Airport Capacity Benchmarks

//and//

Metroplex Airspace Optimization

Presentation to:

TRB 8th National Aviation System Planning Symposium

By: Kent Duffy, FAA Airports Planning
and Environmental Division (APP-400)

Date: 22-May-2012

Federal Aviation Administration

Agenda

- Airport Capacity Benchmarks
- Metroplex Airspace Optimization

2012 Airport Capacity Benchmarks

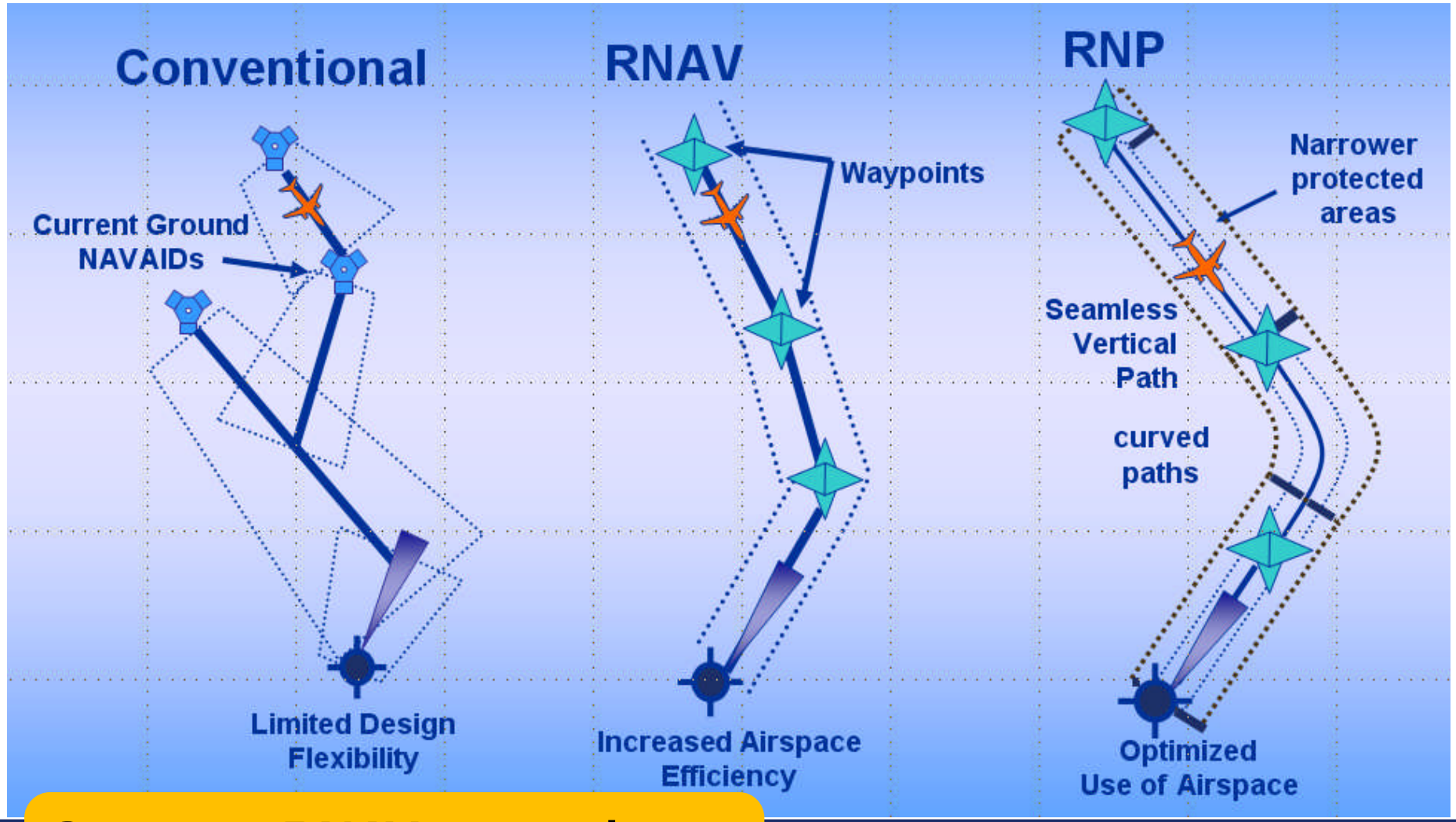
- Purpose: provide a high-level assessment of airport runway capacity now and in the future (2020)
- Benchmark Definition: hourly throughput that an airport's runways are able to sustain during periods of high demand
- Update to previous benchmark reports published in 2001 and 2004
- What:
  - ATC Facility Rates (i.e., call rates) and model-estimated capacity rates
  - Highest capacity configuration during Visual, Marginal, and Instrument weather conditions
  - 30 Core Airports
  - LGB, OAK, SNA are also included, because they were identified as capacity-constrained in FACT2
- Intended Use
  - Reference point on the throughput rate of selected US airports at a specific time
  - Internally, FAA uses the benchmarks as an input to FACT3 and NextGen Systems Analysis
- When: soon!

Agenda

- Airport Capacity Benchmarks
- Metroplex Airspace Optimization

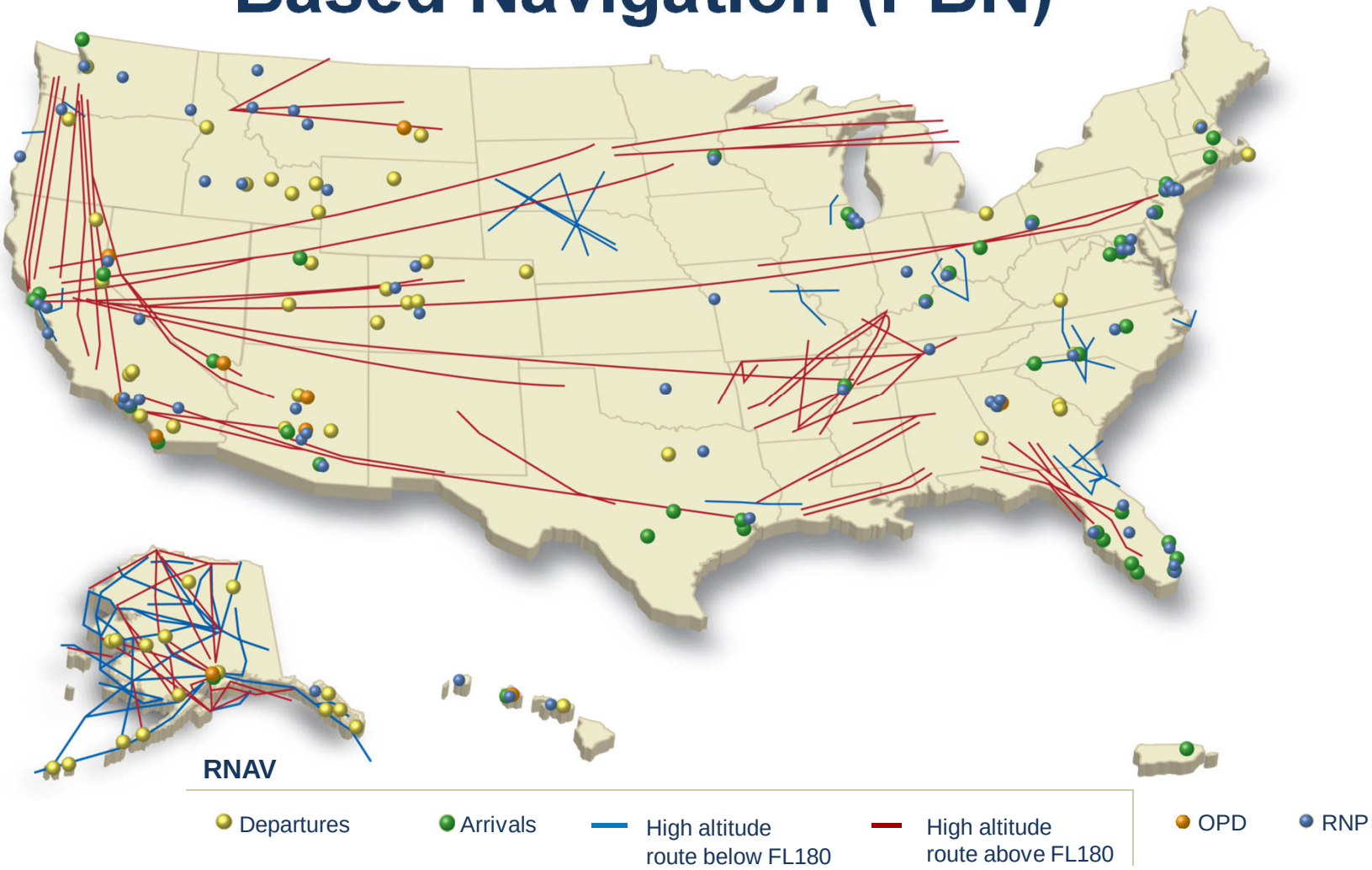
Performance Based Navigation

Area Navigation (RNAV)
Required Navigation Performance (RNP)

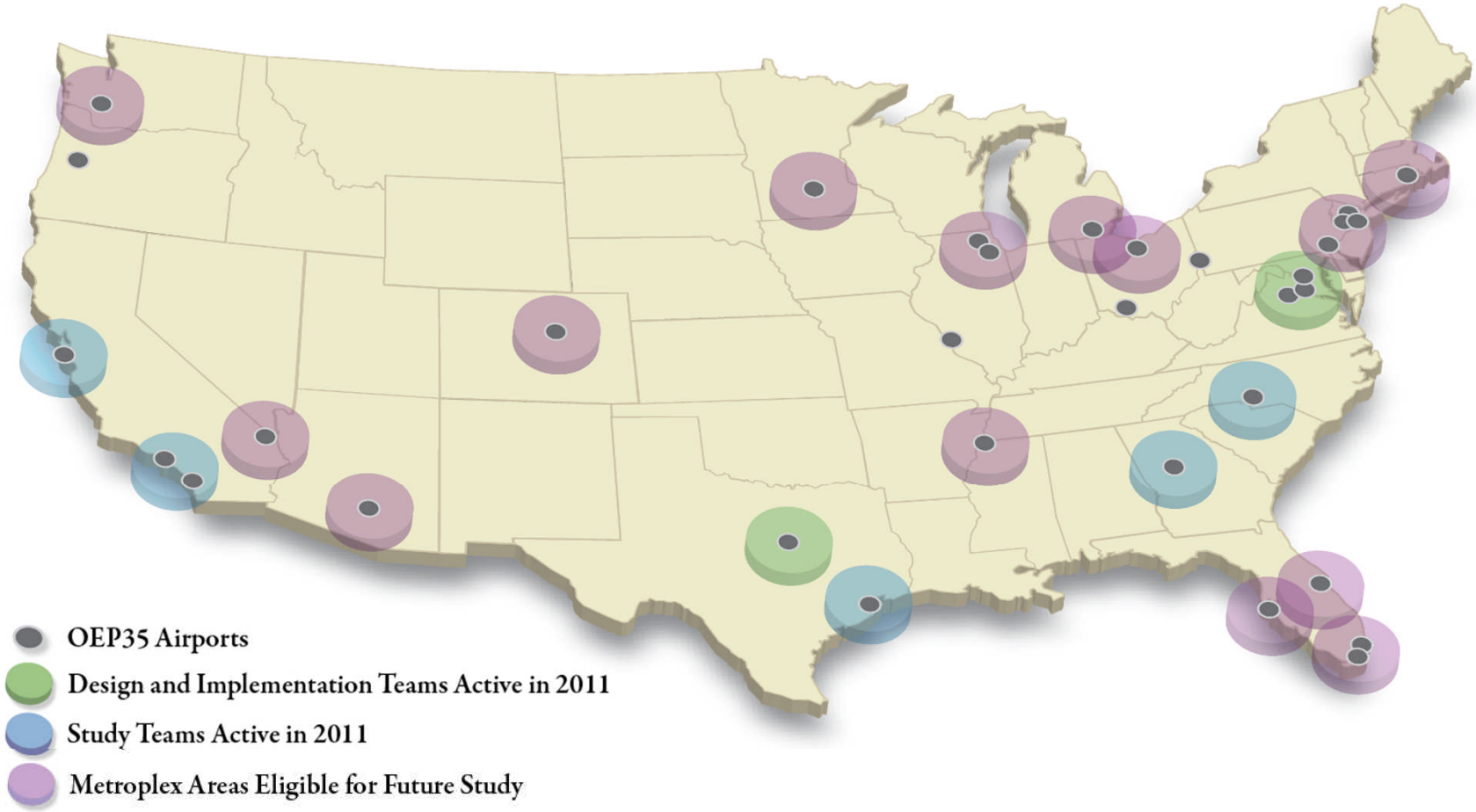


Strategy: RNAV everywhere, RNP where beneficial

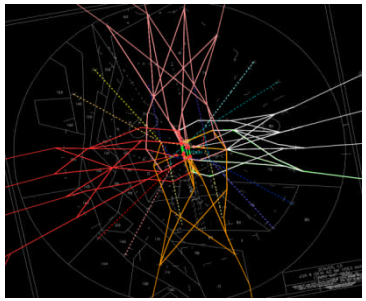
Existing Performance Based Navigation (PBN)

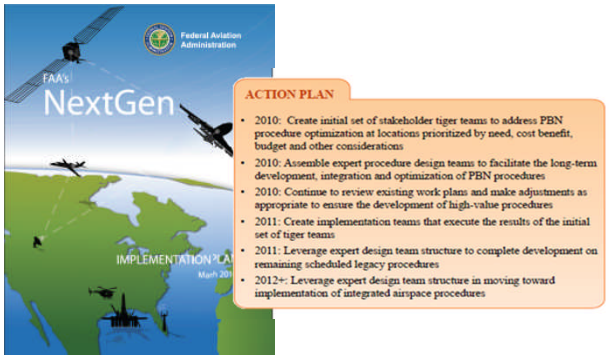


OAPM: Metroplex Airspace Optimization



OAPM's Relationship to NextGen…

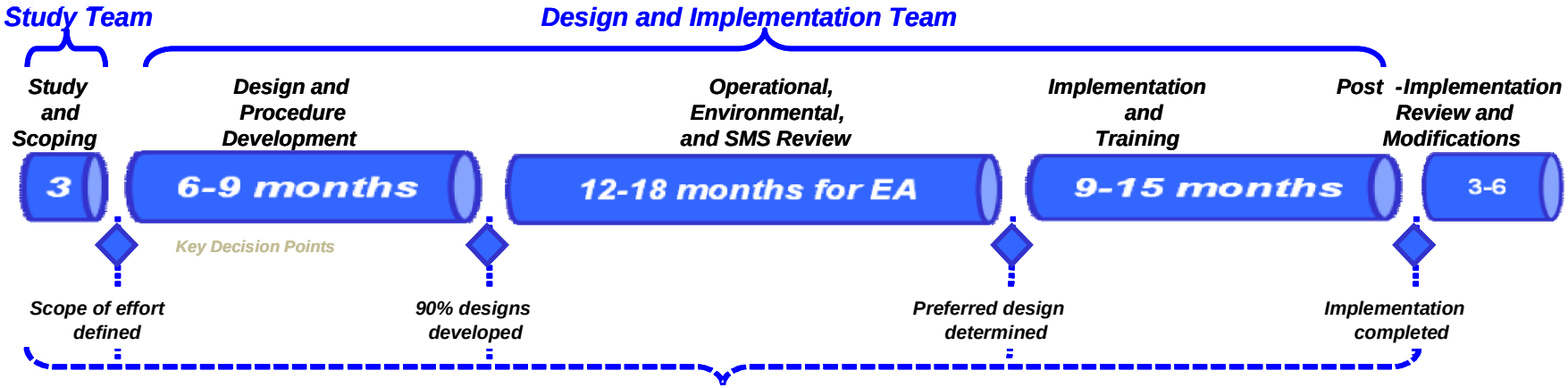




- **Performance-Based Navigation is an enabling technology and Airspace Redesign is a key building block for NextGen**
- **RTCA's Task Force 5 recommendations for NextGen implementation included:**
  - RNAV operations that focus on quality should be increased and optimized
  - A structured and systematic approach to PBN implementation is necessary
  - Promote RNAV "everywhere" and RNP "where beneficial"
  - Decouple operations arriving and departing adjacent airports
- **NextGen Implementation Plan includes specific actions and commitments concerning OAPM**

OAPM Site Timeline Comparison

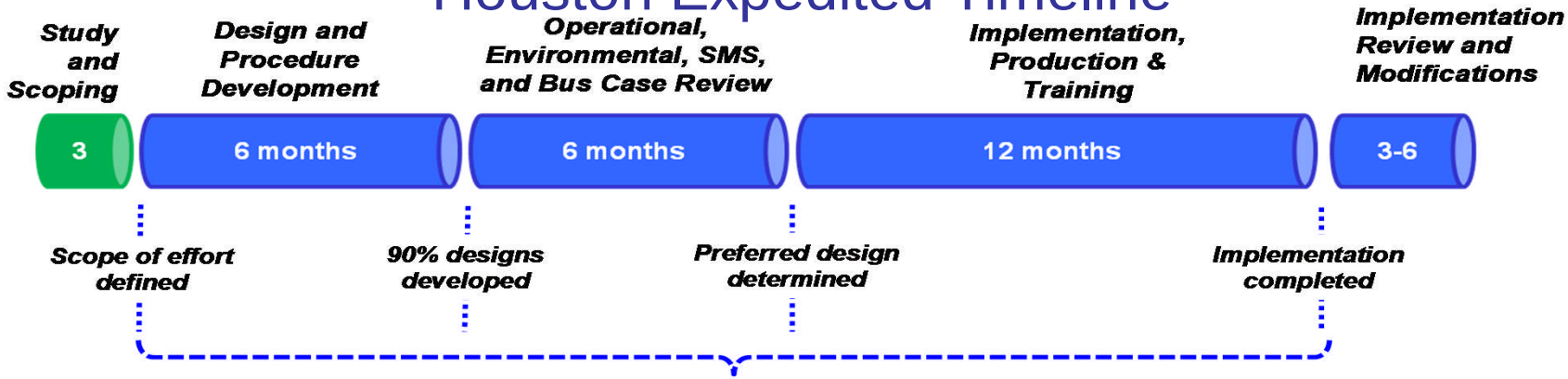
Typical OAPM Site Timeline



Notes: Time associated with decision points may be several weeks to months.
Environmental involvement required at all stages of process.

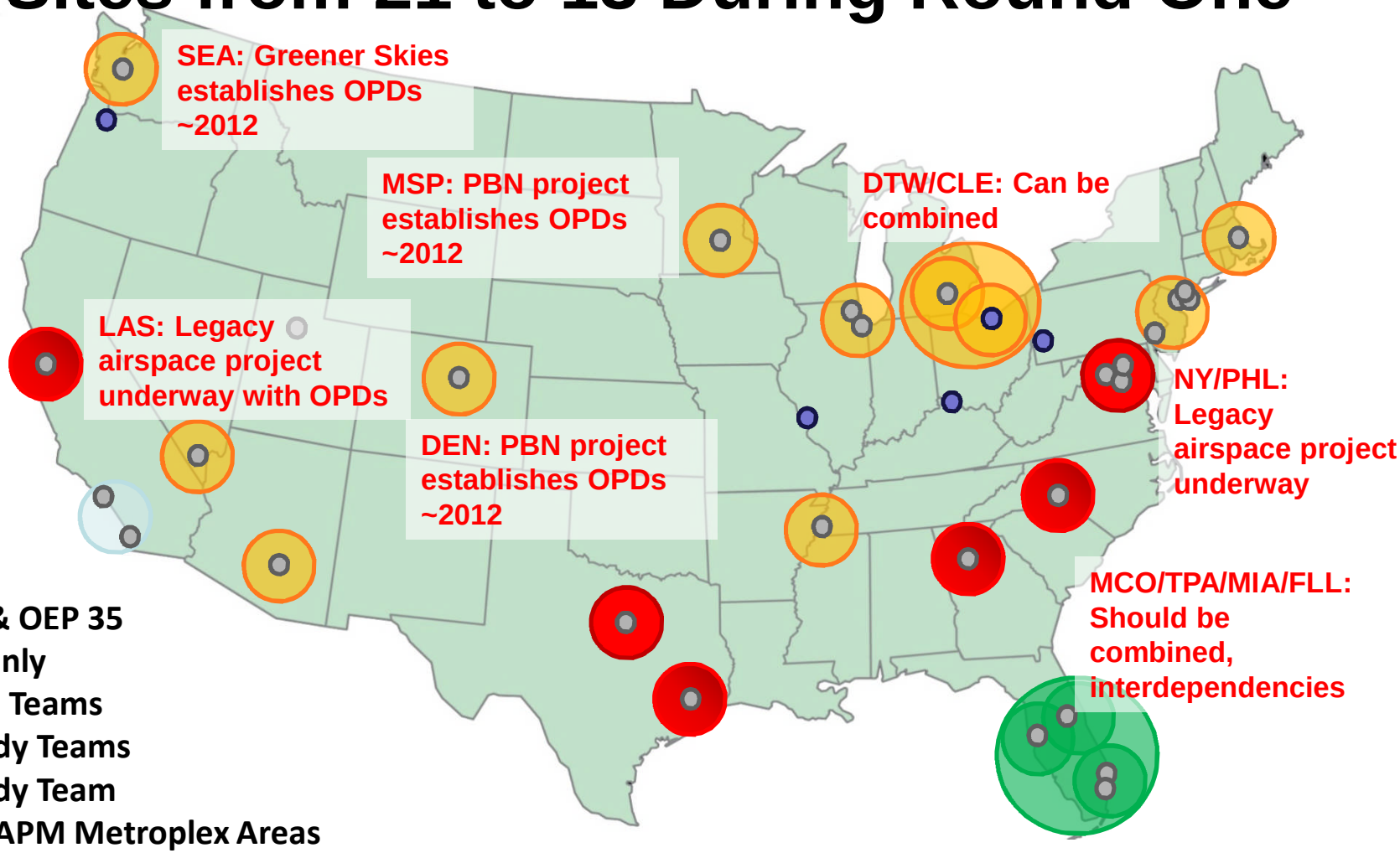
Total elapsed time, kickoff through implementation is 30 – 45 months

Houston Expedited Timeline



Total Elapsed Time from Beginning of Design through Implementation is 24 Months

Current Plan Reduces OAPM Sites from 21 to 13 During Round One



- Core 30 & OEP 35
- OEP 35 Only
- FY12 D&I Teams
- FY12 Study Teams
- FY11 Study Team
- Future OAPM Metroplex Areas

Current OAPM Schedule

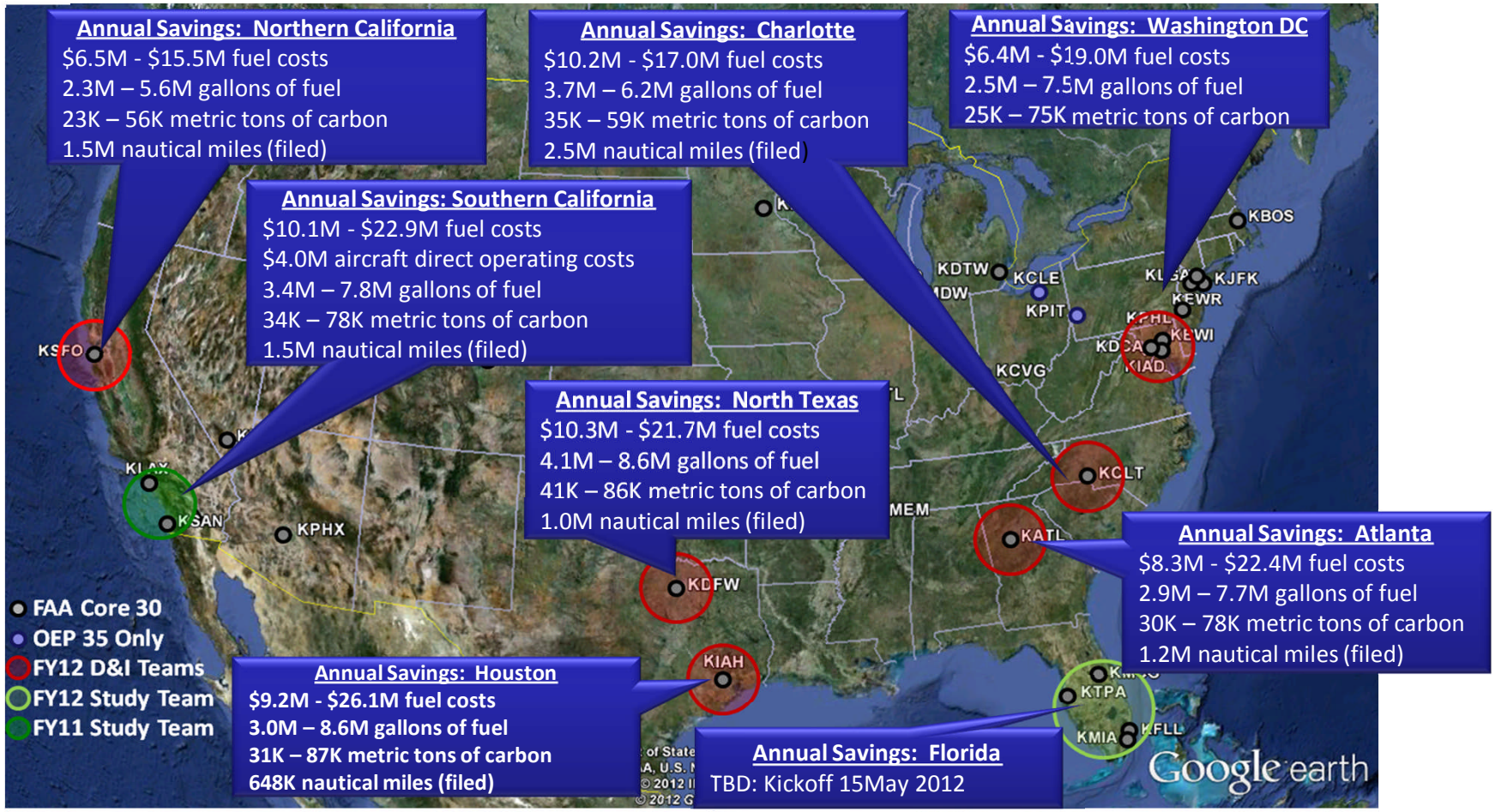
	FY11		FY12				FY13				FY14				FY15				FY16				FY17				FY18		
Site	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q
DC	D	D	D	D	E	E	E	E	E	I	I	I	I	P	P														
No Tex		D	D	D	E	E	E	E	E	I	I	I	I	P	P														
Charlotte	S			D	D	D	E	E	E	E	E	I	I	I	I	P	P												
No Cal	S			D	D	D	E	E	E	E	E	E	I	I	I	I	P	P											
Houston	S	S		D	D	E	E	I	I	I	I	P	P																
Atlanta		S	S	D	D	D	E	E	E	E	E	I	I	I	I	P	P												
So Cal		S	S				D	D	D	E	E	E	E	E	I	I	I	I	P	P									
Florida					S	S		D	D	D	E	E	E	E	E	I	I	I	I	P	P								
Chicago							S	S	D	D	D	E	E	E	E	E	I	I	I	I	P	P	P						
Phoenix							S	S		D	D	D	E	E	E	E	E	I	I	I	I	P	P	P					
Memphis											S	S		D	D	D	D	E	E	E	E	I	I	I	I	P	P	P	
Cleveland/Detroit											S	S		D	D	D	E	E	E	E	E	I	I	I	I	P	P	P	
Boston												S	S		D	D	D	E	E	E	E	E	I	I	I	I	P	P	P

Key:

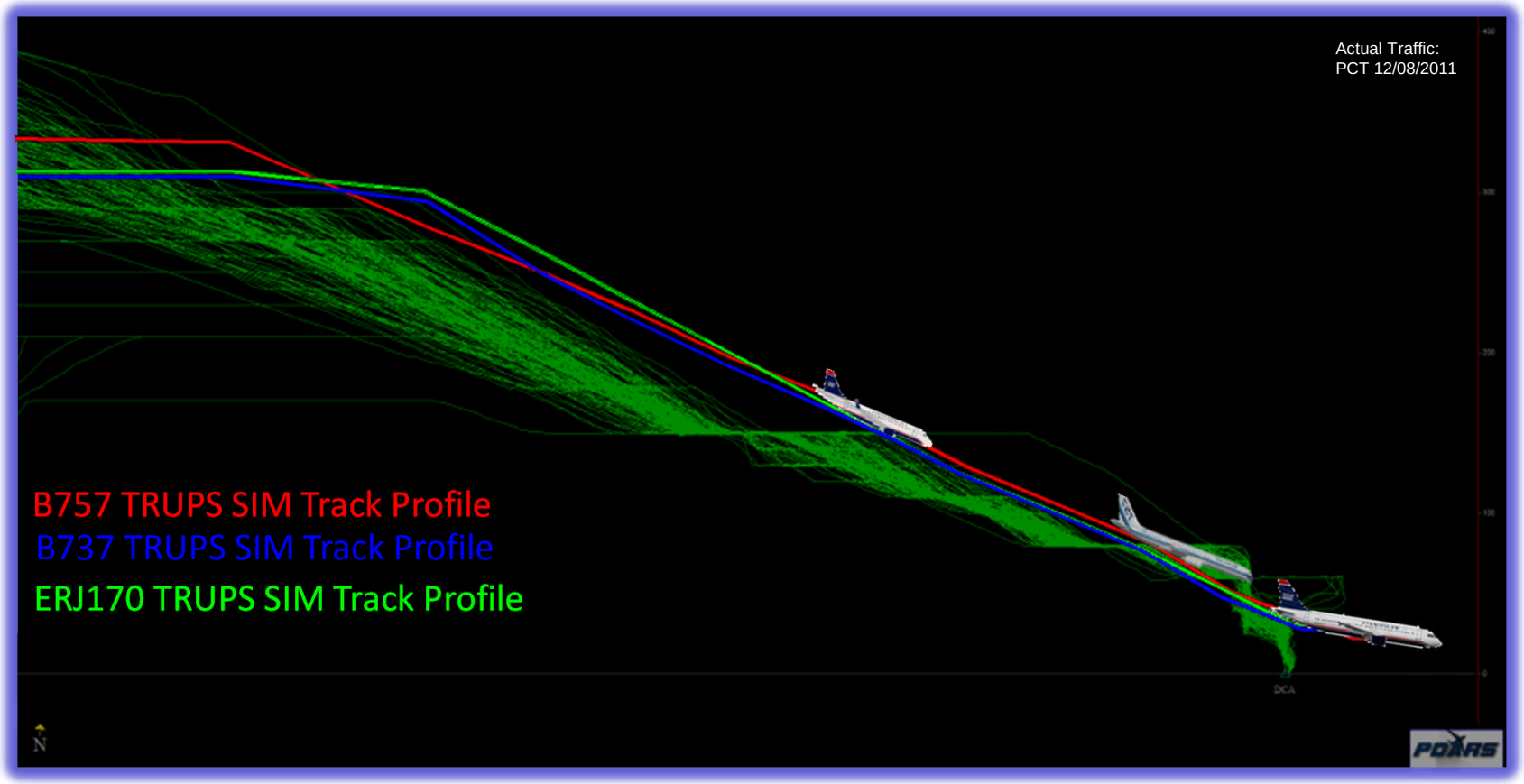
- Eastern Service Area
- Central Service Area
- Western Service Area

- S Study
- D Design
- E Evaluate
- I Implement
- P Post-Eval

OAPM Study Teams

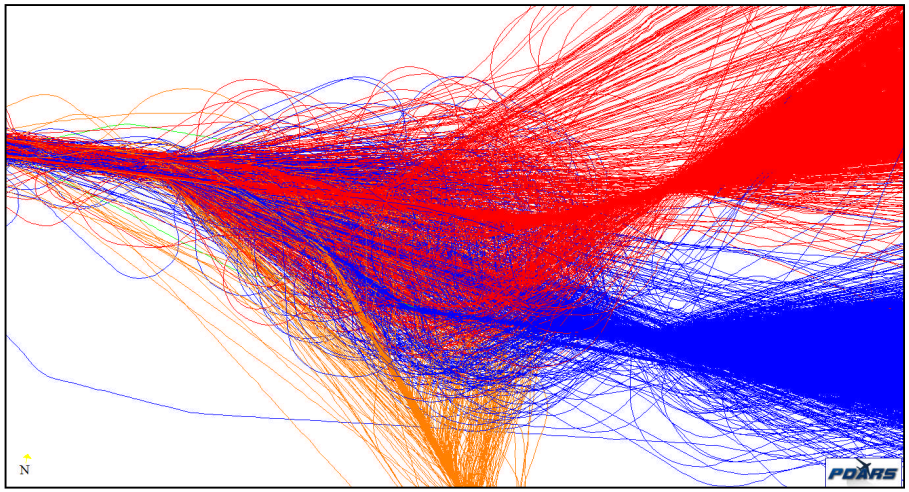


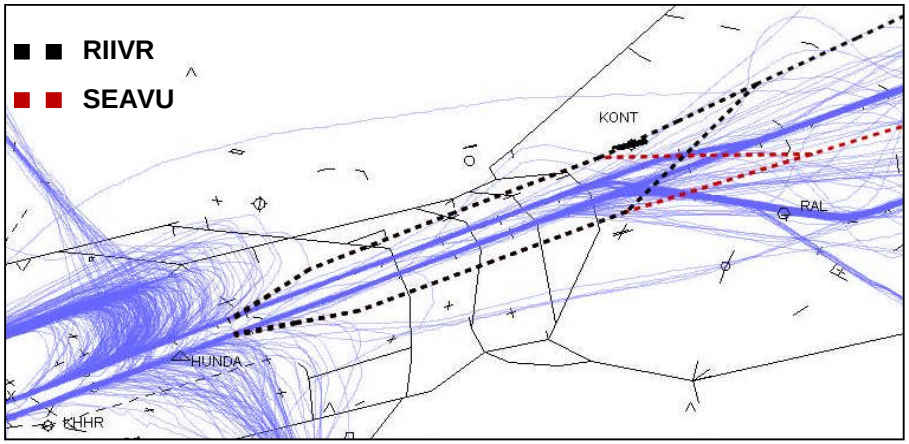
Washington D.C. Example
TRUPS RNAV OPD *(Replaces EDLEE)*



Southern California Example
LAX RIIVR/SEAVU Arrivals *(1 of 2)*

- **Issue Statements**
  - Inefficient vertical and lateral paths
  - Lack of dual independent finals
  - Reduced throughput
  - Excessive delay vectoring
- **Initial Concepts**
  - RNAV STARs
  - Optimized profile descents
  - Optimized lateral paths
  - Dual independent finals
  - Multiple runway transitions





Southern California Example
LAX RIIVR/SEAVU Arrivals *(2 of 2)*

Estimated Fuel Burn Savings from Lateral/Vertical Optimization

RIIVR

		Low	High
Estimated Annual Fuel Savings (Dollars)	Distance	N/A	
	Profile	$558K	$1.30M
	Cost to Carry	$76K	$150K
Total Estimated Annual Fuel Savings (Dollars)		$634K	$1.4M
Total Estimated Annual Fuel Savings (Gallons)		216K	496K
Total Estimated Annual Carbon Savings (Metric Tons)		2.2K	5K

SEAVU

		Low	High
Estimated Annual Fuel Savings (Dollars)	Distance	N/A	
	Profile	$496K	$1.32M
	Cost to Carry	$120K	$202K
Total Estimated Annual Fuel Savings (Dollars)		$616K	$1.53M
Total Estimated Annual Fuel Savings (Gallons)		210K	521K
Total Estimated Annual Carbon Savings (Metric Tons)		2.1K	5.2K

ADOC Savings from Throughput Increases and Delay Reduction

Estimated Annual ADOC Savings: LAX Dual Independent Finals	$3.99M

Existing Aircraft RNAV Equipage

PBN	Capability	Users	Current Fleet Equipage	
			AC	GA
RNP 10	Reduced oceanic separation	Air Carrier, BizJet	58%	<5%
RNP 4	Further reduced oceanic separation (in conjunction with FANS-1/A)	Air Carrier, BizJet	58%	<5%
RNAV 2 = EnRoute RNAV 1 = Terminal	Ability to fly on more efficient routes and procedures	All users	92%	80%
RNP w/Curved Path	Ability to precisely fly departure, arrival and approach procedures including repeatable curved paths	Air Carrier, BizJet, Helos	57%	<5%
LPV	Improved access to many airports in reduced visibility, with an approach aligned to the runway (Category I)	All users…but primarily GA	<5%	30%
RNP AR (Authorization Required)	Improved access to airports in reduced visibility with an approach that can turn to the runway; improved procedures to separate traffic flows	Air Carrier, BizJet	36%	<5%

Source: 2012 NGIP, Appendix A

Contact Information

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Backup

What is OAPM?

- A **systems approach** to PBN initiatives and airspace design
- An **expedited approach** for Integrated Airspace and Procedures efforts
- Provides a **geographic focus** to problem solving
- Uses an educated **prioritization** process
- Based on **collaborative** teams
- Enables **predictable and repeatable** flight paths
- Reduces air traffic controller **task complexity, maximize safety and efficiency**

Task Force 5 Metroplex Recommendations

- Focus on major metropolitan areas
- Optimize flight paths and climb/descent profiles
- Institute collaborative teams to broadly proliferate existing PBN experience and expertise
- Promote RNAV “everywhere” and RNP “where beneficial”
- Integrate airspace and procedure design
- Decouple operations arriving and departing adjacent airports
- Use 3 NM and terminal separation rules wherever possible

Collaborative Teams

Study Teams

- ***Analyze and describe operational challenges in a Metroplex***
- ***Assess planned solutions and explore new solution opportunities***
- ***Develop notional airspace and procedures, with initial estimates of benefits, costs, and risks (environmental, safety, etc.)***
- ***Provide recommendations to decision makers***
- ***Provide notional solutions, analyses, data, and recommendations to D&I Teams***

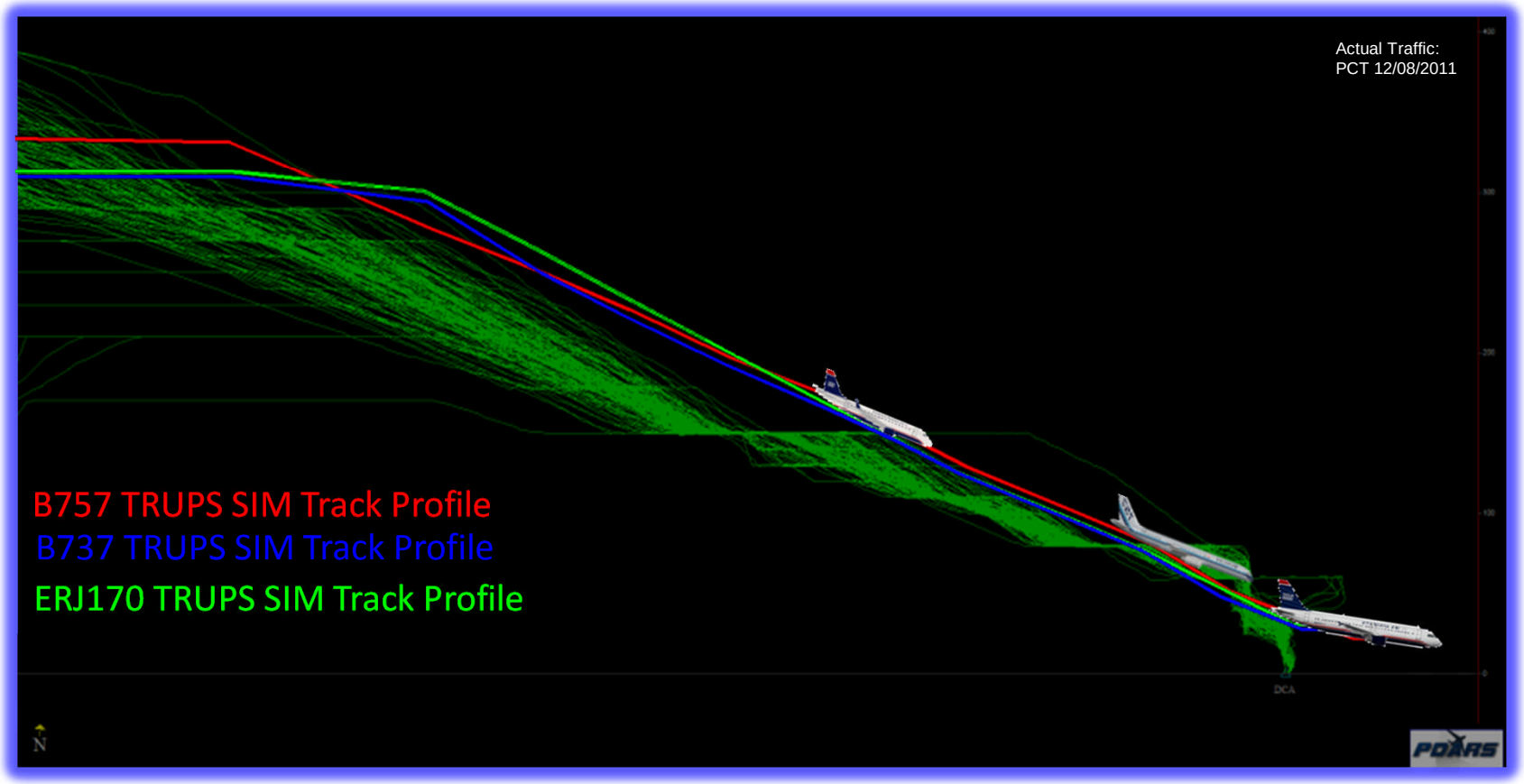
Design and Implementation Teams

- ***After FAA approval, execute the design and analysis through implementation, including post-implementation evaluation***
- ***Conduct all appropriate operational, safety and environmental analyses and assessments***

Qualitative Benefits Identified at the First Seven Sites

- More efficient lateral and vertical flight paths providing segregated flows where practicable
- Repeatable, predictable PBN procedures for more accurate fuel planning
- Reduced ATC task complexity and pilot/controller communications due to reduced radar vectoring
- Reduced need for Traffic Management Initiatives
- Improved situational awareness, enhancing safety
- Increased departure throughput from additional departure gates and earlier divergence off the runway
- Foundations for NextGen capabilities and tools (e.g., use of Relative Position Indicator; Required Time of Arrival)

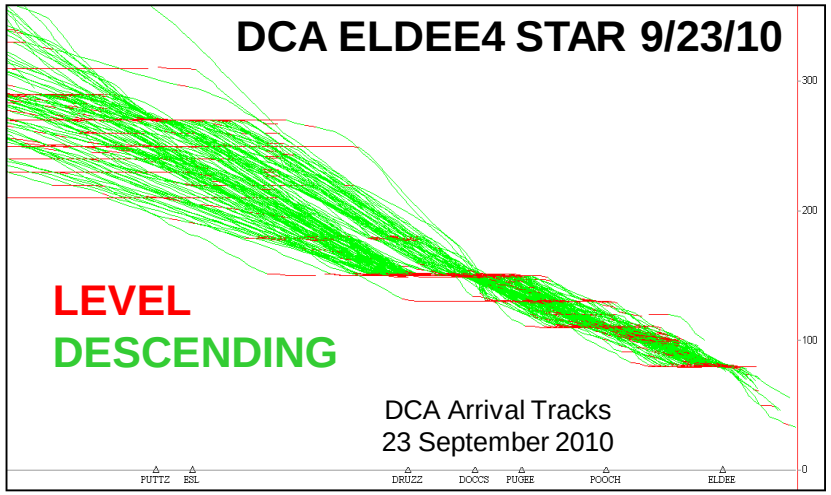
Washington D.C. Example
TRUPS RNAV OPD *(Replaces EDLEE)*



Washington D.C. Example
FRDMM and TRUPS *(Replace ELDEE - 3 of 3)*

Operational/Safety	
Benefits	**Impacts/Risks**
– Reduced ATC task complexity – Increased efficiency – Procedural (altitude) separation from southwest IAD/DCA arrivals	– Need for environmental assessment (leg between DRUZZ and AML below 10,000 feet) – Non-participating aircraft – Further optimization of altitude definition – Controller training

Airspace User	
Benefits	**Impacts/Risks**
– Predictable, repeatable flight path – Clarity on transitional altitudes – Reduces fuel burn and emissions – Accurate fuel planning	– Pilot training



Comparative Track Length on ELDEE STAR (nm)			
	Baseline	Proposed	Difference
ELDEE BUCKO	154.6	153.6	- 1.0
ELDEE BKW	231.1	231.1	0.0
ELDEE HVQ	255.0	253.5	-1.5

OAPM Status

as of April, 2012

- Washington DC Metroplex
  - Design phase completed March 2012
  - Began evaluation, including EA kickoff in April 2012
- North Texas Metroplex
  - On track for completion of design phase April 2012
  - Expect evaluation to begin May 2012
- Houston (Expedited Track)
  - Design 75% complete, expect completion July 2012
  - Working parts of EA concurrently with design
- Charlotte
  - Design underway expect completion in early fall 2012

OAPM Status

as of April, 2012

- Atlanta
  - Design underway expect completion in fall 2012
- Northern California
  - Design phase underway expect completion winter 2012/13
- Florida
  - Study Team kick-off scheduled for May 15, 2012
  - Currently working logistics and identifying team members
- Southern California
  - Design phase kick-off scheduled for early FY2013

General Issues Identified – Completed Sites

Issues

- **En route**
  - Inefficient routes (track distance)
  - Conflicting flows
  - En route sectors performing terminal functions (complexity)
  - Sector congestion
- **Terminal**
  - Impacts of Special Activity Airspace (SAA)
  - Delay vectoring
  - Noise abatement departure procedures
  - Aircraft types, performance and volume have changed in recent years; airspace underutilized by a position may be more efficiently used by another position
- **Arrival**
  - Inefficient vertical profiles
  - Merging of arrival flows
  - Reliance on radar vectoring
  - Actual flight paths do not follow current procedures
- **Departure**
  - Frequent use of Miles-in-Trail
  - Reliance on radar vectoring
  - Less efficient routings to en route airspace
  - Excess fuel loading due to legacy procedures

Solution Strategies

- **Modify several existing and create new RNAV SIDs and STARs**
  - Increase structure, repeatability, and predictability
  - Provide additional terminal ingress/egress points
  - Enable increased flow segregation
  - Enhance connectivity between city pairs
  - Optimize vertical paths
  - Reduce controller task complexity
- **Apply Q/T-Routes**
  - Reduce track miles flown
  - Accommodate optimized vertical profiles
  - Enhance connectivity between city pairs
  - Reduce controller task complexity
- **Modify airspace**
  - Accommodate increased flow segregation
  - Increase ability to apply terminal area separation rules
  - Accommodate optimized vertical profiles
  - Reduce controller task complexity

Original OAPM Schedule

Key
- S Study
- D Design
- E Evaluate
- I Implement
- P Post Eval

	FY11		FY12				FY13				FY14				FY15				FY16				FY17				FY18	
Site	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q
DC	D	D	D	E	E	E	E	E	E	I	I	I	I	P	P	P												
No Tex		D	D	E	E	E	E	I	I	I	I	P	P	P														
Charlotte	S			D	D	D	E	E	E	E	E	I	I	I	P	P												
No Cal	S	D	D	D	E	E	E	E	E	E	I	I	I	I	P	P												
Houston	S	S	D	D	D	E	E	E	E	E	I	I	I	P	P													
Atlanta		S	S	D	D	D	E	E	E	E	E	E	I	I	I	I	P	P										
So Cal		S	S	D	D	D	E	E	E	E	E	I	I	I	I	I	P	P										
Metroplex 8			S	S	D	D	D	D	E	E	E	E	E	I	I	I	I	P	P	P								
Metroplex 9			S	S	D	D	D	E	E	E	E	E	E	I	I	I	I	P	P	P								
Metroplex 10				S	S		D	D	D	E	E	E	E	E	I	I	I	I	P	P	P							
Metroplex 11					S	S		D	D	D	D	E	E	E	E	I	I	I	I	P	P	P						
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Metroplex 13						S	S	D	D	D	E	E	E	E	E	I	I	I	I	P	P	P						
Metroplex 14						S	S	S	D	D	D	E	E	E	E	E	I	I	I	I	P	P	P					
Metroplex 15							S	S		D	D	D	E	E	E	E	E	I	I	I	I	P	P	P				
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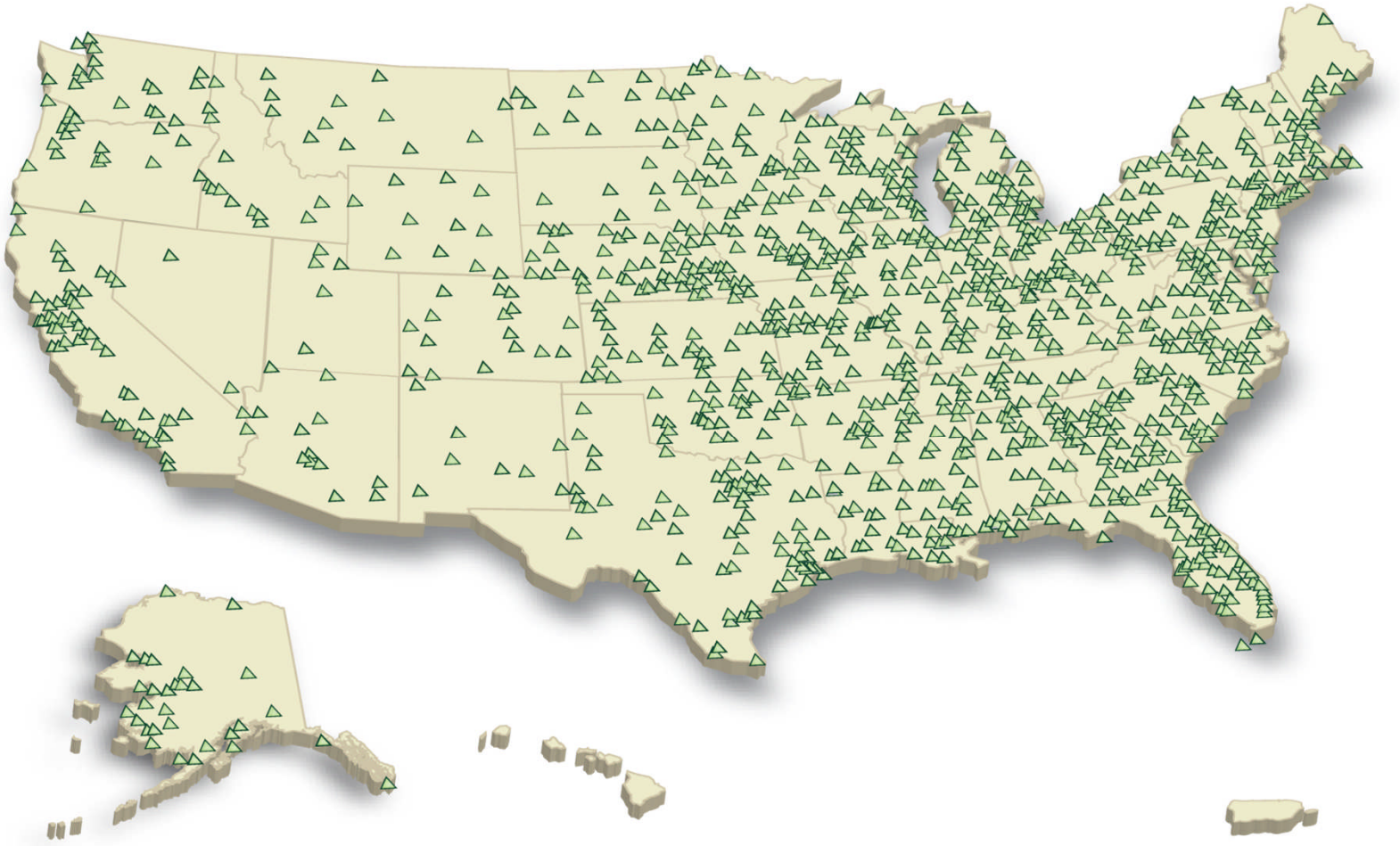
Metroplex 19									S	S		D	D	D	E	E	E	E	E	I	I	I	I	P	P	P		
Metroplex 20										S	S	D	D	D	E	E	E	E	E	I	I	I	I	P	P	P		
Metroplex 21											S	S	D	D	D	E	E	E	E	E	I	I	I	I	P	P	P	

2,708+ WAAS/LPV Procedures

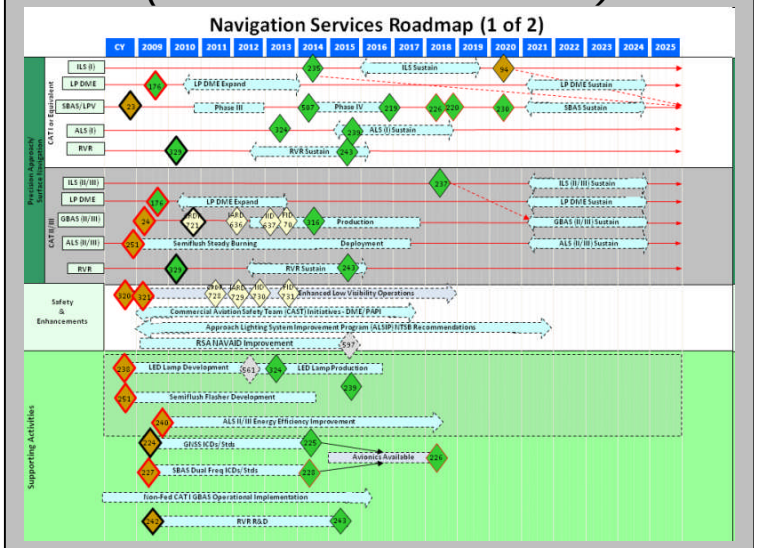


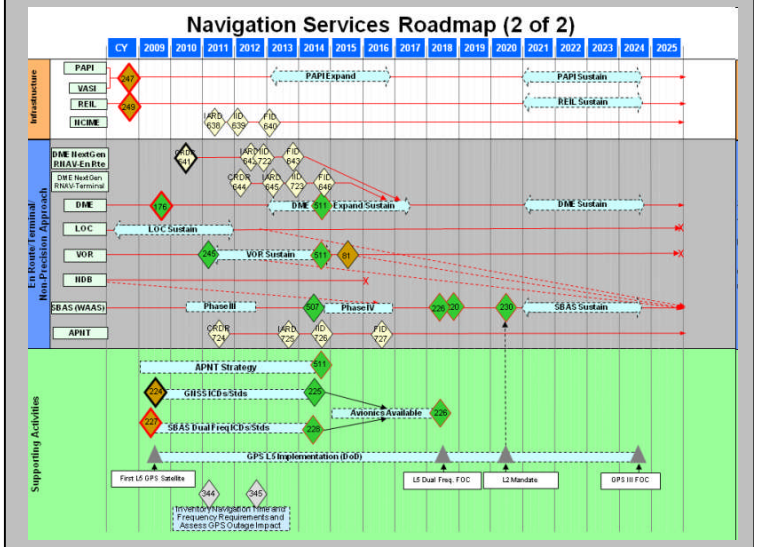
NAVAID *plan* and Legacy Phase-Out

- 2011: ILS and SATNAV combinations for parallel approaches in FAA Order 7110.65
- 2014 and 2020: Decisions on ILS Cat-I drawdown
- 2015: Decision on VOR drawdown
- 2016: NextGen DME available
- 2016: Decision on Alternative Position/Navigation/Timing (APNT)
- 2016: LPVs to all qualified runway ends in NAS
- 2018: Decision on replacement ILS Cat-II/III (some to remain as backup)

NAS Enterprise Architecture
Navigation Services Roadmap

(Plan…not Commitment)





Online Resources for Instrument Flight Procedure (IFP)

- RNAV inventory: http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/approaches/index.cfm
- Initiation: http://www.faa.gov/air_traffic/flight_info/aeronav/ifpinitiation/
- Production Plan: http://avnweb.jccbi.gov/schedule/production
- Coordination: https://aeronav.faa.gov/acifp.asp