

Performance Based Navigation: RNAV and RNP

FAA Program Update

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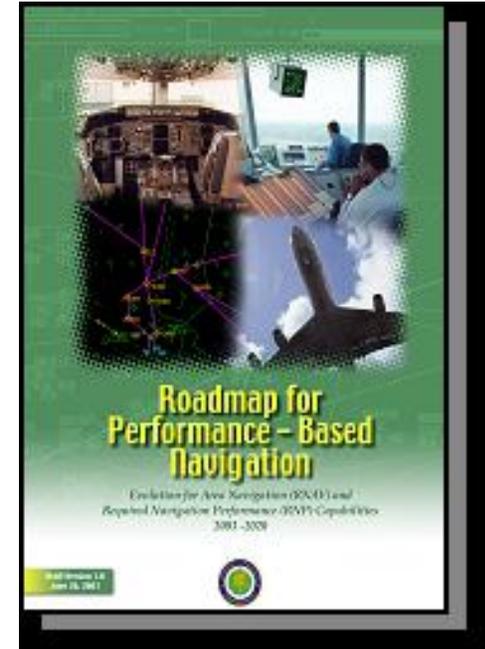


Overview

- Performance-Based Navigation Roadmap
- Enabling Criteria and Guidance
- Update on RNAV and RNP Implementation
- Implementation Challenges
- International



FAA's Roadmap for Performance-Based Navigation

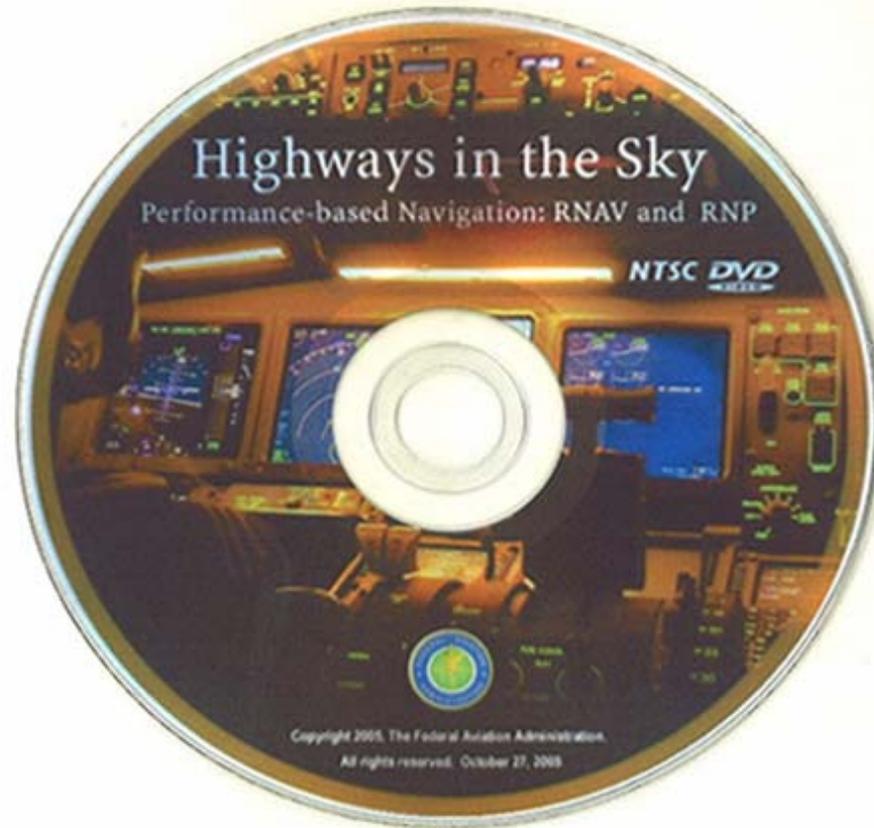


- **Collaborative effort among aviation industry stakeholders**
 - Performance-based Operations Aviation Rulemaking Committee (PARC)
- **Three Planning Horizons (updated version)**
 - Near-term 2003 to 2006 (2006 to 2010)
 - Mid-term 2007 to 2012 (2011 to 2015)
 - Far-term 2013 to 2020 (2016 to 2025)
- **Harmonization considerations**
- **Focuses on operational capabilities in:**
 - En route domain
 - RNAV Q-Routes
 - RNAV T-Routes
 - Terminal domain
 - RNAV Standard Terminal Arrivals (STARs)
 - RNAV Standard Instrument Departures (SIDs)
 - Approach domain
 - RNP Special Aircrew and Aircraft Authorization Required (SAAAR)
 - RNP Parallel Approach Transition

Draft Update available at
<http://www.faa.gov/ats/atp/rnp/rnav.htm>



Highways in the Sky

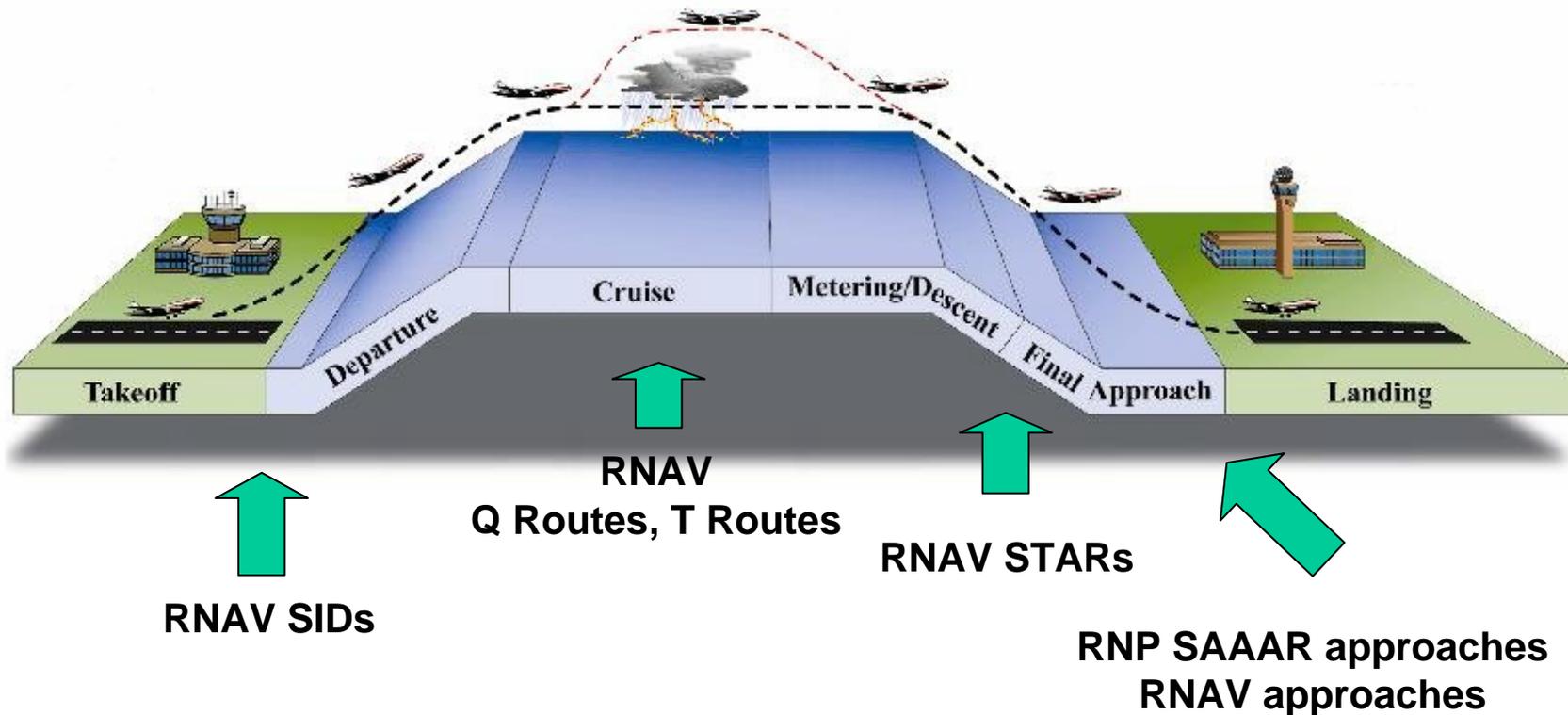


Visit our website for a link to the video -
<http://www.faa.gov/ats/atp/rnp/rnav.htm>



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Performance-Based Navigation In All Phases of Flight “Snapshot” of Current U.S. Implementations



Draft Roadmap Milestones (in Industry Coordination)

Near Term (2006-2010)

En Route

- RNP-2 Q Routes
- RNP-1 in selected areas high altitude
- GPS Direct and RNAV T Routes
- Lower MEAs on routes based on GPS

Mandate RNAV
above FL350

Terminal

- RNAV SIDs/STARs at OEP Airports
- Controller Tools for Merging and Spacing
- RNP-2/1 SIDs/STARs in busy terminal areas

Approach

- Complete Standards for Performance-based Approaches
- Initial sites for Basic RNP
- 25 RNP SAAAR per year
- 300 LPV per year
- Standards for closely spaced parallel and converging approaches (e.g., enhanced surveillance)

Mid Term (2011-2015)

En Route

- RNP-2/1 Q Routes and Airspace
- GPS Direct and RNAV T Routes
- Lower MEAs

Mandate RNP
above FL290

Mandate RNAV above FL180
and for arriving/departing at
OEP Airports

Terminal

- RNP 2/1 and RNAV SIDs/STARs
- Merging and Spacing with Time of Arrival Control

Approach

- Hundreds of Basic RNP, RNP SAAAR, and LPV per year
- Standards for closely spaced parallel and converging approaches (e.g., improved surveillance)

Far Term (2016-2025)

Performance-based NAS Operations

- Optimized Airspace and procedures based on Required System Performance
- 4D Trajectory Management
- Delegation of separation tasks

Mandate RNP in
busy en route and
terminal airspace

Explore need for
4D, data link, and
enhanced
surveillance
capability
mandates



Enabling Criteria and Guidance

- **AC 90-100 U.S. Terminal and En Route Area Navigation (RNAV) Operations**
 - Airworthiness, Operational Approval, Operating Procedures, and Training guidance for RNAV Departure Procedures, RNAV Standard Terminal Arrivals, and RNAV routes
 - Currently in revision by FAA and Industry team to incorporate lessons learned and harmonize with international developments
- **Order 8260.52 United States Standard for Required Navigation Performance (RNP) Approach Procedure with Special Aircraft and Aircrew Authorization Required (SAAAR)**
 - Written for approach procedure designers to develop public RNP SAAAR instrument approach procedures
- **Notice 8000.300 RNP SAAAR**
 - This document outlines the operational approval process for special (non-14CFR Part 97) RNP SAAAR operations and addresses the implementation of special aircraft and aircrew authorization requirements similar to current ILS Category II/III approvals
- **AC 90-101 Approval for RNP procedures with Special Aircraft and Aircrew Authorization Required (SAAAR)**
 - Airworthiness, Operational Approval, Operating Procedures, and Training guidance for RNP SAAAR Instrument Approach Procedures
- **AC 20-153 Acceptance of Data Processes and Associated Navigation Databases**
 - How to evaluate whether data processes comply with the requirements of RTCA/DO-200A, Standards for Processing Aeronautical Data
 - How to obtain a Letter of Acceptance (LOA) from the Federal Aviation Administration (FAA)
 - How to define the aeronautical data quality requirements when obtaining airworthiness approval of new equipment or installations where the function of the equipment is dependent on an updateable database

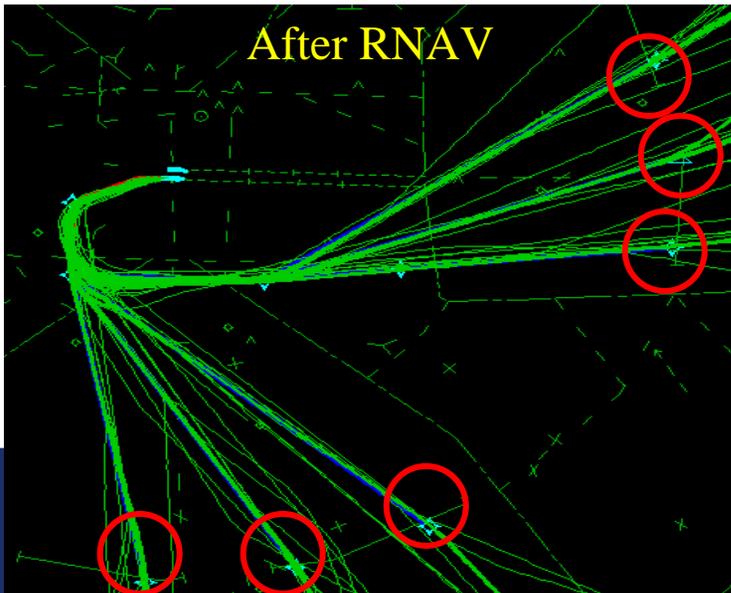
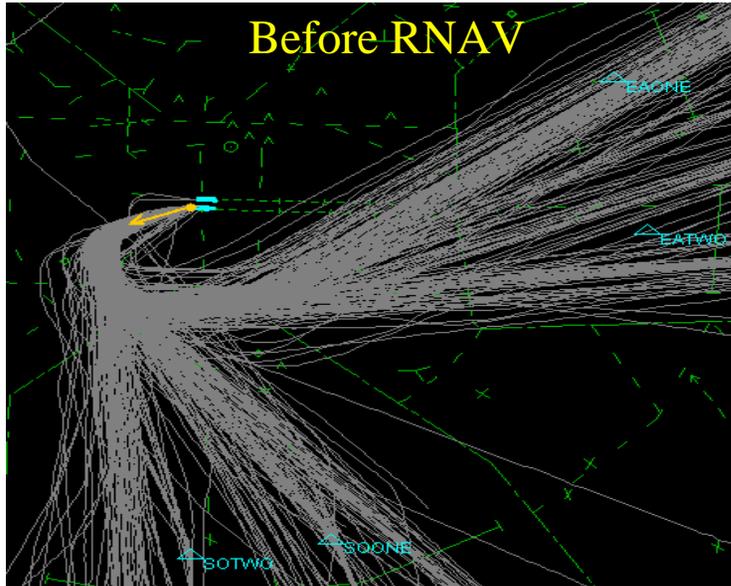


RNAV and RNP 2005 Accomplishments and Plans for 2006

Description	Completed FY05	In Development FY06	Funding Plan FY07
RNAV T-Routes and GPS MEAs	4	14	16
RNAV Q-Routes	21	23	28
SIDs/STARs	58	63 New	98
		22 Revised	
RNP SAAAR	6	34 New	25
		2 Revised	
Total	89	158	167



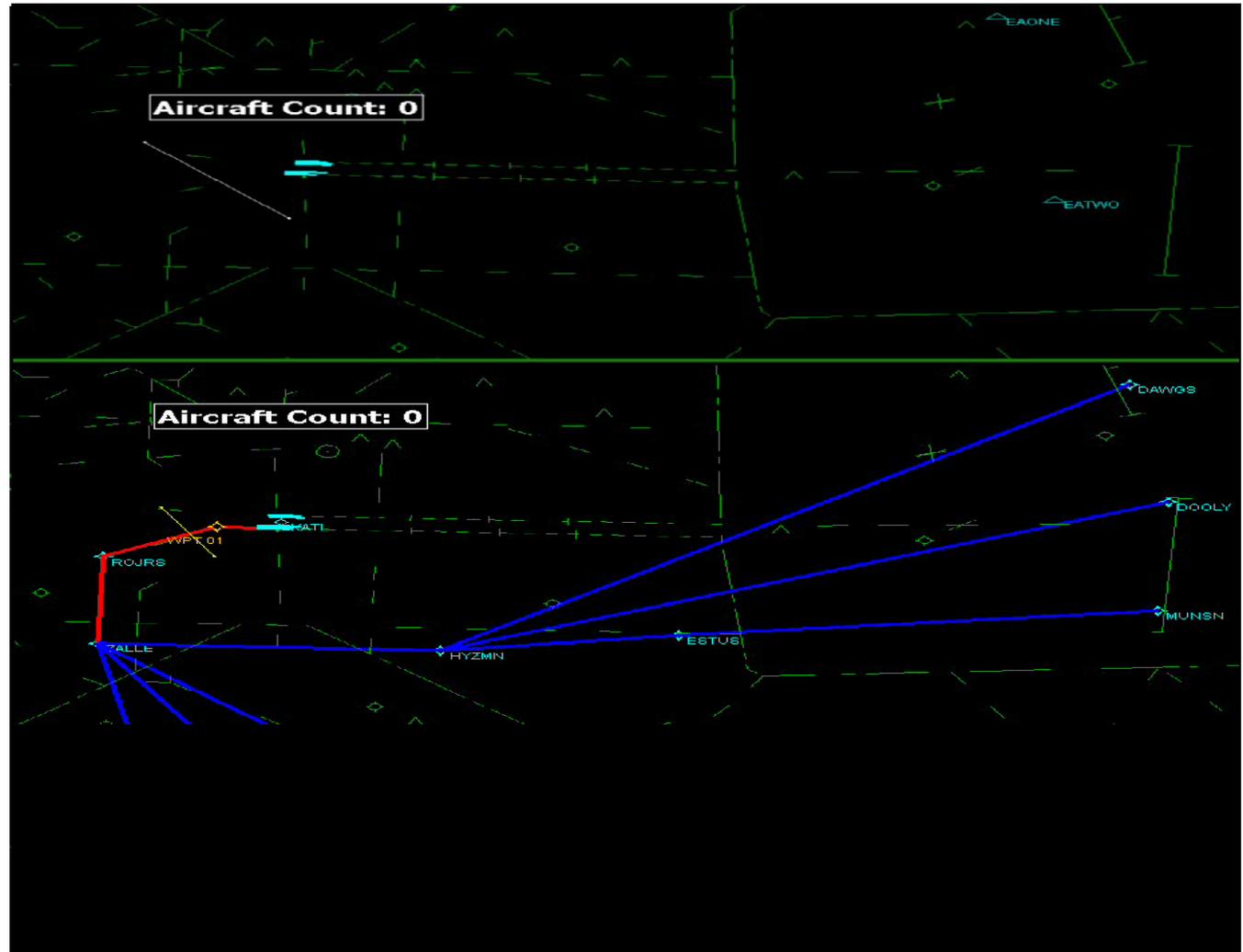
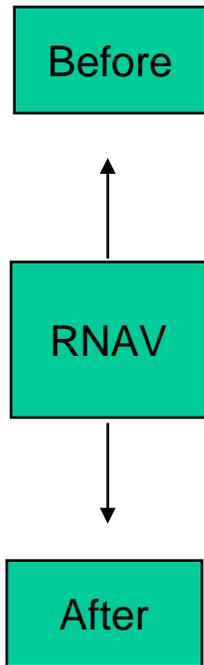
Atlanta RNAV Departure Procedures



- 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)
- Validated model estimates of annualized benefits are ~\$39M
 - Realized from delay and capacity benefits

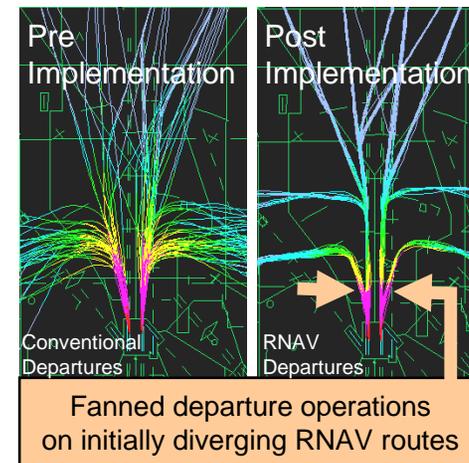
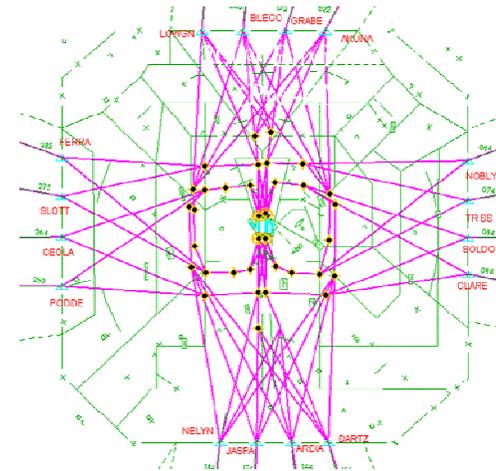


ATL Efficiency Benefits (2)



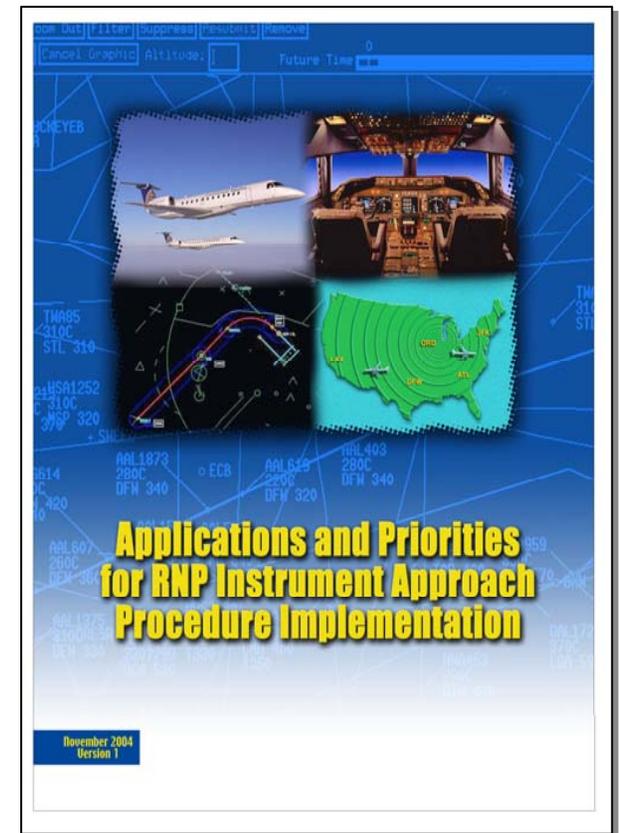
Dallas Fort Worth RNAV Departure Procedures

- Approx 85% of 990 daily IFR departures are RNAV capable
- Structured “lanes” to en route airspace
- Over 3,700 routine daily pilot/controller voice transmissions eliminated (40% reduction)
- Validated estimates ~\$8.5M annual benefits
 - Realized from delay and capacity benefits
 - Up to ~\$13M with 100% RNAV

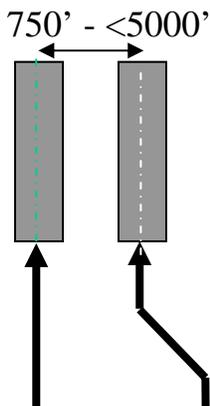
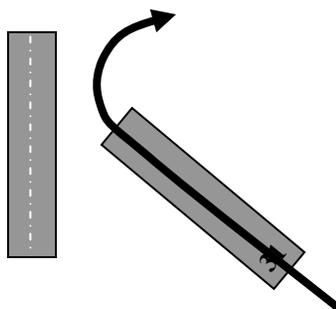
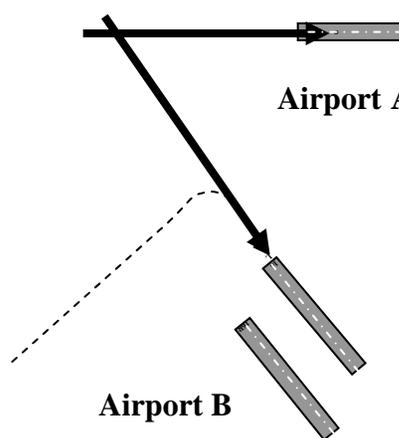
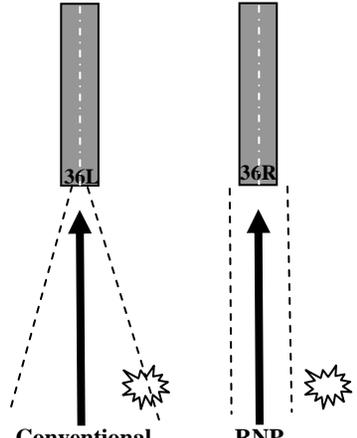


RNP SAAAR Approach Site Prioritization

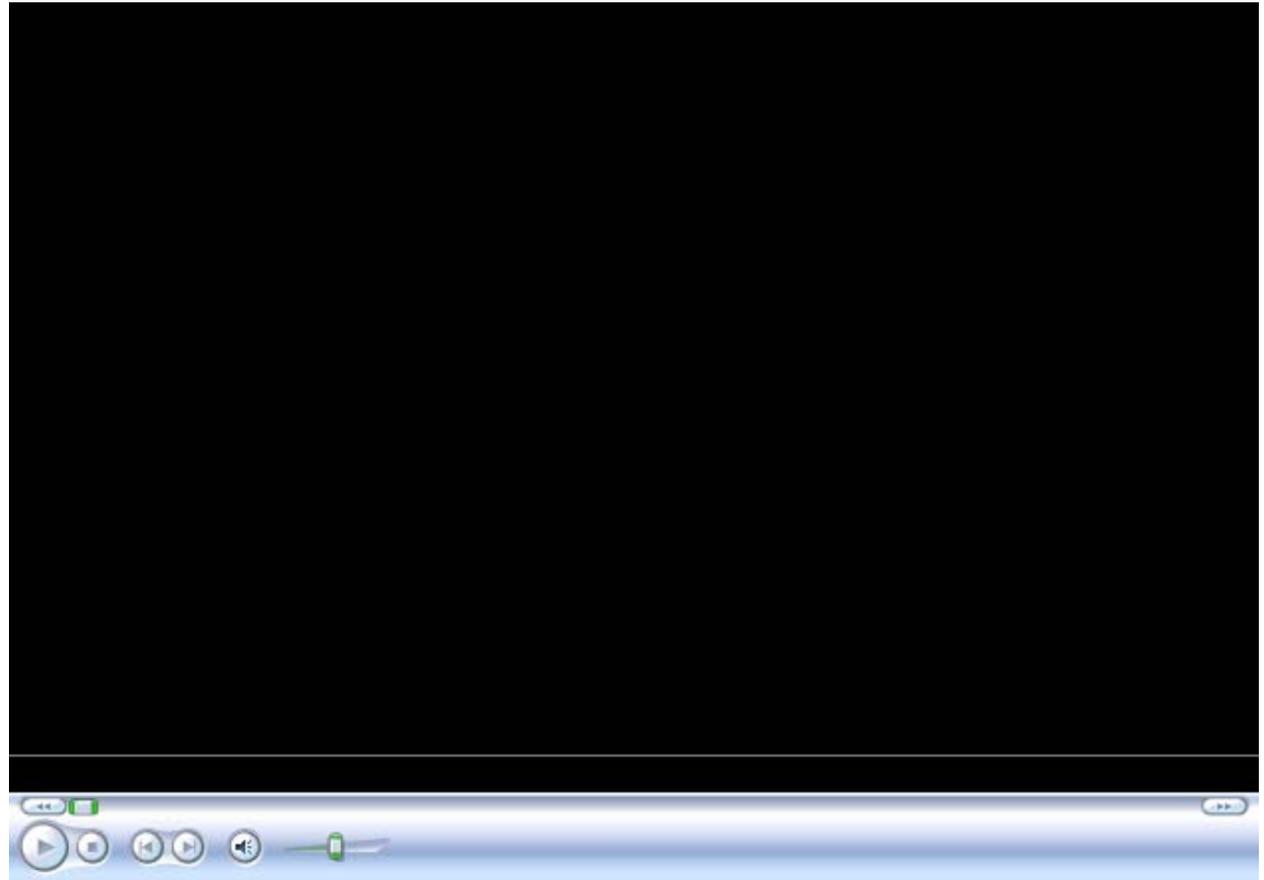
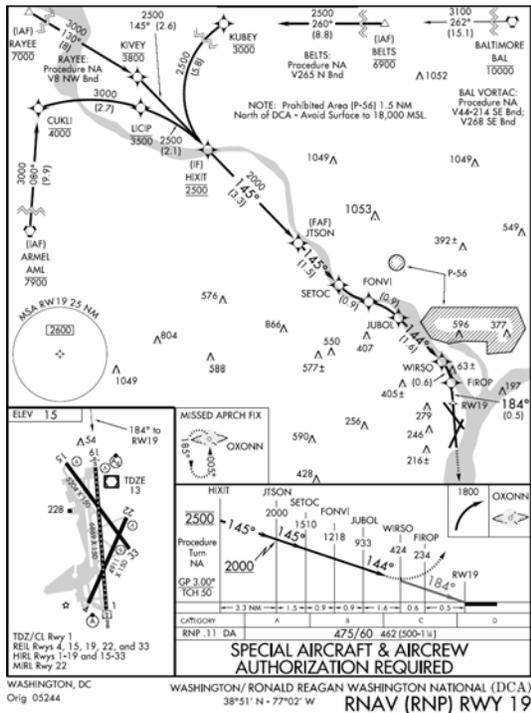
Airports	Characteristics
Tier 1	<ul style="list-style-type: none"> • Includes converting 2004/2005 <i>specials</i> to public • Urgent capacity needs, with national impact • Risk mitigation cases
Tier 2	<ul style="list-style-type: none"> • Regional capacity impact • Access and risk mitigation enhancement
Tier 3	<ul style="list-style-type: none"> • Single runway access and risk mitigation • Predominantly future airspace de-confliction



Applications of RNP SAAAR Criteria

Parallel Operations	Converging Operations	Adjacent Airport Operations	Single Runway Access
			
<p>10 to 15 Top Airports</p>	<p>15 to 20 Top Airports</p>	<p>10 to 15 Top Airports</p>	<p>Several hundred runway ends</p>
<p>Arrival capacity gains up to 60% over single runway operations</p>	<p>Arrival capacity gains up to 50% over single runway operations</p>	<p>Increased arrival and departure rates for adjacent airports involved</p>	<p>Approach minimums lower than existing minima</p>

RNP SAAAR: KDCA



- First “public” RNP SAAAR, published 1 Sept 05
 - FAA Order 8260.52 criteria
 - Avoids prohibited airspace
 - Significantly improves RWY 19 availability in low visibility



International Harmonization

- **ICAO RNP Special Operations Requirements Study Group is primary forum for harmonization**
 - Members include Australia, Brazil, Canada, EUROCONTROL, France, Japan, United Kingdom, United States, IATA, ICCAIA, IFALPA
 - Rewriting ICAO Doc 9613, *Manual on RNP* (to be renamed *Performance-Based Navigation Manual*)
 - Agreed on globally consistent definitions of RNAV and RNP
 - Agreed on “ICAO RNAV” – harmonized Europe’s P-RNAV and US RNAV
 - Performance-Based Navigation Implementation considerations & guidance
 - Publication planned for Fall 2006



International Harmonization

- **U.S. Harmonization activities with regions**
 - FAA/EUROCONTROL Joint “Train the Trainers” proposal to ICAO
 - week-long sessions in ICAO Regions beginning in 2007
 - ICAO Seminar in Beijing 22-24 May (w/FAA, EUROCONTROL, China, Japan, Australia, Boeing, Airbus, IATA) for China & 10 East Asia States
 - North American Aviation Trilateral activities with Canada, Mexico
 - Western Hemisphere coordination via ICAO GREPECAS subgroup (regional planning & implementation)
 - Multiple initiatives with Civil Aviation Administration of China



RNAV and RNP Implementation Challenges

- Environmental
 - Sites unavailable due to ongoing environmental issues
 - Costs unpredictable
- Standardization of aircraft performance
- Flight crew training
- Need DME/DME infrastructure changes
- Rate of industry aircraft equipage and compliance



Questions?

