

Area Navigation (RNAV) and Required Navigation Performance (RNP)

Program Overview

Presented to: CDA Workshop

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RNAV and RNP Group

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**Federal Aviation
Administration**



Roadmap for Performance-Based Navigation

- The FAA published the *Roadmap* in July 2003
- Collaborative effort among aviation industry stakeholders
 - Performance-Based Operations Aviation Rulemaking Committee (PARC)
- Aligned with **FAA *Flight Plan*, ATO *Business Plan*, OEP, and RTCA**
- Updating December 2005 to reflect lessons learned

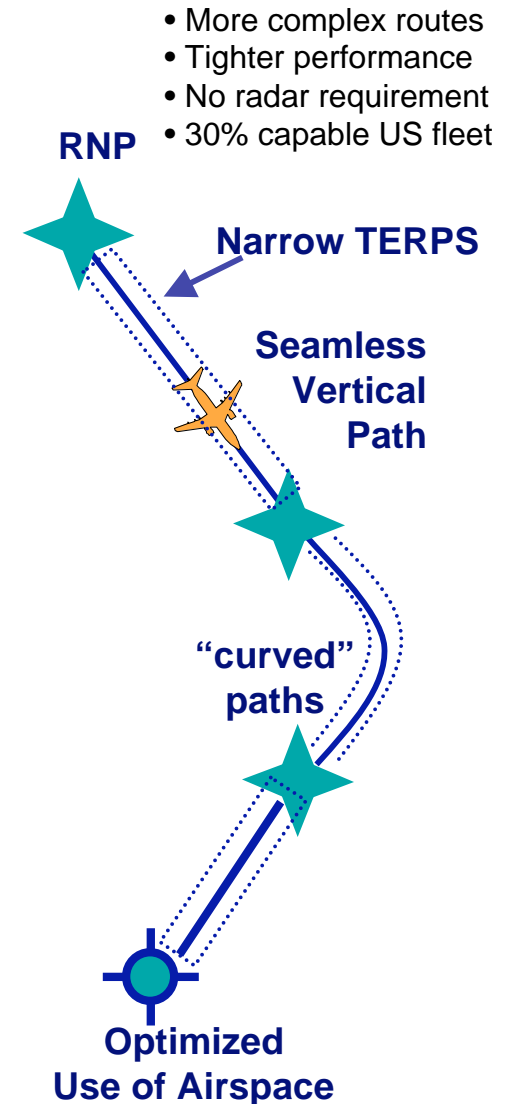
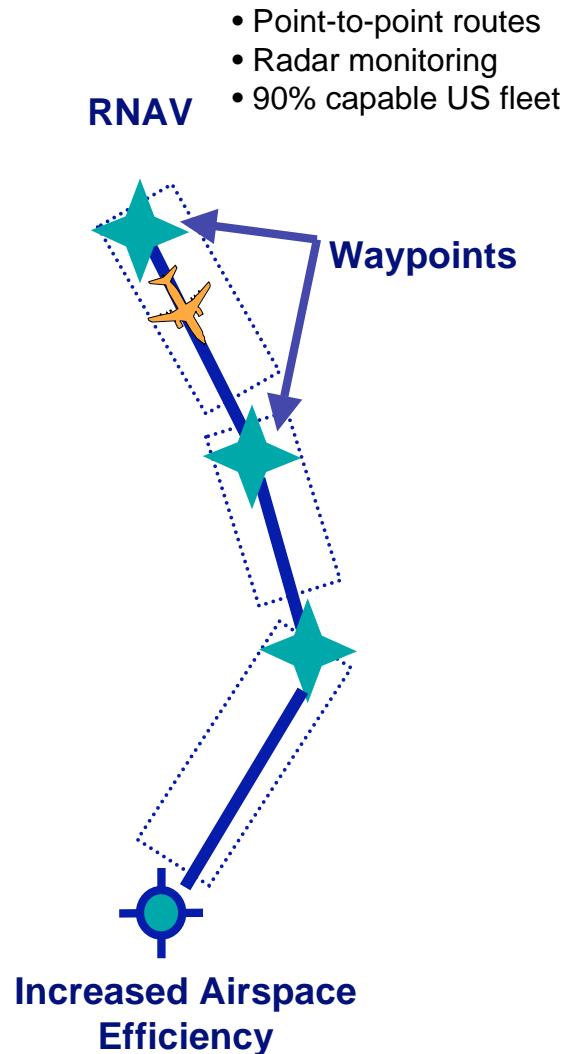
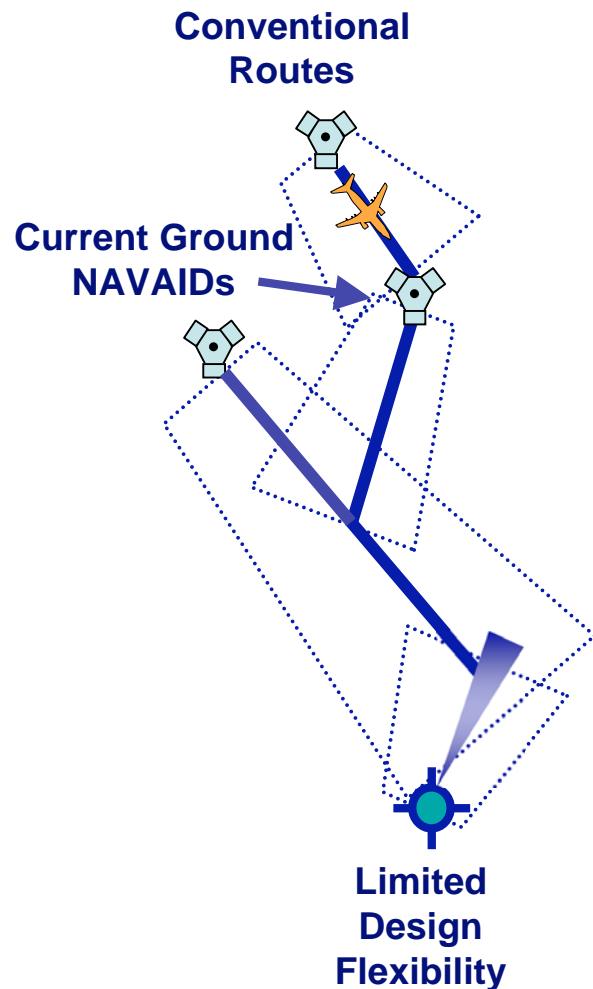


What is “Performance-Based Navigation”?

- **Aviation authorities specify the aircraft capabilities and performance requirements necessary to operate in a given airspace or use a given procedure (instead of specifying required technologies or specific avionics)**
 - RNAV is achieved through a combined use of aircraft navigation accuracy, route separation and/or air traffic control intervention (e.g., via radar monitoring, automatic dependent surveillance (ADS), multi-lateration, communications)
 - RNP is RNAV operations with on-board navigation containment, monitoring and alerting

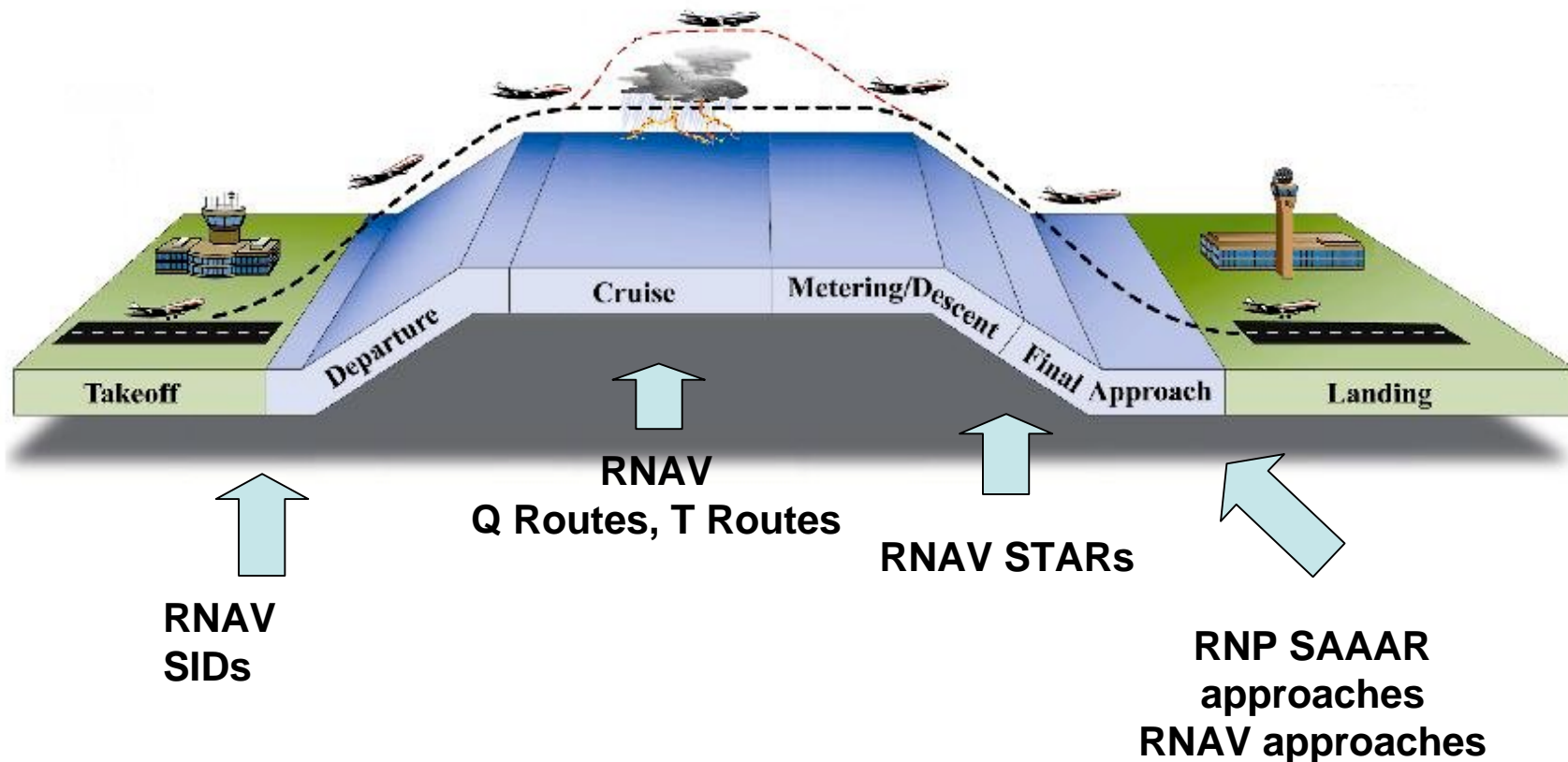


Performance-Based Navigation Evolution



Performance-Based Navigation In All Phases of Flight

“Snapshot” of Current U.S. Implementations



Enabling Criteria, Guidance and Tools

- **Part 75 Revision for RNAV routes**
- **AC 90-100**
 - US Terminal and En Route Area Navigation (RNAV) Operations
- **Order 7470.1**
 - DME/DME Evaluation
- **Order 8260.44A**
 - Civil Utilization Of Area Navigation (RNAV) Departure Procedures
- **RNAV-PRO DME Screening Tool**
- **TARGETS development tool**
- **Order 8260.53**
 - United States Standard for Instrument Departures that use Radar Vectors to Join RNAV Routes
- **AIM Revisions for RNAV**
- **Charting Specifications for RNAV routes and procedures**
- **Notice 8000.302**
 - Stand-Alone Area Navigation (RNAV) Transition Procedures



Enabling Criteria, Guidance and Tools (Completed)

- **AC 90-96A**
 - Approval of U.S. Operators and Aircraft to Operate Under Instrument Flight Rules (IFR) in European Airspace Designated for Basic Area Navigation (B-RNAV) and Precision Area Navigation (P-RNAV)
- **AC 20-153**
 - Acceptance of Data Processes and Associated Navigation Databases
- **Notice 8000.300**
 - Required Navigation Performance (RNP) Airworthiness Approval, Operational Approval, and Design Guidelines for Special Aircraft and Aircrew Authorization Required (SAAAR) Approach Procedures
- **Order 8260.52**
 - United States Standard for Required Navigation Performance (RNP) Approach Procedure with Special Aircraft and Aircrew Authorization Required (SAAAR)

Enabling Criteria, Guidance and Tools (Completed)

- **US RNP SAAAR Criteria (FAA Order 8260.52) was submitted to the ICAO OCP as a model for international criteria for RNP approach procedures**
 - OCP accepted the order in total
 - A drafting group will adapt the order to be consistent with PANS-OPS
 - Intent is to publish this criteria as a stand-alone document supplementing PANS-OPS
 - The end state objective is to have mature criteria for introduction into PANS-OPS at OCP/15 in the fall of 2007
- **AC 90-101**
 - Approval for RNP procedures with Special Aircraft and Aircrew Authorization Required (SAAAR)

FY2005 Highlights

- Published 6 RNP Special Aircraft and Aircrew Authorization Required (SAAAR)
 - 1 public RNP SAAAR
 - 4 special RNP SAAARs
 - 1 special RNP Parallel Approach Transition (RPAT)
- Published/Implemented 25 RNAV Routes
 - 21 high altitude (Q-Routes)
 - 4 low altitude (T-Routes)
- Implemented 58 Standard Terminal Arrivals (STARs) and Standard Instrument Departures (SIDs)

RNAV Departure and Arrival Procedures

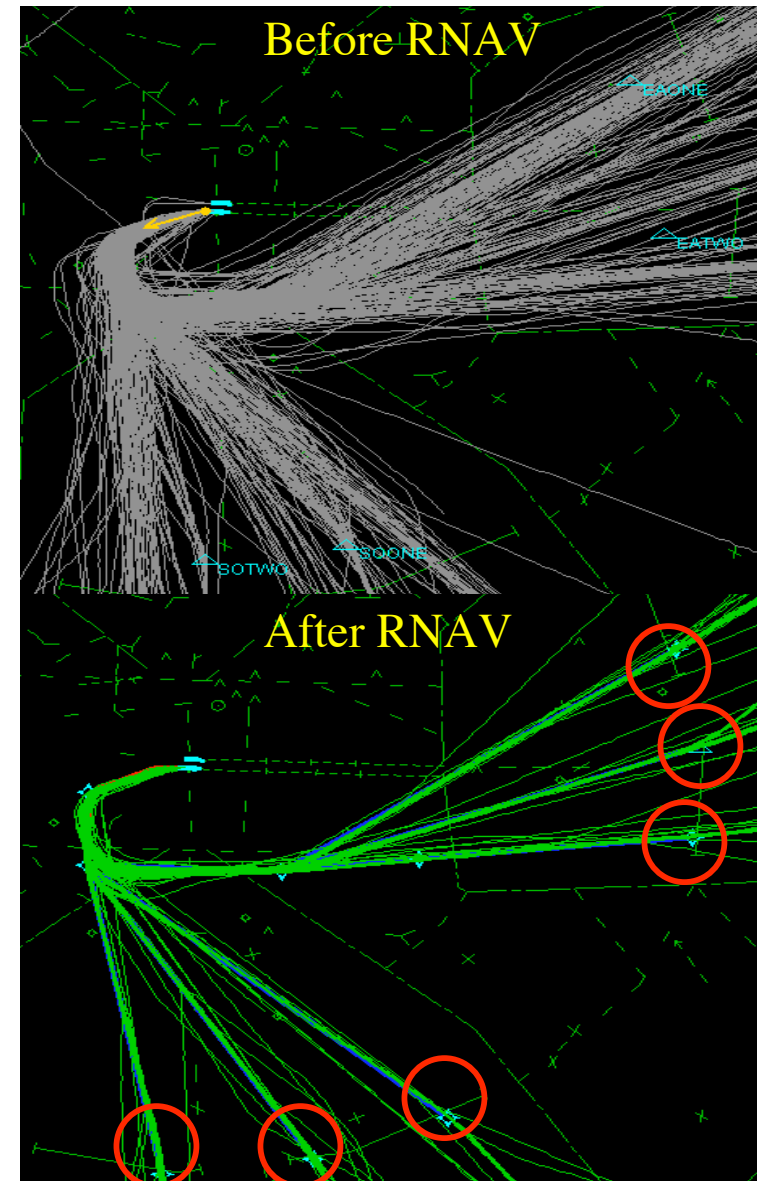
Examples of Near-term Implementation

| Airport | Date | Procedure |
|--|---------------------------|-------------------------------|
| Las Vegas (America West, Southwest) | Nov 2004 | 4 STARs and 5 SIDs |
| Dulles (United, Independence Air) | Jan 2005 | 4 STARs |
| Philadelphia (US Airways) | March 2005 | 2 STARs |
| Atlanta (Delta) | April 2005 | 4 STARs 13 SIDs |
| Dallas Fort Worth (American) | September 2005 | 16 SIDs |

Atlanta RNAV Departure Procedures

April 2005

- Approx 90% of 1350 daily IFR departures are RNAV capable
- Structured “lanes” to en route airspace
- Over 4,000 routine daily pilot/controller voice transmissions eliminated (30% reduction)
- Delta Airlines estimates \$30M annual savings
 - Decreased taxi times
 - Decreased departure delays
 - Improved flight profiles
 - Reduced distances

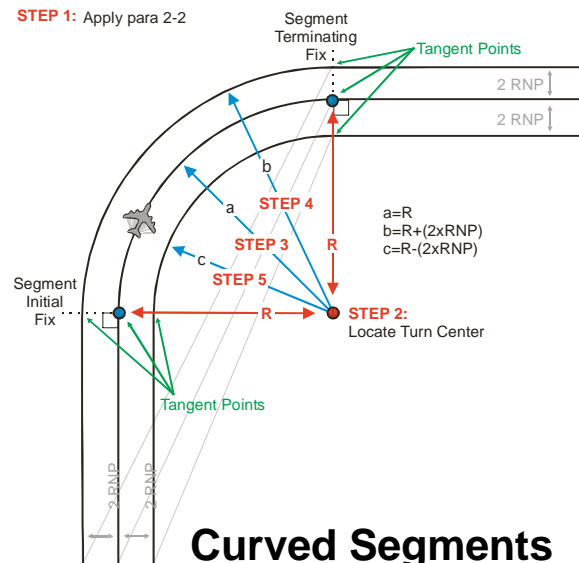


RNP SAAAR Approach Criteria

Enabling Features



STEP 1: Apply para 2-2



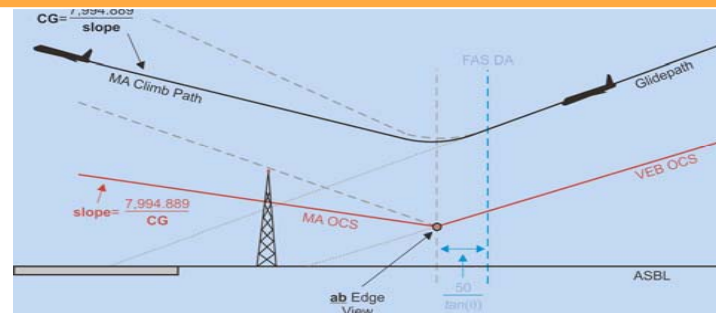
Curved Segments

Narrow lateral linear segments
(RNP-0.3 or less with no secondary buffers)

Curved segments anywhere along the approach
(Radius-to-fix legs with shorter leg lengths)

Guided, narrower turns on missed approaches
(Radius-to-fix legs, and RNP-1 or less)

Performance-based Vertical Profiles
(Vertical Error Budget vs. Barometric Vertical Nav)

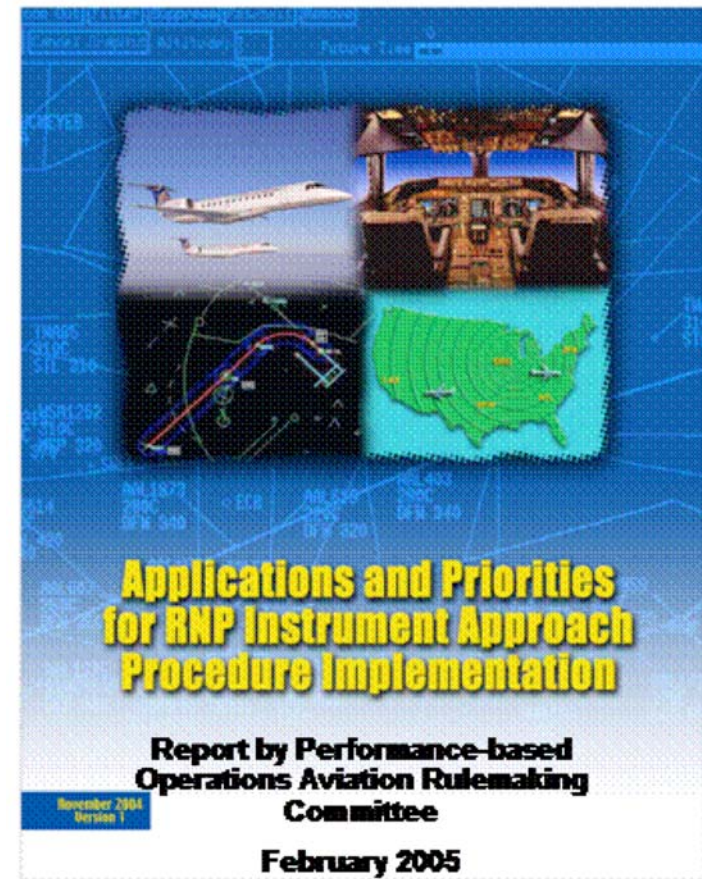


Vertical Profiles & Missed Approach

RNP SAAAR Approach Applications and Priorities

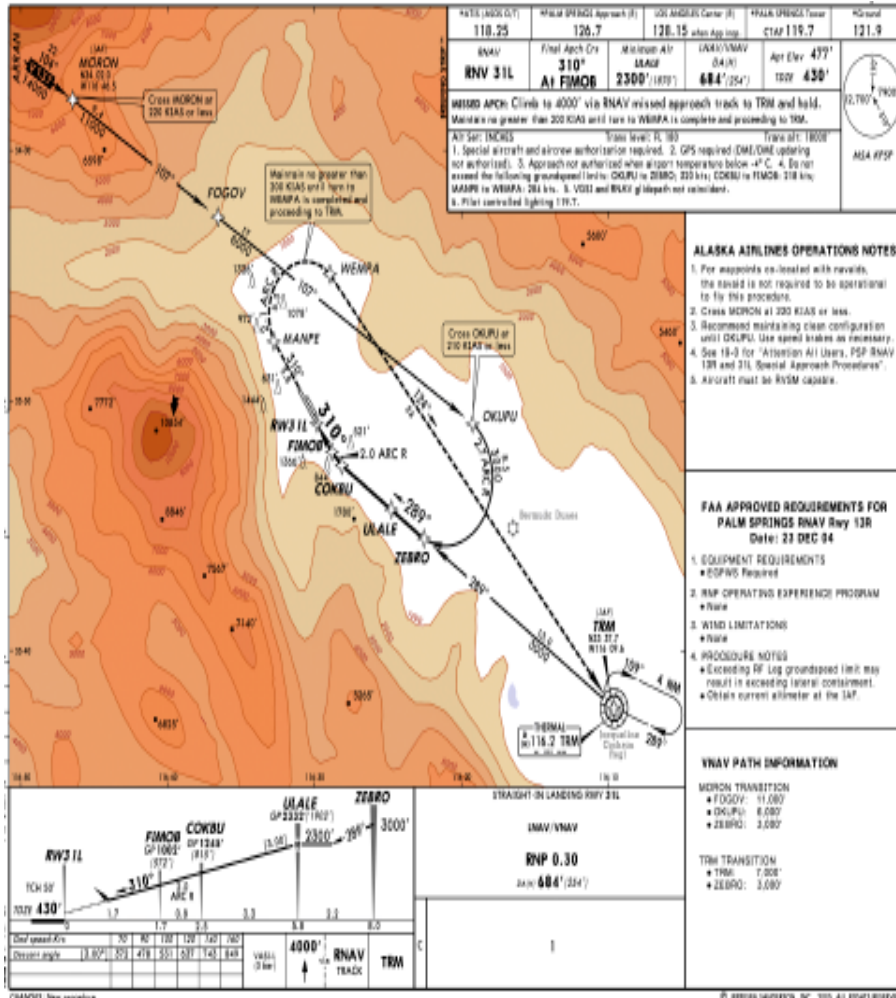
Analysis of Top 100+ Airports

| Airports | Characteristics |
|----------|--|
| Tier 1 | <ul style="list-style-type: none">• Near-term capacity needs, with national impact• Safety enhancement applications |
| Tier 2 | <ul style="list-style-type: none">• Regional capacity impact• Access & safety enhancements |
| Tier 3 | <ul style="list-style-type: none">• Single runway access and safety enhancement• Future airspace de-confliction |



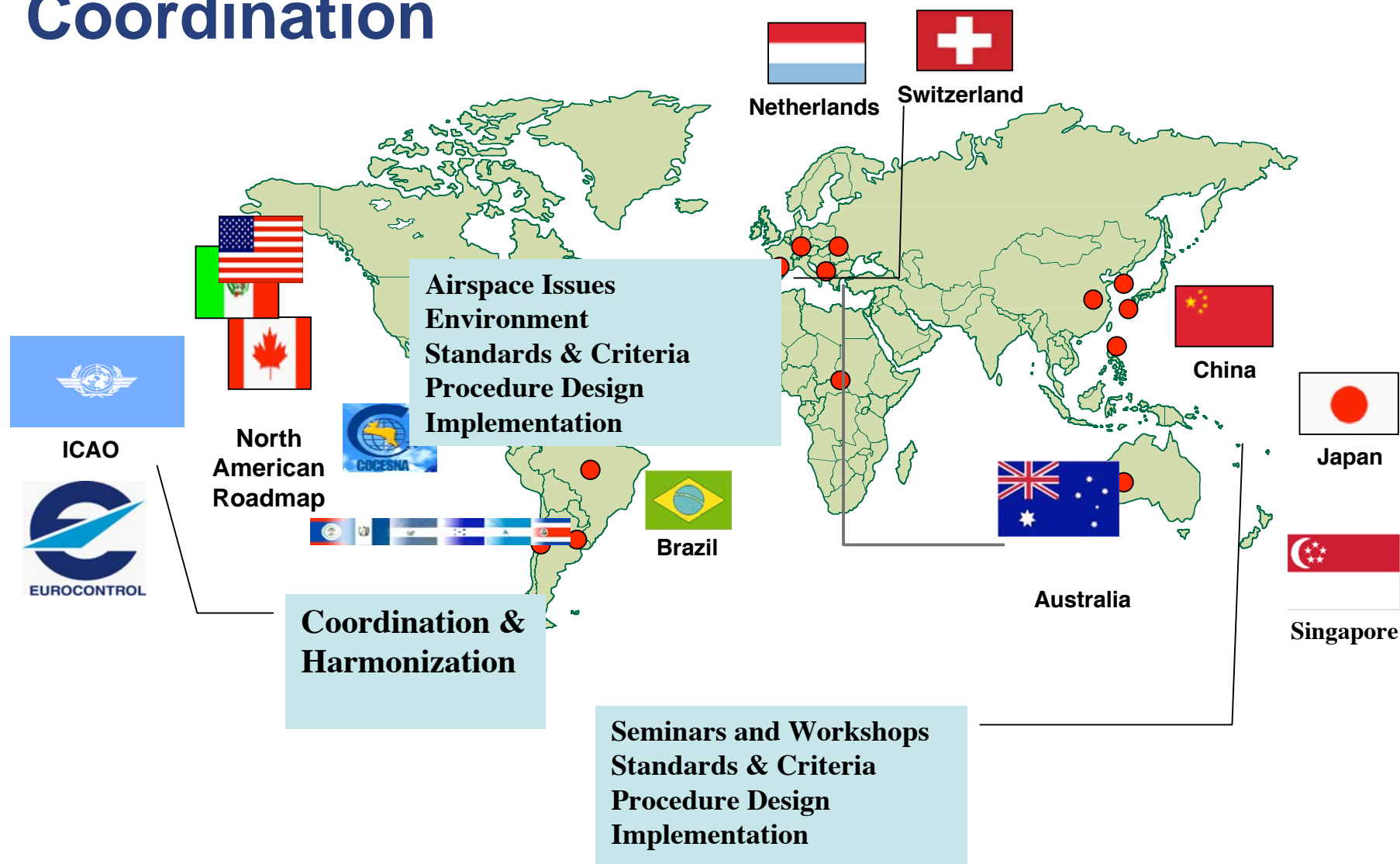
Palm Springs RNP Approach

January 2005



- **Avoids non-precision approach into a valley with mountainous terrain**
- **Safety enhancement, with guided, stabilized 3D path to runway**
- **Reduced time & distance (approximately 30 miles)**
- **Reduced minima, averting cancellations & diversions**
 - 20 flights “saved” in first few weeks of implementation
 - A SAVE is a flight that would have been canceled or diverted if the RNP procedure was not available

International Harmonization and Coordination



International

- **Work with ICAO and EUROCONTROL on international standard for RNAV and RNP**
 - ICAO RNP Study Group agreed to move forward single ICAO RNAV standard (AC90-100, TGL10)
 - Revise RNP Manual (Doc 9613)
- **Support international harmonization**
 - North American Aviation Trilateral (NAAT)
 - Signed *Joint Strategy for Implementation of Performance-Based Navigation in North America*
 - FAA, Transport Canada, DGAC Mexico, NAV CANADA, and SENEAM
 - Departamento de Controle do Espaço Aéreo (DECEA) (Brazil)
 - Asia-Pacific Economic Cooperation (APEC)
 - European Organisation for the Safety of Air Navigation (EUROCONTROL)
 - Japan Civil Aviation Bureau (JCAB)
 - Civil Aviation Authority of China (CAAC)
 - Caribbean/South American (CAR/SAM) Regional Planning and Implementation Group (GREPECAS)

Flight Standards “Special” Approval Process

- **Waiting on slides from Les**

