Estimating Current and Future Benefits of Airport Surface Congestion Management Techniques*

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Outline

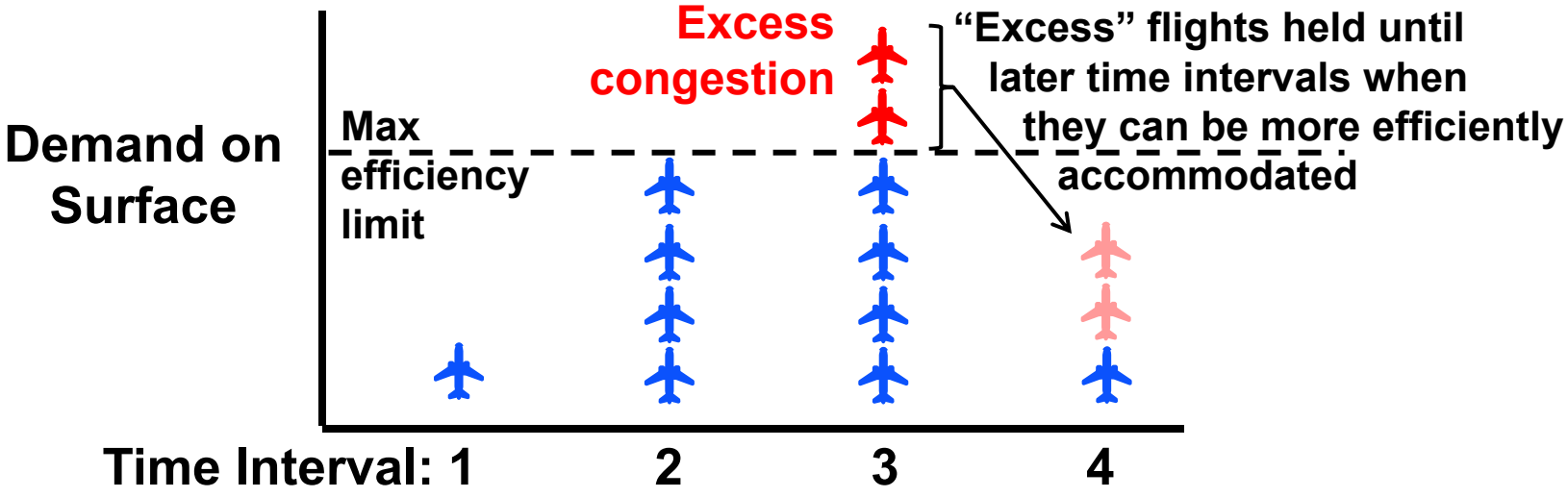
- Introduction to Surface Congestion Management
- Surface Congestion Management Benefits Assessment Methodology
- Current and Future Benefits Estimates at 8 key US airports
- Conclusions

Surface Congestion Management (SCM)

- Surface congestion => increased taxi times, fuel burn & emissions

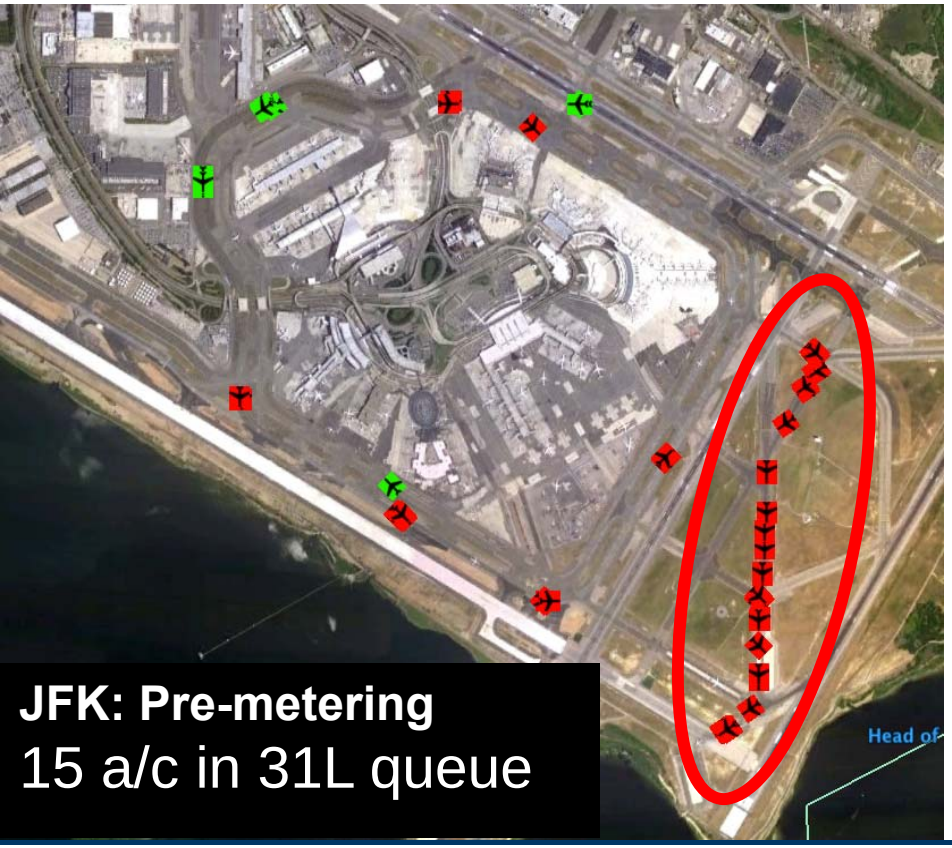
- Annually, at major airports in the United States (2010 ASPM)
  - Over 48 million mins taxi-out delay (over unimpeded times)
  - 194 million gallons excess taxi fuel => $388-582 million @ $2-3/gal

- Surface congestion management can help:

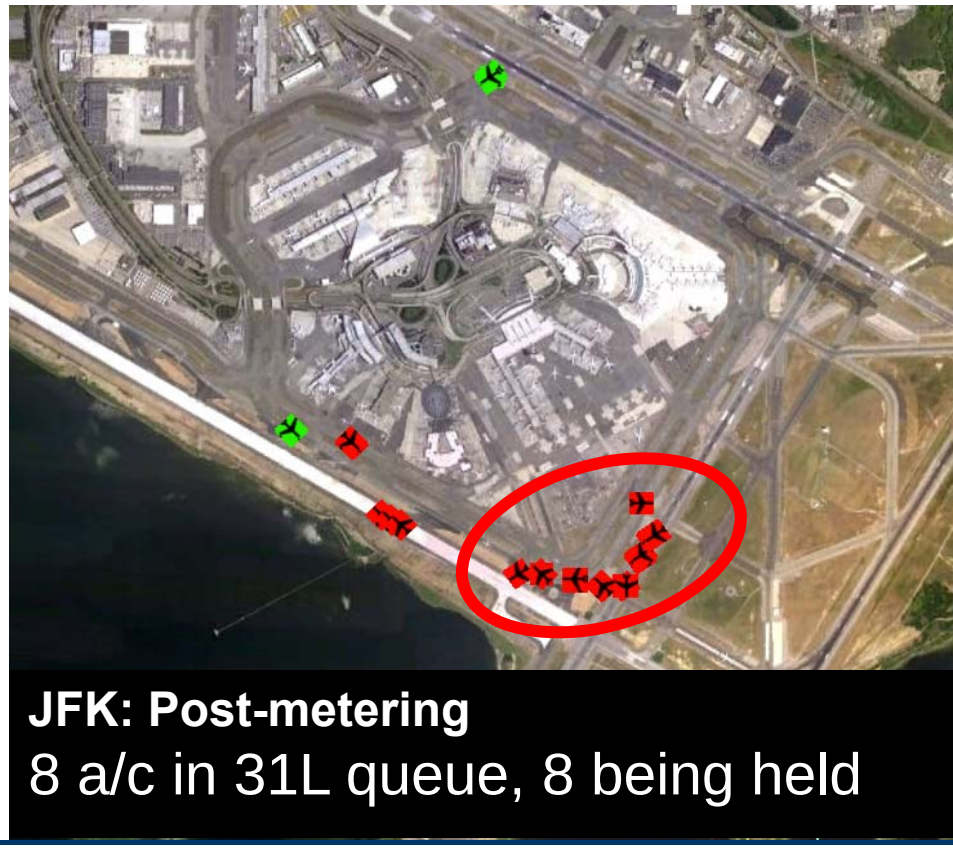


Surface Congestion Management (SCM)

- **At times of congestion, hold aircraft at gate or other designated location (with engines off) to reduce surface congestion & fuel burn while not adversely affecting throughput**
  - **Concepts demo-ed at BOS, JFK, MEM, MCO airports**



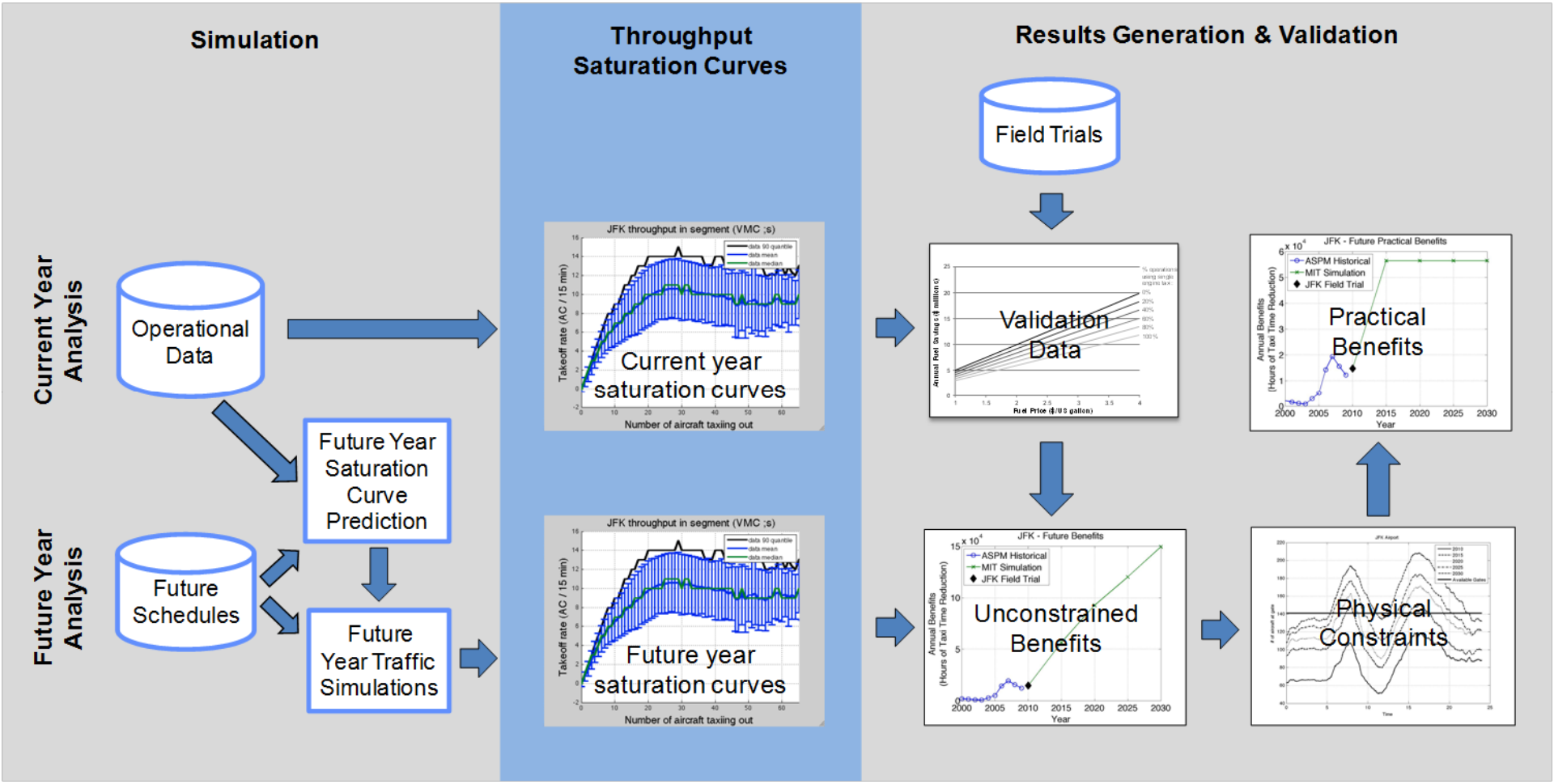
JFK: Pre-metering
15 a/c in 31L queue



JFK: Post-metering
8 a/c in 31L queue, 8 being held

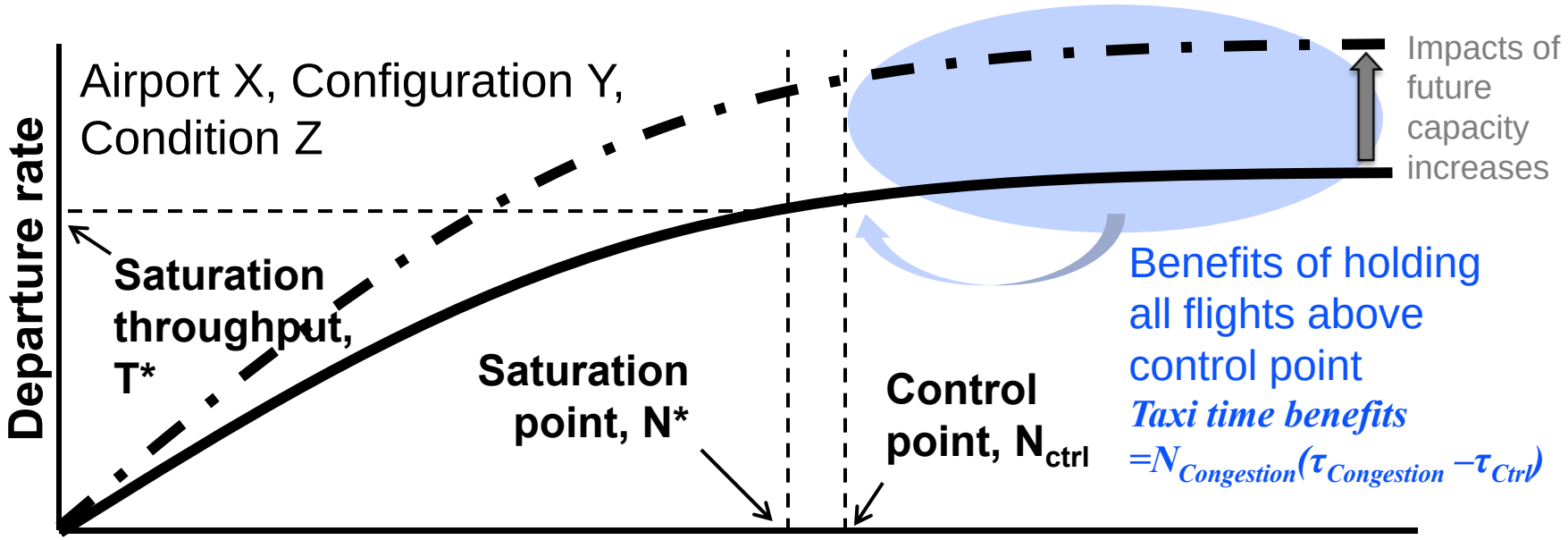
Benefits Assessment Needs & Methodology

- **Benefits assessment activities required to understand impacts of SCM at different airports and make case for deployment**



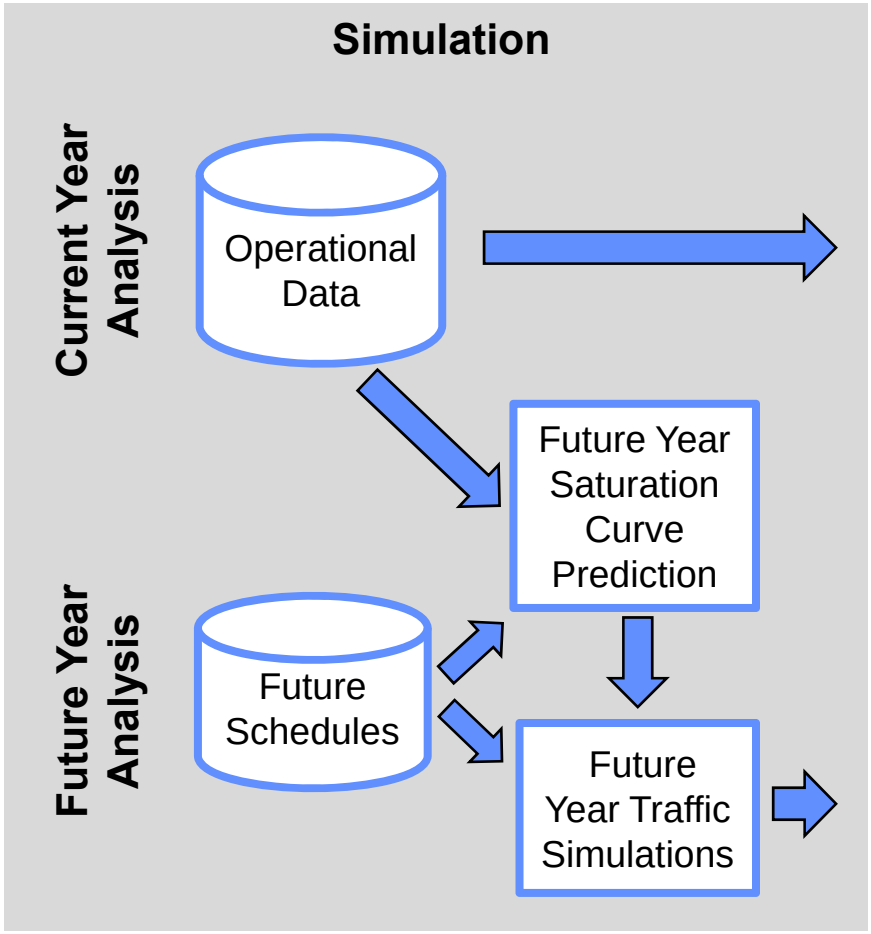
Throughput Saturation Curves

- **Throughput saturation curves at core of methodology**



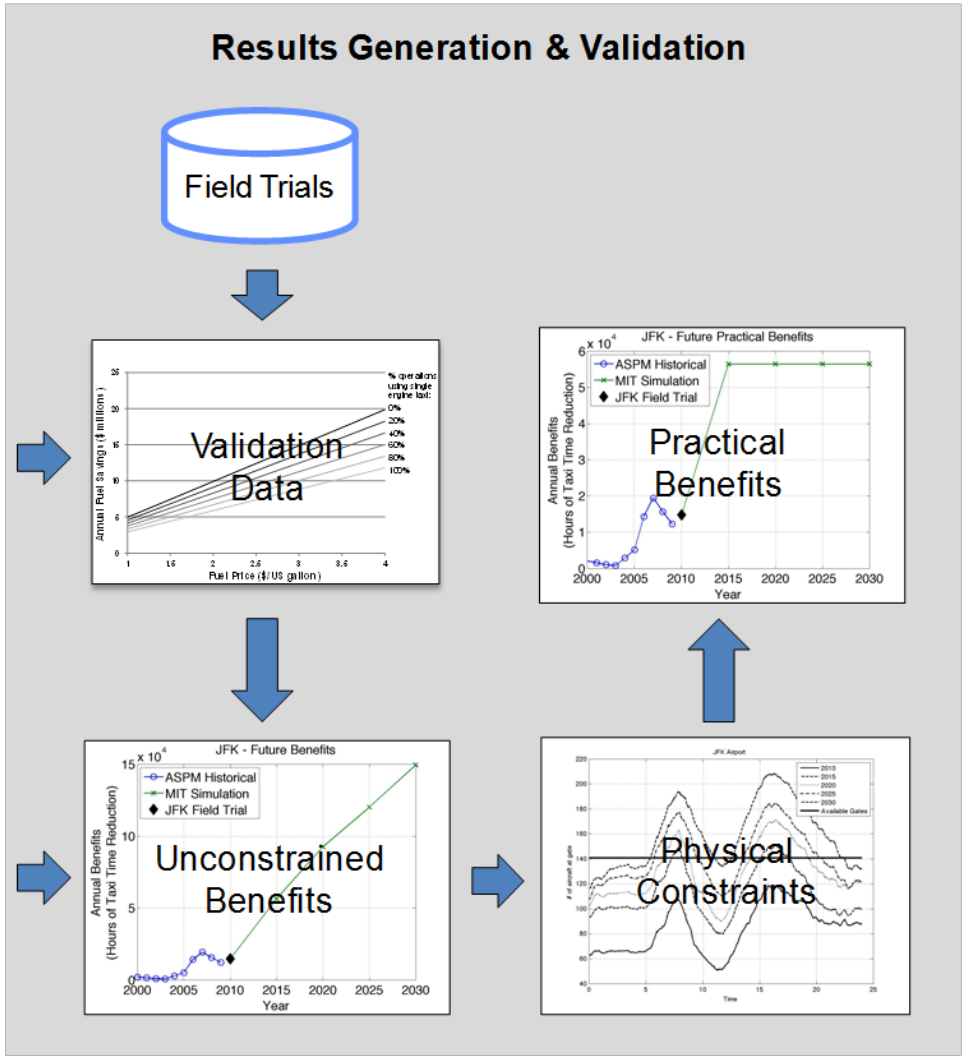
- **Current year: curves can be established from operational data**
- **Future years: curves estimated from demand/capacity forecasts**

Simulations



- **Inputs**
  - **Current year: ASPM OOOI, ASDE-X**
  - **Future year: FAA demand/capacity predictions 2015, 2020, 2025, 2030**
- **Future year saturation curves**
  - **Random Forest method**
  - **Forests "grown" on 2000-2010 data**
  - **Relationships between key input vars, N* & T* => future year N* & T***
- **Future year traffic simulations**
  - **Simple queuing model of taxi time as f(future yr demand, service time)**
  - **Operating point on future yr curve**

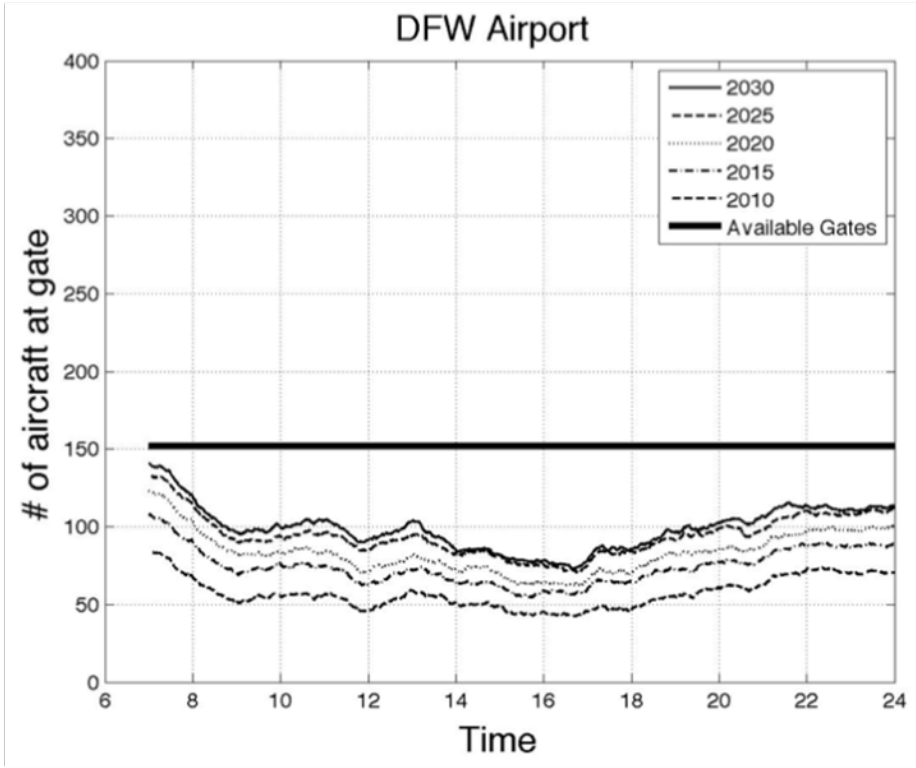
Results Generation/Validation

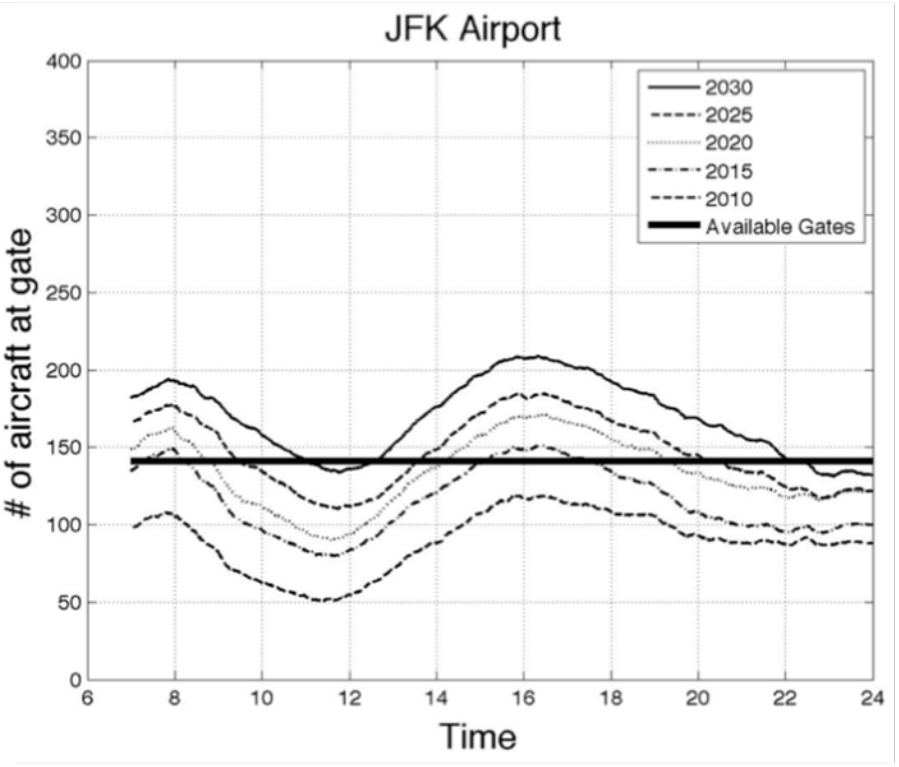


- **Current year validation**
  - **Simulated current year benefits estimates compared to field trial results where available**
    - **BOS, JFK**
- **Future year estimation**
  - **Operating point on curve => "unconstrained" benefits calculated at each future year**
  - **Limited gate/hold space physical constraints**
  - **Benefits in last year with sufficient gate/hold space => "practical benefits"**
  - **Taxi time & fuel burn benefit metrics**

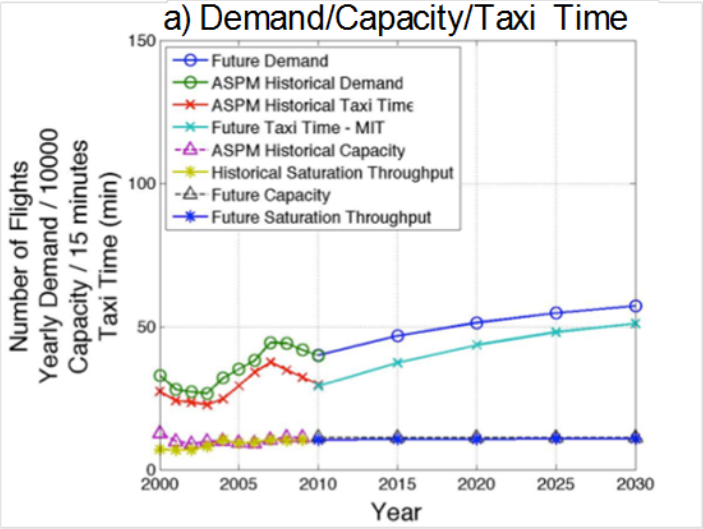
Gate/Hold Space Constraints

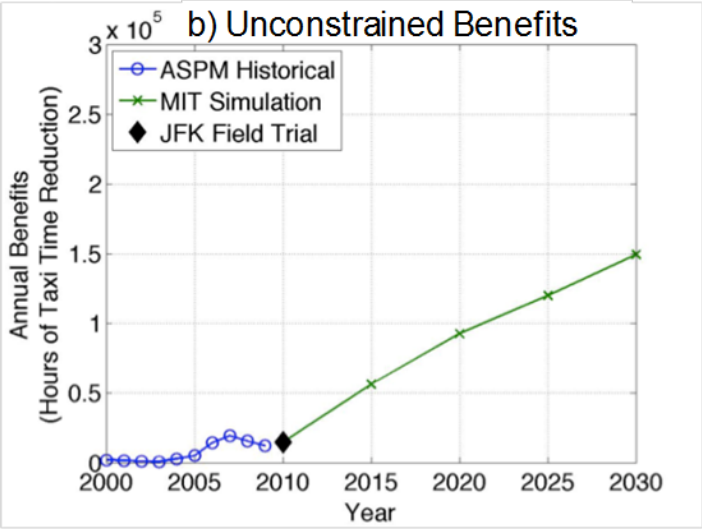
- **Gate utilization calculated for each airport & year & compared to number available**

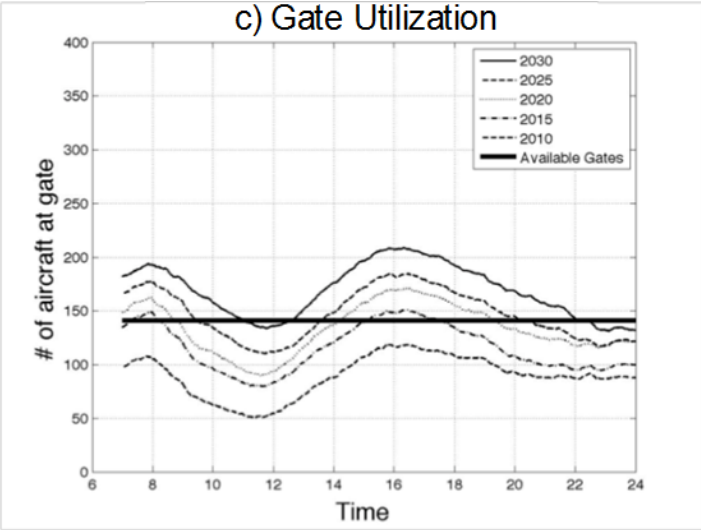


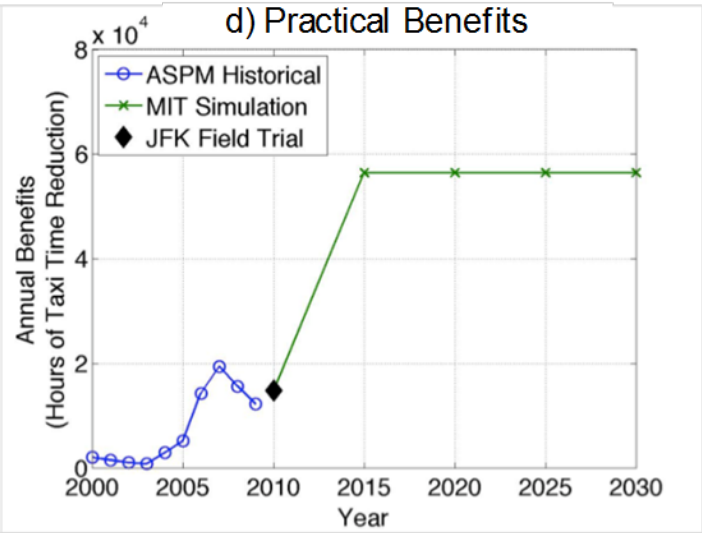


Results: JFK Airport



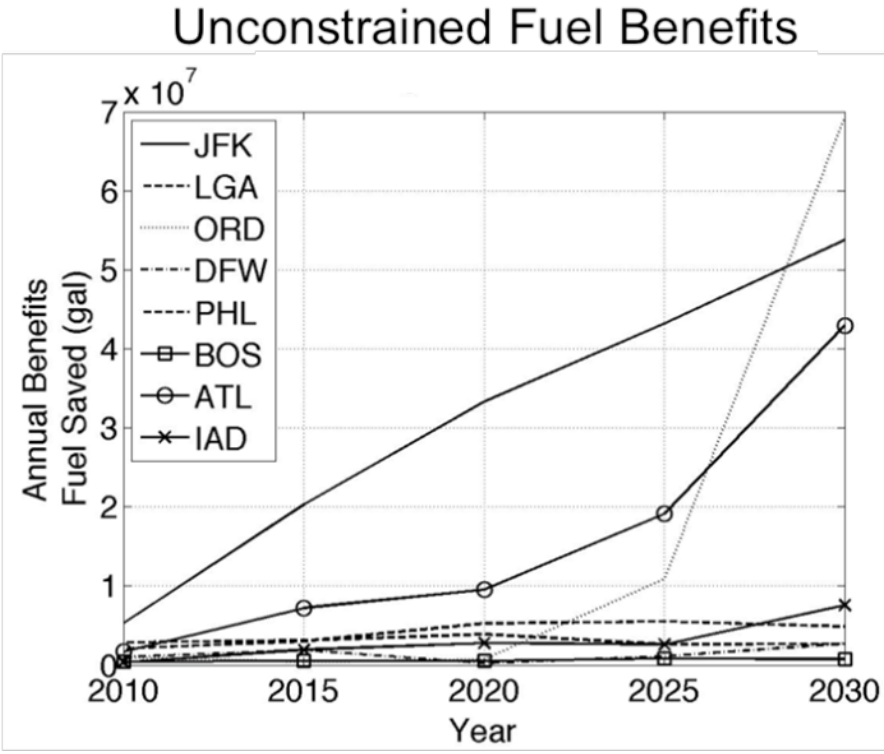


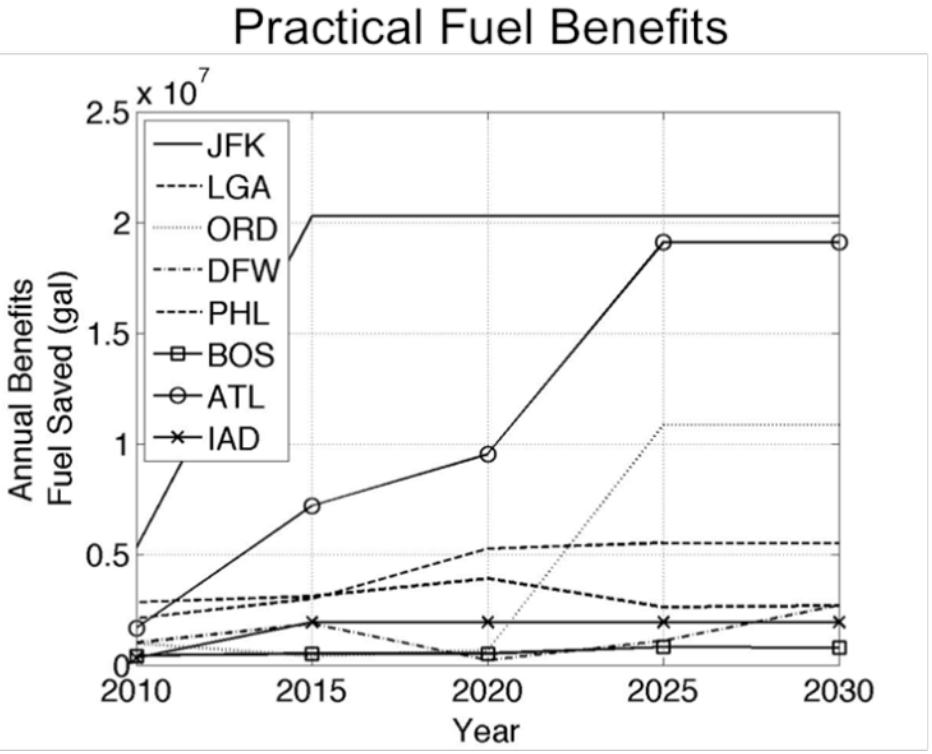




- **Unconstrained benefits rise over time as demand increases without added capacity**
- **Practical benefits capped at 2015 levels due to gate constraints**
- **Validation against field trial results**

Results: Aggregate Across Study Airports





- **Fuel burn benefits estimation using ICAO ground idle fuel flows**
- **Dominant airports: JFK, ATL, ORD**
- **Gate constraints limit benefits at different years**

Results: Aggregate Across Study Airports

Airport	Practical Benefits Aggregated 2010-2030				
	Thousand Hours Taxi Time Reduction	Fuel Saving Million Gallons	Fuel Cost ($2.43/gal)	Savings as % of taxi-out fuel cost	Savings as % of total fuel cost
ATL	965	242	$587m	21%	1.2%
BOS	59	13	$31m	4%	0.2%
DFW	105	27	$66m	4%	0.2%
IAD	177	36	$86m	11%	0.6%
JFK	1060	381	$926m	35%	1.9%
LGA	326	65	$157m	22%	1.2%
ORD	390	95	$231m	10%	0.5%
PHL	455	92	$223m	20%	1.1%
TOTALS	**3,537**	**949**	**$2.4bn**	**18% wt. av.**	**1.0% wt. av.**

- **Fuel cost of $2.43/gallon per FAA recommendation**
  - **Higher fuel costs => proportionately higher fuel cost savings**
- **% taxi-out and total fuel estimates based on actual fuel upload at each airport from 2010 BTS data and scaled to future traffic**

Conclusions

- **Surface congestion management is an effective solution for addressing surface inefficiencies**
- **Need for current & future year benefits assessment**
- **Methodology and simulations developed to develop benefits estimates at 8 key US airports**
- **Total practical benefits estimated to be over $2bn fuel saving (≈18% of taxi-out and 1% of total) at study airports over 20 yrs**
- **Related work:**
  - **Create system-wide benefits estimates**
  - **Explore practical SCM implementations at range of airports**