

Analysis of Thanksgiving Weekend 2007 Air Travel to New York Metropolitan Airports

SYST 460/560

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Summary

- The Set-up
 - Media attention leading up to Thanksgiving weekend
 - Little attention after, unclear on results
- How did System Perform?:
 - Wednesday (before) & Monday (after) exhibited delays *in excess* of the average delays on congested Summer days
 - Sunday (after) exhibited delays *less than* the average delays on congested Summer days
- Why difference in performance for similar situations?
 - Scheduled flights above/close too the airport capacity limit
 1. As demand approaches the capacity, outcomes become unpredictable performance
 - In this region, small disruptions can lead to large changes in performance
 2. Airport capacity varies significantly (e.g. weather)
 - A feasible schedule on one day, may no longer be feasible on another
 3. Flight demand varies due to policy of equal access
- Solutions:
 - Need to achieve predictability and avoid excessive delays need to:
 - Synchronize scheduling and operating the system in the linear, controllable, predictable region
 - Scheduling needs to account for/adapt to changes in capacity
 - Evaluate equal/free access policy
 - New technologies and airspace mods can create additional capacity, but not the root problem

Outline

- 1. The Set-up?**
- 2. How did the system perform?**
- 3. Why Different Performance?**
- 4. Relationship between Scheduled Flights and Available Arrival Capacity?**
- 5. Scheduled Flights do not equal Operated Flights**
- 6. Relationship between Operated Flights and Available Arrival Capacity**
- 7. Relationship between Delays and Demand/Capacity**
- 8. Causes of Delays**
- 9. Conclusions & Solutions**

1. The Set-up?

npr [Hourly News Summary](#) [24-hour Program Stream](#) [Schedule](#) Search NPR.on

Delays Due to Clog Thanksgiving Air Travel

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Morning Edition, November 21, 2007 · The day before the Thanksgiving holiday is a **1** the busiest travel days of the year in the U.S. According to the FAA, some 39 million Americans due to travel at least 50 miles. Many will be in crowded airports where flights are bound to be either delayed or cancelled.

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Los Angeles Times

Bush seeks to head off air travel chaos

On the eve of a crowded holiday travel season, the president says he'll open up airspace for use as 'express lanes' for commercial traffic.

By Maura Reynolds and Peter Pae, Los Angeles Times Staff Writers
November 16, 2007

WASHINGTON -- To try to ease **2** called an "epidemic of aviation chaos," President Bush on Thursday announced a series of new measures -- including a temporary Thanksgiving "express lane" for commercial airplanes in military airspace -- to head off what many feared could be the worst holiday travel season ever.

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Mild Weather Guides Holiday Air Traffic to Smooth Landing

By Kendra Marr
Washington Post Staff Writer
Tuesday, November 27, 2007; Page D01

3-a

Despite doom-and-gloom forecasts, most Thanksgiving air travelers zipped through security lines onto punctual flights.

Over the 12 days...

The New York Times

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Air Traffic Delays Up Over Last Thanksgiving

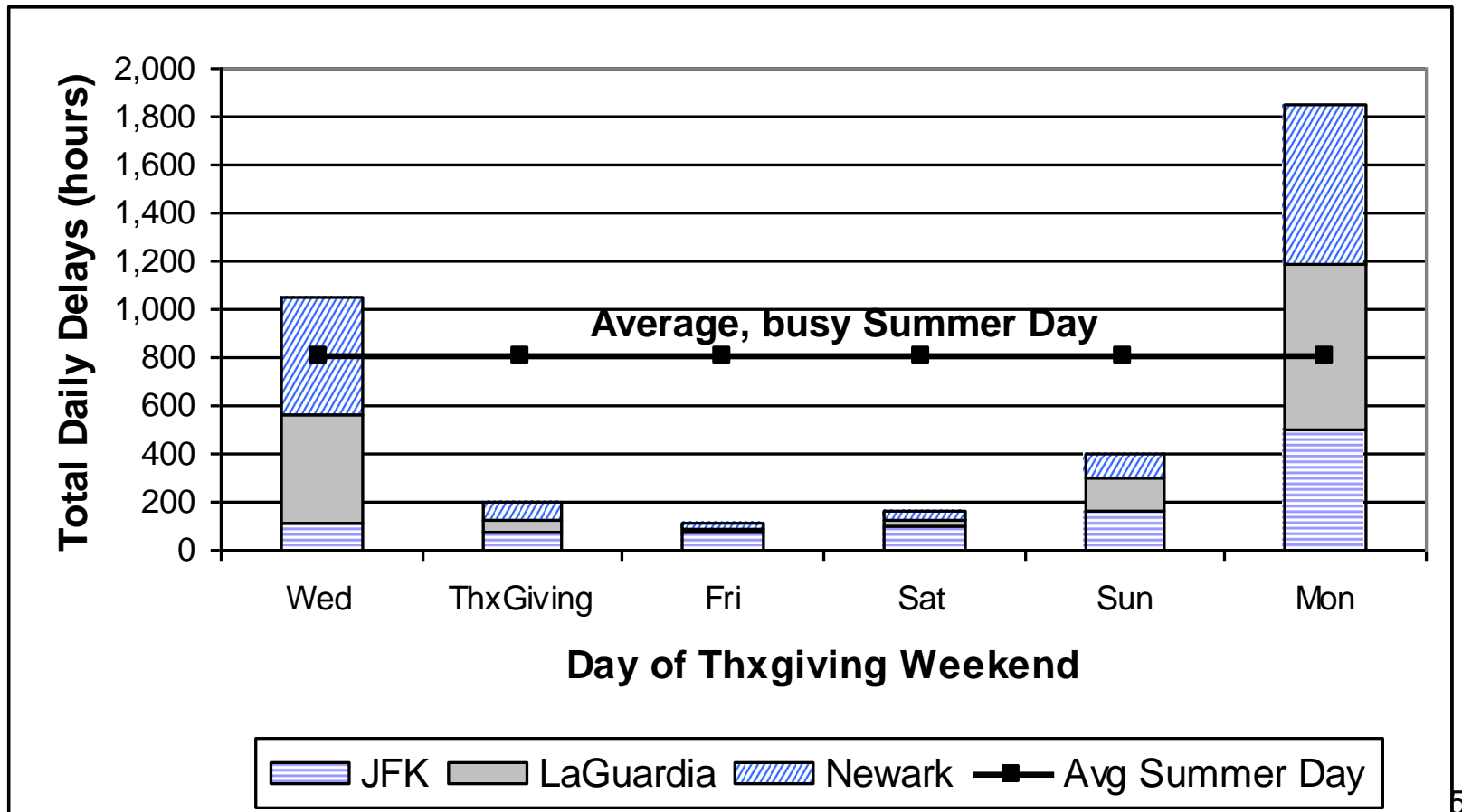
By MATTHEW L. WALD
Published: November 27, 2007

3-b

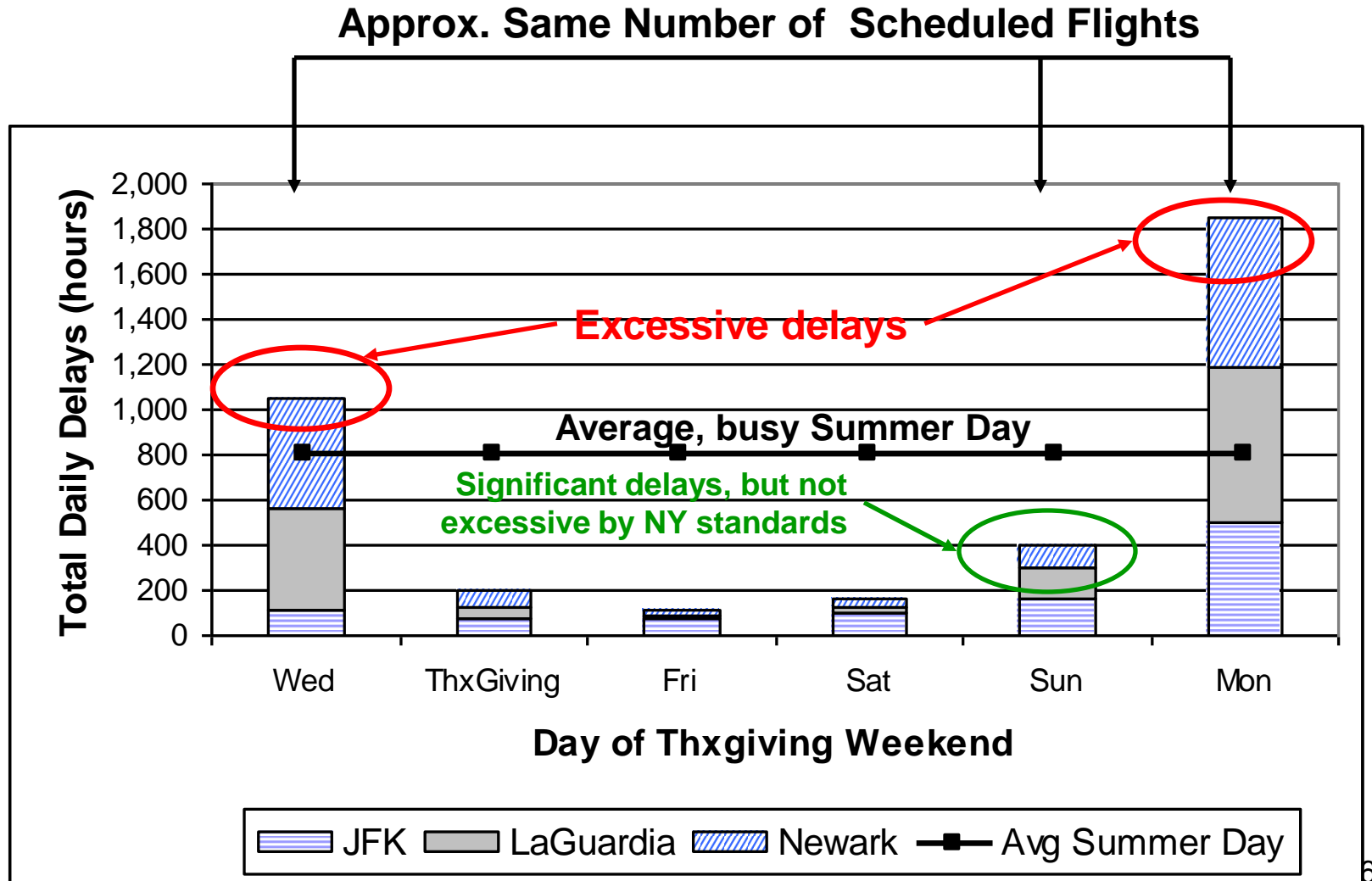
Air traffic delays were worse on the two main travel days of this Thanksgiving holiday period compared with a year ago, according to preliminary Federal Aviation Administration statistics. Delays on the

2. How did the System Perform?

Arrivals into New York Airports (JFK, LaGuardia, Newark)



2. "A Tale of Two Cities"

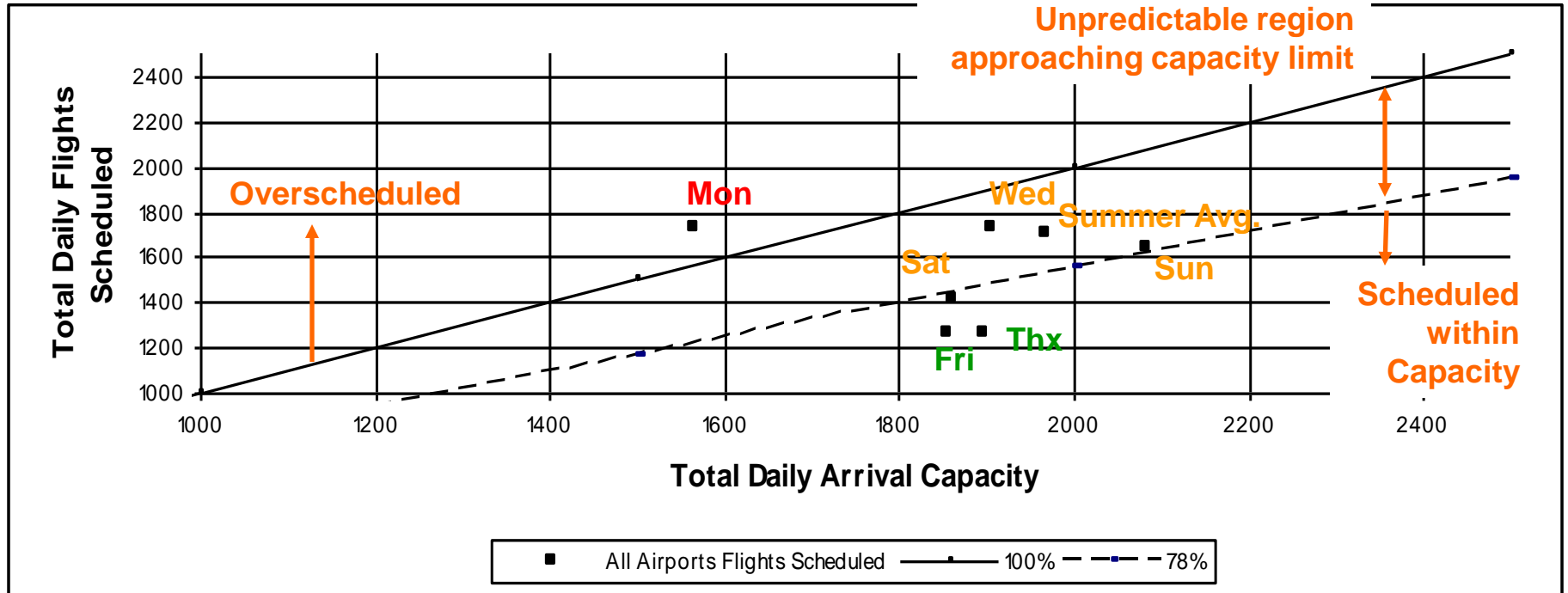


3. Why Performance Different?

- Not poor judgment and incompetence
 - Too isolated to explain large system impact
 - Dedicated and had working airline and ATC personnel run an exceptionally safe and efficient operation (under difficult circumstances)
- Scientific explanation – the system, intentionally scheduled at it's capacity, is running on the edge chaos
 - small changes in similar situations will yield significantly different outcomes

4. What is Relationship between Scheduled Flights and Available Arrival Capacity ?

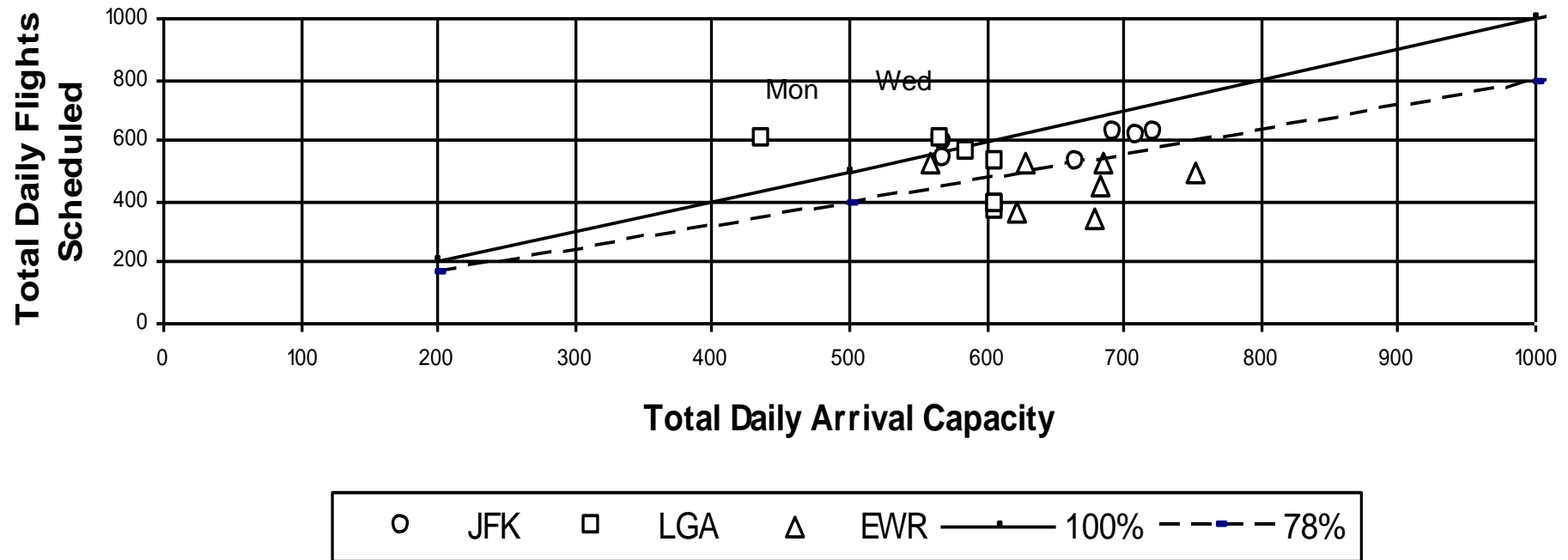
New York Airports = JFK + LaGuardia + Newark



4. What is Relationship between Scheduled Flights and Available Arrival Capacity ?

Individual Airports:

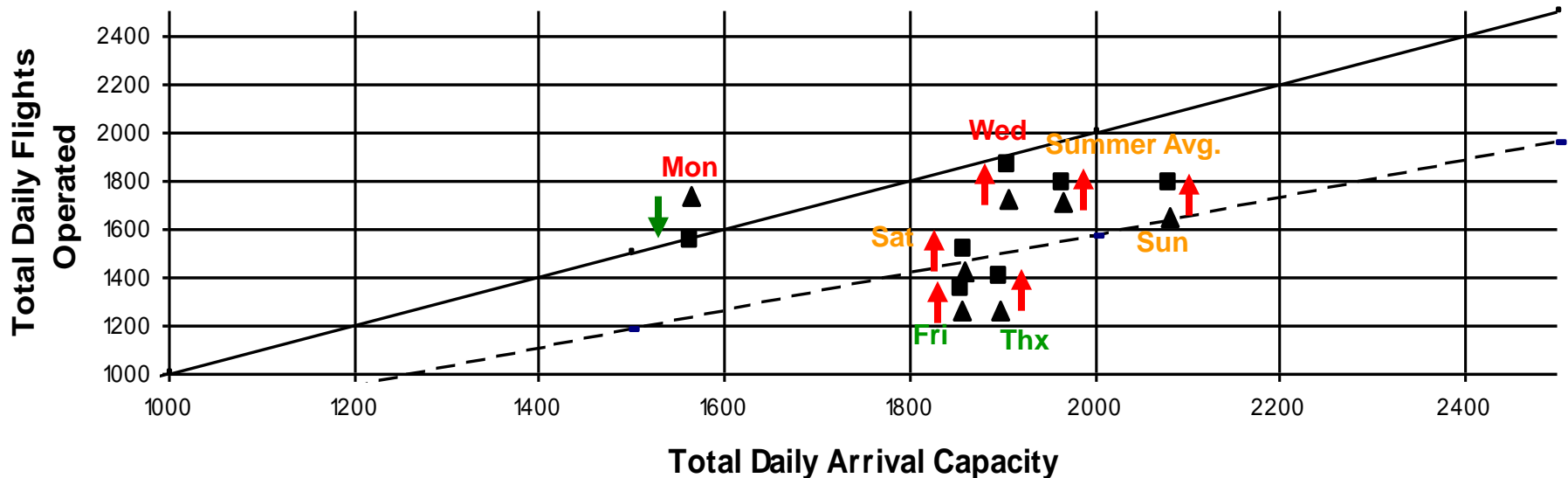
- JFK – scheduled in unpredictable region
- LaGuardia - overscheduled
- Newark – scheduled at predictable threshold



5. But Scheduled Flights do not equal Operated Flights?

Sanity prevails?

- Scheduled flights above capacity are **reduced** by cancellations
 - Passengers penalized by cancelled flights
- Scheduled flights *below* capacity are **increased** by unscheduled business jets and General Aviation
 - Equal access to all allows unscheduled flights

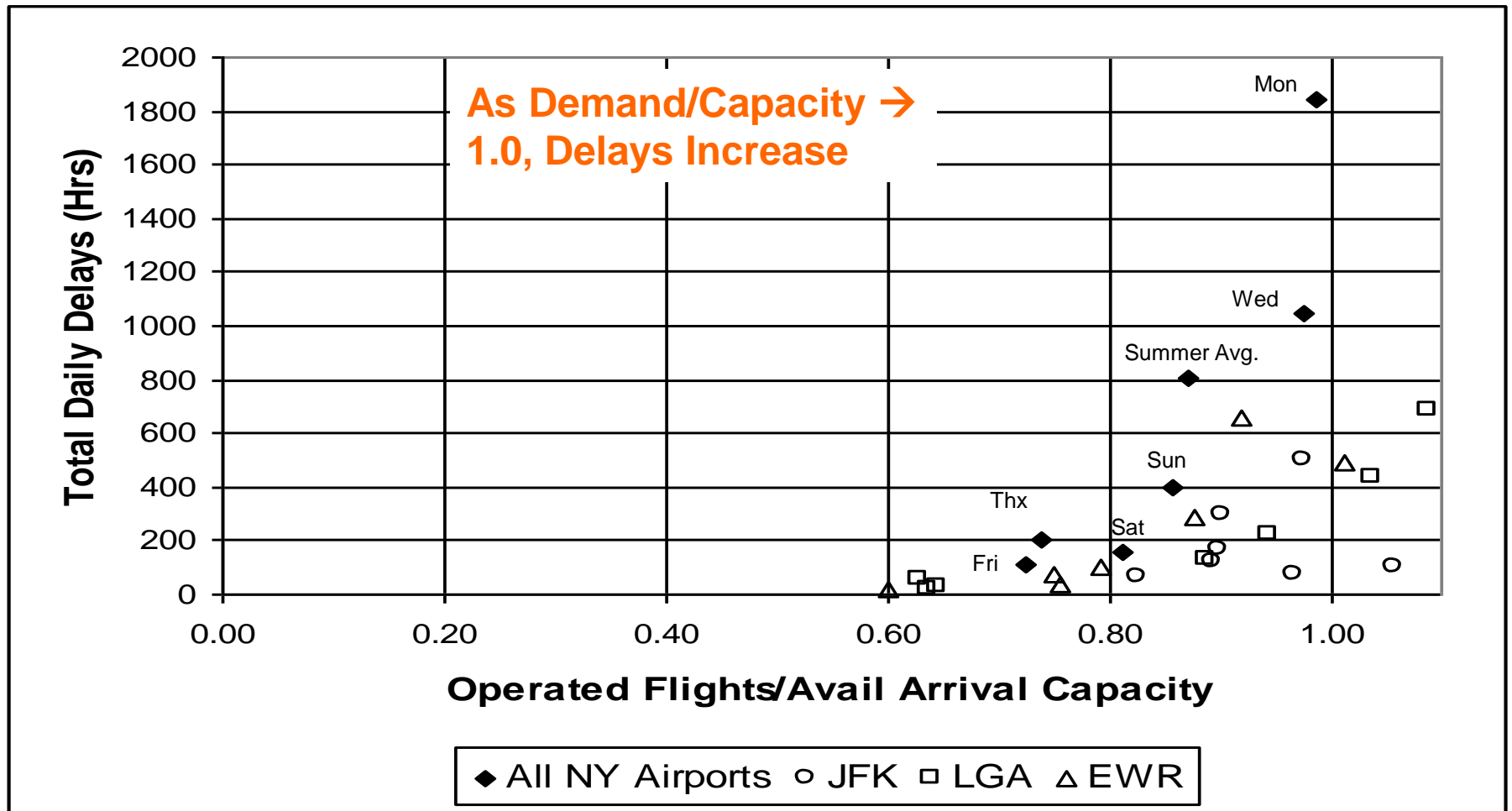


■ Flights Operated — 100% - - 78% ▲ Flights Scheduled

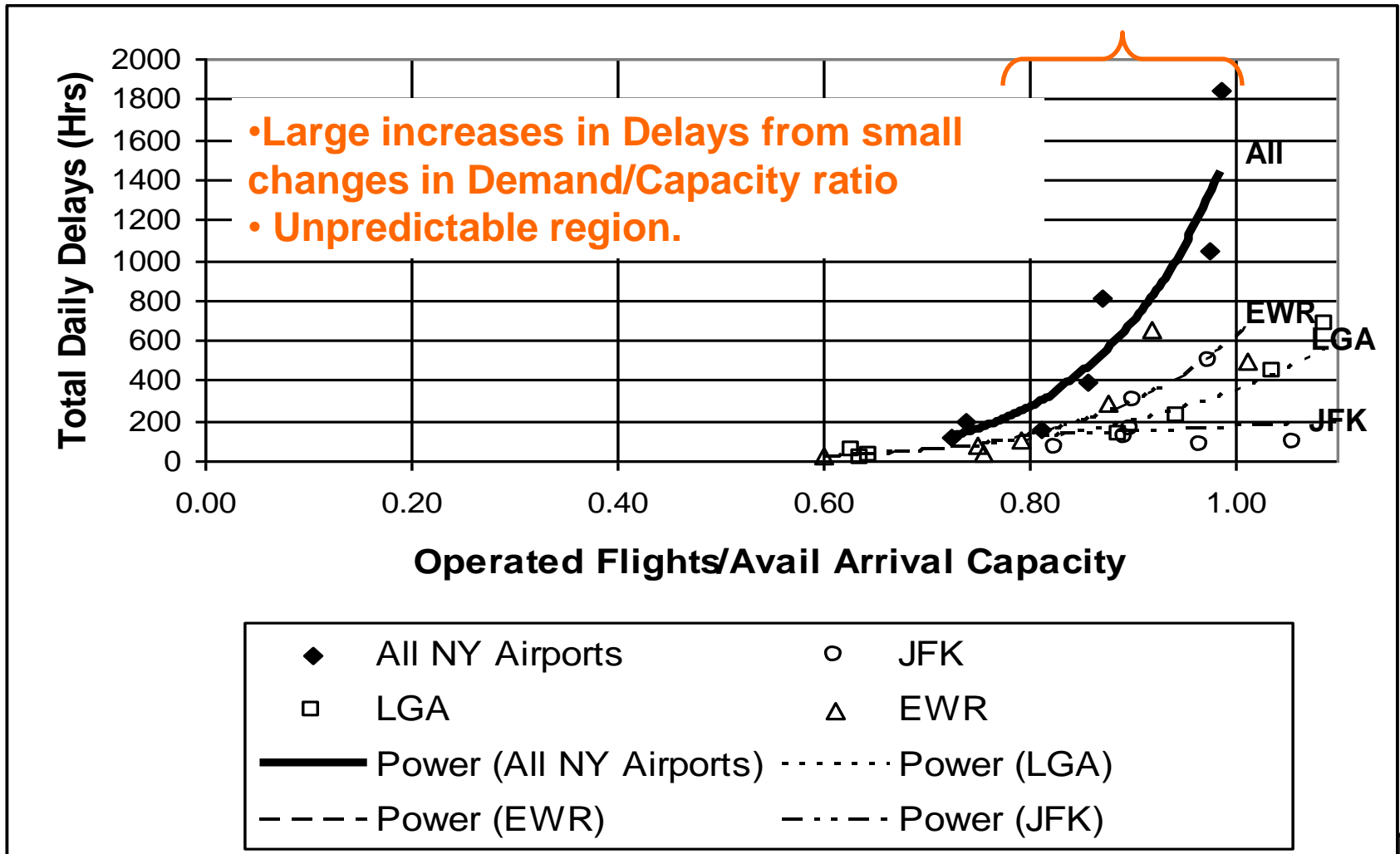
5. Operated Flights/Available Arrival Capacity

Day of Week	Airports			
	All NY	Newark	JFK	LGA
Wed	0.98	1	0.89	1.04
Thxgiv	0.74	0.75	0.83	0.63
Friday	0.74	0.6	0.97	0.64
Sat	0.83	0.8	1.06	0.64
Sun	0.86	0.8	0.9	0.89
Mon	1.00	0.92	0.98	1.1

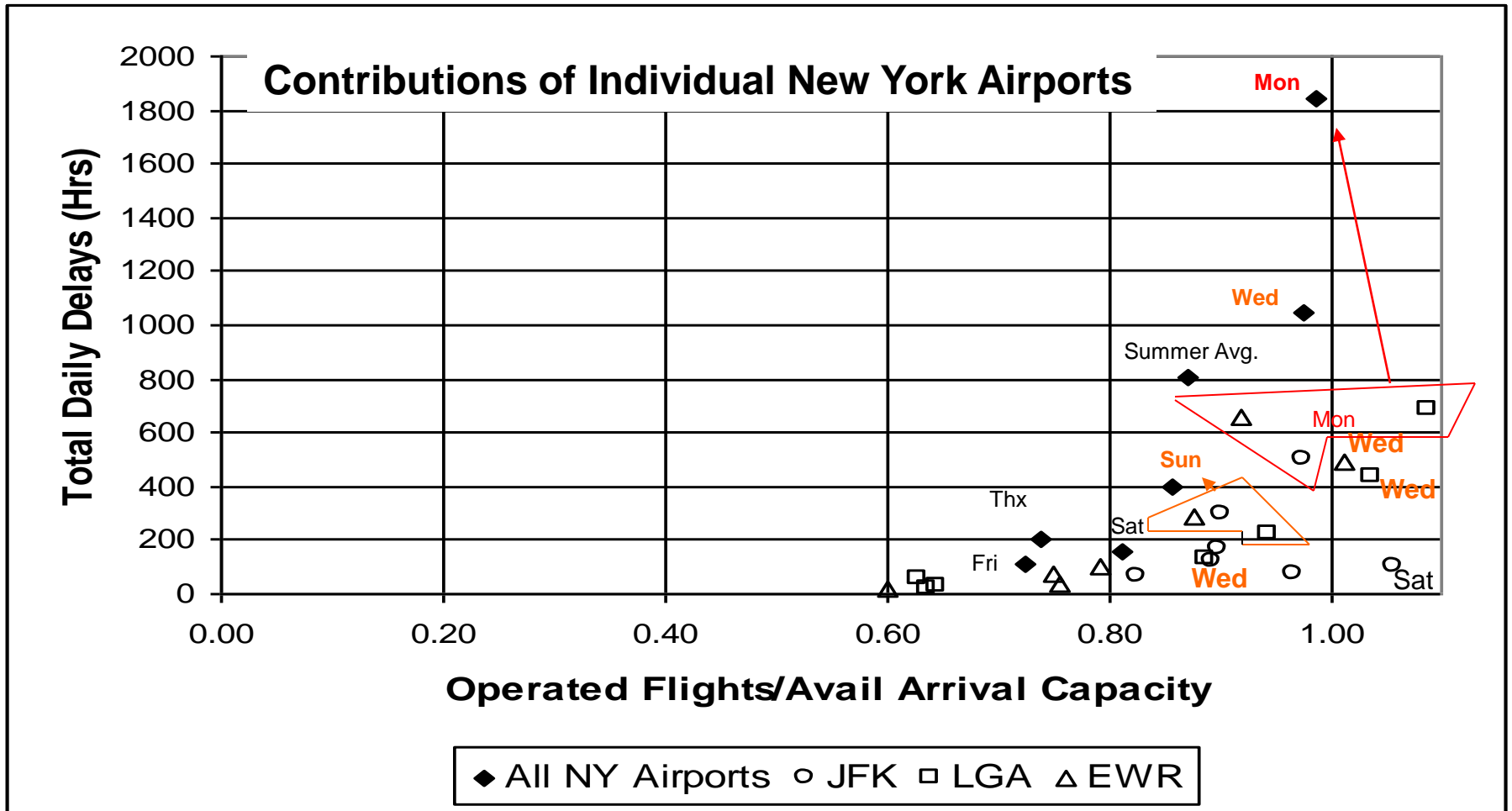
6. Relationship Demand/Capacity and Delays



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6. Relationship Demand/Capacity and Delays



7. Causes of Delays

- It's not “rocket science”
 - Delays occur when Demand greater than 78% of Arrival Capacity
 - Excessive delays occur when Demand > 100% of Arrival Capacity
1. Scheduled flights greater than “standard” capacity
 2. Unscheduled flights (“pop-ups) increase demand to capacity limit
 3. Capacity is reduced significantly (by weather)

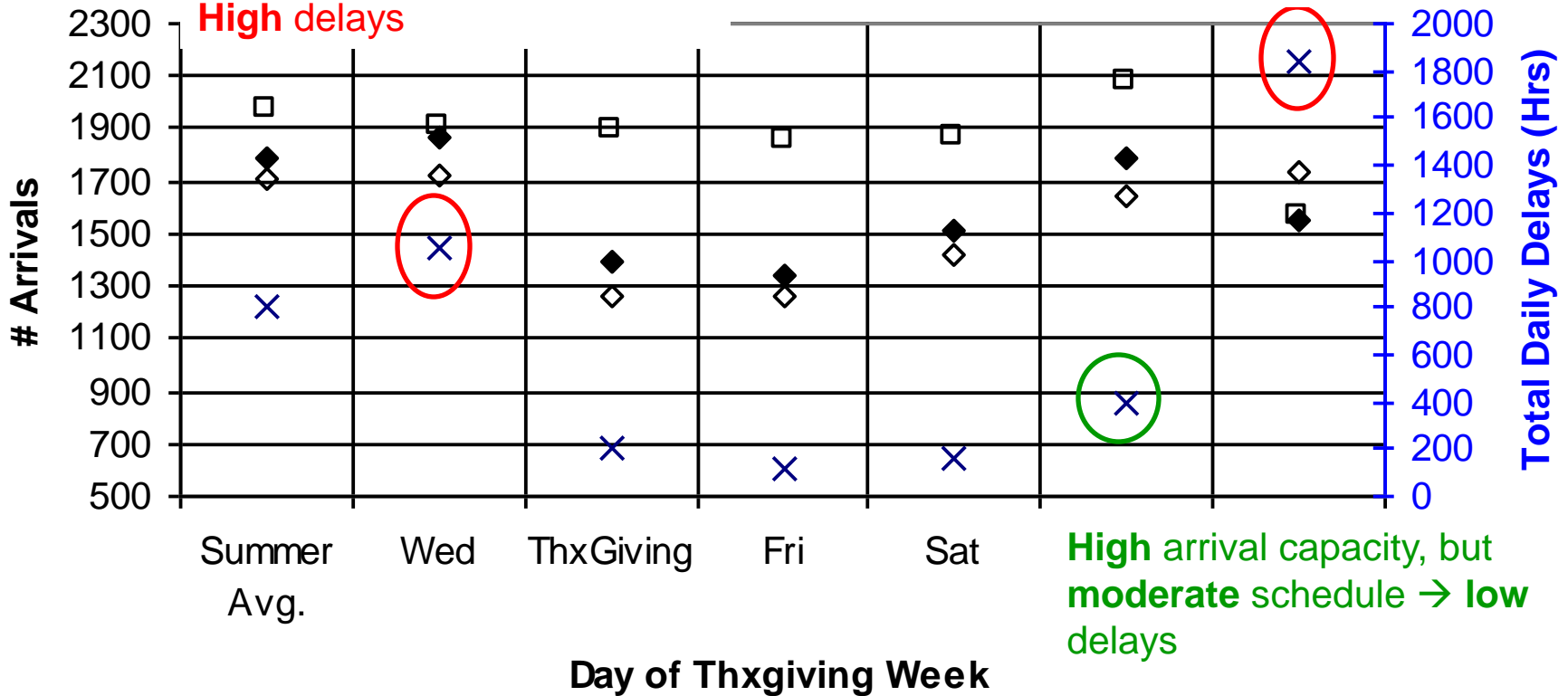
7. Causes of Delays

	Wed	Thx	Fri	Sat	Sun	Mon
Demand	High scheduled arrivals + High Pop-ups	Low scheduled arrivals + Low Pop-ups	Low scheduled arrivals + Low Pop-ups	Low scheduled arrivals + Low Pop-ups	High scheduled arrivals + High Pop-ups	High scheduled arrivals – Cancelled Flights + Low Pop-ups
Capacity	High = Approx. Average Summer Day	High = Approx. Average Summer Day	High = Approx. Average Summer Day	High = Approx. Average Summer Day	Super High = Greater than Average Summer Day	Low = 20% Lower than Average Summer Day
Demand/ Capacity Ratio	0.98	0.74	0.74	0.83	0.86	1.0
Delays	High	Low	Low	Low	Low	Very High

7. Causes

Low arrival capacity, but high schedule – cancellations → Very High delays

High arrival capacity, but high schedule + pop-ups → High delays

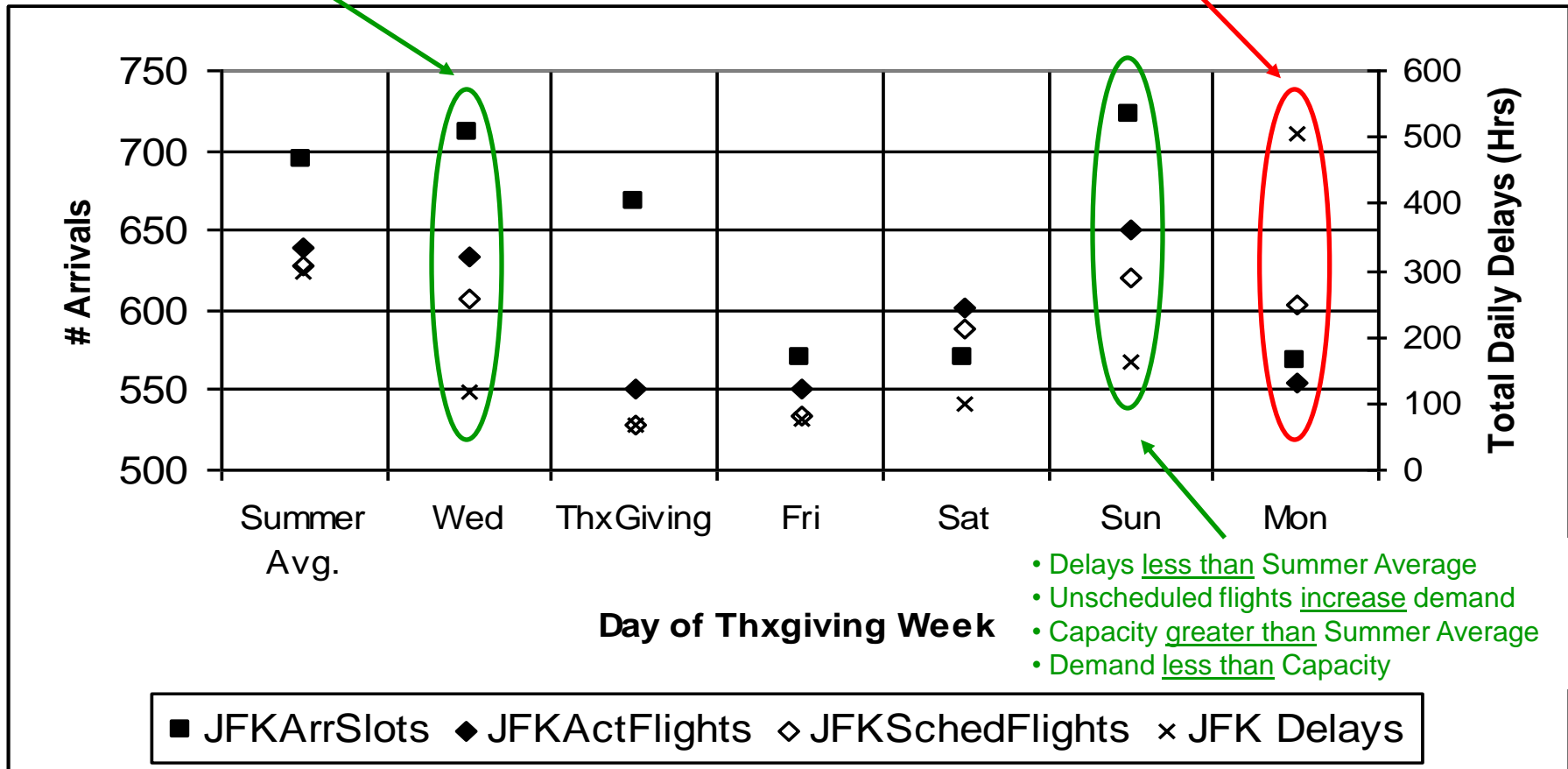


□ All NY ArrSlots ◆ All NY ActFlights ◇ All NY SchedFlights × All NY Delays

7. Causes (JFK)

- Delays less than Summer Average
- Unscheduled flights increase demand
- Capacity greater than Summer Average
- Demand less than Capacity

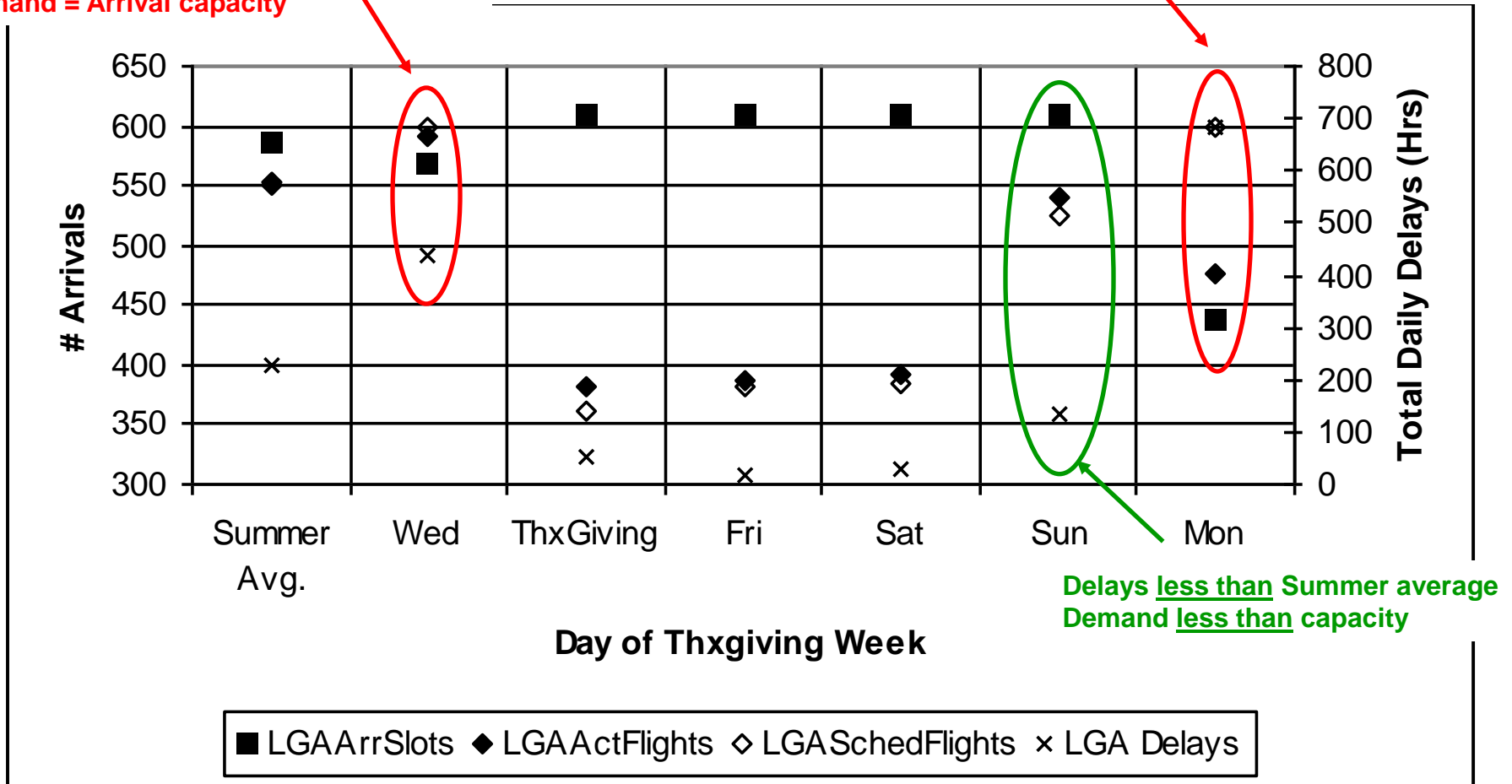
- Delays in excess of Summer average
- GDP institutes large scale delays to manage large demand greater than capacity
- Large scale cancellations reduce demand
- Demand still greater than Arrival capacity



7. Causes LGA

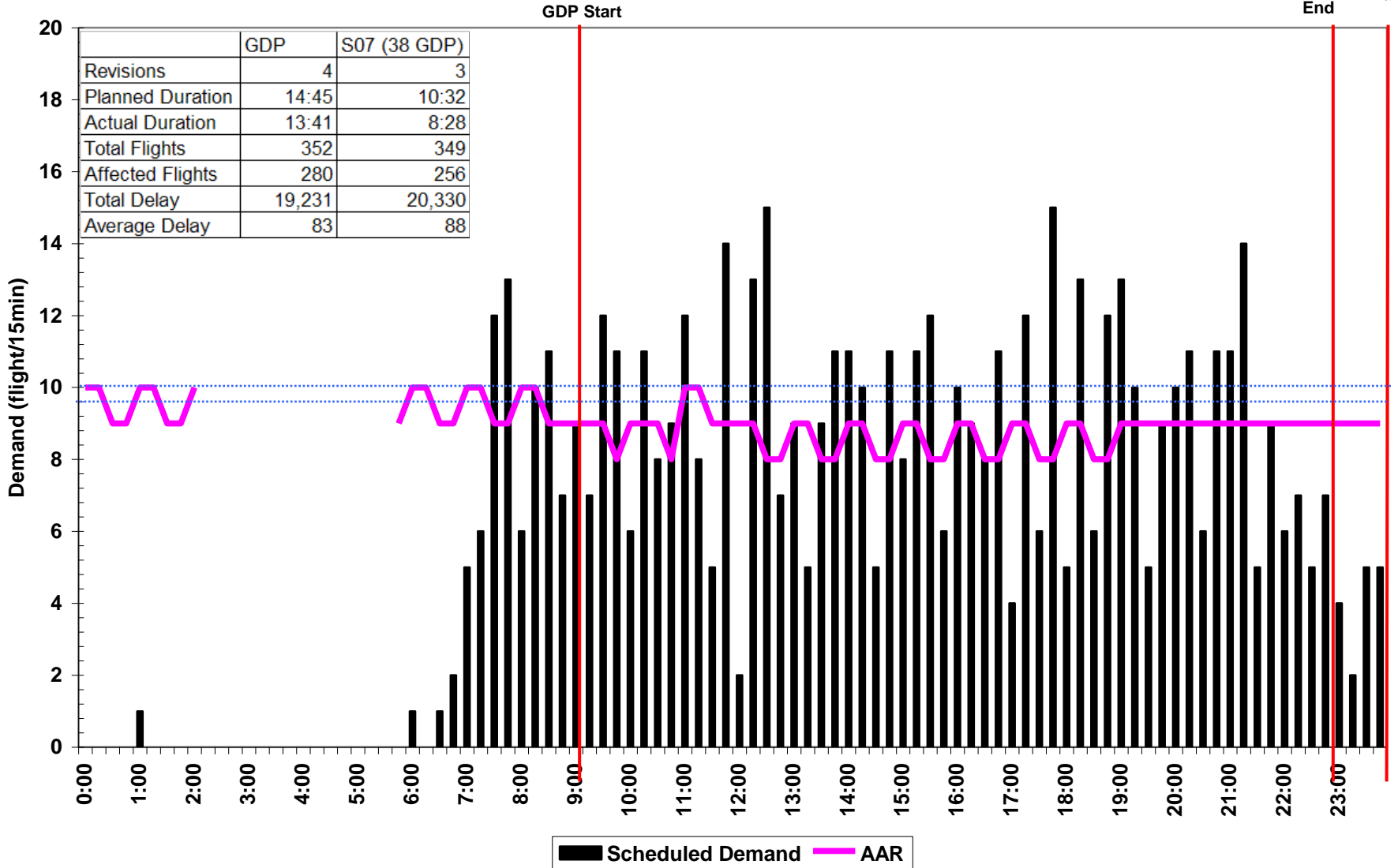
- Delays in excess of Summer average
- GDP limits arrival flow to manage demand greater than capacity
- Limited cancellations reduce demand
- Demand = Arrival capacity

- Delays in excess of Summer average
- GDP institutes large scale delays to manage large demand greater than capacity
- Large scale cancellations reduce demand
- Demand still greater than Arrival capacity

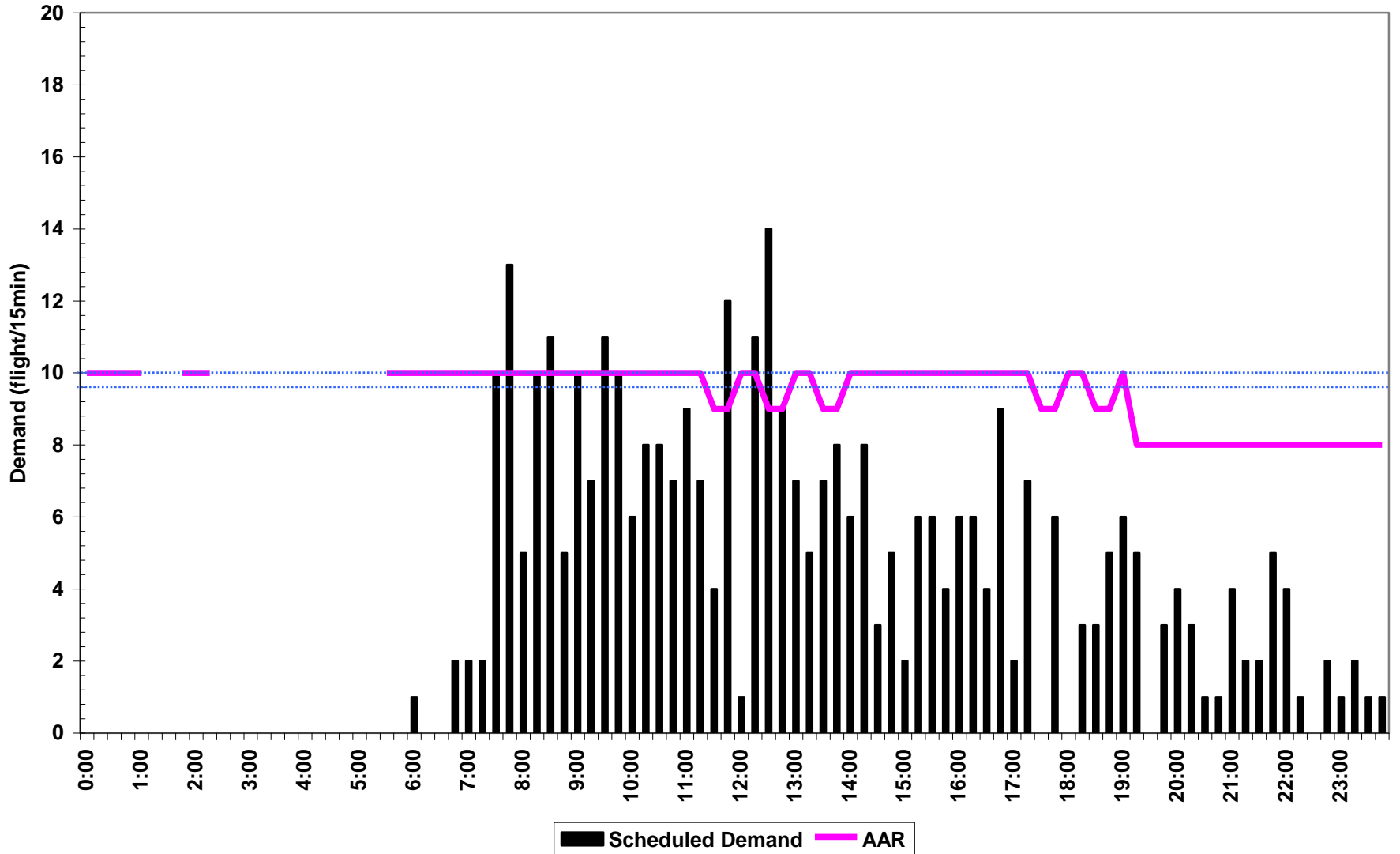


LGA-Thanksgiving-Wednesday (11/21/2007)

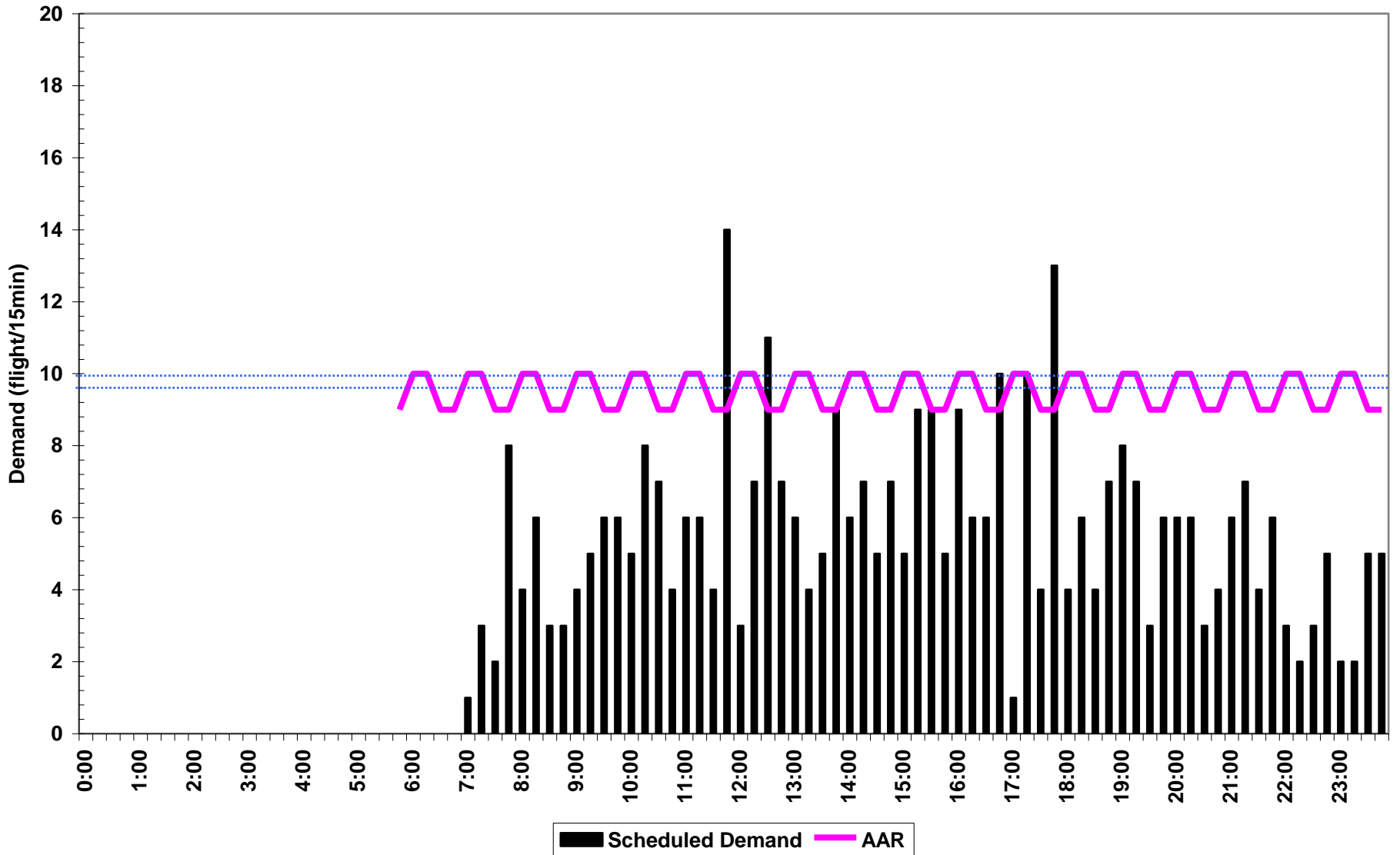
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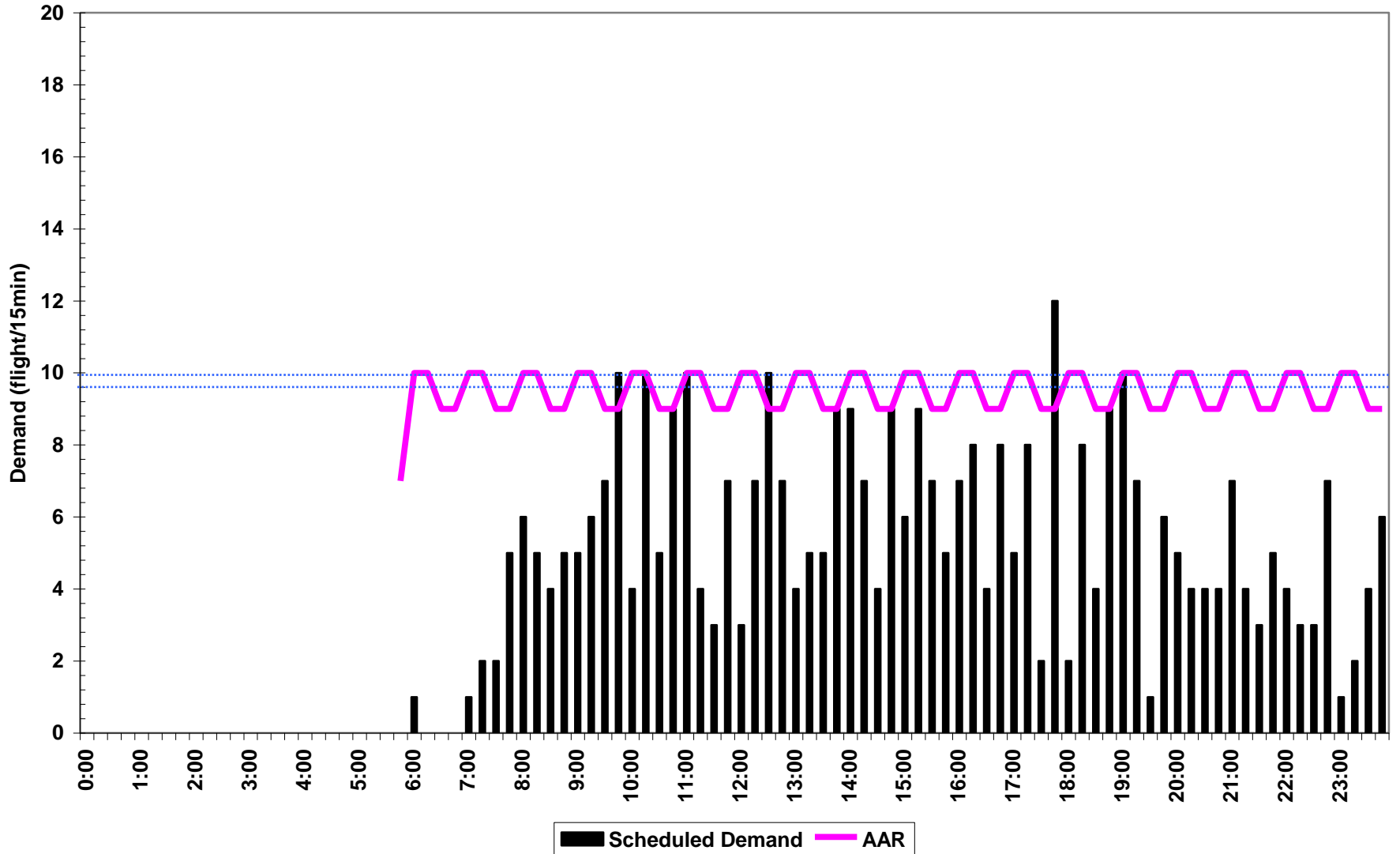
LGA-Thanksgiving-Thursday (11/22/2007)



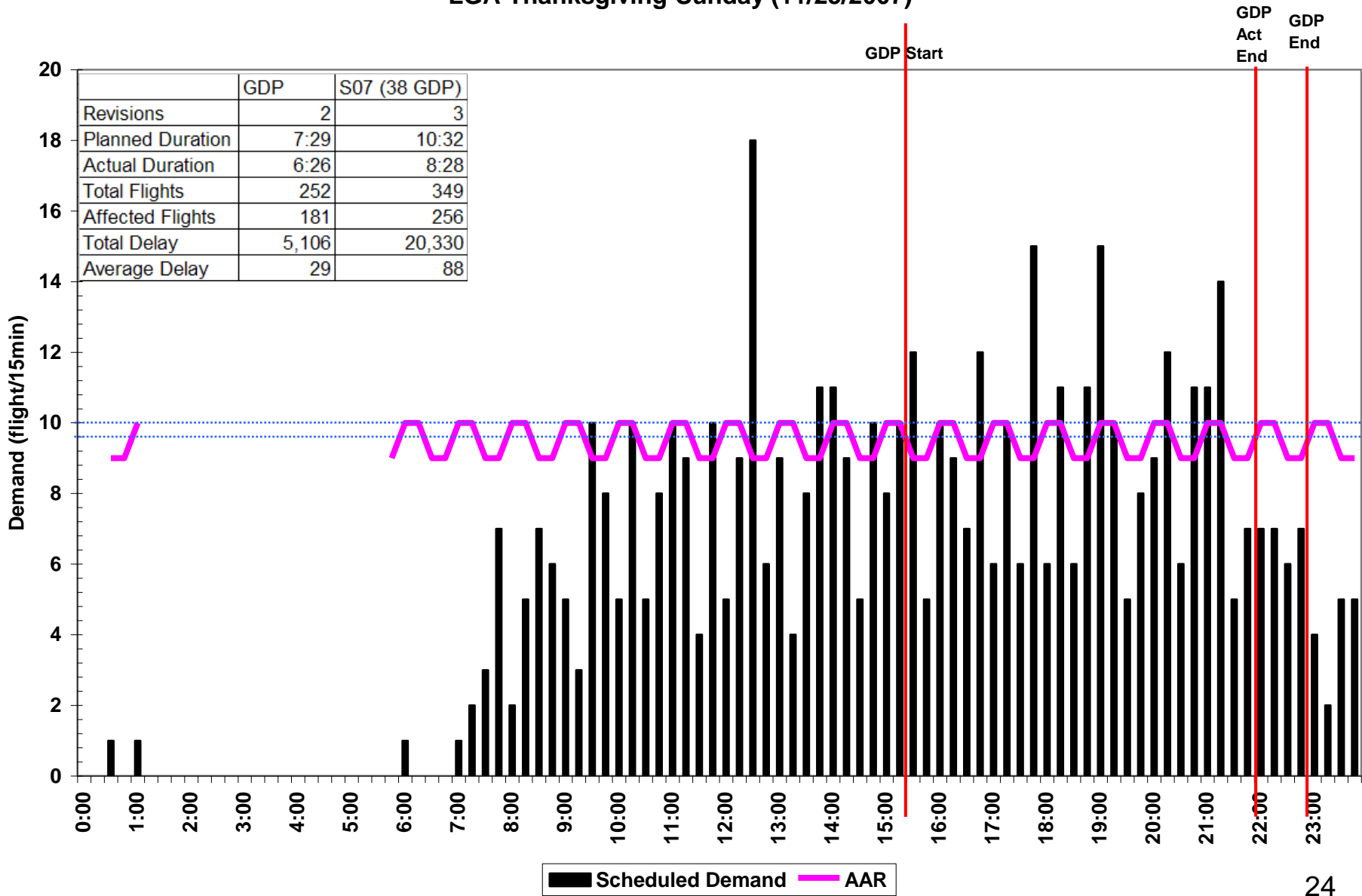
LGA-Thanksgiving-Friday (11/23/2007)



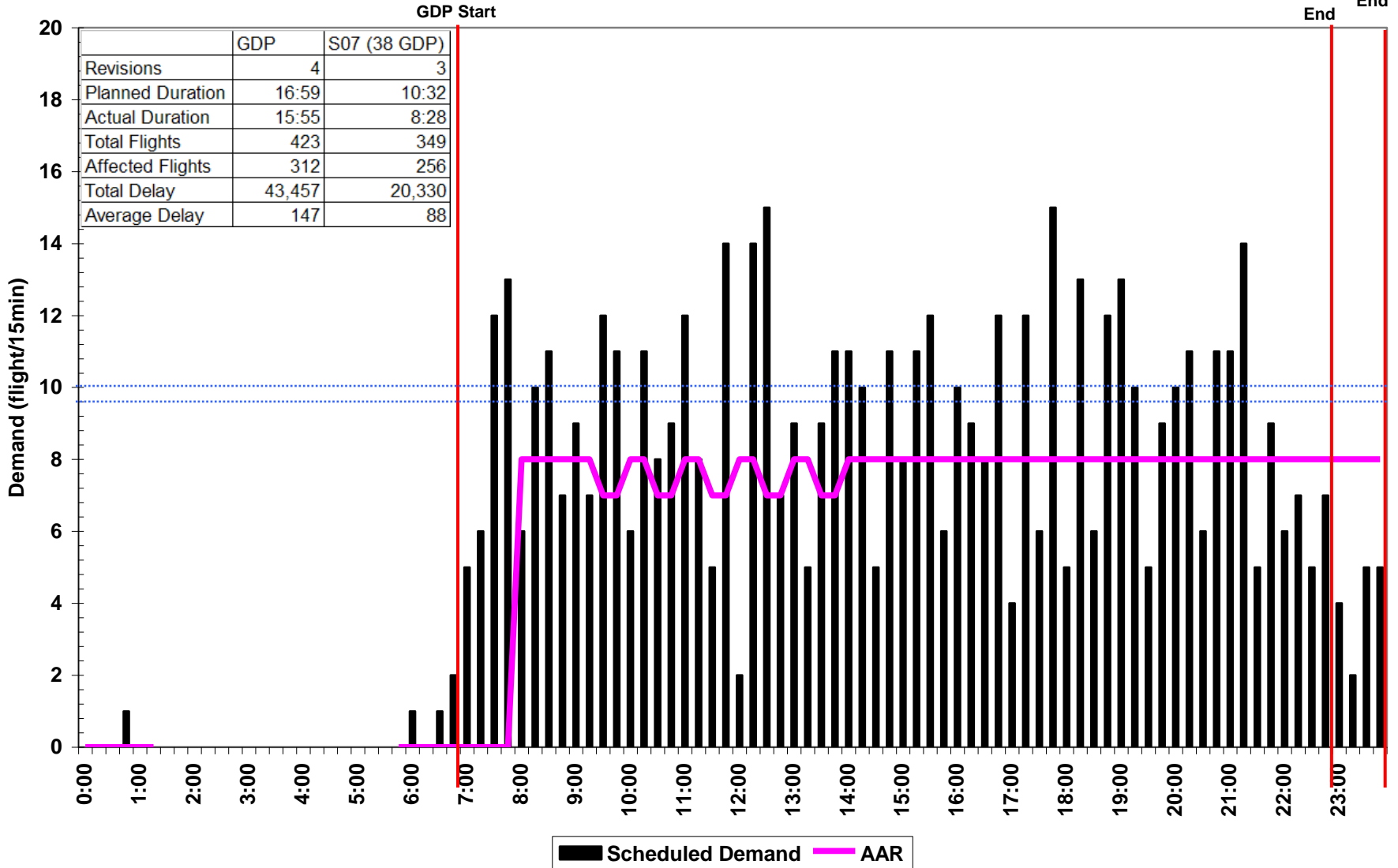
LGA-Thanksgiving-Saturday (11/24/2007)



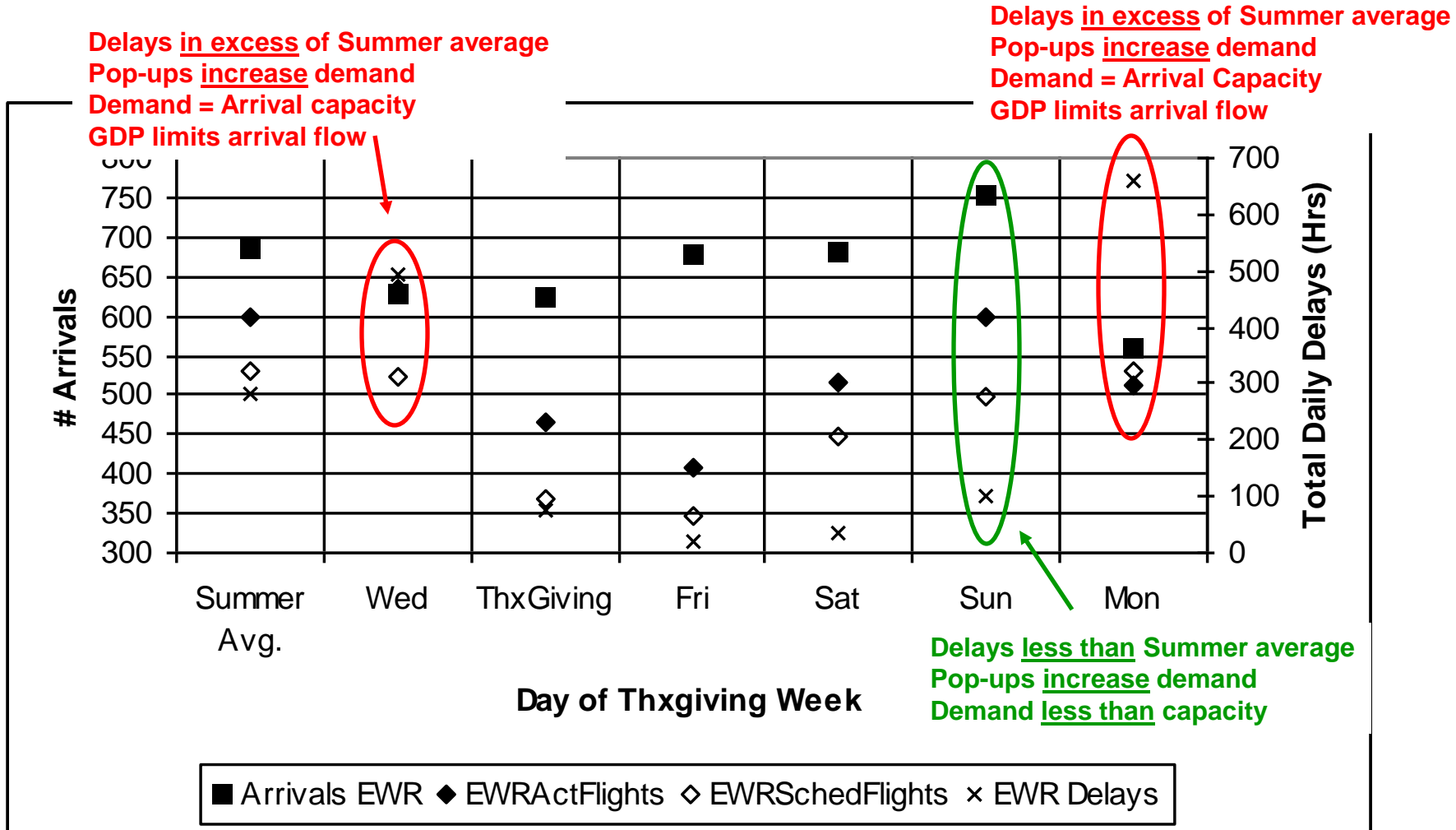
LGA-Thanksgiving-Sunday (11/25/2007)



LGA-Thanksgiving-Monday (11/26/2007)



7. Causes (EWR)



8. Conclusions

- Travel delays were worse than the Average Congested Summer delays on Wed and Monday
- Travel delays were better than the Average Congested Summer Delays On Sunday

8. Conclusions

- Wed, Sunday, and Monday had the same number of Scheduled Flights
 - Operating the system at capacity limits results in unpredictable behavior
 - Small changes may have large impacts
- Thxgiving day, Friday and Saturday exhibited low delays
 - Demand below 78% of the available capacity

8. Solutions (2/3)

- Under the assumption that the goal is to eliminate massive delays

Options:

1. Do nothing

- Continue to Ground Delay flights according to implicit equity rules
- Accept delays (but at least be honest about it to passengers)
- Reality is that the political fall-out occurs, before the market-based mechanisms for the “Prisoners Dilemma” airlines take effect

2. Increase capacity

- Increase productivity of existing airport and airspace (new technologies)
- Build/expand airports near major population centers
 - Don't wait too long, there is a long lead time
 - Don't impact the environment
 - Don't interfere with other airport arrival/departure airspace
- Until passenger/cargo demand stops growing, capacity will need to be improved continuously

8. Solutions (3/3)

- Under the assumption that the goal is to eliminate massive delays

Options (cont/d)

3. Re-evaluate “equal access” proviso

- Unscheduled flights are not the root cause of the problems, but do contribute to variance
- Determine equitable use of public resources

4. Expect reductions in capacity (due to weather)

- Recognize the costs and hedge
- Potential for growth industry

5. Schedule and Run system within Capacity Limits of the System

- Regulate schedule to the capacity limits of the system
- Maintain competition by competing for the slots (auctions, congestion pricing)
- Will adjust the industry structure
- Will require “political will” and

