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(Responsible for Airside Planning)**



Airfield Capacity Study

HNTB Corporation

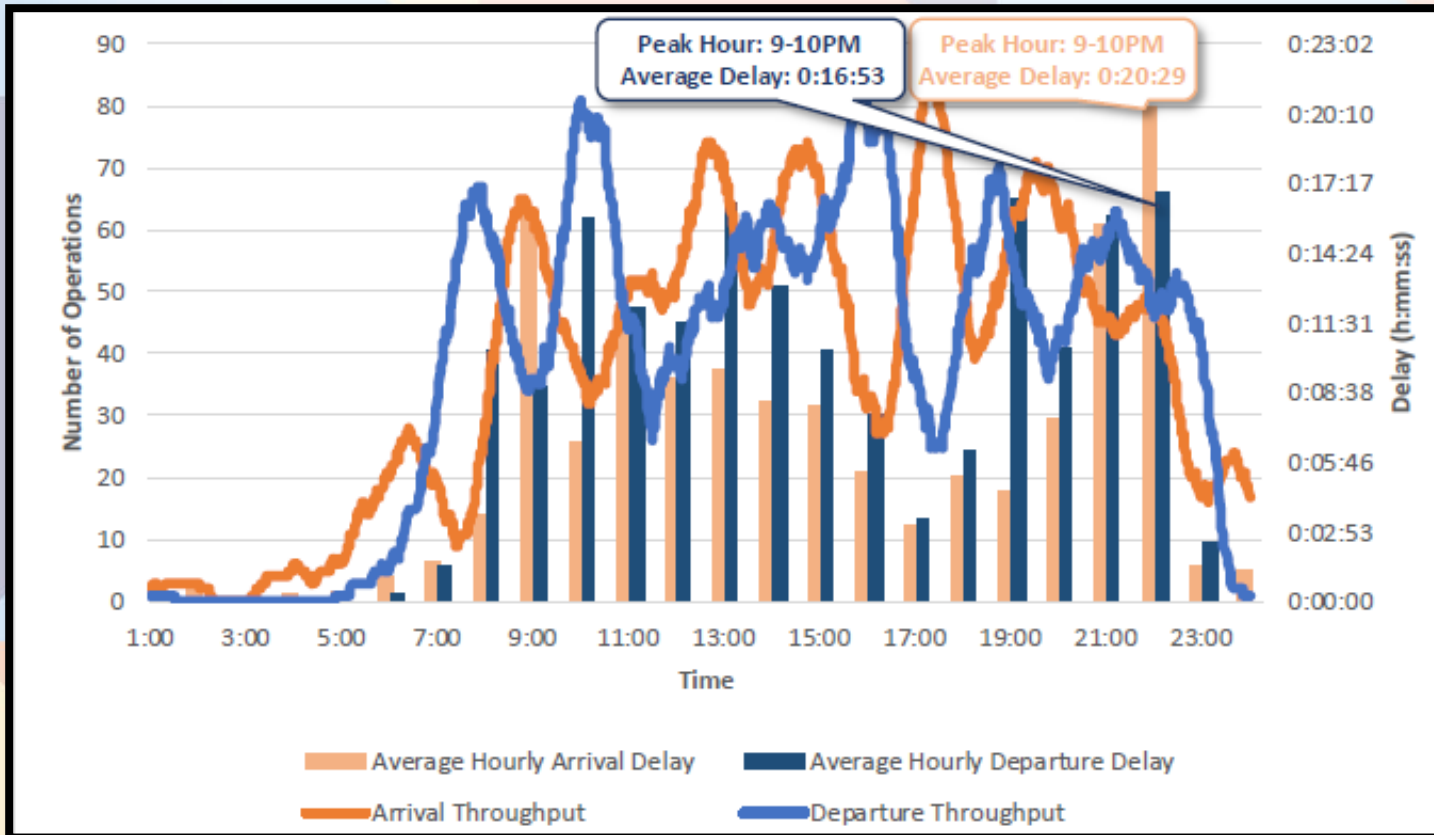
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Study Objectives

- Develop A Well-Calibrated Baseline Simulation That Takes Into Account The Present-State Airfield And Close-In Airspace
- Predict How Much Of The Existing Airfield's Capacity Is Needed To Accommodate Existing And Forecast Demand Levels And Estimate Associated Levels Of Delay
- Develop A Flexible Simulation Model That Can Be Used To Test How Alternative Scenarios Affect Airfield Capacity
- Provide Summary Results In A Manner That Facilitates Effective Dialogue Across Stakeholder Groups And Promote A Better Understanding Of The Relationship Between Airfield Capacity Aircraft Delay

Capacity Definition: Demand vs. Delay



- Number Of Aircraft Operations (takeoffs and landings) That Can Be Accommodated Along With An Acceptable Or Tolerable Amount Of Delay

Capacity: Considerations

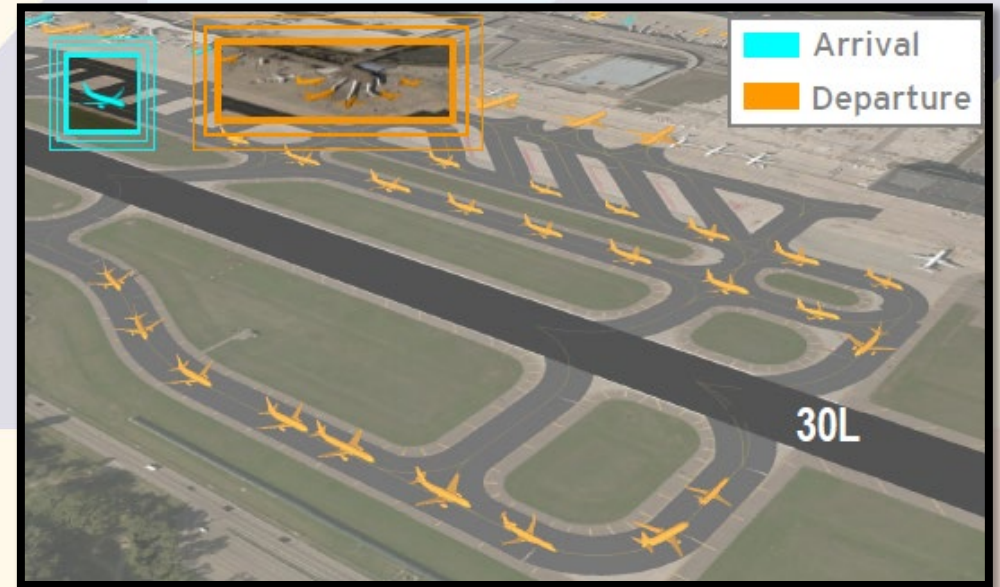
- Annual Capacity Is Best Indication Of How Much Airport Traffic Can Be Handled Throughout A Year
- Many Variables Need To Be Considered
 - When Flights And Peak Activity Occurs (Daily and Seasonal)
 - Runway Use As Directed By ATC
 - Five Typical Configurations
 - Each Affects How Quickly Aircraft Can Arrive, Depart and Move Around The Airfield
 - Weather Conditions
 - Wind Has A Major Impact On Which Runways Can Be Used
 - The Safe Distances Required Between Aircraft Is Less In Good Visibility Than In Poor Weather Conditions
- Hourly Capacity Has Also Been Determined For This Study

Delay Definition

- Delay is any increase in time beyond the time it would take an aircraft to make its trip by flying or taxiing at normal speeds along the shortest typical route

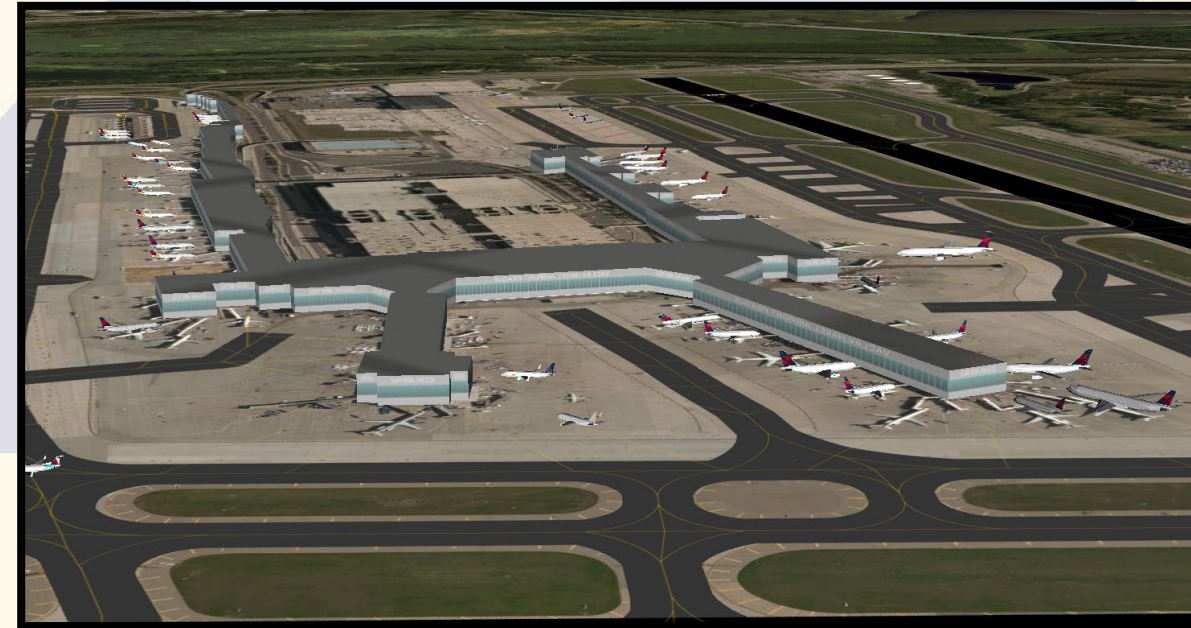
– Examples of Delays:

- Waiting for room to push from gate
- Waiting for clearance to enter the runway and takeoff
- Congestion along a taxiway
- Waiting to cross a runway
- An aircraft needs to slow down or take a longer path to provide spacing

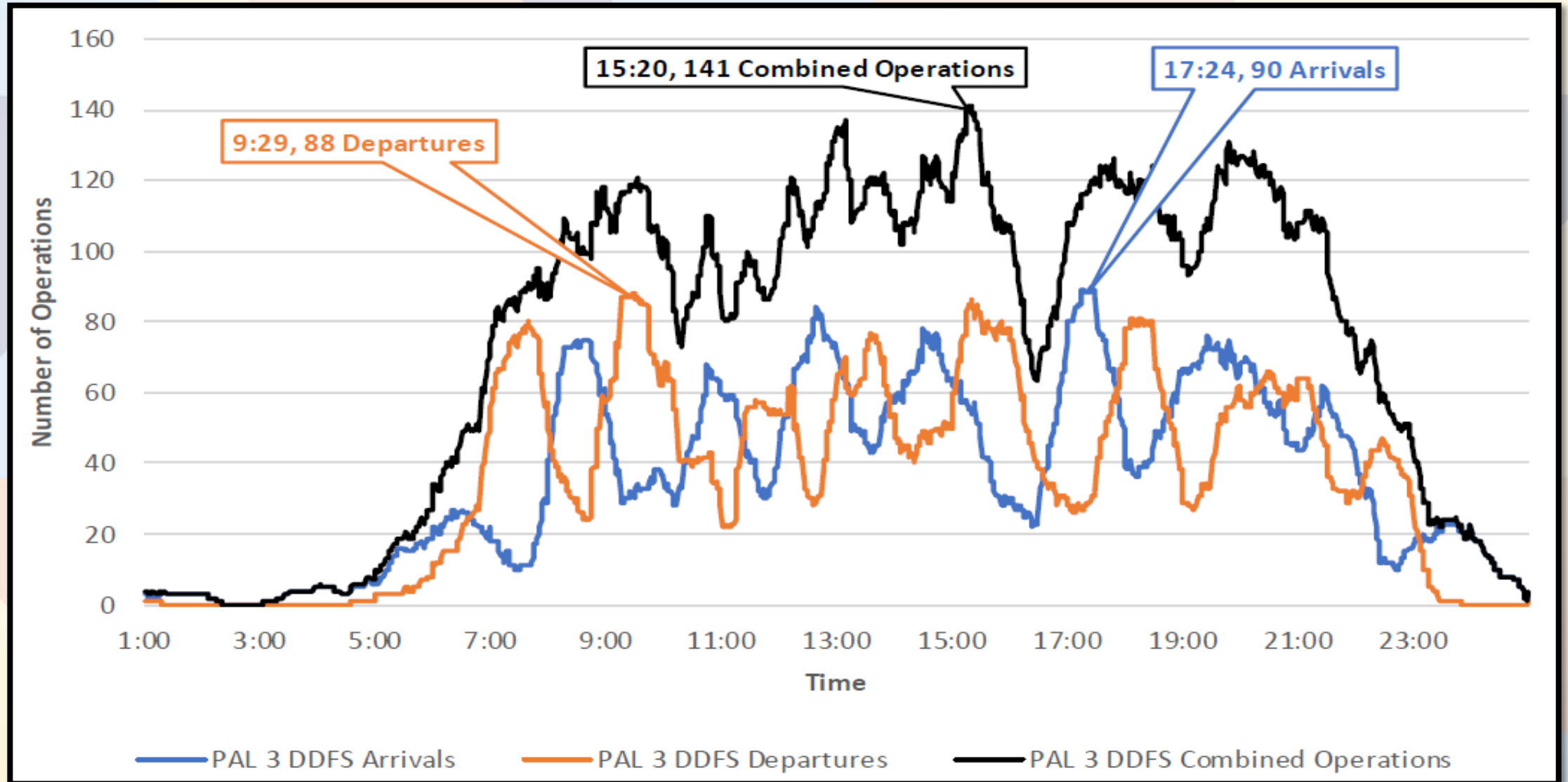


MSP Capacity and Delay

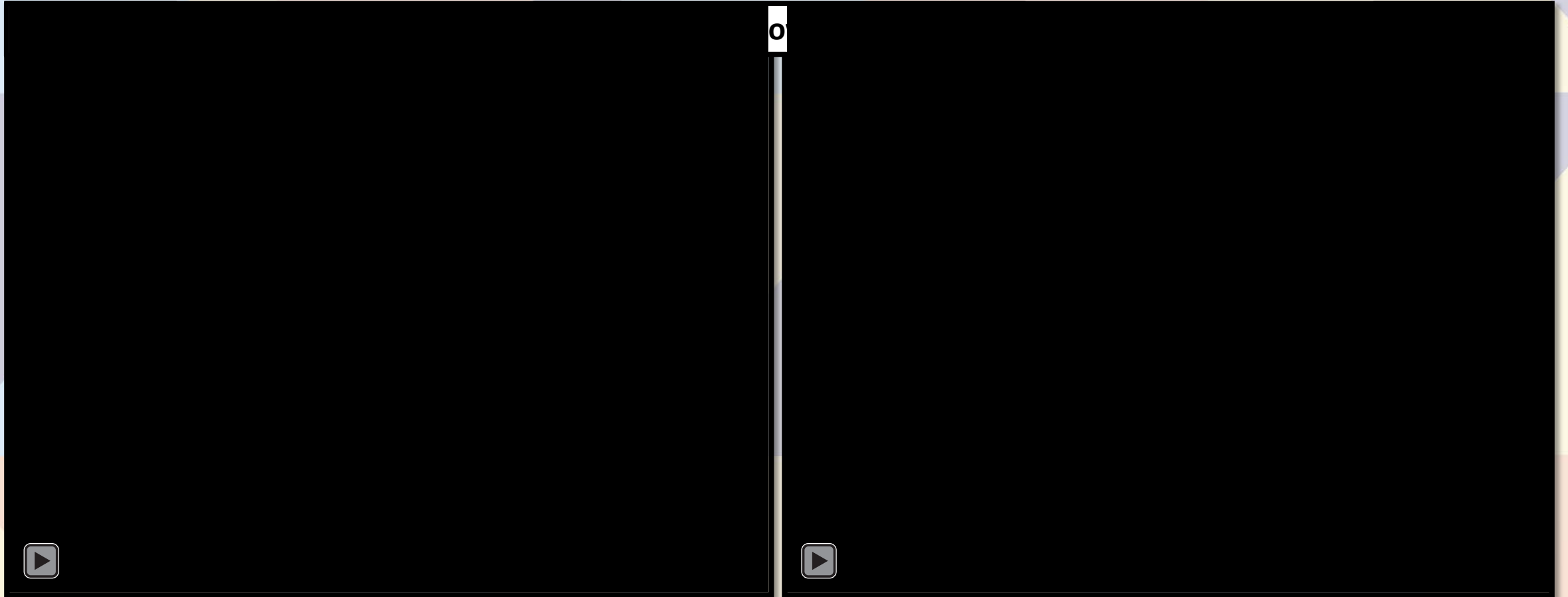
- Utilize the state-of-the-art fast-time airport/airspace simulation software, AirTOP
- Models were calibrated working closely with: FAA Air Traffic, MAC, Airlines
- 56 Simulations constructed:
 - 5 primary runway use configurations with 3 major weather categories
 - 4 planning activity levels (PALs)



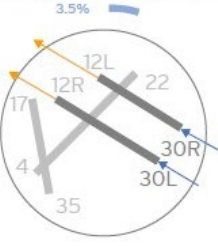

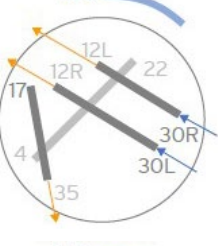
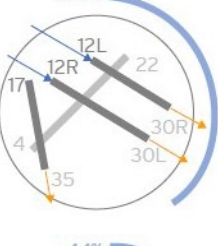
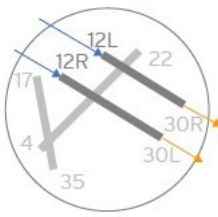
Planning Activity Level (PAL) 3 Design Day Flight Schedule



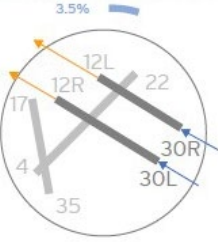

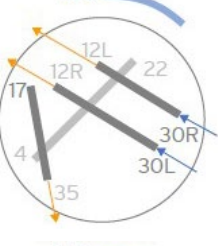
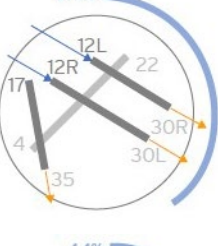
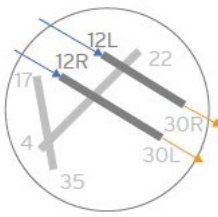
MSP Capacity and Delay



MSP Capacity Metrics Summary for 2018 ADPM Modeled Configurations (Minutes)

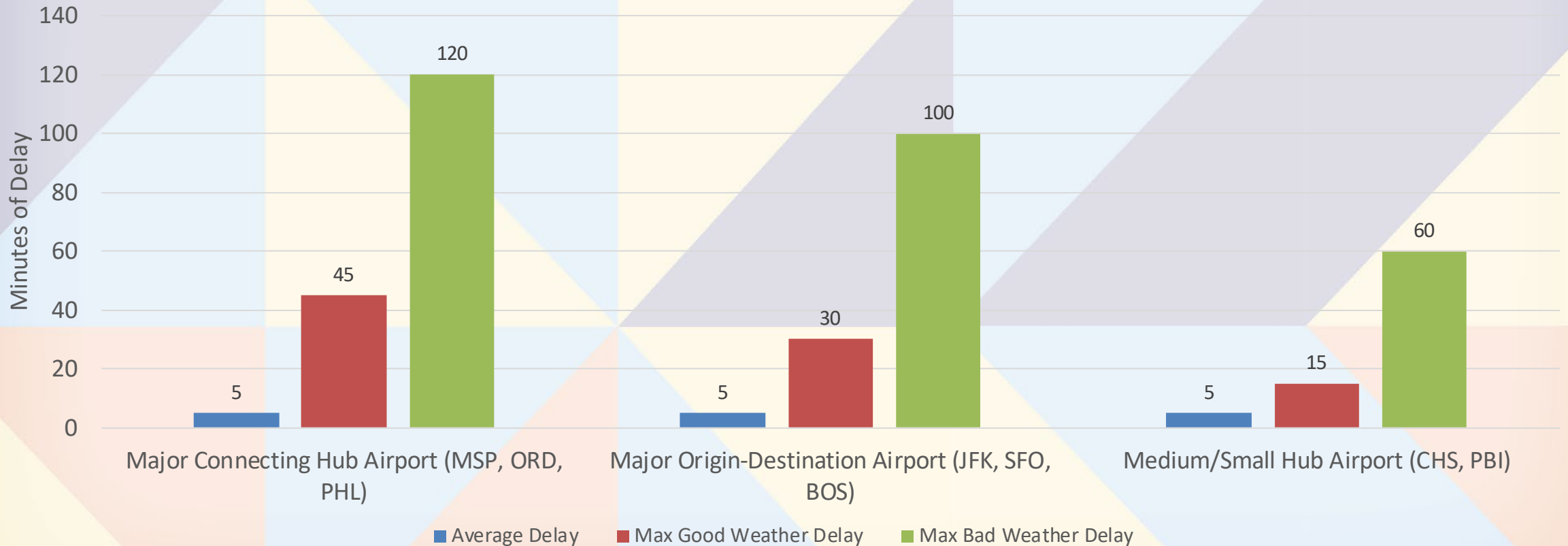
Runway Configuration	Weather	Average Total Delay Per Operation	Modeled Annual % In Flow	Average ADPM Delay
Straight North 	Good (VMV)	3.41	11.18%	2.60
	Marginal (MVMC)	3.76	5.06%	
	Poor (IMC)	3.97	1.30%	
North 	Good (VMC)	2.97	16.68%	
	Marginal (MVMC)	3.22	2.00%	
Mixed A 	Good (VMC)	2.19	9.74%	
	Marginal (MVMC)	2.32	1.69%	
	Poor (IMC)	2.35	0.38%	
South 	Good (VMC)	2.01	28.26%	
	Marginal (MVMC)	2.05	6.81%	
	Poor (IMC)	2.12	2.99%	
Straight South 	Good (VMC)	2.93	3.47%	
	Marginal (MVMC)	3.10	1.42%	
	Poor (IMC)	3.23	0.94%	

MSP Capacity Metrics Summary for PAL 3 ADPM Modeled Configurations (Minutes)

Runway Configuration	Weather	Average Total Delay Per Operation	Modeled Annual % In Flow	Average ADPM Delay
Straight North 	Good (VMV)	22.71	1.5%	8.26
	Marginal (MVMC)	23.01	0.7%	
	Poor (IMC)	23.55	1.3%	
North 	Good (VMC)	8.78	26.3%	
	Marginal (MVMC)	9.64	6.4%	
Mixed A 	Good (VMC)	7.10	9.7%	
	Marginal (MVMC)	8.04	1.7%	
	Poor (IMC)	8.08	0.4%	
South 	Good (VMC)	5.87	28.6%	
	Marginal (MVMC)	6.26	7.4%	
	Poor (IMC)	6.77	3.5%	
Straight South 	Good (VMC)	13.65	3.2%	
	Marginal (MVMC)	15.53	0.8%	
	Poor (IMC)	15.85	0.4%	

Relationship Between Average Delays and Peak Delays: ACRP Report 104 – *Defining and Measuring Aircraft Delay and Airport Capacity Thresholds (2014)*

Comparison of Airports with Frequent Low Visibility Conditions with Throughput Limitations



Industry Guidance On Level Of Service (ACRP 79 – 2012)

The following scale for levels of service was suggested by a DOT report to Congress:

- **4 to 6 minutes of Annual Average Delay (AAD) per operation**
 - Limited peak-hour Visual Flight Rules (VFR-Good Weather) delays
 - Moderate Instrument Flight Rules (IFR-Bad Weather) delays
- **6 to 8 minutes of AAD per operation**
 - High peak hour delays in VFR
 - Consistently high levels of delays throughout the day in IFR
- **8 to 10 minutes of AAD per operation**
 - Delays expand beyond peak hours in VFR
 - Unsustainable delays resulting in multiple cancellation in IFR
- **Over 10 minutes of AAD per operation**
 - Consistently high level of delays throughout the day in VFR
 - Extensive flight cancellations and delays reverberate through other airports in IFR

Maximum Delay Level Chosen For MSP Capacity

- Used Several Sources To Chose 10 Minutes of Average Daily Delay
 - FAA
 - US DOT
 - Airport Cooperative Research Program (ACRP) Studies
- Evaluated 10 Minutes Of Average Delay For The Average Day Of The Year (AAD) And The Average Day Of The Busiest Month (ADPM)

Summary of MSP Capacity

- 10 Minutes of Average Annual Delay Set as Acceptable Capacity Limit for MSP
- Modeling/Simulation Analysis Shows the Existing Airfield Would Be Able to Accommodate the Projected Operations Over The 20 Year Planning Horizon
- During Some of The Busiest Periods (Summer) Delays Will Approach The 10 Minutes Of Average Delay
- A New Runway Is Not Needed

Next Steps

- Long Term Plan will evaluate a number of options for increasing the airfield's efficiency:
 - Modifications to existing airfield geometry
 - Construct additional taxiways
 - Construct additional holding and parking aprons
 - *An additional runway is not being considered within this Long Term Plan*

Thank You!