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 confliction 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
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?
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

Every 10 minutes of Latitude
Every 1 degree of Longitude
HAR Weather Reroute with NRS

- Current Jet Routing: 1,620 NM
- Current SWAP Routing: 1,700 NM
- HAR Non-Restrictive Routing: 1,590 NM
- HAR Re-Routing Using NRS: 1,610 NM

80 Additional Re-Route Miles
30 Additional Re-Route Miles
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

Latitude Origin is Equator (00) and Terminates at 75 degrees
Longitude Origin is Prime Meridian (Greenwich, UK)

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 Sub Boundary

Latitude

Longitude

PE78W = 58 00N 156 00W

FIR
User Environment
Navigation Capabilities by Altitude*

*Updated data - 8/15/2002
Non-RNAV CY-01 to CY-02

FL290  FL310  FL330  FL350  FL370  FL390  FL410 & Above

CY-01  CY-02
## Waypoint Estimates - HAR

<table>
<thead>
<tr>
<th>Phase</th>
<th>Timeframe</th>
<th>Centers</th>
<th>Pitch, Catch, SUA / ATCAA, Define Route</th>
<th>NRS</th>
<th>Cumulative Total</th>
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<tbody>
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<td>1 - Initial</td>
<td>CY-03</td>
<td>ZSE, ZDV, ZLC, ZOA, ZKC, ZMP, ZAU*</td>
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<td>Full U. S. w/NRS Resolution Max.</td>
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<td>6,500</td>
<td>7,500</td>
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</tbody>
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Notes:
* Partial
** Remainder