Performance-Based Navigation:
Area Navigation (RNAV) and Required Navigation Performance (RNP) Program

Federal Aviation Administration

Presentation to: PBN Task Force

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Acting Manager, PBN Integration Group
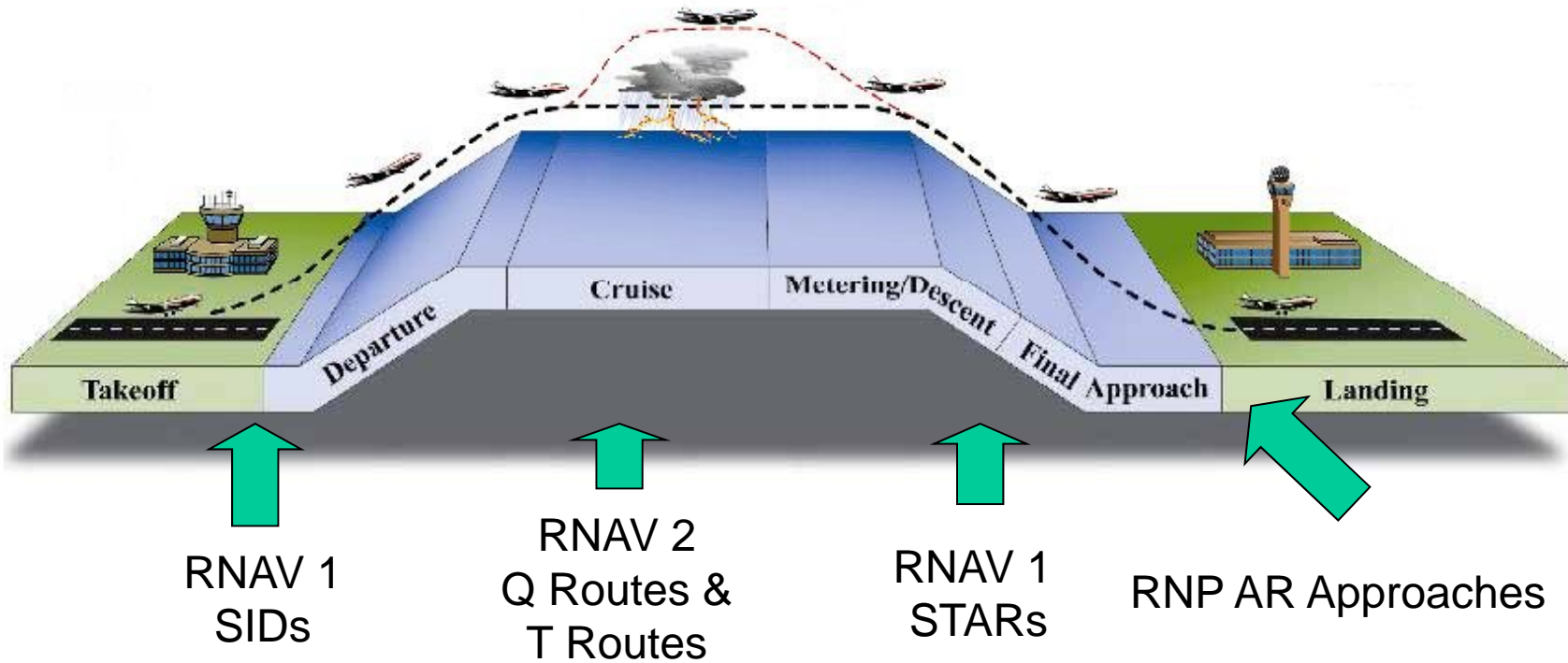
Date: May 10, 2011

Briefing Overview

- PBN Implementation
    - Examples and current status

- Recent Initiatives
    - Integrated Procedures Development/Airspace Optimization
    - Process Improvements
    - Supporting Tools
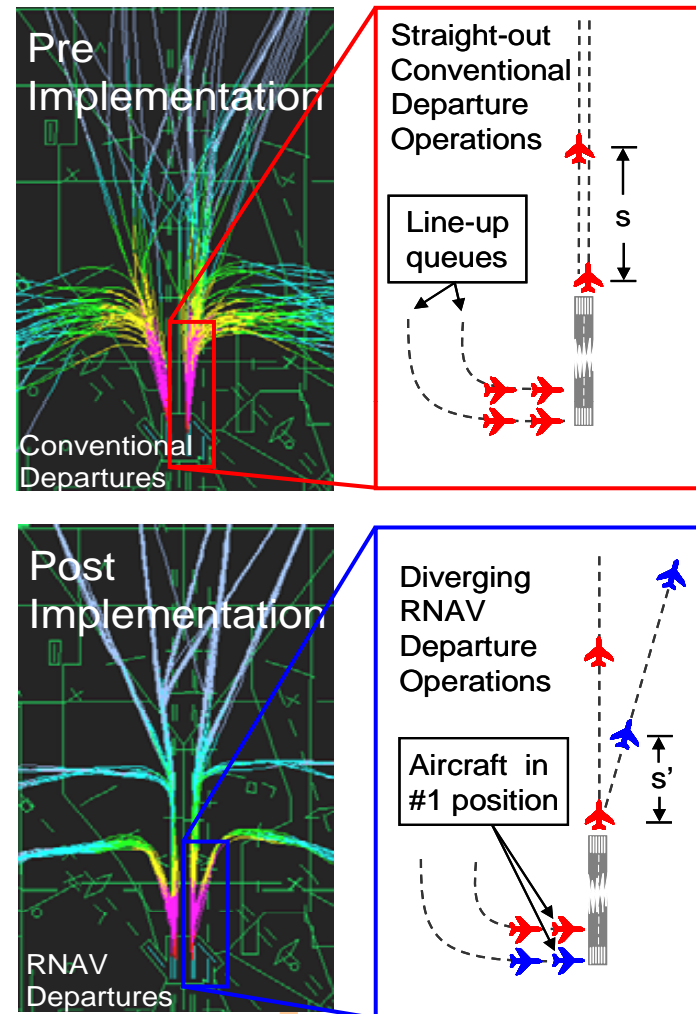
- International Harmonization

Current PBN Applicability in U.S. Domestic Airspace

RNAV 1
SIDs

RNAV 2
Q Routes &
T Routes

RNAV 1
STARs

RNP AR Approaches

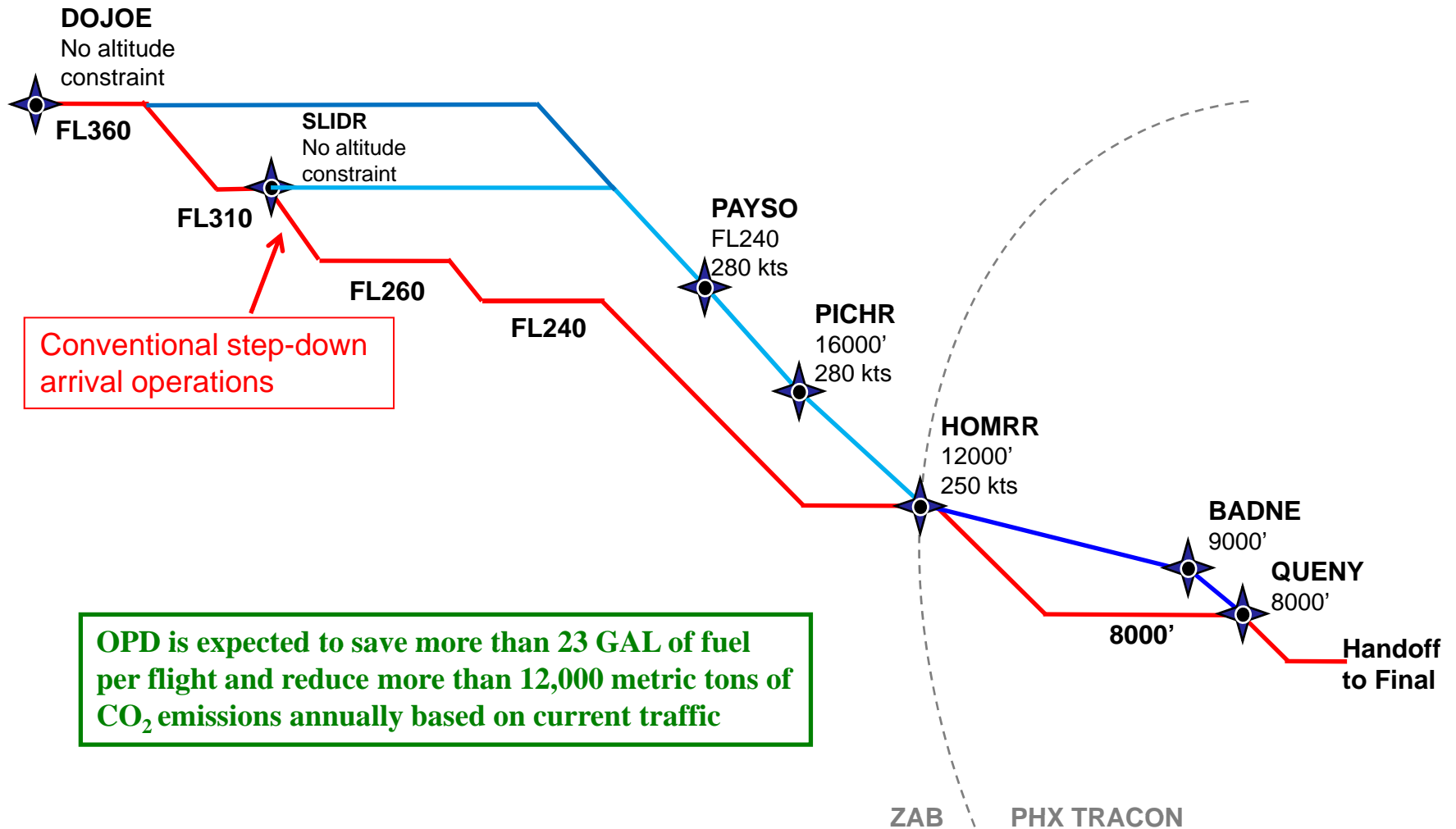+ RNAV (GPS) Approaches
+ LPV Approaches

SID Example - Dallas Fort Worth International (DFW)

- RNAV enabled diverging departures
- Allows application of same runway separation standards, reducing inter-departure times
- Reduction of inter-departure times yields an increase in departure capacity
  - 11 - 20 additional operations /hr
- Increased departure capacity results in approximately between $8.5M - $12.9M in delay savings per year
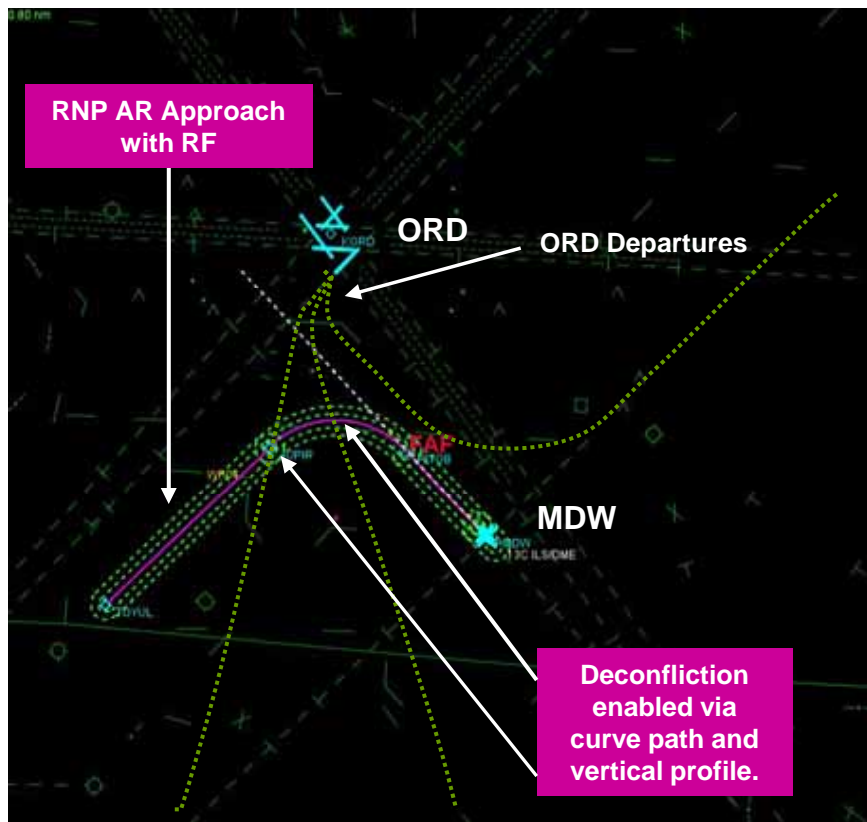 - At 2005 demand levels

Pre Implementation

Conventional Departures

Straight-out Conventional Departure Operations

Line-up queues

s

Post Implementation

RNAV Departures

Diverging RNAV Departure Operations

Aircraft in #1 position

s'

STAR Example - Phoenix OPD Project
EAGUL RNAV STAR Procedure Using Descend Via Ops

DOJOE
No altitude constraint
FL360

SLIDR
No altitude constraint

FL310

FL260

FL240

PAYSO
FL240
280 kts

PICHR
16000'
280 kts

HOMRR
12000'
250 kts

BADNE
9000'

QUENY
8000'

8000'

Handoff to Final

Conventional step-down arrival operations

OPD is expected to save more than 23 GAL of fuel per flight and reduce more than 12,000 metric tons of CO_2 emissions annually based on current traffic

ZAB   PHX TRACON

RNP Example - De-Confliction of Chicago O'Hare/Midway

The PBN Solution

MDW RWY 13C RNP approach provides a method to de-conflict traffic from ORD RWY 22L departures

RNP ARs and STARs Merge

Example - Palm Beach International Airport (PBI)

- Where possible, merging STARs with RNPs ARs so that transition from arrival to approach is smooth and efficient, particularly during instrument meteorological conditions.

- Suitably equipped and authorized operators will reap significant benefits from the vertical profiles and reduced track miles of these integrated PBN flight procedures.

- Some of the projects now under way include MCO, IND, ELP, PBI, BHM, MSP, JAX, SAV, ABQ and OKC.
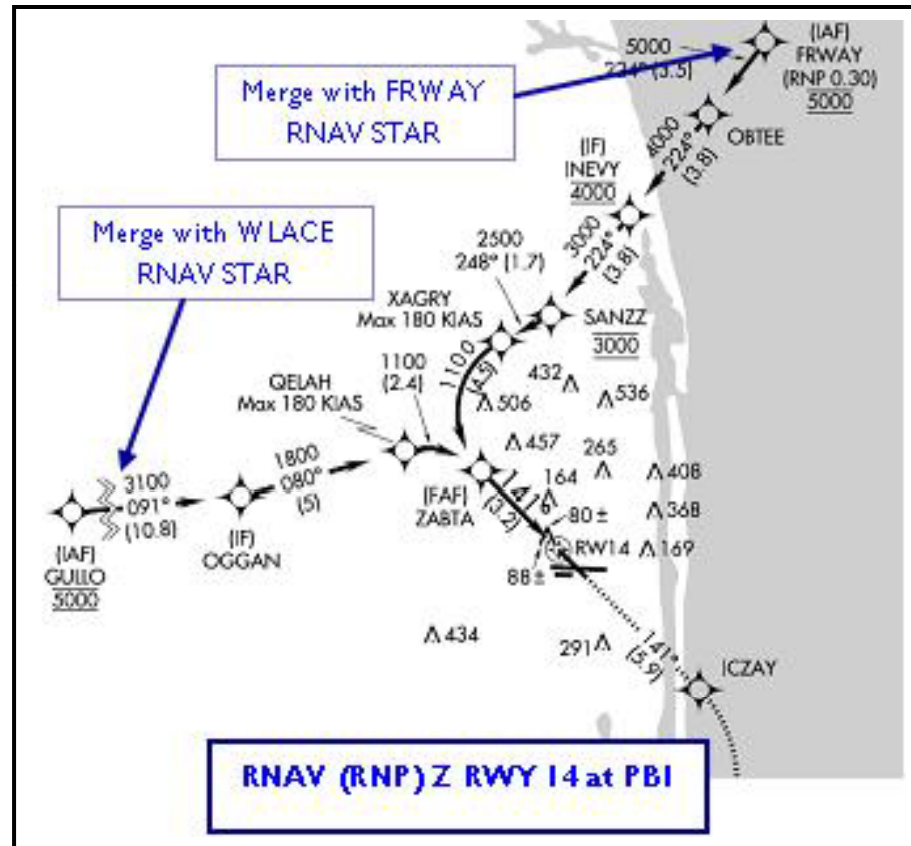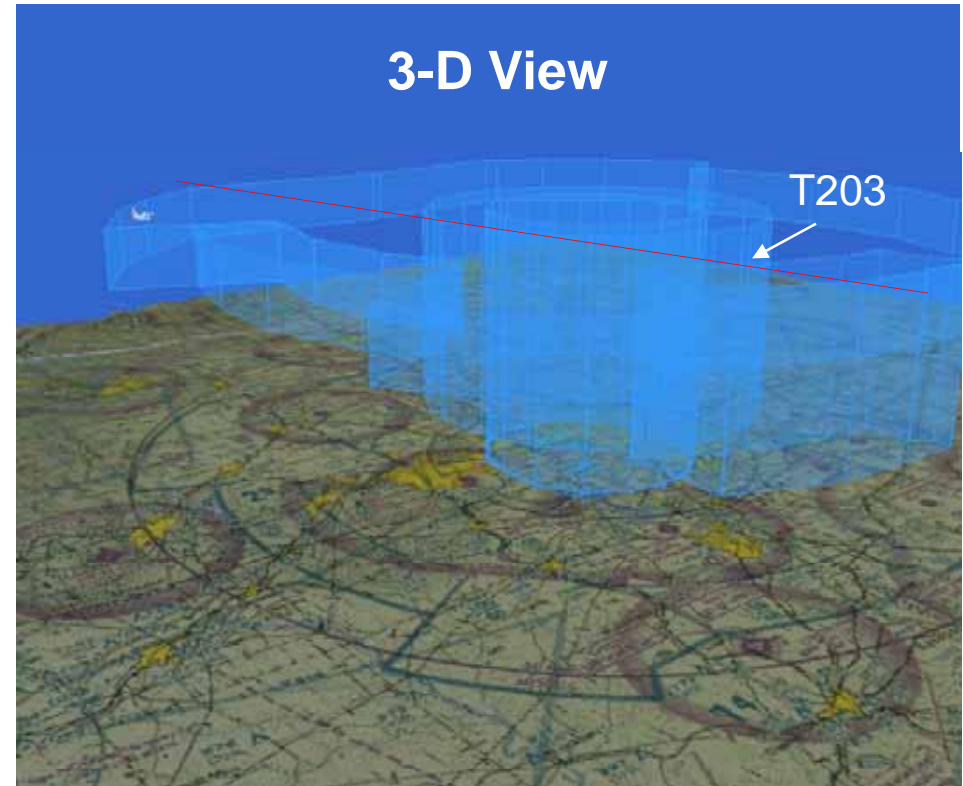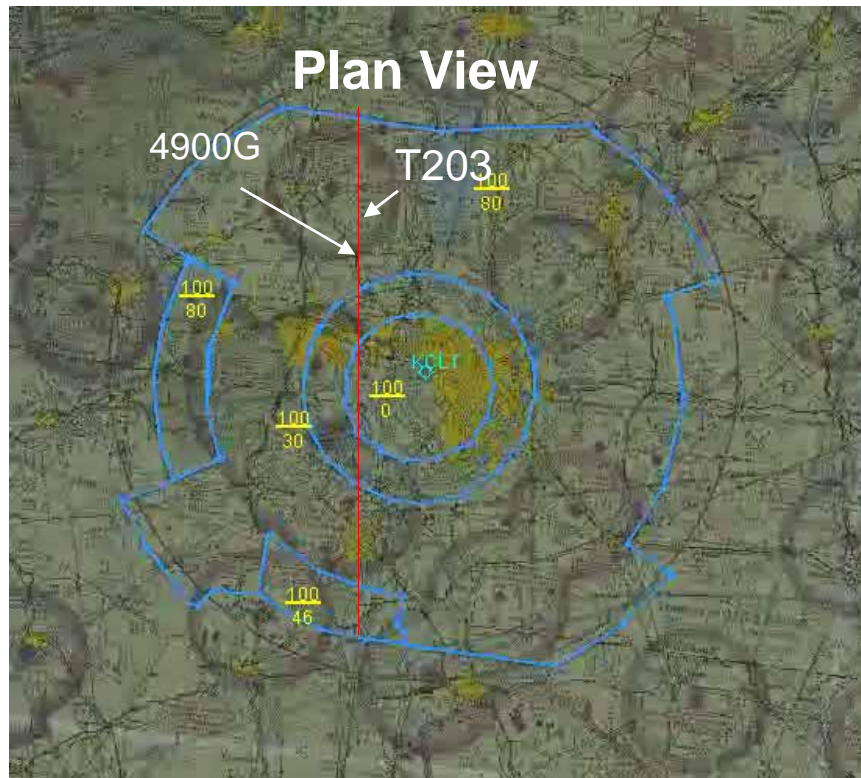
PBN in En Route Domain
Q-Routes

➢ Current route structure primarily based on ground navigation aids

➢ RNAV Routes can be placed where needed and beneficial independent of ground based VORs
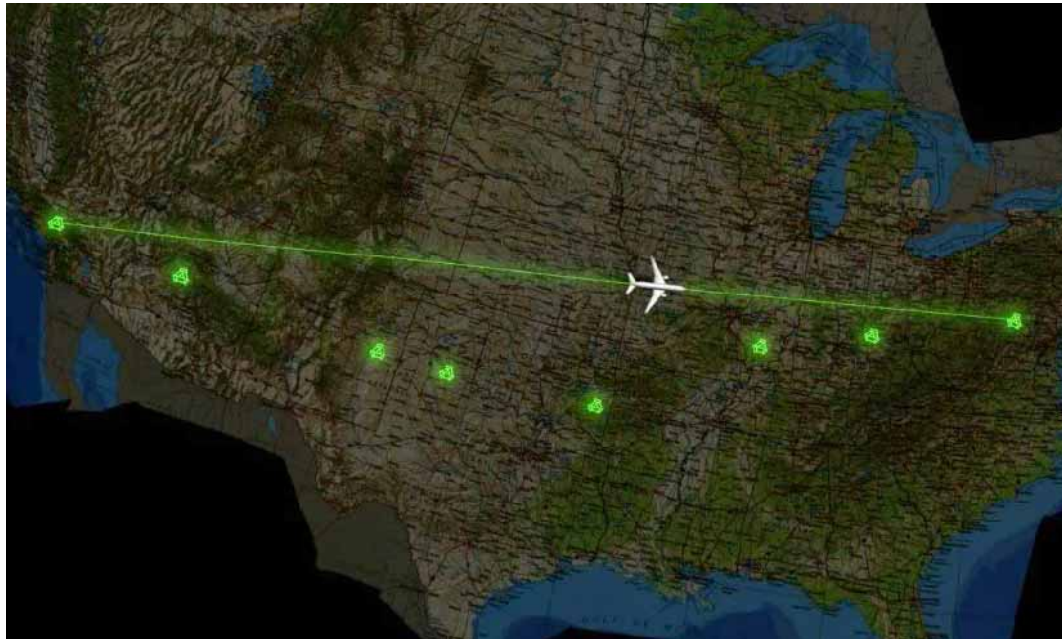
# PBN Routes in En Route Domain – T-Routes
Increased Capacity and Access

Plan View

4900G
T203

3-D View

T203

- **T-routes requested by Aircraft Owner's Pilot's Association (AOPA)**
- **Better access to Class "B" and Class "C" airspace**
- **Reduced mileage and increased en route capacity due to lower Minimum En Route Altitudes (MEA) based on GPS**

# Initiatives - Integrated Approach to PBN Procedures

- Integration of the airspace management process and PBN procedure design process - focus on optimization of procedures and airspace.

- Denver – Completed initial design packages for 40 procedures in August 2010. Now under environmental review.

- Las Vegas - Designed routes and procedures supporting LAS Optimization. Evaluated and modified resulting airspace sector modifications. Now under environmental review.

- Seattle - Initiated and helped design procedures for Seattle's "Greener Skies" Project.

- Metroplex update:
    - Washington and North Texas Study Teams complete; Design and Implementation Study teams begin work Feb/Mar 2011.
    - Study Teams to begin work on Charlotte, Atlanta, Houston, North Cal, and South Cal metroplexes.
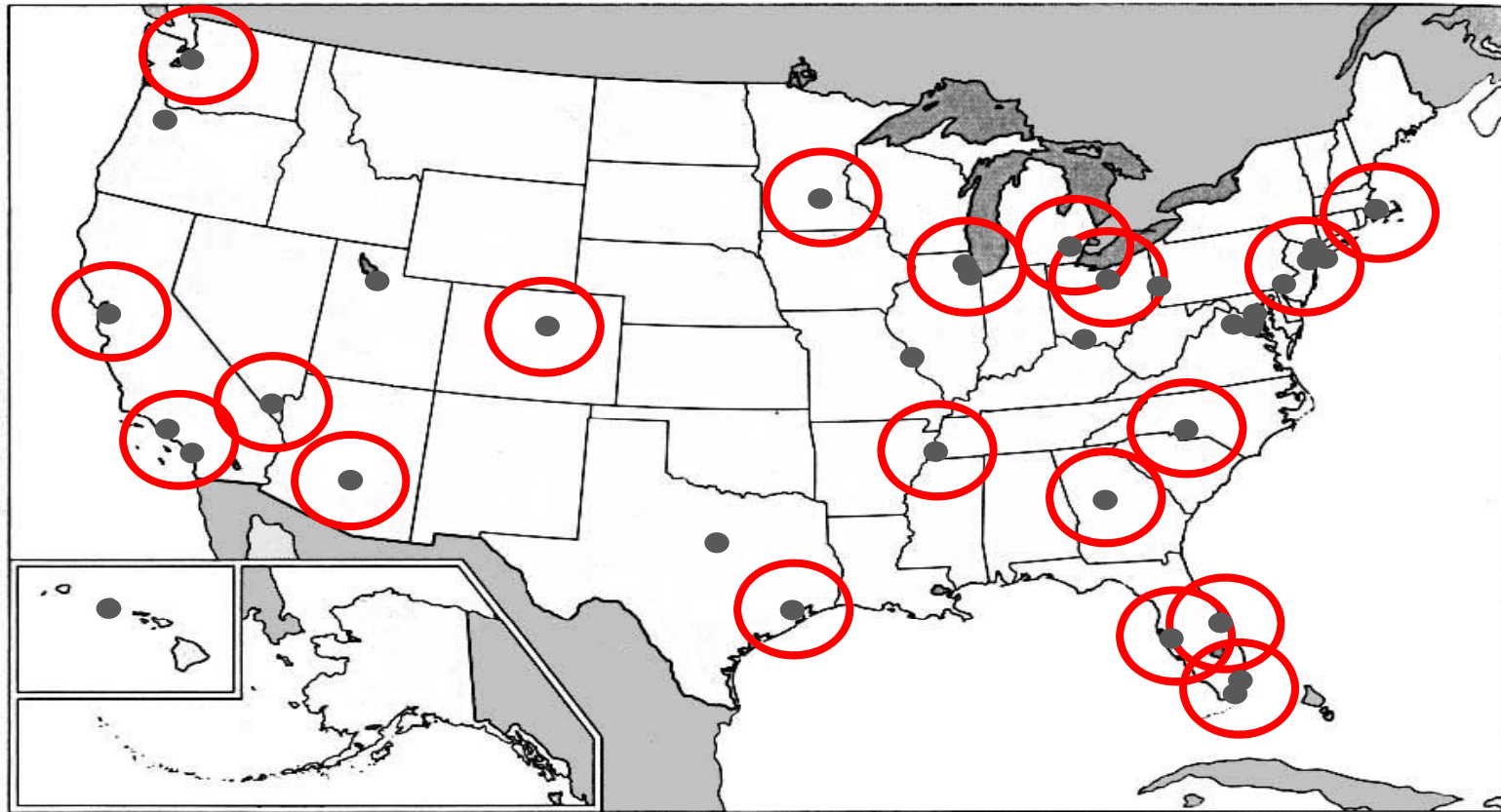
Denver RNAV Project - Example

Current – Before RNAV
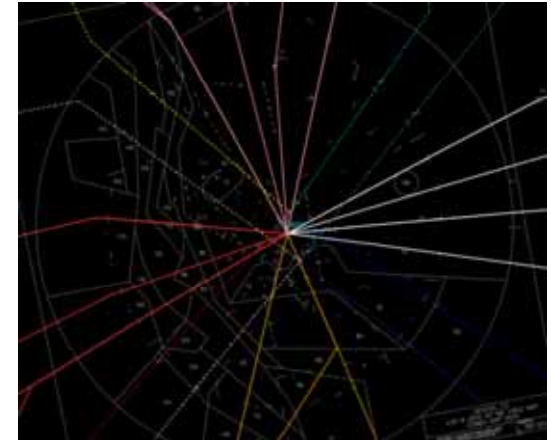
Projected (After RNAV)
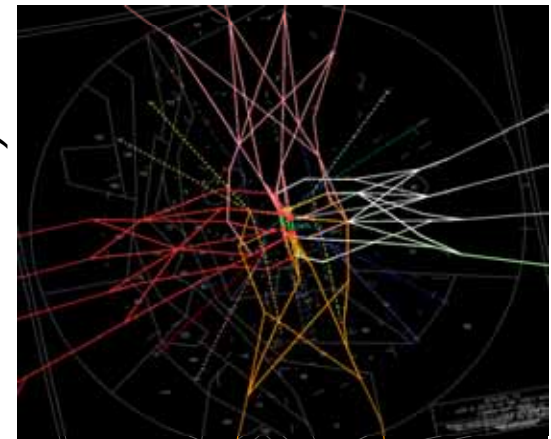
Optimization of Airspace and Procedures in the Metroplex

- **Washington and North Texas studies are complete**

- **2011 Study Team work on Charlotte, Atlanta, Houston, North California, and South California metroplexes**

# Process Improvement Initiatives – NAV Lean Project 2010

- **Purpose**
  - Improve and streamline processes used for optimizing air traffic procedures to include their request, processing, approval, and implementation
  - Result should be safe, repeatable, beneficial, and more efficient processes that comply with applicable regulations

- **Approach:**
  - Reviewed all IFP processes, tools, and procedures related to standards, policies, development, approval, publication, and utilization including environmental, safety & operational approval.

- **Status:** Under implementation
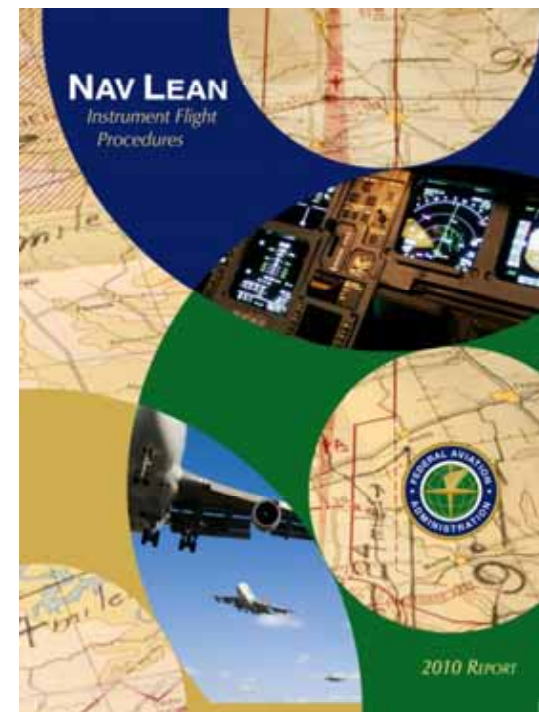
Initiatives – Streamlining Environmental Review

- Developed a process to use Integrated Noise Modeling (INM) tool in conjunction with the procedures design tool (TARGETS) to assess noise impacts early in the process.
- The process will aid in environmental decision-making
- Currently using this process to assess procedures at more than 30 airports.

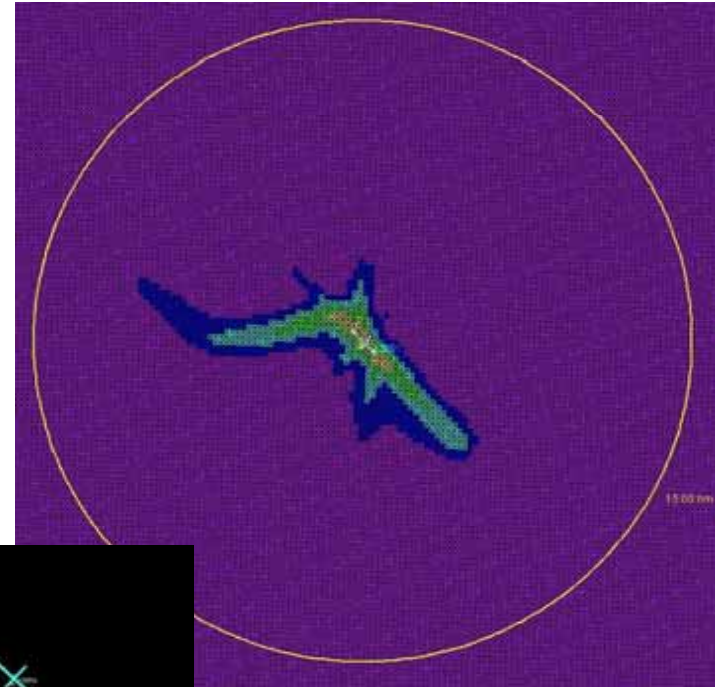- Developing a similar process to assess aircraft emissions impacts.

Noise Screening Concept – Notional Example

Noise contours with existing traffic
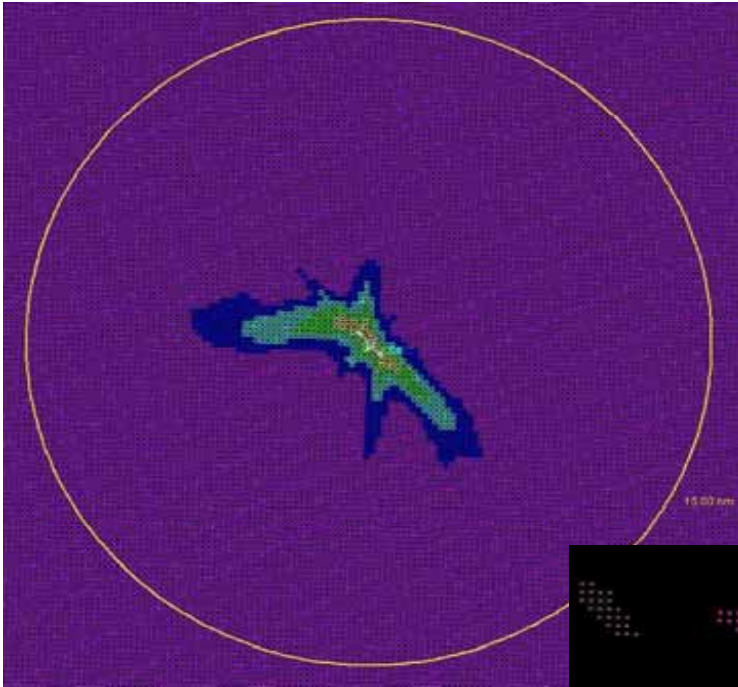
Noise contours with proposed RNAV procedure traffic

Different colors indicate the noise levels and changes in noise levels around the airport

Compare the scenarios to asses the change in noise maps

Airport Site Packages

- Provides site specific analysis to enable beneficial procedures

- Site Package Content includes:
  - Airport Operational Overview
  - PBN Capability
  - Arrival Flow Analysis
  - Departure Flow Analysis
  - Adjacent Airport Interaction (de-confliction)
  - Metrics – fuel, time, delay, distance, etc.

- Identify traffic flows where the removal of level-offs would provide the most benefit and locations for de-confliction opportunities
- Expanding capabilities and data for Metroplex efforts

Other Initiatives

- Developing RNAV based en route system.

- Developing a comprehensive PBN Order
  - Includes all types of PBN routes and procedures
  - Utilizes a 5-Phase implementation approach
  - Complies with FAA's Safety Management System

- Developing a "web-based" comprehensive management and reporting tool for PBN projects (deployment in 2011)

International Harmonization

- **ICAO PBN Study Group**

- **ICAO-FAA-EUROCONTROL PBN Manual seminars**
  - 11 presented 2007-2009

- **Participated in several International PBN seminars/workshops in FY 2010.**
  - Luxembourg (January 2010)
  - Lima, Peru (May 2010)
  - Brussels, Belgium (July 2010)
  - Singapore (June 2010)
  - Santiago, Chile (July 2010)
  - Chendu, China (August 2010)
  - Johannesburg, South Africa (September 2010)
  - Provided technical expertise to the ICAO PBN Study Group. Provided extended staff technical support to the ICAO Navigation Bureau ATM Section.
  - New Delhi, India (May, 2011)

ICAO-FAA-EUROCONTROL Joint PBN Seminars

St Petersburg
Montreal
Paris
Baku
Santo Domingo
Cairo
New Delhi
Bangkok
Abuja
Lima
Nairobi

Questions?