

# Introduction to FACT3

*Goals, Changes, and Status*

Presented to: TRB 8<sup>th</sup> National Aviation System  
Planning Symposium

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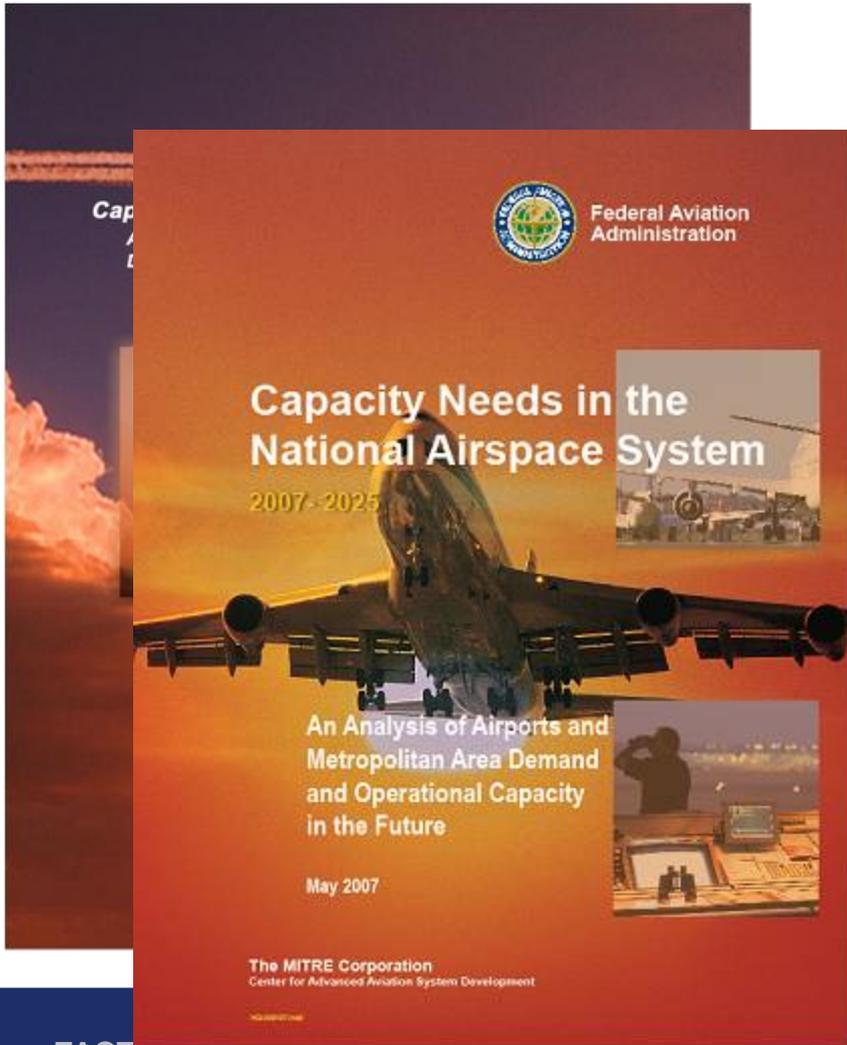


Federal Aviation  
Administration



# Future Airport Capacity Task (FACT)

## *Which airports will need more capacity?*



- Published as *Capacity Needs in the National Airspace System*
  - **FACT1** (2004)
    - Initial problem identification and screening
  - **FACT2** (2007)
    - Refined criteria
    - Detailed modeling of smaller airports
- **FACT3** to be published in 2013
  - Forecast to 2020 and 2030

# FACT2 Maps Widely Used...

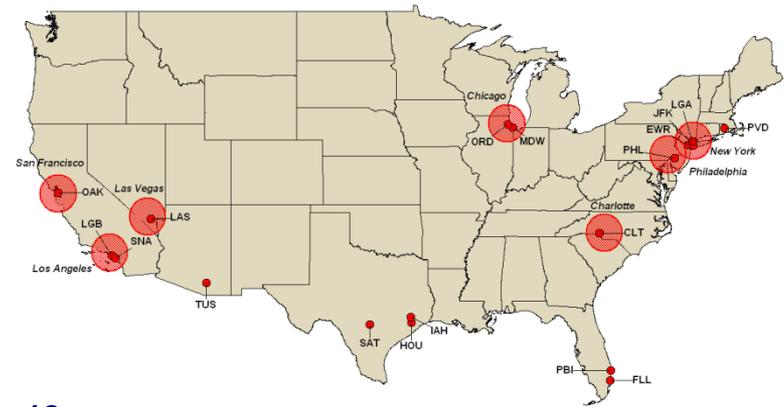
2015

After Planned Improvements



6 airports that need additional capacity  
4 metro areas that need additional capacity

If Planned Improvements Do Not Occur



18 airports that need additional capacity  
7 metro areas that need additional capacity

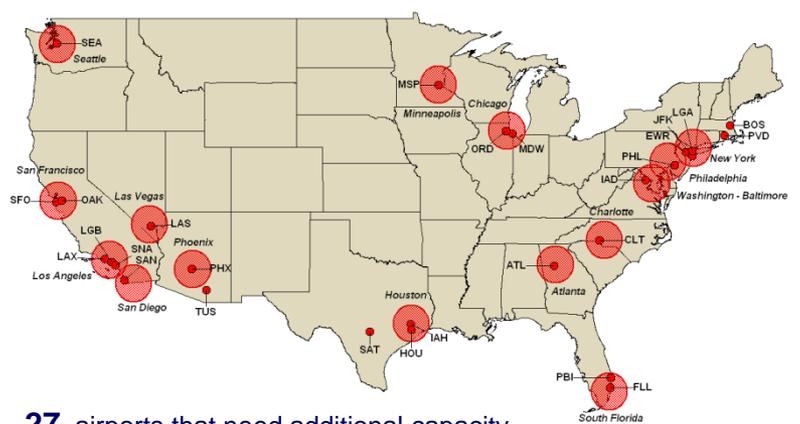
2025

After Planned Improvements



14 airports that need additional capacity  
8 metro areas that need additional capacity

If Planned Improvements Do Not Occur



27 airports that need additional capacity  
15 metro areas that need additional capacity

# FACT2 Needs to be Updated

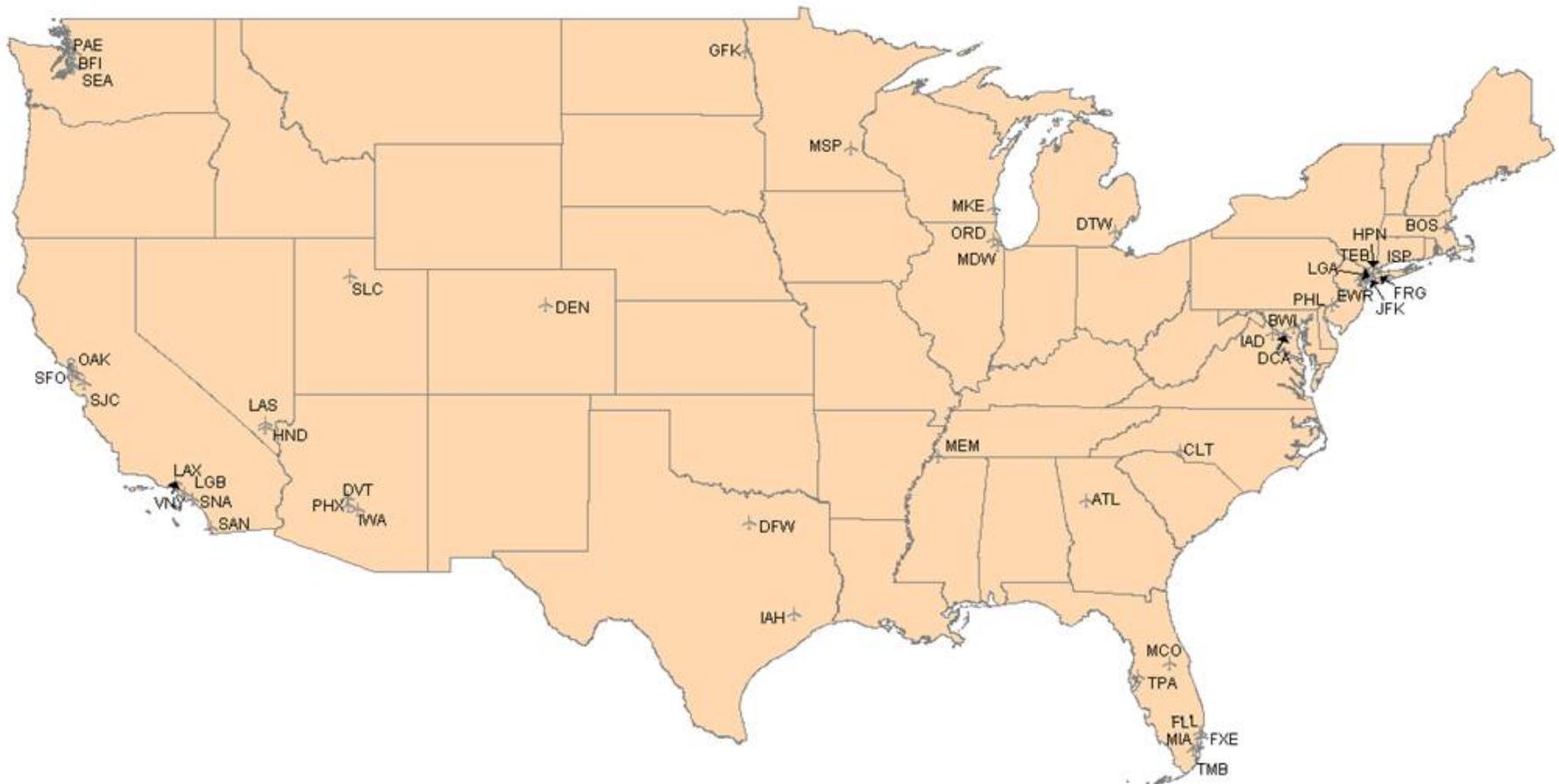
- Since FACT2 was published:
  - Base activity levels and forecasts have changed due to economic conditions and airline restructuring
  - New runways have opened / OEP completed
  - NextGen plans and performance capabilities have matured
- *Which airports and metro areas are likely to be constrained in the future, based on what we know today?*

# Airports of Interest in FACT3

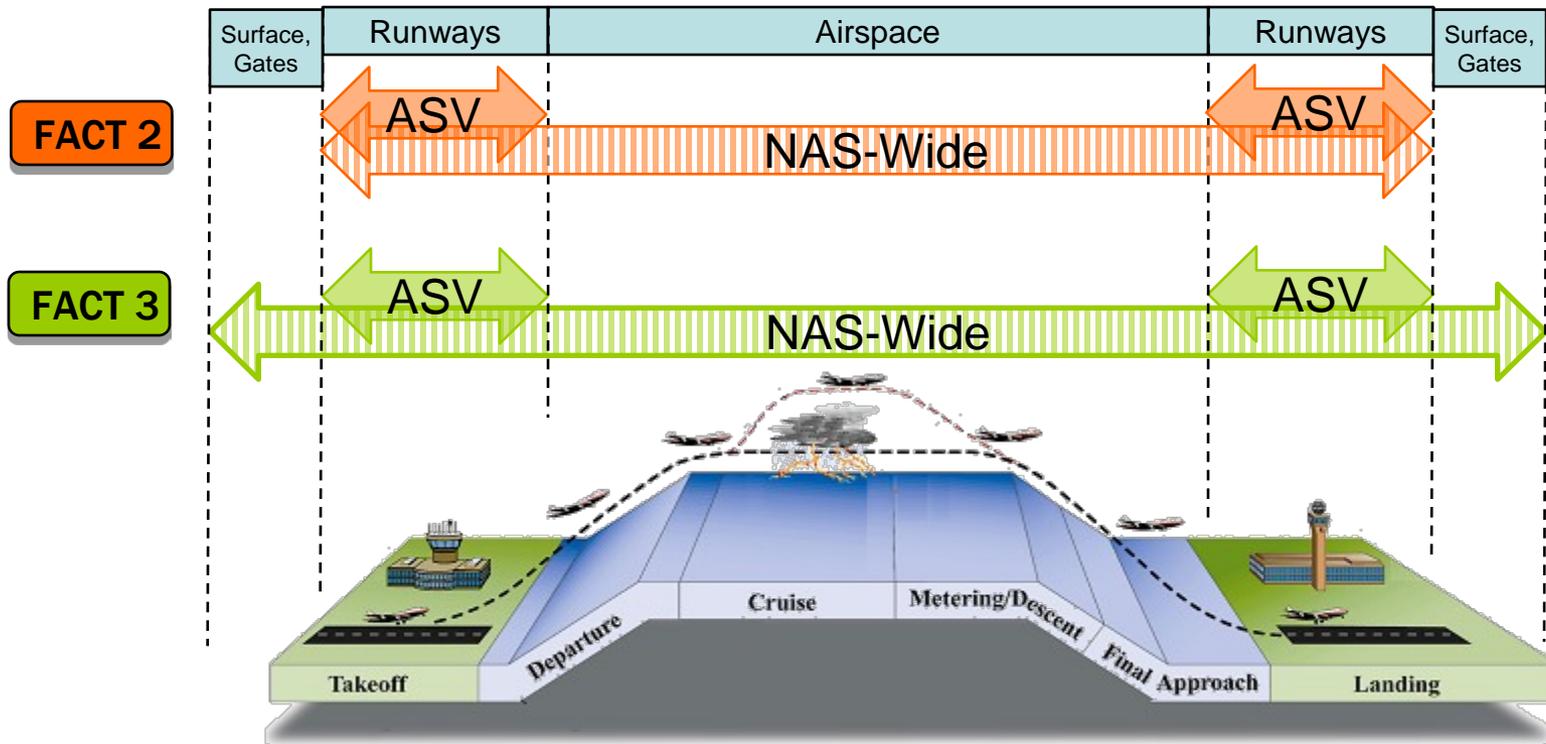
- Core 30 airports
  - 29 Large Hubs and Memphis
- FACT 2 Congested airports, not in Core
  - LGB, OAK, SNA
- Broad survey of the airport system:
  - Significant general aviation airports in key metro areas
    - *500+ airports considered, identified 11 (e.g., TEB, FRG, IWA, VNY) for further analysis*
  - Other commercial airports with possible capacity shortfalls
    - *301 airports considered; compared 2030 demand to current capacity*
  - Result: Identified 16 additional airports for further analysis

# Airports included in FACT3

## *Significant General Aviation airports added*



# FACT3 Concept: Expand the Core Analysis



- Updated demand schedules and forecasts (2012 TAF)
- Current plans for NextGen improvements
- Expanded analysis
  - Forecasted fleet mix evolution
  - NAS-Wide analysis includes taxiway and gate consideration

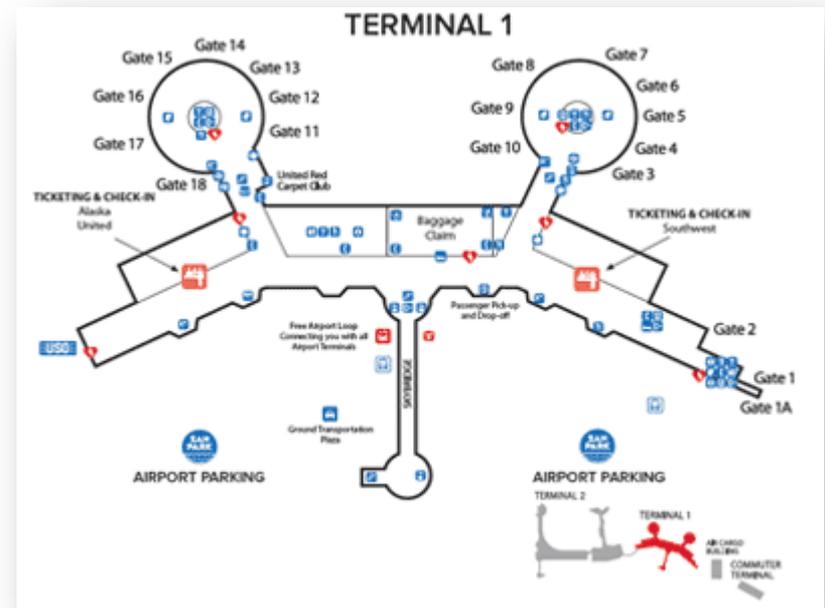
# FACT3 Additions to NAS-Wide Modeling

- **Taxi Time Model**

- Not a detailed taxiway model
- Estimate of additional taxi time as a factor of arrival and departure operations

- **Gate Resource**

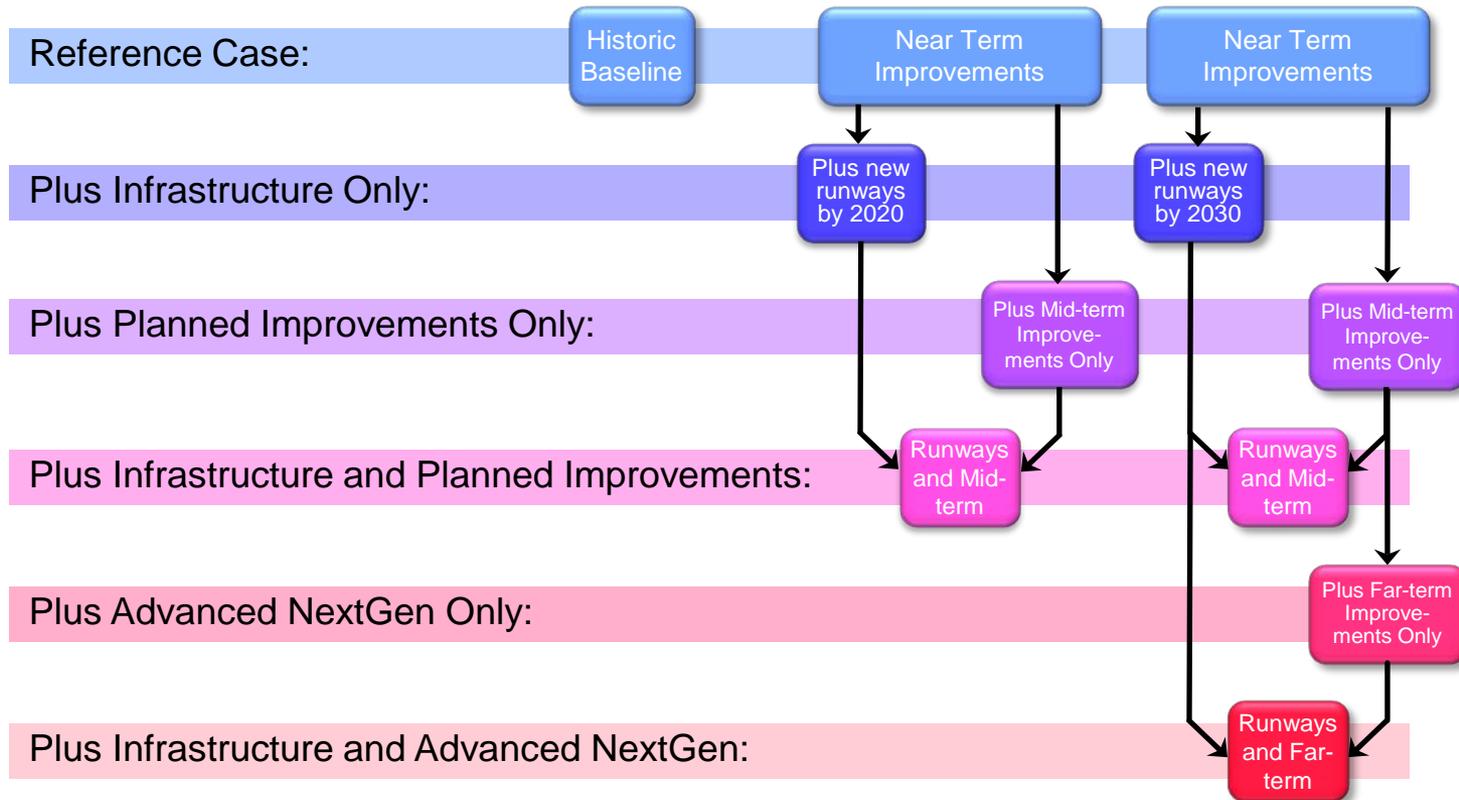
- Flights will be assigned to a cluster of possible gates
  - Difficult to forecast gate assignments, airline scheduling, or even airline presence in 2020
- For 2030, will only track additional gates needed
- Only a general indication of gate delay and gate need



Sample Gate Diagram: Terminal 1 at San Diego International Airport

# FACT3: Scenarios for Analysis

Demand:



# FACT3 Scenarios (1 of 3)

- **Reference Case**

- Includes many of the NextGen capabilities that are expected to mature through 2015
  - New procedures that have been implemented or are expected soon
- These “Near Term” improvements include:
  - **Wake Turbulence Mitigation for Departures (WTMD)** at 3 demo sites (IAH, MEM, SFO)
  - **Wake Recategorization**, Phase 1
  - **Closely Spaced Parallel Operations (CSPO)**
    - **Reduced minimum runway spacing (3600 ft)** for dual independent approaches
    - Additional dependent staggered approaches with **7110.308**

# FACT3 Scenarios (2 of 3)

- **Plus Infrastructure Only: New runways and gates**

- 2020 with Current ROD: FLL, ORD, PHL
- 2030 with Current ROD or mature planning with demand/capacity trigger: IAD, IAH, PHL

- **Plus Planned Improvements Only (2020 and 2030)**

- Without new runways
- “Mid-Term” NextGen improvements include:
  - **WTMD** at remaining 7 sites
  - **Wake Turbulence Mitigation for Arrivals – Procedures for Heavy/757 Aircraft (WTMA-P)**
  - Increased **delivery accuracy** to runway
  - OAPM Metroplex **airspace improvements**
  - Additional **fanned departure** headings

# FACT3 Scenarios (3 of 3)

- **Plus Infrastructure and Planned Improvements**

- Combine improvements from Infrastructure-Only and Planned-Improvements-Only scenarios

- **Plus Advanced NextGen Only (2030)**

- NextGen improvements deferred past 2020
  - e.g., paired approaches to SFO in IMC
- JPDO *Targeted NextGen Capabilities by 2025*
  - Modeling assumptions are based on NextGen trade space analyses for JPDO
  - Beyond 2025 Targeted Capabilities not used
  - Additional wake, delegated interval management, and departure/departure separation improvements

- **Plus Infrastructure and Advanced NextGen (2030)**

# FACT3 Milestones

Description	Date
Alignment of Demand Days/Fleet Evolution	June 2011 <complete>
Identify airports and metro areas	June 2011 <complete>
Alignment with NextGen Improvements	Nov 2011 <complete>
2011 TAF available	January 2012 <complete>
2020 & 2030 NAS-Wide results	June 2012
Annual Service Volume results	June 2012
Metro Area analysis results	Sept 2012
Additional scenario results	Sept 2012
Coordinate with airports	4Q12/1Q13
Complete FACT3 report	March 2013



# Contact

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# Backup



# Near Term Improvements in 2020/30 Reference Case



## Implement SATNAV or ILS for Parallel Runway Operations

### **Approach:**

Allows for GPS guidance when conducting a simultaneous instrument approach.

Does not affect runway spacing required for simultaneous approach.

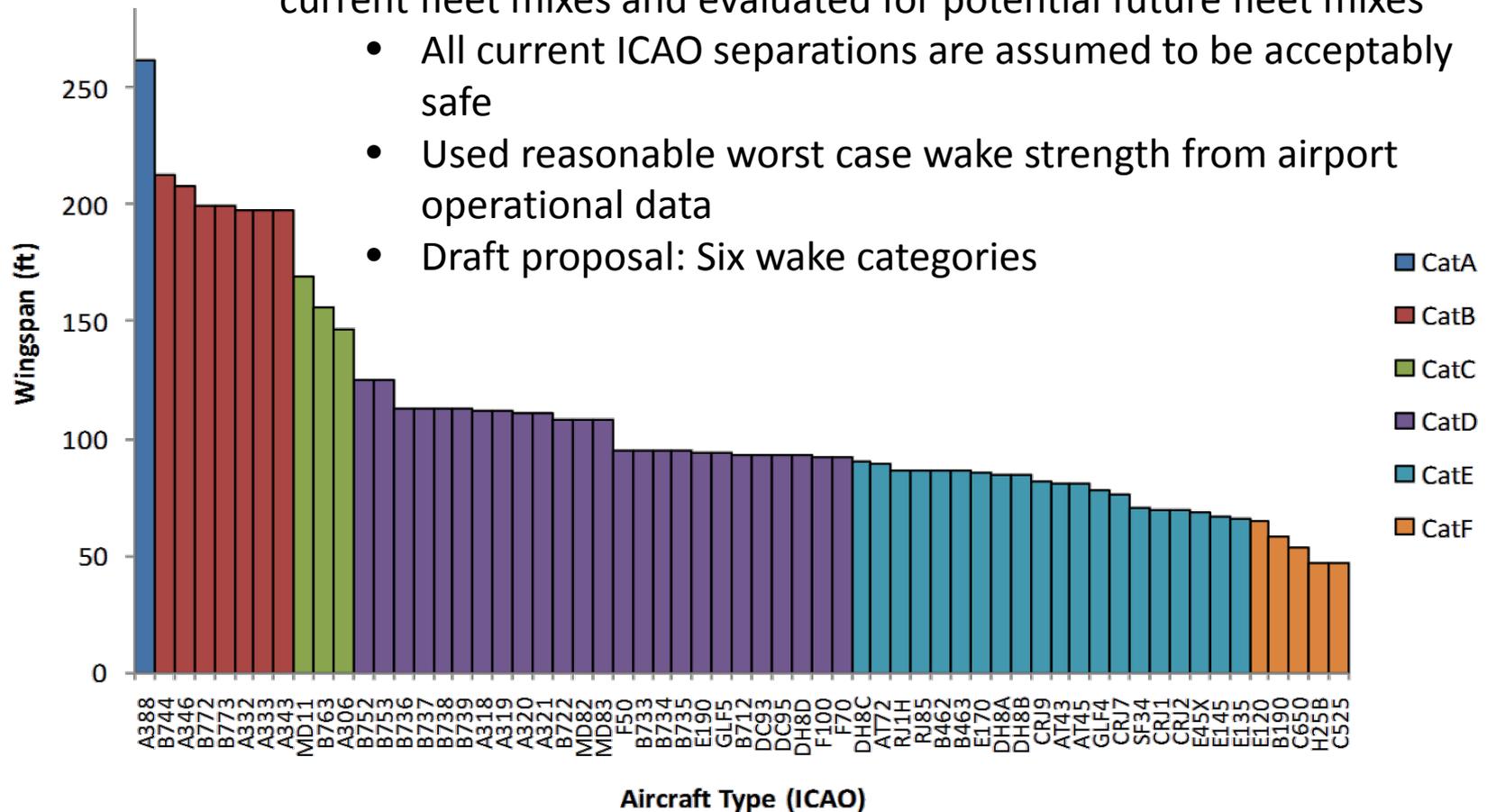
No effect on capacity at Core 30 airports – ILS currently available for all runways.

# Wake Re-Categorization (RECAT) Phase 1 – Aircraft Recat

## Approach:

Provides new wake vortex categories and separations optimized to current fleet mixes and evaluated for potential future fleet mixes

- All current ICAO separations are assumed to be acceptably safe
- Used reasonable worst case wake strength from airport operational data
- Draft proposal: Six wake categories

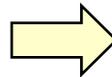


# Wake Re-Categorization (RECAT) Phase 1 – Aircraft Recat

## Separation Minima:

RECAT Step 1: Possible Changes to Separation Matrix  
(NOTE: new separations are not official)

		Trailing Aircraft				
		Super	Heavy	B757	Large	Small
Leading Aircraft	Super	2.5	6	7	7	8
	Heavy	2.5	4	5	5	6
	B757	2.5	4	4	4	5
	Large	2.5	2.5	2.5	2.5	4
	Small	2.5	2.5	2.5	2.5	2.5



		Trailing Aircraft					
		CatA	CatB	CatC	CatD	CatE	CatF
Leading Aircraft	CatA	2.5	5	6	7	7	8
	CatB	2.5	3	4	5	5	7
	CatC	2.5	2.5	2.5	3.5	3.5	6
	CatD	2.5	2.5	2.5	2.5	2.5	5
	CatE	2.5	2.5	2.5	2.5	2.5	4
	CatF	2.5	2.5	2.5	2.5	2.5	2.5

Because visual standards are pilot-defined, not controller-defined, current visual “minima” will be assumed even under RECAT

- Visual separation is not applied behind Super/Cat A (A380)

## RNAV SIDs and STARs at Single Sites

**Approach:** RNAV departure routes can allow **departure fanning** with less than 15-degrees divergence. Also known as Equivalent Lateral Spacing Operations (ELSO).

**Airports:** ATL has a waiver allowing departure fanning with less than 15-degree divergence, effective October 2011.

ELSO fanned departures are expected to be implemented at other airports as well. However, an Environmental review is required first.

**Separation Minima:** The departure-departure separation is reduced from 3NM airborne to 1NM and diverging.

Additional separation due to wake vortex (e.g., 120 sec at start of roll) is still applied when needed.

## Amend Independent Runway Standards in Order 7110.65

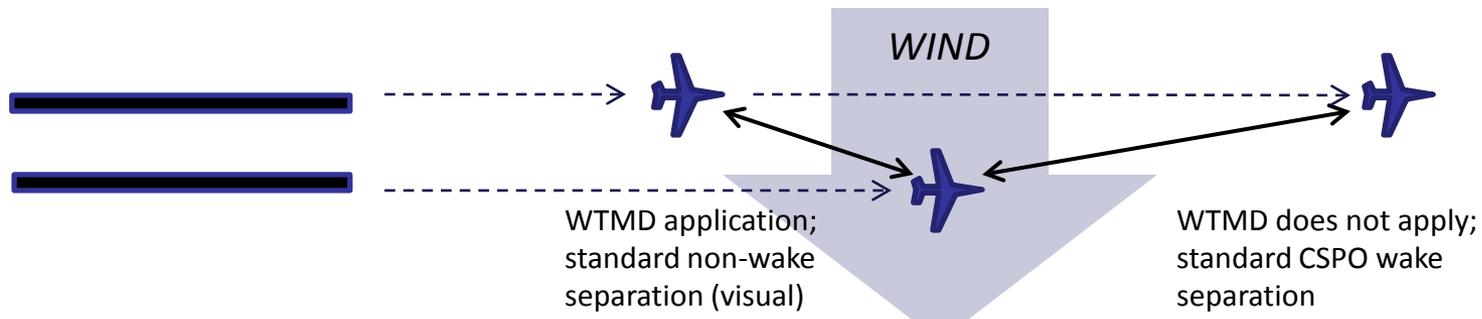
- Approach:** Will reduce runway spacing requirement for simultaneous instrument approaches with standard radar from 4300 ft currently to 3600 ft.
- No change to method for modeling simultaneous approaches, but may change location with simos.
- Airports:** Runway extension at FLL is planned to have simultaneous approaches (4000 ft runway spacing).

# Wake Turbulence Mitigation for Departures (WTMD)

**Approach:** Parallel dependent runways normally apply wake separation between successive departures. With WTMD, no wake rules apply to the trailing runway if the leading operation is downwind.

- Requirements:**
- Wind speed thresholds based on runway separation
  - Wind measurement equipment
  - Non-IFR conditions (VMC or Marginal (MMC))

**Airports:** Initial demos at IAH, MEM, SFO



# Additional 7110.308 Airports

## Approach:

Allows reduced separation for arrivals in weather below visual approach minimums (MMC and IMC).

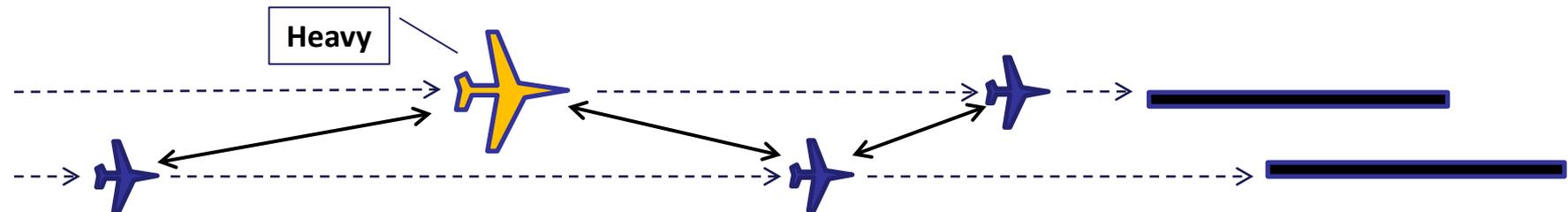
1.5NM diagonal separation is authorized only at approved airports and only in operations where the lead aircraft in the arrival-arrival pair:

- a) lands at the runway with the closer threshold
- b) is in the Small or Large wake class category

## Airports:

BOS, EWR, PHL, SEA, etc.

Heavy



### Standard separation

7110.308 does not apply; NOT a Small/Large in lead

### Standard separation

7110.308 does not apply; NOT arriving at closest threshold first

### 1.5NM separation

7110.308 applies; Small/Large in lead and arriving at closest threshold first

## Implement TMA at Additional Airports

**Approach:** An average increase of 3% was seen for arrivals across all airports where TMA operates. This was due to an improvement in precision of delivery of aircraft to final.

Based on simulations, an average 3% improvement in arrival capacity is seen across all airports when the IAT-sigma\* parameter is reduced to 16.5 seconds (from the default 18 seconds).

**Modeling:** For all arrival-arrival separations, reduce the IAT-sigma value to 16.5 seconds.

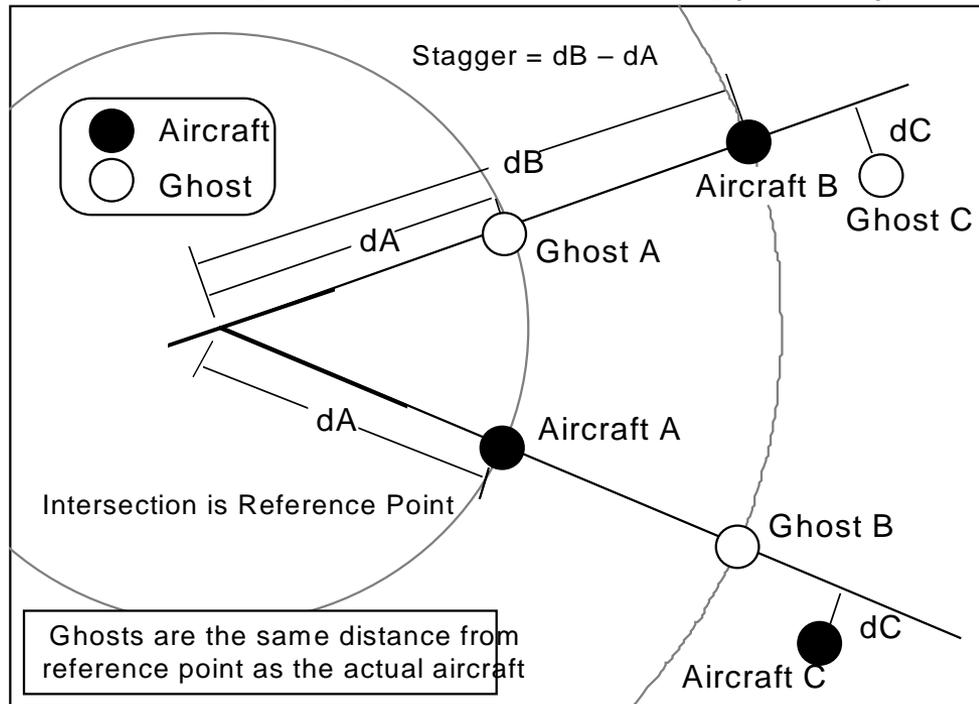
**Airports:** DCA, CLE, BWI

\* “IAT-sigma” is a measure of the accuracy with which controllers can separate aircraft. It represents the standard deviation of Inter-Arrival Times (IATs), usually at the runway threshold.

# Use Converging Runway Display Aid (CRDA)

**Approach:** “Ghost” separation applied between aircraft on different approaches, based on distance from common point, per FAA Order 7110.110A.

**Airports:** Current: PHL, IAD, etc. Future: EWR, possibly others.



# Mid-Term Improvements in 2020/30 Planned Improvements Case

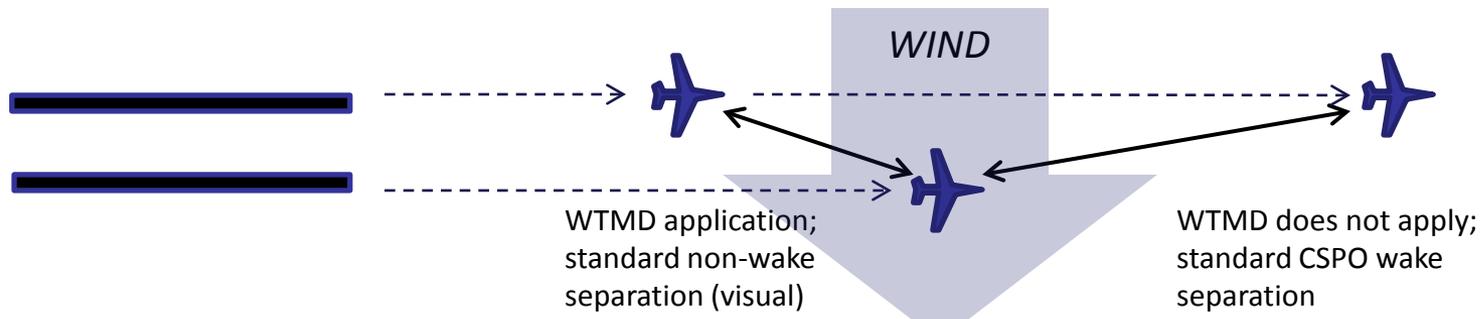


# Wake Turbulence Mitigation for Departures (WTMD)

**Approach:** Parallel dependent runways normally apply wake separation between successive departures. Under this OI, if a downwind operation is the leading operation, no wake rules apply to the trailing runway.

- Requirements:**
- Wind speed thresholds based on runway separation
  - Wind measurement equipment
  - Non-IFR conditions (VMC or Marginal (MMC))

**Airports:** Remaining airports planned for WTMD (BOS, DTW, EWR, MIA, PHL, SEA, STL)



# Wake Turbulence Mitigation for Arrivals – Procedural (WTMA-P)

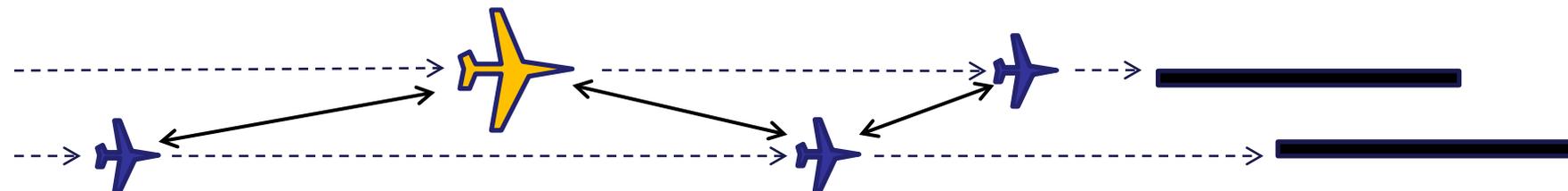
**Approach:**

Allows reduced separation for arrivals in weather below visual approach minimums (MMC and IMC).

This reduced separation is only at approved airports. Minimum separation behind the arrival to the closest threshold is as follows:

**Small/Large leading aircraft**  
**757/Heavy leading aircraft**

1.5NM separation applies  
 Separation credit is based on centerline spacing and runway offset



**Separation TBD**  
 WTMA-P applies;  
 reduction in separation based on centerline spacing and runway offset

**Standard separation**  
 WTMA-P does not apply; NOT arriving at closest threshold first

**1.5NM separation**  
 WTMA-P applies;  
 Small/Large in lead and arriving at closest threshold first

# Amend Dependent Runway Separation Standards in Order 7110.65

## Approach:

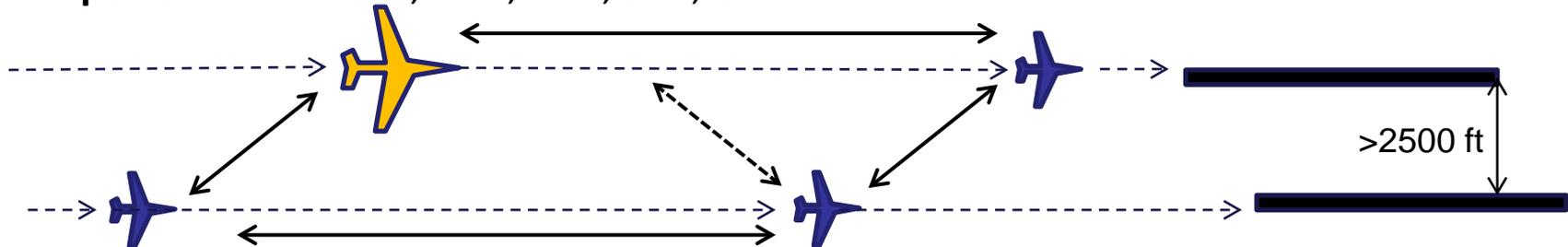
Reduces current 1.5 NM diagonal separation for dependent parallel approaches to 1.0 NM in weather below visual approach minimums (MMC and IMC).

Runway spacing > 2500 ft avoids need for wake vortex separation between approaches.

Standard separation (radar or wake vortex) applies between aircraft on the *same* approach.

## Airports:

JFK, MSP, PHX, SEA, etc.



### 1NM diagonal separation

No wake hazard due to runway spacing

### Standard separation

Applies between two aircraft on the same runway

### 1NM diagonal separation

Applies behind any lead aircraft (on either runway)

## Metering to Fixes Within Terminals

**Approach:** This will improve the precision of delivery to final.

**Modeling:** This piece is not modeled alone but is included in the list of improvements that allow airports with TMA to reduce their IAT-sigma to 12 seconds (from a default of 18 seconds).

## RNAV SIDs and STARs, Optimization of Airspace and Procedures in the Metroplex (OAPM)

- Approach:** RNAV departure routes can allow **departure fanning** with less than 15-degrees divergence. One goal of OAPM is “diverging departure headings.”
- Airports:** Departure fanning is assumed at CLT, DEN, DFW, EWR, and MKE by 2020. EWR is covered by the New York Airspace Redesign. The other airports were identified by Task Force 5 as “Least Complex” for RNAV implementation.
- LAS is not included. The Las Vegas Airspace Redesign does not include fanned departures, presumably for environmental concerns.
- Separation Minima:** The departure-departure separation is reduced from 3NM airborne to 1NM and diverging.
- Additional separation due to wake vortex (e.g., 120 sec at start of roll) is still applied when needed.

# Improvements in 2030 Advanced NextGen Scenario

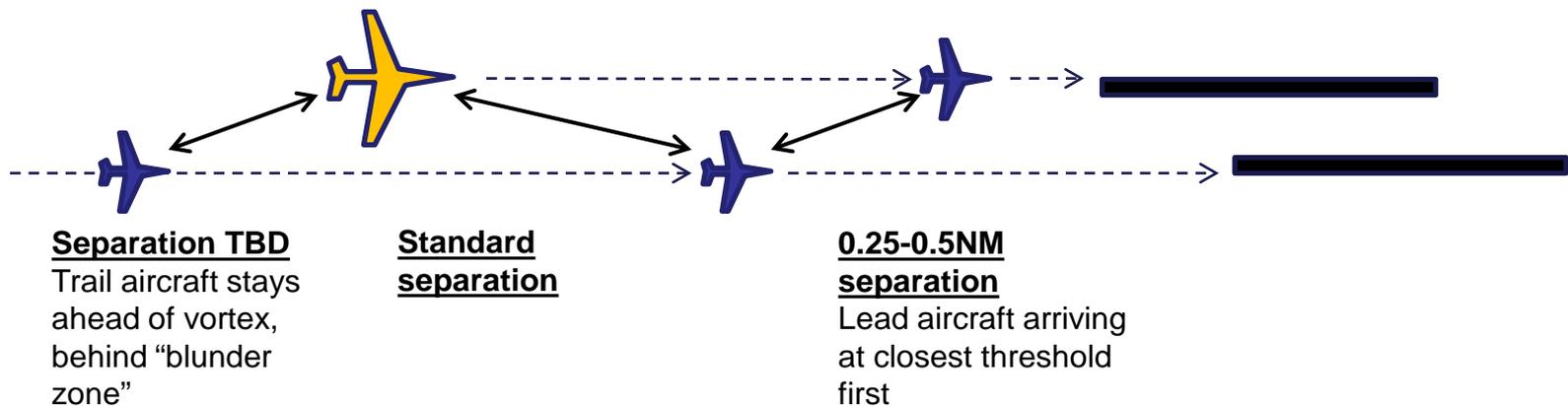


## Paired Approaches for Runways Spaced Less than 2500 Feet Apart

**Approach:** Similar to paired approaches at SFO, except conducted in instrument conditions.

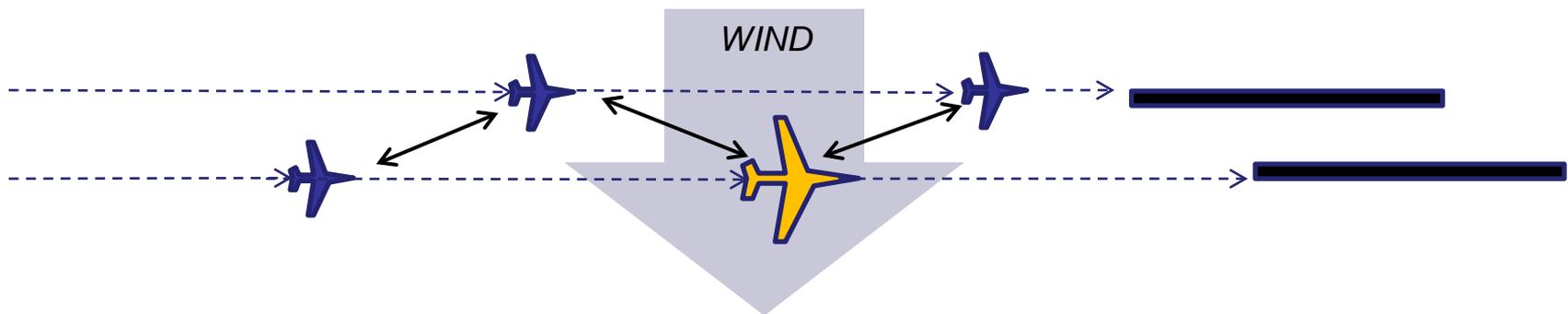
**Requirements:** Expected to include ADS-B In, CDTI. May involve linking aircraft FMS systems.

**Airports:** SFO, EWR



## Wake Turbulence Mitigation for Arrivals: System (WTMA-S)

- Approach:** Allows reduced separation for arrivals to closely spaced runways, in weather below visual approach minimums (MMC and IMC) when winds disperse/divert wake turbulence.
- Requirements:** Wind measurement equipment. Wind speed thresholds based on runway separation must be calculated.
- Modeling:** For all aircraft, 1.5 NM separation applies.
- Airports:** BOS, DTW, EWR, SFO



# Modeling JPDO Improvements in “Advanced NextGen”

- **Modeling assumptions are based on NextGen trade space analyses for JPDO**
- **Wake mitigation + Delegated Interval Management → 1 NM reduction in IMC separations between arrivals**
  - Reduction in Wake RECAT separations
  - But not less than 2.5 NM
    - Reduction in Runway Occupancy Times would be needed
- **Also reduction in departure/departure separations**
  - 60 sec → 48 sec
    - Equivalent reduction in distance-based separation
  - No change to 120 sec behind a wake-producing aircraft