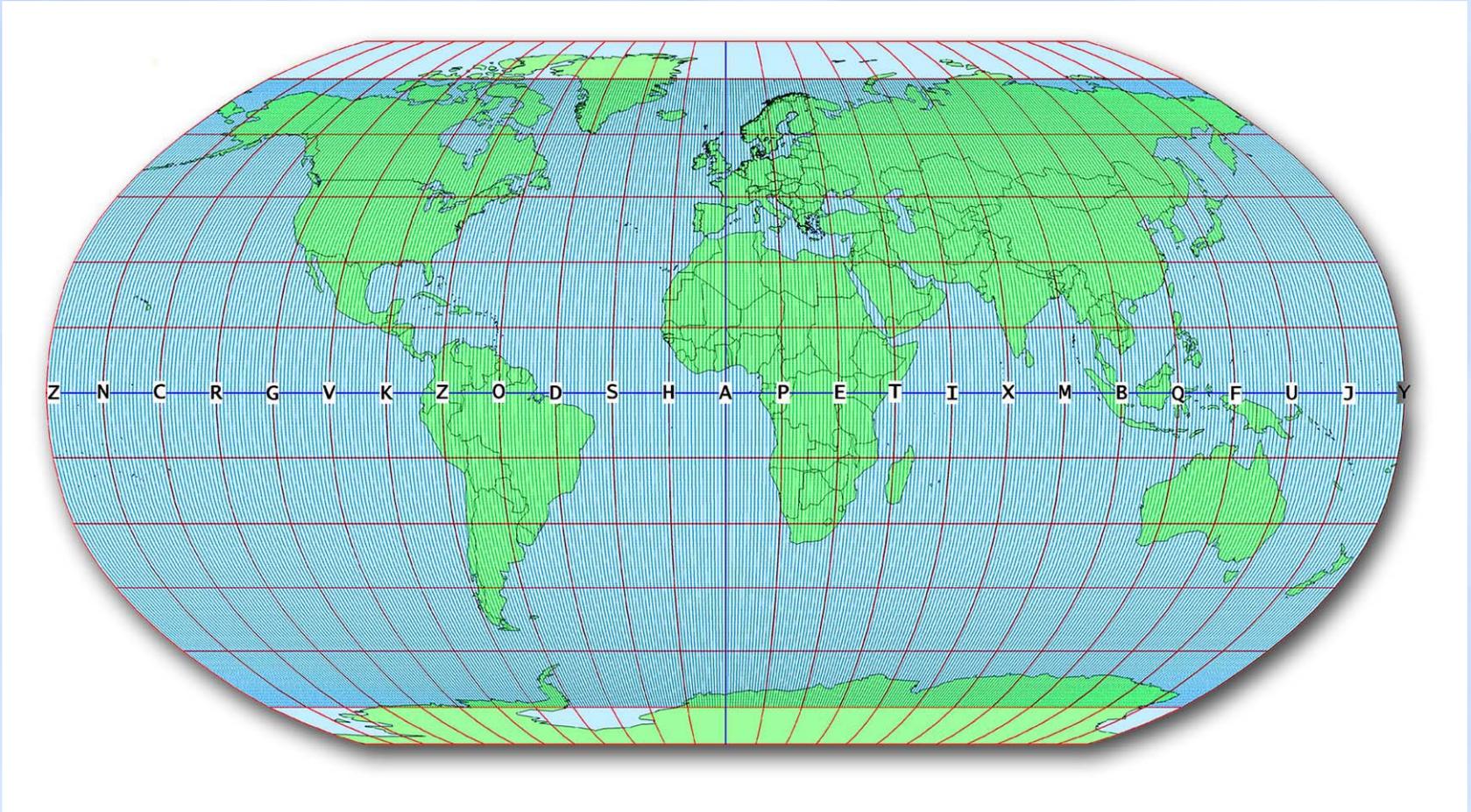
Navigation Reference System



Waypoints every 30 minutes of latitude, every 2 degrees longitude

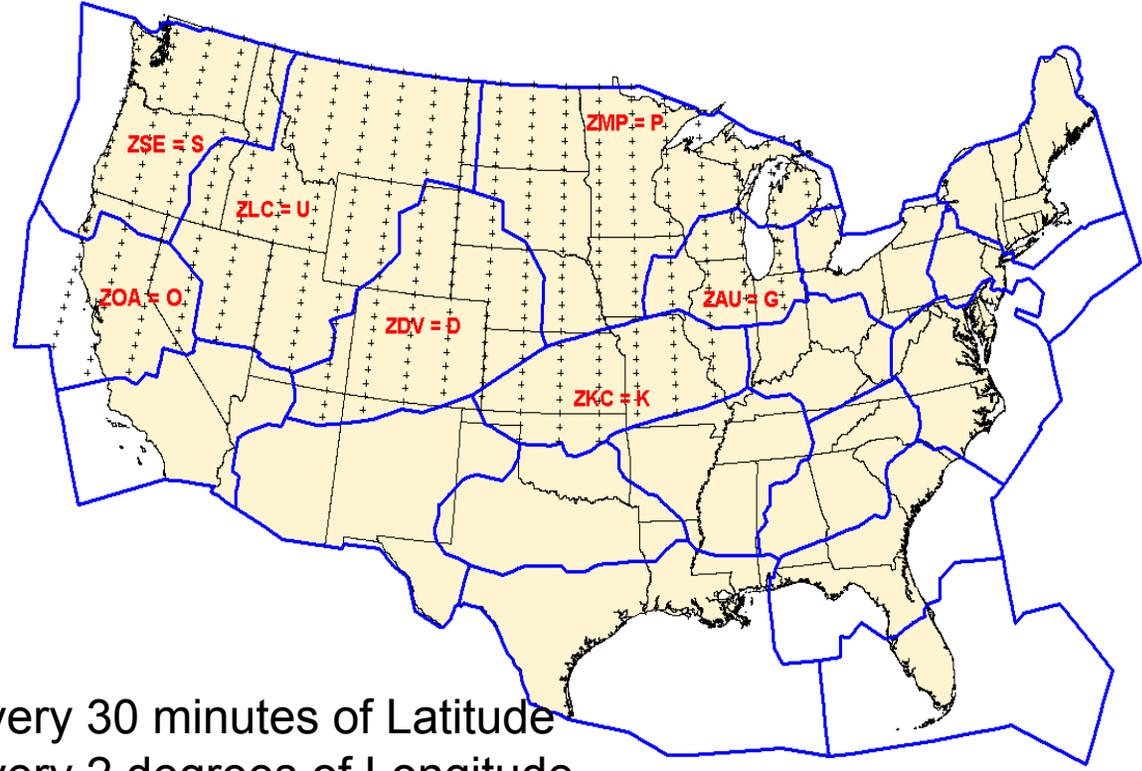


Global NRS Concept



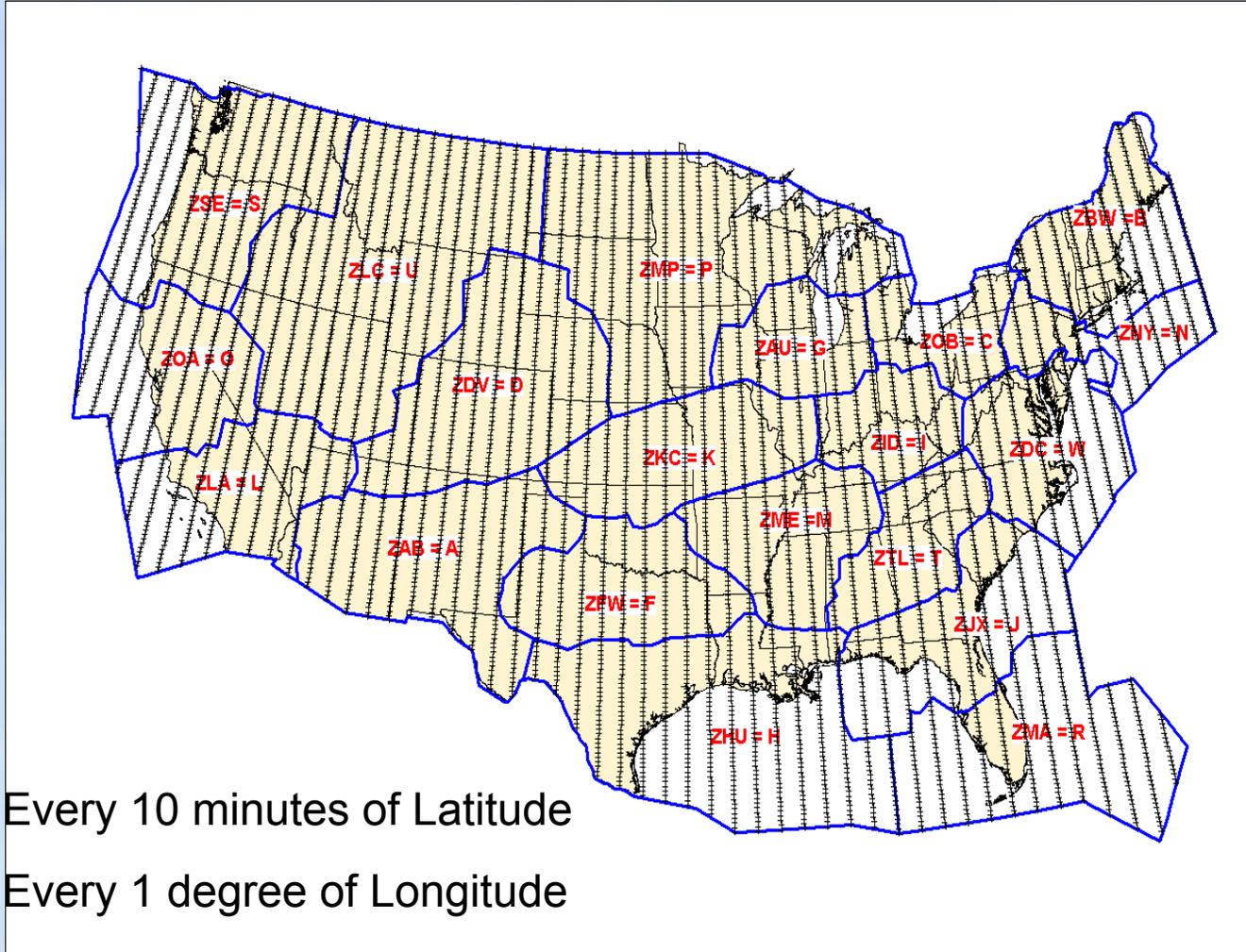
NRS Initial Implementation

7 Center Area

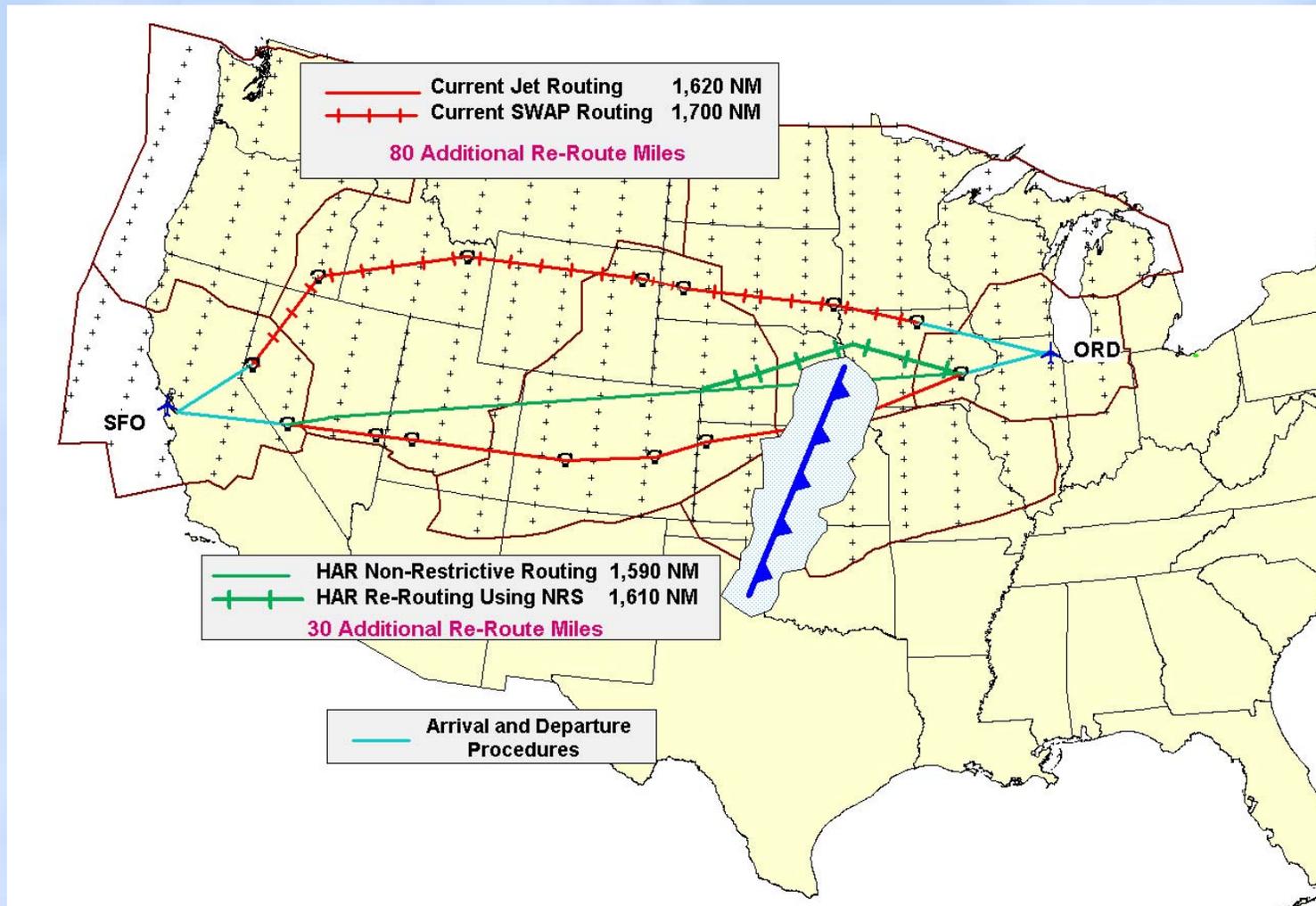


Every 30 minutes of Latitude
Every 2 degrees of Longitude

Full Populated NRS



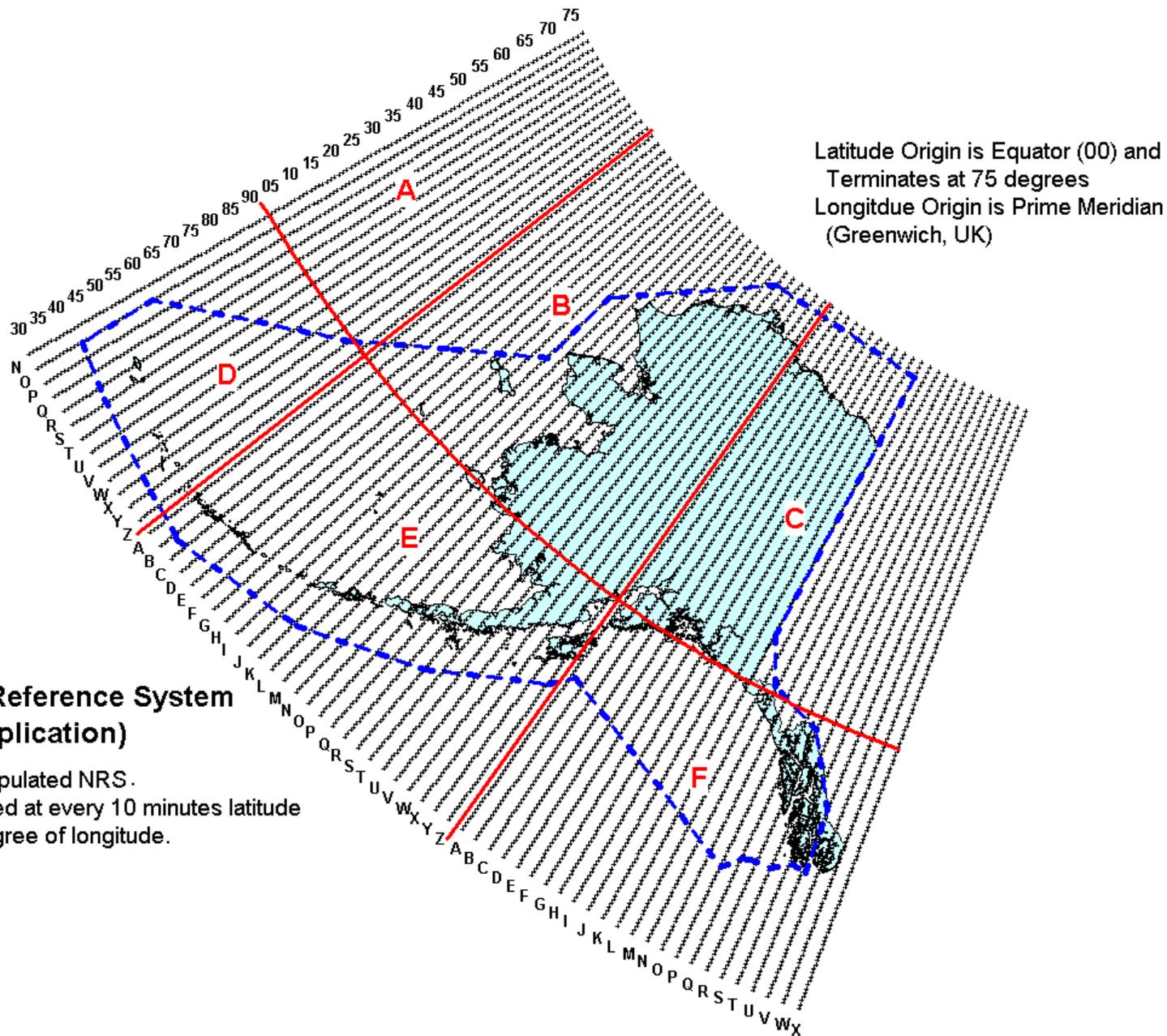
HAR Weather Reroute with NRS



Application to Other Areas

- **ICAO representatives have asked on 2 occasions for copies of NRS for application consideration elsewhere**
- **Conceptual design applied in draft to Alaska**

Navigation Reference System - Alaskan FIR and Subdivisions



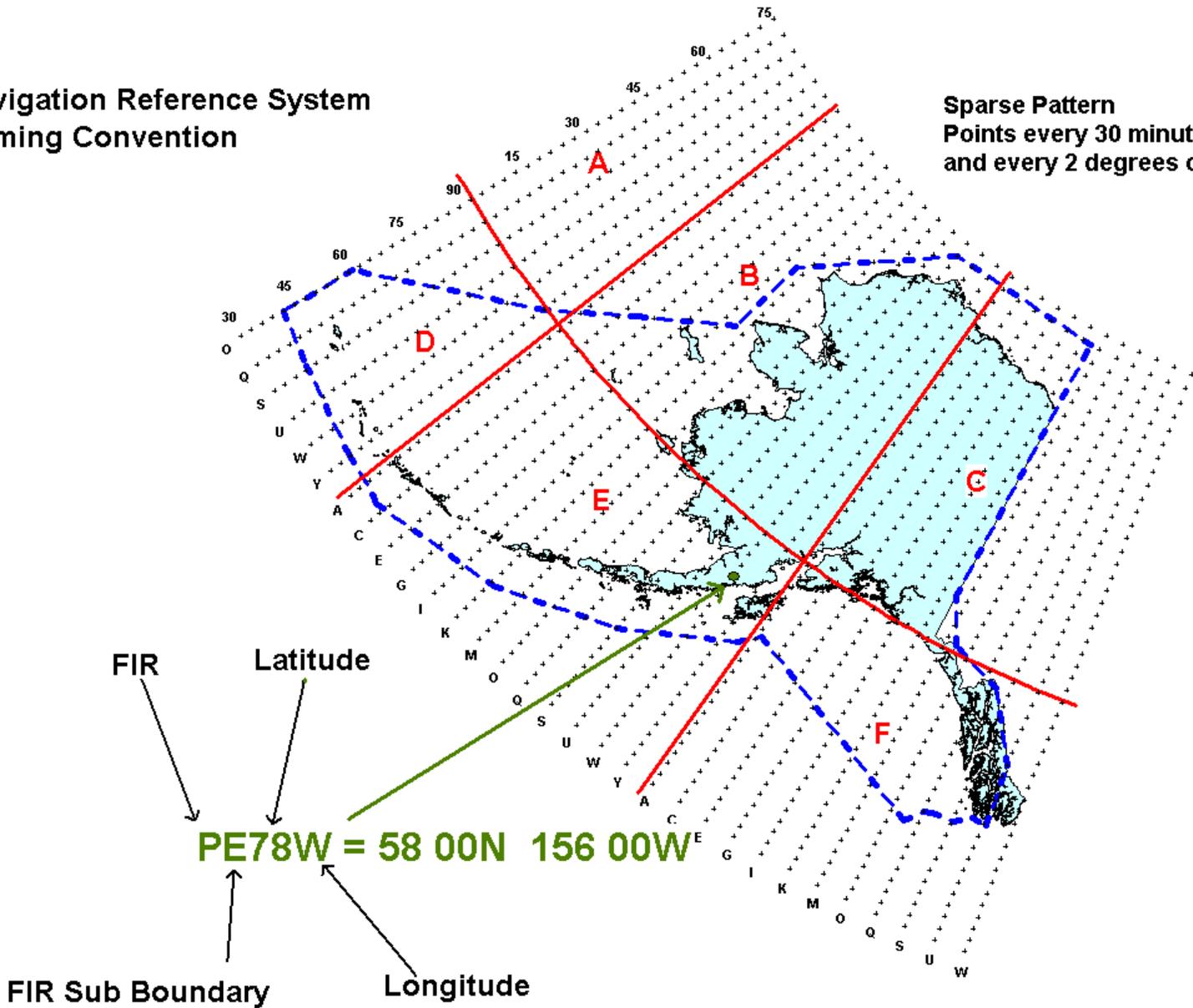
Navigation Reference System (Alaskan Application)

This is a fully populated NRS.
Points are placed at every 10 minutes latitude
and every 1 degree of longitude.

NRS Naming Convention for Alaskan FIR

Navigation Reference System
Naming Convention

Sparse Pattern
Points every 30 minutes of latitude
and every 2 degrees of longitude

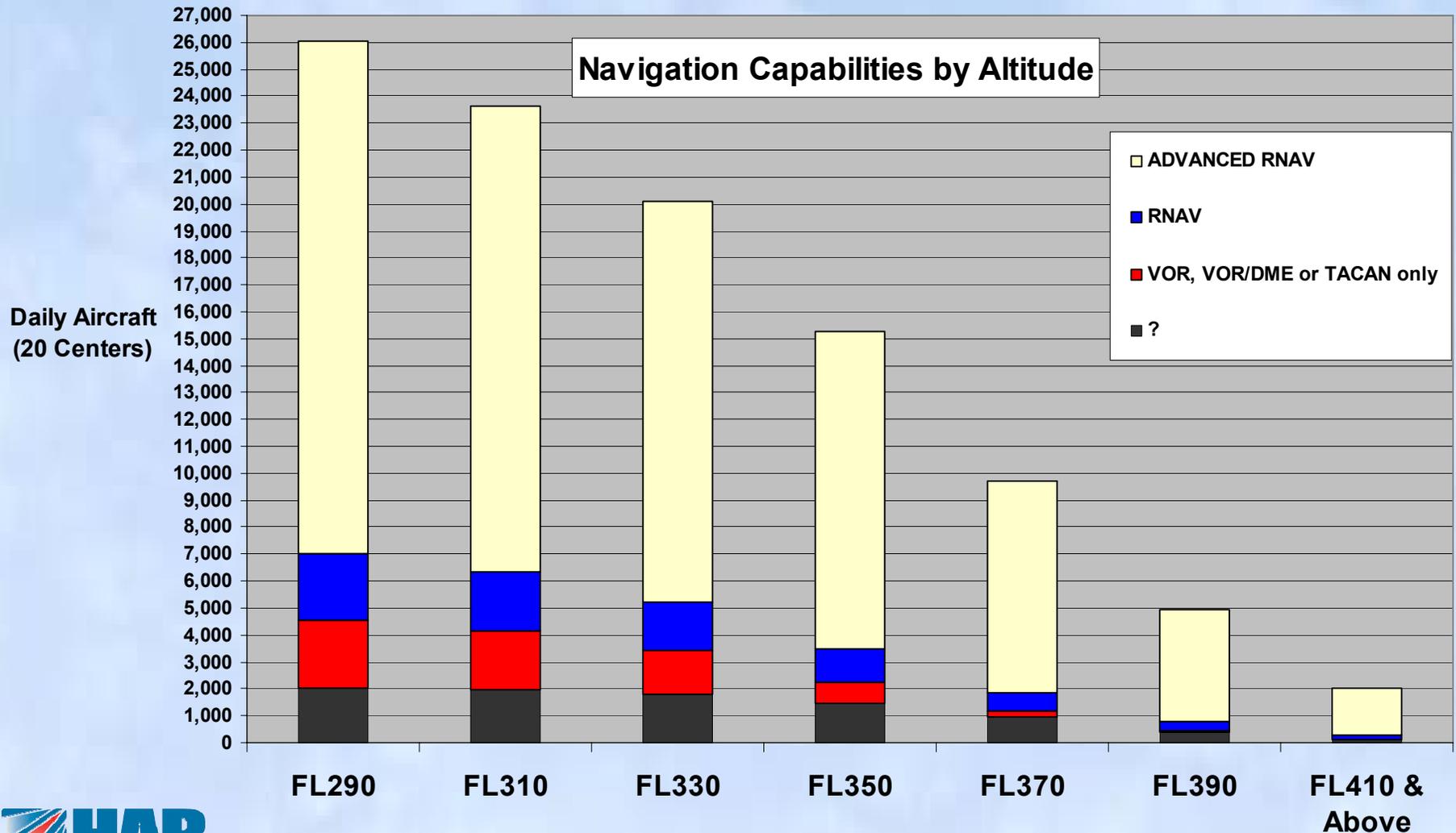


FIR Latitude

PE78W = 58 00N 156 00W

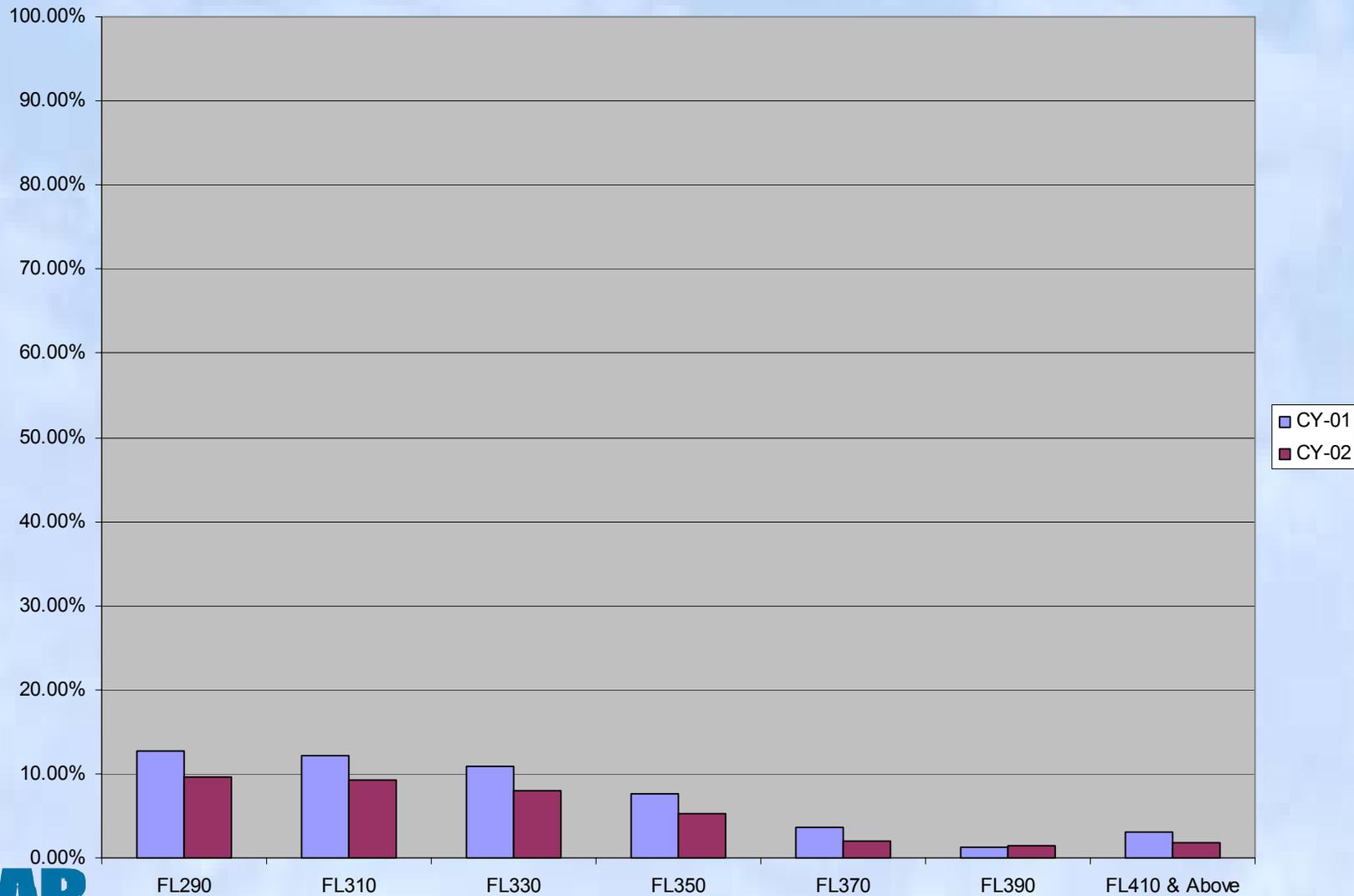
FIR Sub Boundary Longitude

User Environment Navigation Capabilities by Altitude*



*Updated data - 8/15/2002

Non-RNAV CY-01 to CY-02



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