Economic Impact for Airlines from Air Traffic Control Tower Modernization at LaGuardia Airport

Presented at SCEA
Marc Rose, MCR LLC
202-548-5584
mrose@mcricom
24 June 2007

"Creating Customer-Focused Success"

The Problem

- **LaGuardia (LGA) Air Traffic Control Tower (tower) needs Modernization**
  - **Aging infrastructure – Tower over 40 years old**
  - **Increasing traffic levels**
  - **Modern equipment require increased space**
- **Current Tower Located within Terminal**
  - **Construction would directly impact American Airlines**

"Creating Customer-Focused Success"

LGA Tower

"Creating Customer-Focused Success"

The Alternatives

- **Replace Existing Tower with New in non-Terminal area**
  - **Advantages**
    - **Avoids terminal area construction**
    - **Provides ability to site tower in most efficient location**
  - **Disadvantages**
    - **Increased cost**
- **Upgrade Existing Tower**
  - **Advantages**
    - **Lower cost**
  - **Disadvantages**
    - **2 to 4 Gate closures during construction**

"Creating Customer-Focused Success"

Evaluation Methodology

- **Model the airport as a queue and estimate airline and passenger cost from the resulting delays**
  - **Gates are the limited resource**
  - **Occupancy time at the gate based on collected data and applied statistically**
  - **Desired arrival time based on historical data**
- **Model Developed in Excel™ using VB Macros**

Data Sources

- **Aviation System Performance Metrics (ASPM)**
- **Airline Service Quality Performance (ASQP)**

"Creating Customer-Focused Success"

Inputs: Gate Occupancy Time

- Needed at the airline level and the overall airport
- ASPM provides
  - Detailed flight information for 75 large airports
  - Tail number, allows tracking of individual aircraft
  - Gate arrival and departure times for individual flights
- Mapped tail numbers into a sorted list across a years worth of data ~12 Million flights (note not all flights provide tail number)
- Eliminated long turn-around times (over 2 hours)
  - Over night
  - Other reasons besides passenger loading/unloading, etc
- Subtract Departure from Arrival times, Collect Statistics
- Due to incomplete data, statistical distribution (normal) is used

"Creating Customer-Focused Success"

Other Inputs

- **Number of Gates: 38**
- **Gates lost due to construction 2 to 4**
- **Desired arrival time at gate – historical data from ASPM, September 2005, over 16,000 flights**
- **Gate Occupancy: Mean=52, std dev = 15 minutes**

"Creating Customer-Focused Success"

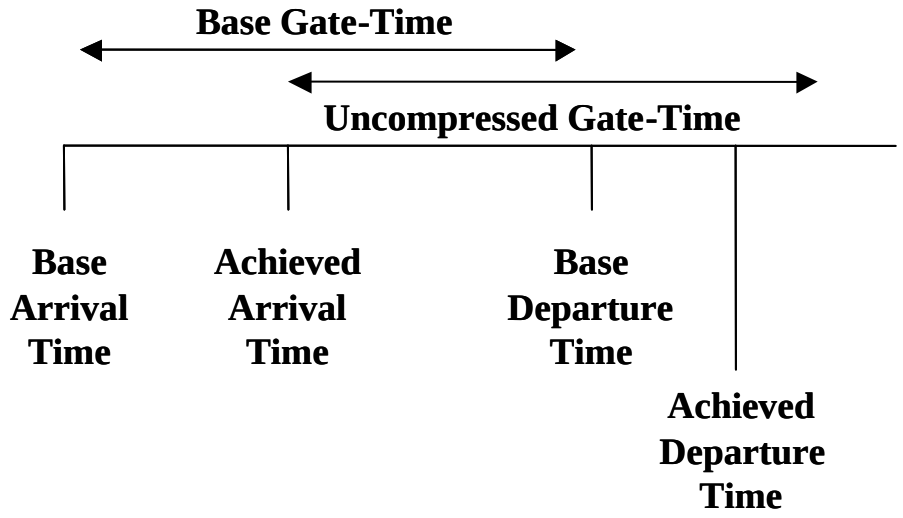
Assumptions

- All Gates are equal
  - During construction aircraft can use any gate, not just those assigned to the airline
    - As an excursion the analysis looked at American Airline in isolation (all gates lost are in the AA terminal)
  - No size limitations: e.g., a 747 can use any gate
- No Flight Cancellations
  - Airlines might choose to reduce demand by flight elimination
- Turn-Around time has a minimum of 20 minutes and a default maximum of 2 hours
- No end-of-day effects are include

"Creating Customer-Focused Success"

Compression

- **During high delay times it may be possible for airlines to compress their gate occupancy**
  - **For modeling purposes, compression would reduce the calculated time (no less than the minimum)**
  - **Reduces delay**



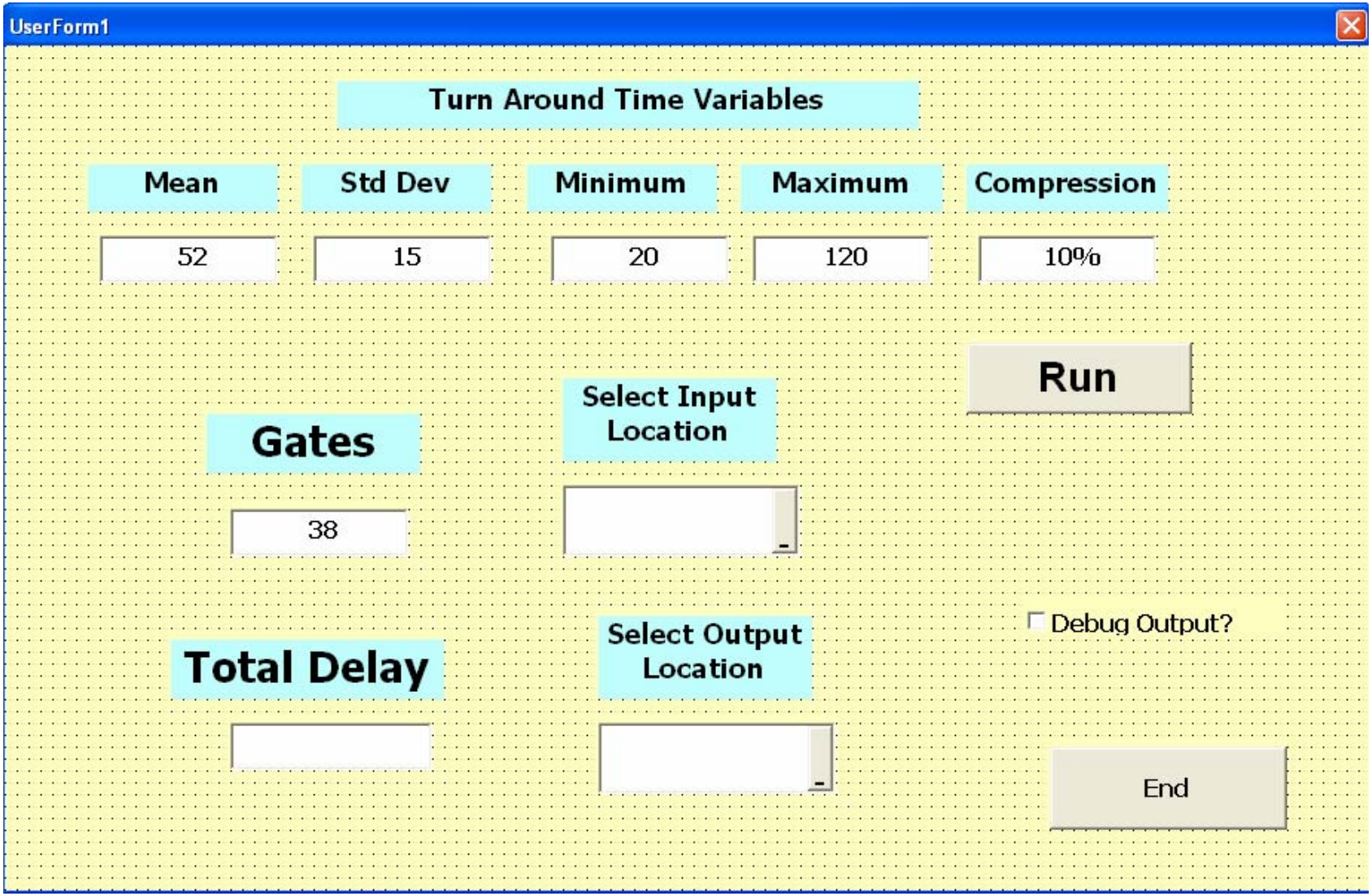
"Creating Customer-Focused Success"

Algorithm Overview

- **Delay occurs when an arrival occurs and no gate is available**
  - **Departure Time = Arrival Time+Turn-Around Time(TA)**
  - **If no gate available:**
    - **Adjusted Arrival Time =Arrival Time + Delay**
    - **Delay is shift to next departure + 20 seconds (avoid overlap)**
    - **Departure Time= Adjusted Arrival Time +TA'**
    - **TA'=TA*Compression (e.g., 90%), not less than minimum**
- **Maintain an ordered list by departure time**
  - **Continuous sorting, but limited to the aircraft at a gate (only 34 to 38 elements)**
  - **Allows easy determination of next departure**

"Creating Customer-Focused Success"

Model Input Screen



"Creating Customer-Focused Success"

Sample Excel Inputs

Microsoft Excel - lga_model4.xls

File Edit View Insert Format Tools Data Window Cell Run CBTools Help

Arial 10 100%

A1 =

	A	B	C	D	E	F	G	H	I	J	K	L	M
1		AA only		Arr Time									
2		**actinsec**		All LGA									
3		810038460		810038460		Total Delay							
4		810039960		810038700		1483.8							
5		810040440		810038820									
6		810040440		810038820		Run Time (s)							
7		810041640		810038919		3.7734375							
8		810041700		810039060		Total Delay							
9		810042960		810039180		1637							
10		810044100		810039300									
11		810044220		810039312		Run Time (s)							
12		810045000		810039360		3.6953125							
13		810045840		810039445		Total Delay							
14		810046500		810039548		4976.3	3476.3						
15		810047100		810039960			57.93833333						
16		810047880		810040080		Run Time (s)							
17		810048240		810040201		3.69140625							
18		810048720		810040440		Total Delay							
19		810048780		810040440		4212.3	2712.3						
20		810050100		810040560			45.205						
21		810050460		810040626		Run Time (s)							
22		810050460		810040860		3.72265625							
23		810050760		810041040		Total Delay							
24		810051420		810041100		3836.8	2336.8						
25		810051480		810041220			38.94666667						
26		810051600		810041340		Run Time (s)							
27		810051840		810041400		3.72265625							
28		810052860		810041640									
29		810053160		810041640									
30		810053760		810041700									
31		810054480		810041760									

LGA Queuing Start

"Creating Customer-Focused Success"

Results

- **Using a 4 gate loss**
  - **Direct Airline delays of up to 350 hours/month**
  - **Using a simple $20/minute for airline costs (ground)**
  - **Passenger time is $28.60/hour, and applies to both arrival and departure delay with an average of 76/flight**
  - **Downstream impact ~80%**

Total Potential Benefits of New Tower:

350*$1200/hour+2*350*28.6*76*(1+80%)=3.1M/mo or nearly $38 million over the course of a year

An excursion looking at AA (10 gates reduced to 6) has nearly 4 times the impact

Backup

"Creating Customer-Focused Success"

Gate Occupancy Example

Tail no Origin Dest Time

N1234, ORD to LGA, 10:23AM (arrival time)

N1234, LGA to DCA, 11:18AM (departure time)

Gate Occupancy = 11:18-10:23 or 55 minutes

"Creating Customer-Focused Success"

LGA Airport Diagram