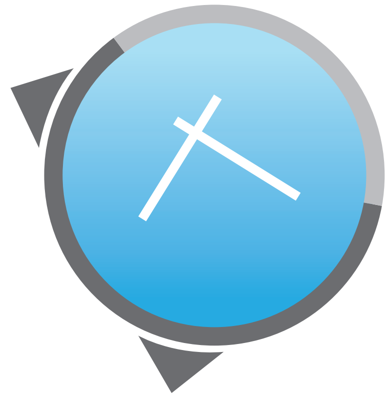
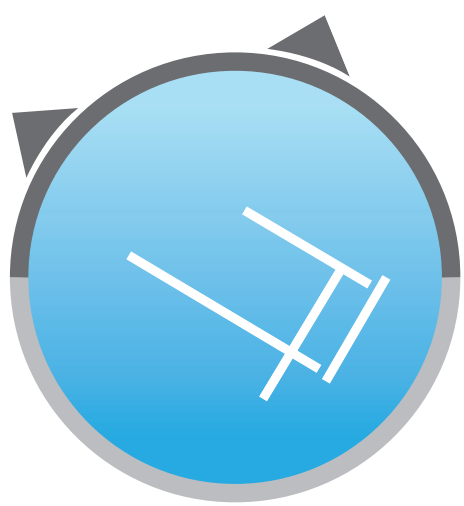
Upgrading *to* World Class



The Future *of the* New York Region's Airports



Technical Appendices

January 2011

by Jeffrey M. Zupan, Richard E. Barone and Matthew H. Lee

Regional Plan Association

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Airline Terminal Functions

The efficiency of airline terminals is defined by five major functions. The current operations of these functions, and issues that could affect future operations, are described below.

1. **Passenger and Outbound Baggage Check-in.** Two profound changes have occurred that have reshaped passenger/baggage check-in and passenger screening, the terrorist attacks on 9/11 and advances in technology. In the past, a large amount of space was required at the front of the terminal, sometimes called the "head-house", to accommodate a long line of check-in counters to serve departing passengers. However, the advent of e-ticketing and self-service kiosks has reduced the need for some of this space and has resulted in its reconfiguration. Today, almost 80% of passengers use self-service or online ticketing options. Terminals in the future will continue to reduce traditional counter space and increase the number of these kiosks. Jet Blue's new Terminal 5 at JFK provides an excellent example of a modern airport terminal.

    To further reduce overhead expenses and increase flexibility, airlines may choose to use common-use kiosks instead of their proprietary ones, especially at an airport where they have only a few flights. These would allow passengers to retrieve their boarding pass for any airline operating at the airport and could also provide access to ticketing for connecting public transit passengers. Terminals 1 and 4 at JFK already have only common-use/shared check-in facilities. However, these facilities are assigned to one airline during a specific time period and are more akin to "preferential-use" than common-use. True common-use allows for maximum operational flexibility and typically applies to all of the terminal gates and baggage claim areas as well.

    Self-service baggage check is also being evaluated by some airlines to complement kiosks: passengers would "self-tag" their own luggage and place it on the conveyor belt. This automation would further improve passenger flow and reduce costs. Presently, there are a number of obstacles to this change, for one the TSA does not currently allow "self-tagging" and some of the airlines are concerned about proper placement of the tags (today, they place multiple tags on the bags to reduce the chance of a misread). Radio Frequency Identification (RFID) technology, which will be discussed later, might mitigate some of these concerns.

    The future customer service models that airlines are incrementally adopting are comparable to the self-service check-out centers that are becoming more common at supermarkets and larger retail outlets throughout America.[1]

2. **Passenger and Outbound Baggage Security Screening.** In response to the attacks on 9/11, security screening areas have been expanded to accommodate the higher-level of scrutiny and additional screening equipment. Security improvements targeted both passengers and baggage; post-911 changes require screening of 100% of checked baggage. In most cases this takes place in the head-house or check-in/arrival area of the airport. Most retail is now located beyond the security screening areas. This reconfiguration was in response to passenger anxiety and pressure from concessionaires. Uncertainty during check-in led to many passenger rushing through security to their gates and spending little time shopping[2]. In reality, passengers now have more time than ever to shop because stricter baggage screening regulations requires them to arrive at the airport at least 45 minutes (60 minutes or more for international flights) before their flight boards or else they cannot check in. By moving these amenities after screening passengers are now able to dwell longer, spending their remaining dollars to purchase a few last minute items before boarding their flights. Complementing this change is the introduction of a "great space" or a large public area with amenities lining the perimeter. This space offsets the amount of holdroom space required and is a magnet for amenities, a trend popular with both airport operators and concessionaires.

    Jet Blue's Terminal 5 at JFK is an example of this new terminal design concept. It has one large/centralized security-screening checkpoint near the entrance of the terminal. Check-in areas are located on either side of the checkpoint. Immediately beyond the checkpoint there is a "great space" that acts as a hub, with the concourses radiating out in three directions.

    The two floor plans in Figure A-1 illustrate the major differences between the two terminal design concepts for Terminal 5 and Terminal 4 at JFK. Terminal 4 has a large concession mall in the head-house, located behind the check-in counters, but still accessible to airport visitors and well-wishers who accompany passengers to the airport. The concessions beyond the checkpoint are distributed amongst the gates. The security screening checkpoints are located adjacent to the entrances to its two concourses located at either end of the concession mall.

    Since Terminal 4 was designed prior to year 2001, these security screening areas have since proven to be inadequate and the Terminal 4 management company has plans to construct a platform from the second level check-in area over the shopping atrium, partially obstructing the "air rights" of the expansive promenade. This space is needed for the installation of an inline-baggage screening system, which the origi-

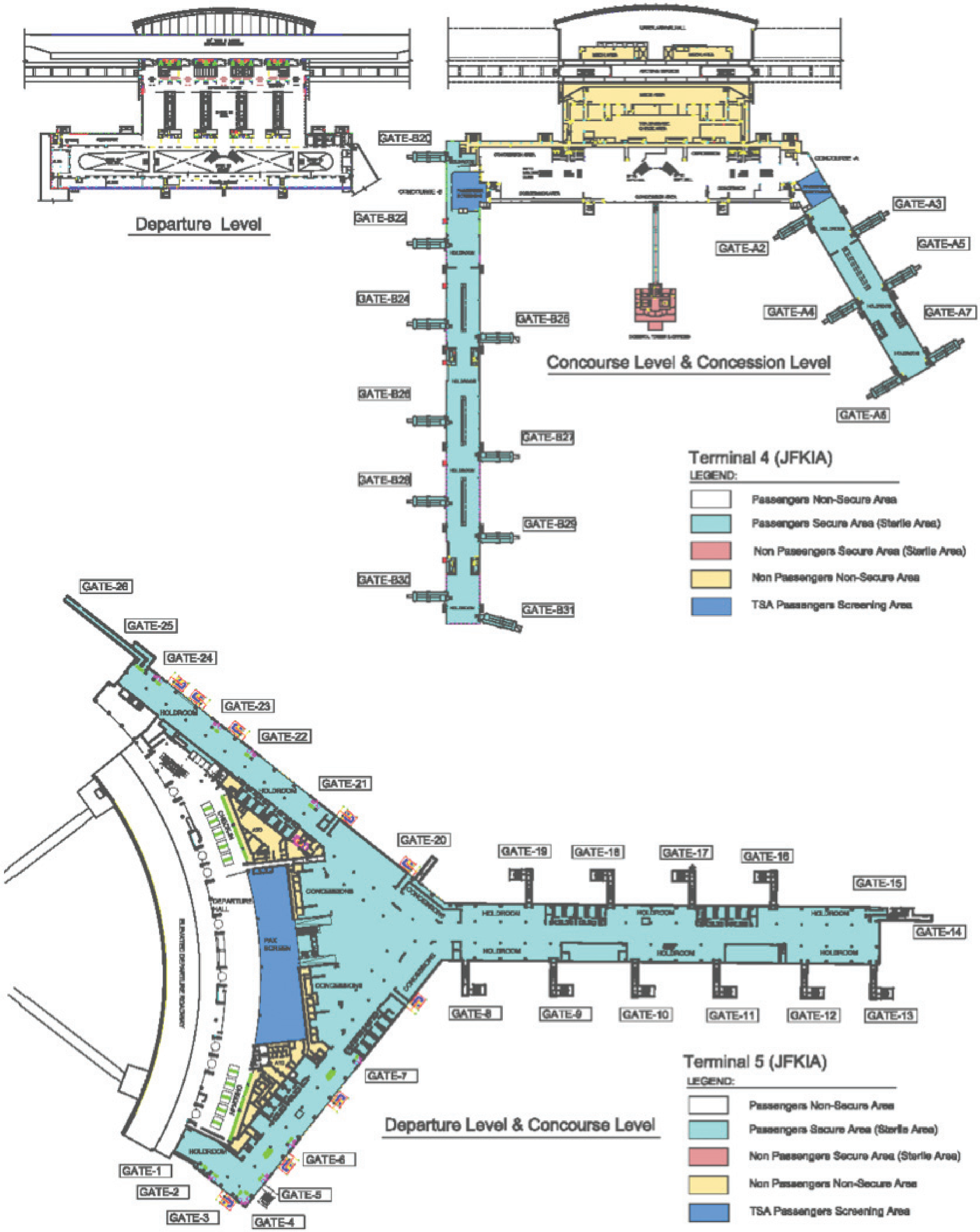
1 Airport Systems Planning, Design and Management, (2003), Richard Neufville and Amedeo Odoni,, McGraw-Hill Companies Inc

2 International facilities are somewhat an exception here, where amenity space before security for "well wishers" is also required and desirable.

FIGURE A-1

Terminals 4 and 5 Comparisons

Source: PANYNY



nal design did not consider. Currently, all baggage at this terminal is screened manually because the head-house does not have sufficient space for the installation of an automated system.

Future terminals will need to provide more space for passenger and baggage screening, while providing less space for check-in and other head-house functions. Most amenities will move behind security with larger common spaces that will serve as magnets for concessionaries. However, head-house space must still be provisioned for "well wishers," especially in international facilities. Existing terminals will likely be reconfigured over time to conform to this new security-centric concept.

3. **Inbound Baggage Handling.** One of the major frustrations for the traveling public occurs when they arrive at their destination and attempt to claim their checked baggage. There are three types of baggage handling, inbound, outbound and rechecked baggage. In many cases, these systems are separate, but in some cases outbound and rechecked baggage operations are combined. Outbound baggage handling was covered in the previous section and rechecked baggage, which is connecting international passengers transferring to a domestic flight, will not be covered in detail.

The delay experienced by many is based on how efficient or balanced the baggage handling operation is. Ideally, the operator tries to not have the luggage arrive at the baggage claim too early or too late. It the baggage arrives early, the carousel will run out of capacity and bags will start pilling up; if it arrives too late the overflow space for passengers will become congested, reducing the efficiency of connections to ground transportation services. Automated systems have helped to calibrate this process, yet there really is no standard design for baggage handling systems and they tend to be customized for each terminal. These systems consume a considerable amount of space over multiple levels, normally consisting of miles of conveyors, sorters and movable belts that are outfitted with lasers to read the bar-coded baggage tags.[3] It is critical to provide sufficient space for the staging areas that are used to manually offload the baggage from airside carts that transport the bags to the aircraft. Delays will occur if this space is inadequate. In some cases airlines or terminal operators have chosen to distribute conveyor access points for both inbound and outbound baggage along the concourse and in other cases these are centrally located in head-house.

According to a survey by the International Air Transport Association (IATA), misplaced baggage costs the airline industry $3.8 billion dollars every year and affects over 42 million air travelers.[4] Lost baggage is second only to travel delays in inconveniencing air travelers. The USDOT recently reported that there were 2.7 mishandled baggage reports for every 1,000 air passengers in the United States.[5] Since this does not count for instances of multiple bags, it's lower in the IATA report using SITA WorldTracer 2007 statistics which counts the number of bags lost, at eight bags per 1,000 passengers; by comparison the worldwide average was almost 19 per 1,000.[6] Future advances in laser readers (allowing the faster scanning of claim tags) and use of Radio Frequency Identification (RFID) technology will help reduce the number of mishandled bags and further increase baggage through-put. RFID tags could eliminate existing bar-coded tags which are susceptible to bending/folding, making them unreadable by the laser scanners. This tends to occur when passengers make multiple connections and bags are handled more frequently. Misreads also are a problem if older tags are not removed from bags. Luggage manufactures and airlines are also exploring the possibility of embedding secure programmable RFID tags in bags, further reducing the costs to the airlines and improving efficiency.

Inbound baggage handling systems are a complex mix of automated and manual operations. There is no standard design, with each terminal at our airports having their own unique configuration. When compared to the worldwide average of mishandled baggage, the United States ranks higher than most. This does not mean that there is no room for improvement, quite the contrary. New technologies, like RFIDs and approaches to permanently tagging bags (SMART luggage) offers a number advantages over the existing system and would further reduce the amount of mishandled baggage and improve the efficiency of these systems.

4. **Passenger Circulation and Amenities.** The ability of passengers to easily navigate through the terminal building with a minimal number of "choke-points" is essential to a well functioning airport, reducing aircraft dwell times at gates and at connections with public transportation. Arrival halls, secure passageways (used to segregate international arriving passengers for customs), and underground transit stations are more likely to be congested, and special attention should be paid to provide sufficient space to accommodate the additional foot traffic.[7] As mentioned earlier, space for holdrooms and passenger amenities must also be considered. Airports are creatively arranging these spaces and establishing new public areas that are more inviting for passengers, to increase retail foot traffic and provide overflow capacity. Providing an inviting space for passengers to linger, work, dine and shop is more important than ever, as passengers are now required to arrive earlier and wait longer at airports before their flight departs.

5. **Passenger Information Systems.** Clear signs for passengers and real-time information on flight status are standard these days at most terminals. Passenger information has moved from cathode ray tubes (CRT or old style TV's) to liquid crystal displays (LCD) and is also accessible online via mobile devices. While there are no national guidelines for terminal signage or way-finding, some signs now incorporate color to key specific audiences. At the Port Authority's airports a standardized design with green signs for arriving passengers, yellow for departing passengers, and black signs for airport services has been installed. Newer terminals like Jet Blue's Terminal 5 also project these colors using indirect lighting to re-enforce the correct pathway for customers. Future developments in passenger information will involve additional

3 (Ibid, Neufville & Odoni - pgs.37 & 161)

4 http://www.iata.org/stb/bip/

5 http://airconsumer.ost.dot.gov/reports/2010/January/2010JANATCR.PDF - There is a one month delay in the release of the FAA's air consumer reports, the January 2010 report contains data for the month of November 2009. The statics in the report are based on a sample of 19 major domestic airlines.

6 Baggage statistics provided to IATA by SITA WorldTracer

7 Airport Design and Operation, (2007), Robert Caves and Antonin Kazda, Elsevier Ltd, pgs.643-660

web-services that will make more information available online for mobile devices, the need to improve Wi-Fi and hi-speed digital cellular access, and integration of airline passenger information with ground transport services.

Airport Capacity and Delay

This appendix intends to provide some background information on the modeling used to derive the aircraft delay levels described in this report. The delay estimates in this study were derived using a spreadsheet-based queuing model that compares hourly aircraft activity and calculates airport runway capacities. Similar to an air traffic control decision, the model evaluates the composition of arrival and departure demand and can alter the airport arrival and departure capacities to accommodate a higher percentage of arrivals or departures. The model provides outputs on the number of aircraft queued for the arrival and departure runways, percent of aircraft waiting specific intervals of time and total runway queue delays. Delay is the difference between the scheduled and actual time it takes an aircraft to perform an arrival or departure. Aircraft delay is a measure of system operational performance that indicates the efficiency with which a given level of runway capacity or throughput is achieved.

The models were calibrated against observed "gate arrival" and "airport departure" delays as recorded in the FAA Aviation System Performance Metrics (ASPM) database in July 2009. Example results of the model calibration are shown in Figures B-1 through B-3. Each figure shows a side-by-side comparison of modeled versus observed delays from ASPM for each airport. Each of these results shows a good weather day at the New York airports. In addition to the good weather days, a cross section of weather conditions was used to calibrate the models. A single model for each airport was then created to represent an average day in July. Thus, the delay modeling shows average delays during the peak month at each airport.

Table B-1 shows the airport hourly runway throughput values for each airport. Three operating modes are shown for each airport:

- Balanced Flow Mode – Used when demand is evenly split between arriving and departing aircraft
- Arrival Push Mode – Used when the percentage of arrivals is greater than the percentage of departures
- Departure Push Mode – Used when the percentage of departures is greater than the percentage of arrivals.

The values shown describe a weighted average of good and poor weather conditions. The weights reflect the percent occurrence of each weather condition.

Figures B-4 through B-6 present the average daily delays by hour for the peak month at each of the three airports. These charts show some higher delay values than the example calibration days shown in Figures B-1 through B-3 because they include delays incurred on both good and poor weather days.

TABLE B-1

Airfield Runway Throughput By Airport

	Capacity	Balanced Flow	Departure Push	Arrival Push	Daily Average
EWR	Arrival	39	50	36	40
	Departure	40	29	44	40
	Total	79	79	80	79
JFK	Arrival	39	51	35	40
	Departure	42	30	46	41
	Total	81	81	81	81
LGA	Arrival	35	43	30	35
	Departure	34	26	39	34
	Total	69	69	69	69

Source: Landrum & Brown analysis

FIGURE B-1

Delay Model Calibration Example - EWR Airport

Source: Landrum & Brown analysis
Note: Actual delays based on FAA ASPM data for July 15, 2009.

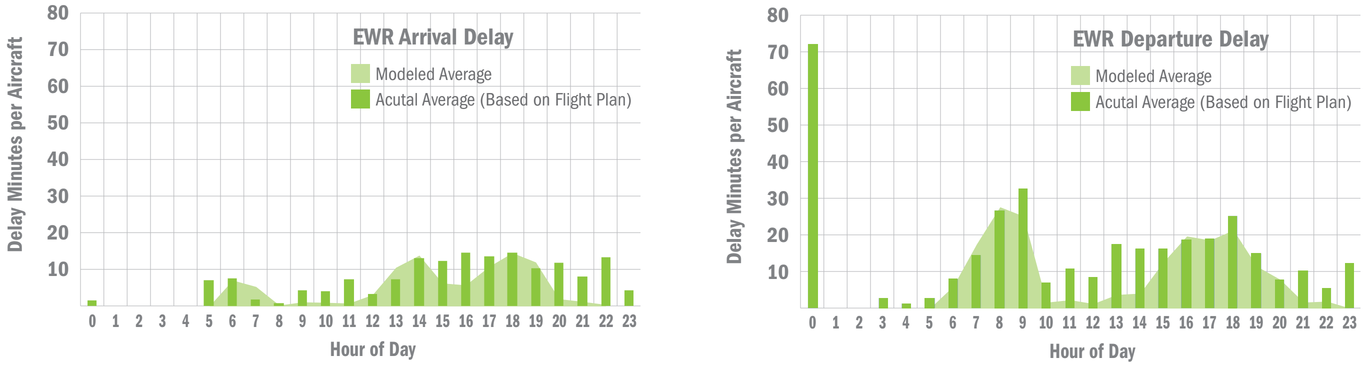


FIGURE B-2

Delay Model Calibration Example - JFK Airport

Source: Landrum & Brown analysis
Note: Actual delays based on FAA ASPM data for July 15, 2009

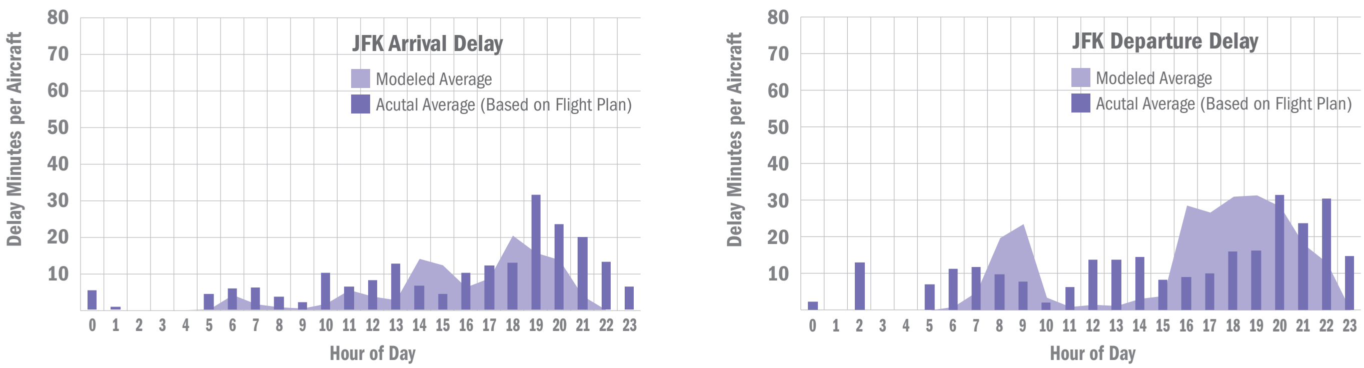


FIGURE B-3

Delay Model Calibration Example – LGA Airport

Source: Landrum & Brown analysis
Note: Actual delays based on FAA ASPM data for July 15, 2009

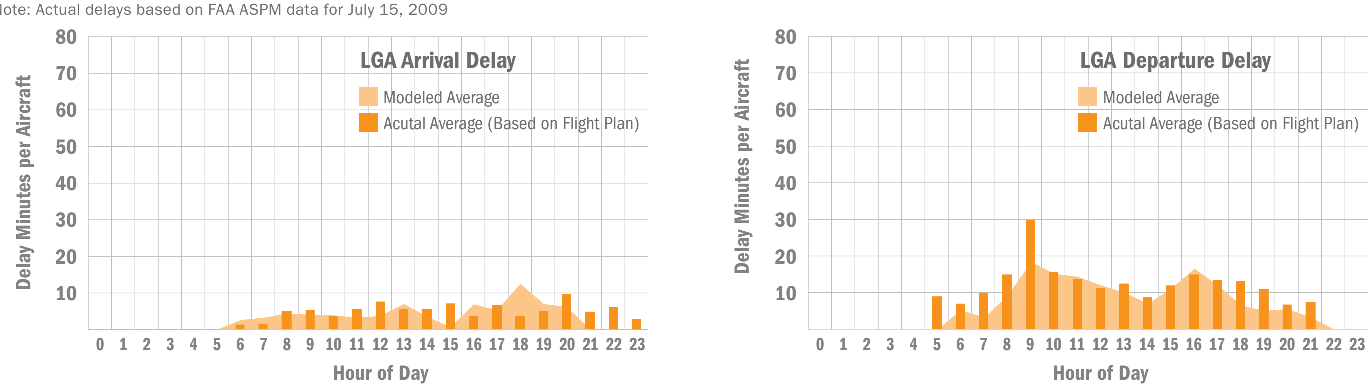


FIGURE B-4

2009 Average Hourly Arrival and Departure Delays – EWR Airport

Source: Landrum & Brown analysis

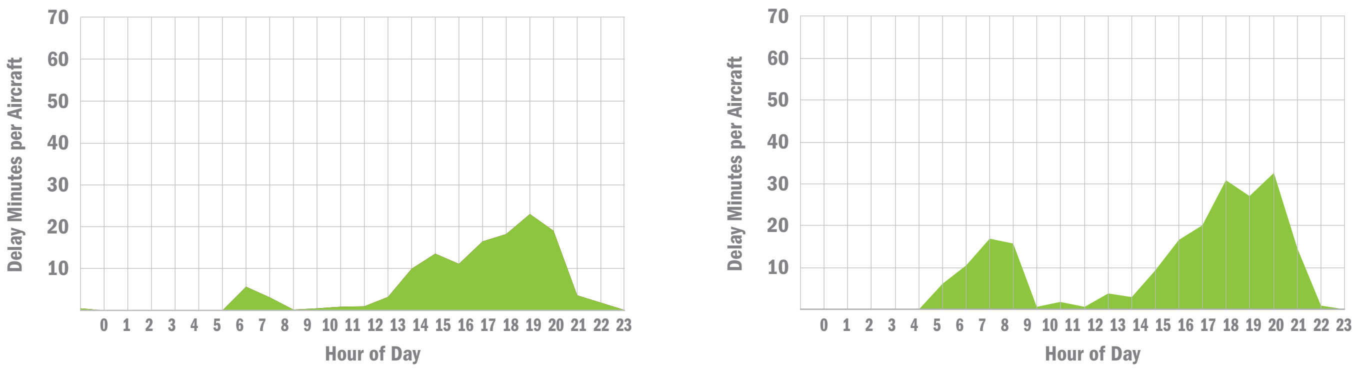


FIGURE B-5

2009 Average Hourly Arrival and Departure Delays – JFK Airport

Source: Landrum & Brown analysis

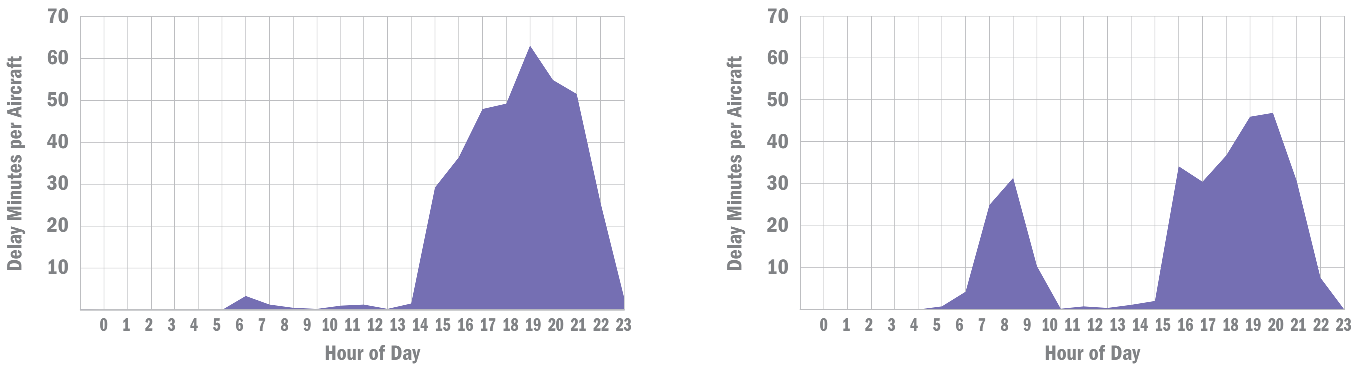


FIGURE B-6

2009 Average Hourly Arrival and Departure Delays – LGA Airport

Source: Landrum & Brown analysis

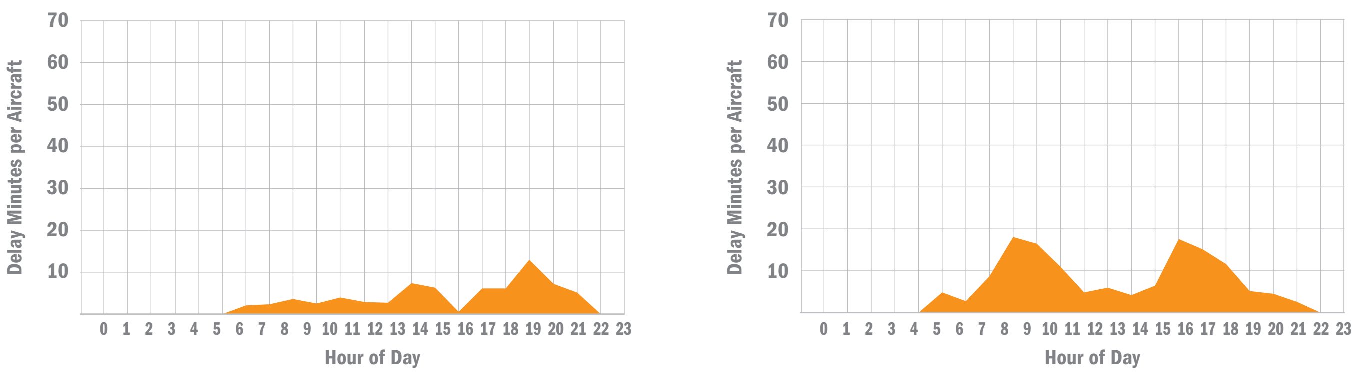
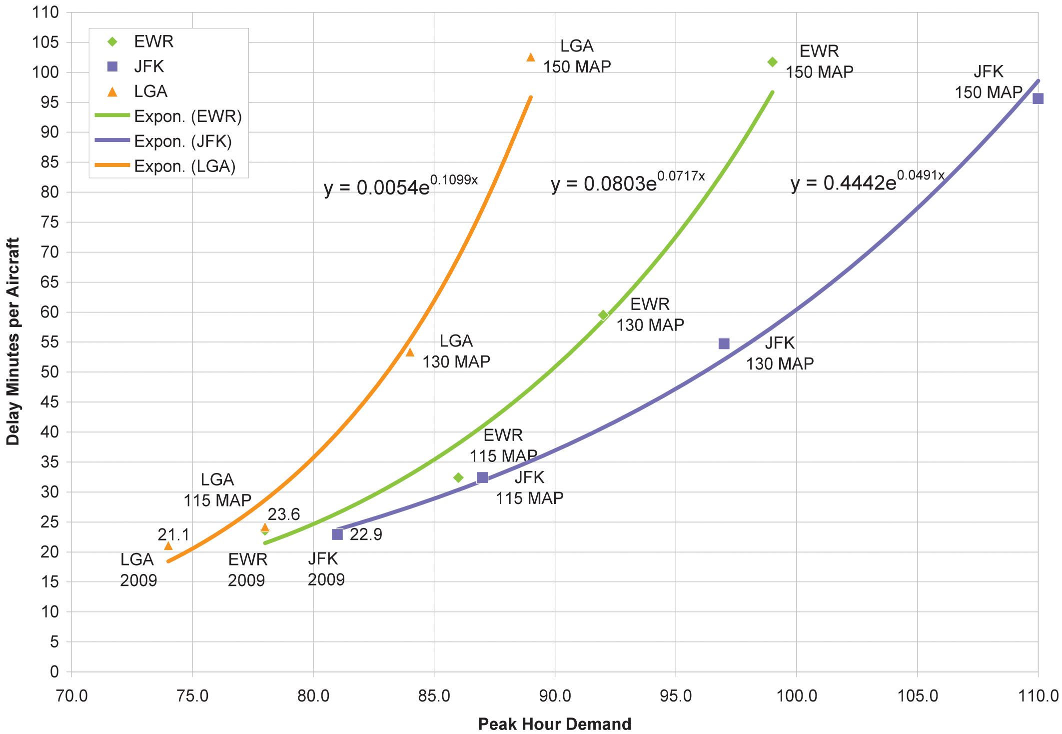


FIGURE B-7

Forecast Delay per Aircraft Operation

Source: Landrum & Brown analysis



Extension of 2009 delay estimates to future conditions

The calibrated queue models were then run for the unconstrained aircraft operations demand cases for 115 MAP, 130 MAP and 150 MAP. The results of this analysis are shown in Figure B-7 and Table B-2. Unconstrained future growth of demand will lead to greatly increased delay, over an hour and a half per aircraft at each airport.

TABLE B-2

Base Case (Unconstrained) Delay by Airport and Passenger Level

		Average annual minutes per aircraft movement			
Demand	**Range of Years**	**JFK**	**EWR**	**LGA**	**System**
109 MAP	**2007**	25	21	19	22
101 MAP	**2009**	23	24	21	22
115 MAP	**2015 – 2021**	32	32	24	31
130 MAP	**2021 – 2034**	55	60	53	56
150 MAP	**2030 – 2042 +**	96	102	103	99

Source: RPA & Landrum & Brown analysis

However, the demand caps at each airport will prevent this unconstrained case from occurring. Instead, delays will remain at the 2007-2009 levels.

Estimating Delay Savings from Future System Improvements

The unconstrained delay curves still serve a useful computational purpose. They provide a tool to estimate delays savings for future changes to the airports, or air traffic control procedures. For this purpose, the interpolated delay curves shown on Figures B-8 through B-10 provide a means to estimate the hourly capacity that could be gained from these future changes. The delay savings shown in Table B-3 result from implementing improved Time Based Flow Management (TBFM) and the phased-in implementation of required navigation performance (RNP) avionics. Phase I shows 50% of the anticipated ultimate benefits from TBFM and implementing all airspace changes enabled through implementing RNP 0.3. Phase II shows 100% of the benefits of TBFM and implementing all airspace changes enabled through implementing RNP 0.1 and advance air traffic control sequencing algorithms currently being researched in the Next-Gen program.

TABLE B-3

Estimated Delay Savings from Next-Gen Air Traffic Improvement Program (Existing Demand)

		NextGen I			NextGen II		
Airport	**Existing Delay**	**Delay Savings**	**Delay After**	**% Reduction**	**Delay Savings**	**Delay After**	**% Reduction**
JFK	22.9	10.1	12.8	44%	4.7	8.1	64%
EWR	23.6	6.6	17.0	28%	4.7	12.2	48%
LGA	21.1	10.2	10.9	48%	3.6	7.3	65%
Region	22.5	9.0	13.5	40%	4.3	9.2	59%

Source: Landrum & Brown analysis

FIGURE B-8

Estimated Capacity Gains at JFK from NextGen Air Traffic Improvements

Source: Landrum & Brown analysis

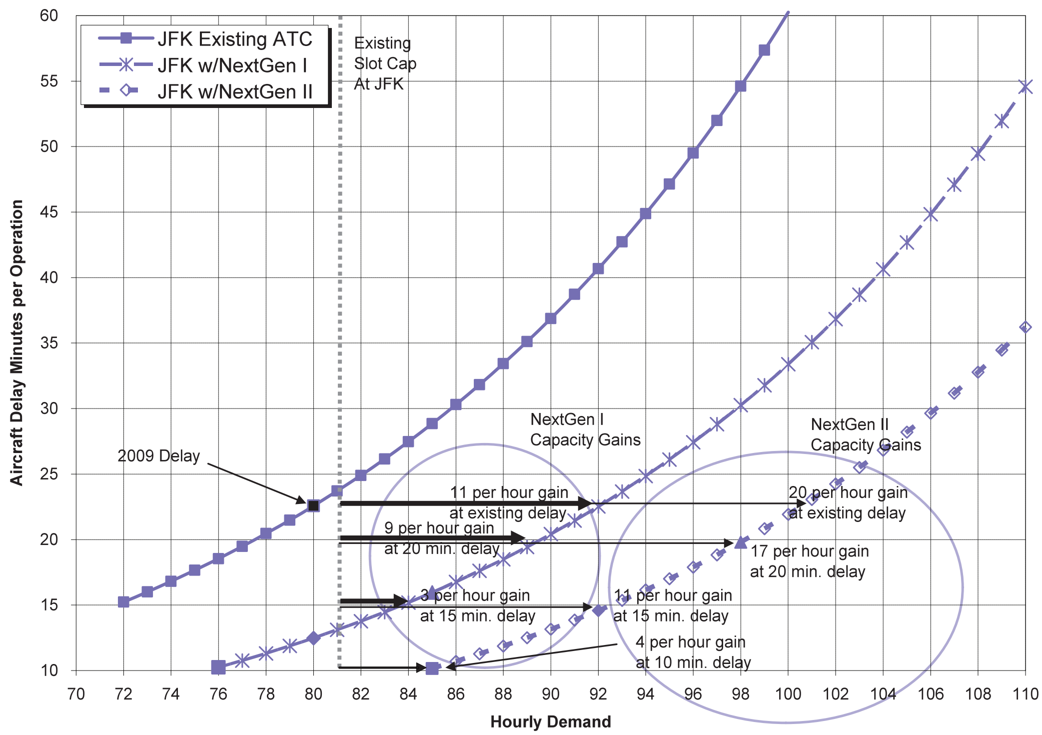


FIGURE B-9

Estimated Capacity Gains at EWR from NextGen Air Traffic Improvements

Source: Landrum & Brown analysis

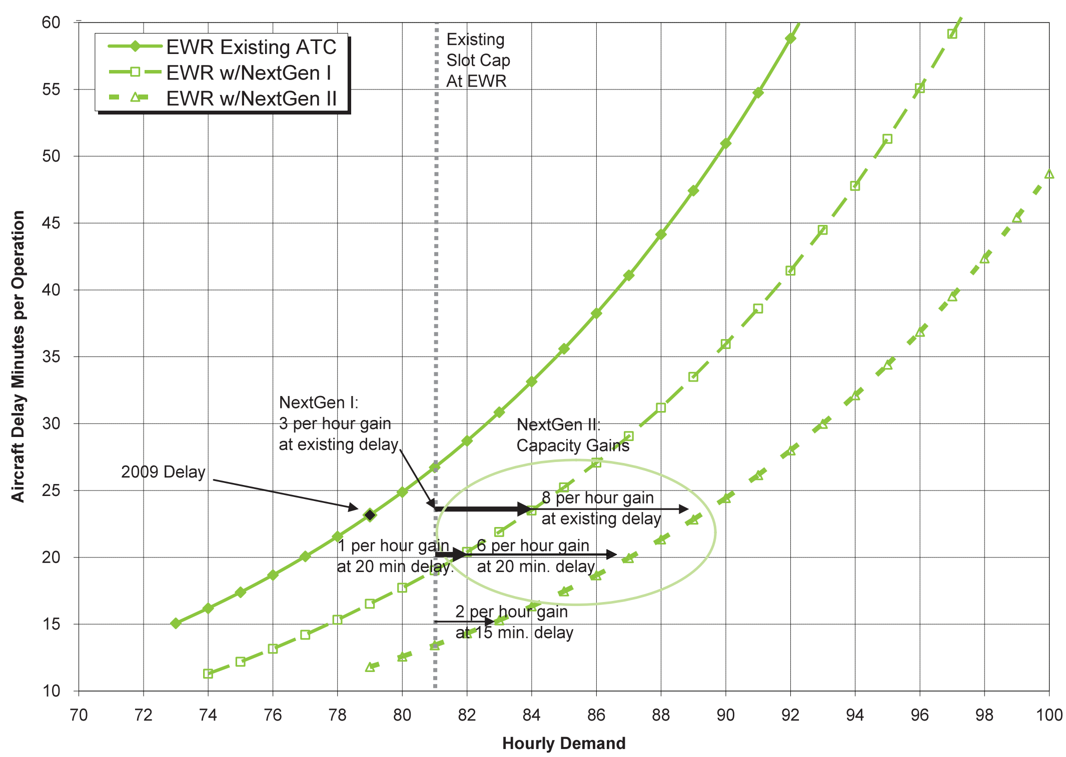
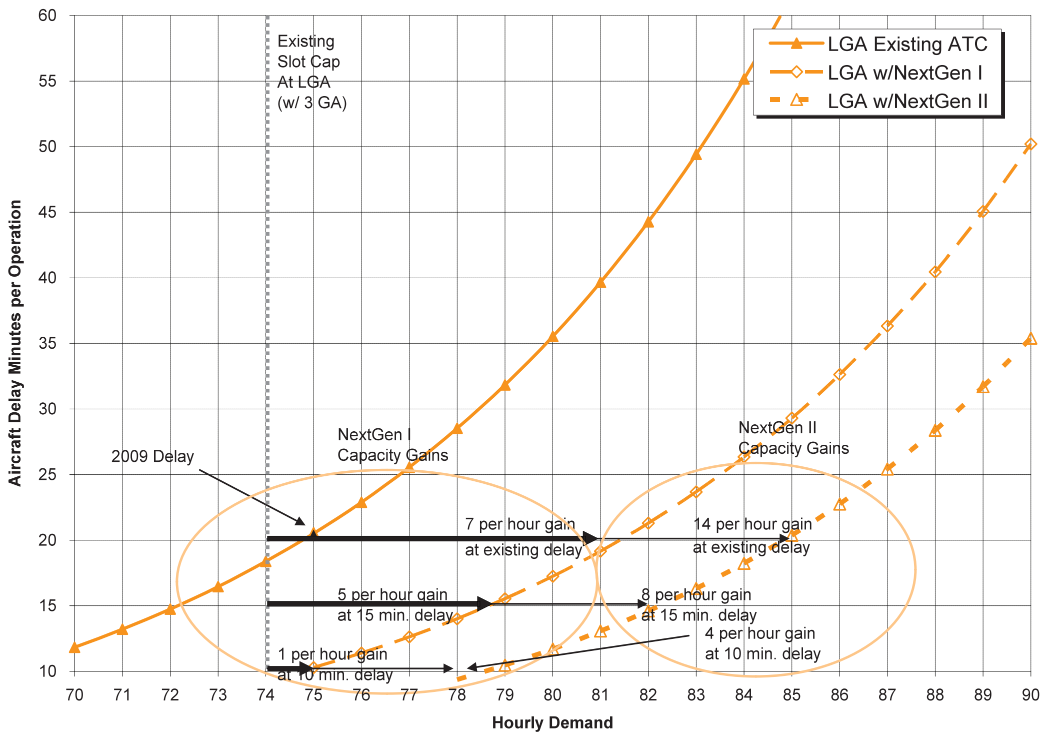


FIGURE B-10

Estimated Capacity Gains at LGA from NextGen Air Traffic Improvements

Source: Landrum & Brown analysis



These estimates of delay savings were derived from various sources. The delay savings from RNP airspace improvements were derived from the 1999 Airspace Improvement Study prepared by The Port Authority of New York and New Jersey, where simulation modeling was used to estimate delay savings.

The capacity gains from TBFM were prepared using a statistical analysis of aircraft separations variability. The current standard deviation of aircraft separations during peak hours is 18 seconds. The ultimate goal of the NextGen program is to reduce this standard deviation to 6 seconds. This study assumes that half of this improvement would occur with implementation of NextGen I. NextGen I would result in average aircraft separations decreasing by one half mile while maintaining existing minimum separation standards. NextGen II improvements would further reduce average separations by an additional one half mile.

Figures B-8, B-9, and B-10 show the application of the delay savings shown in Table 3 to the delay curves for each airport shown in Figure 7 for JFK, EWR and LGA airports. Each figure shows the delay curves for NextGen I and II and the derivation of hourly airport capacity at 10, 15, and 20 minute average annual delay per aircraft, as well as at existing delay levels. The vertical line on each graph shows the existing slot limit. The horizontal arrows show the expected hourly capacity gains from each level of NextGen implementation.

Table B-4 summarizes the expected hourly capacity gains shown in Figures B-8, B-9 and B-10. In some cases, NextGen may not deliver additional capacity if a lower delay standard (15 or 10 minute average annual delays) is applied, especially at EWR.

The hourly capacity estimates from this analysis will get converted to annual aircraft volumes using factors derived in the forecasting effort summarized in Chapter 3. Using a lower delay standard reduces the hourly capacity available from the existing airfields or from NextGen improvements. These lower capacity values translate to lower annual aircraft volumes and lower volumes of passengers carried, which would require additional investment by the Port Authority to further increase airport capacity to serve projected demand during these periods.

TABLE B-4

Hourly Capacity and Incremental Benefits of NextGen I and II

		Capacity			Incremental Benefit		
		JFK	LGA	EWR	JFK	LGA	EWR
10 Minute Delays	Existing Slots	81	74	81			
	Next-Gen I	81	75	81	-	1	-
	Next-Gen II	85	78	81	4	3	-
15 Minute Delays	Existing Slots	81	74	81			
	Next-Gen I	84	79	81	3	5	-
	Next-Gen II	92	82	83	8	3	2
20 Minute Delays	Existing Slots	81	74	81			
	Next-Gen I	89	81	82	8	7	1
	Next-Gen II	98	85	87	9	4	5
Existing Delays	Existing Slots	81	74	81			
	Next-Gen I	92	81	84	11	7	3
	Next-Gen II	101	85	89	9	4	5

Source: RPA & Landrum & Brown analysis

GA Listing & Model Calibration

Table C-1 lists the 59 General Aviation (GA) airports that were included in the Chapter 6 level-one screening analysis

Calibrating the Accessibility Model

To calibrate each of the two models, a trial and error process was used to converge on the exponent that gave the best statistical fit between the share of accessibility on the X-axis that was calculated and the actual shares on the Y-axis. The trials were also based on two other criteria. First, how close the straight line of best fit approximated a slope of one – i.e. the calculated accessibility share and the actual share change at the same rate. Second, how close the best fitting line came to the origin – the point on the graphical representation of the data where the accessibility value and the share value were both zero. Once the best exponent was determined, the plots where analyzed for any systematic biases such as some county / airport combinations always over or under-estimate the shares at a particular airport. This proved to the case in a number of important ways. For both the domestic and international models:

- The five New York City county / airport combinations of were consistently under-estimating the share of air travelers who would use JFK.
- For the international model all combinations were consistently under-estimating the share traveling to JFK.
- For the counties of northern and central New Jersey the model consistently under-estimated the share of air travelers who would choose EWR.
- The counties containing the outlying airports (and in some cases the adjacent counties) were consistently under-estimated for the share choosing that outlying airport. For example, the model under-estimated the share of air travelers in Orange County and four other Hudson Valley counties that would use Stewart airport, and the share of Suffolk air travelers that would use Islip.

By altering the exponent through trial-and-error to account for these biases, both models achieved high best fit statistics (r-squared values), had slopes close to 1.0 and passed close to the origin where the share of accessibility and share of the actual observations were zero. The domestic model had an r-squared value of 0.941, implying that 94.1 percent of the variation in the airports shares can be explained statistically by their accessibility shares. The international model r-squared value was 0.908, implying a 90.8 percent explanatory power.

For the domestic model, the exponent with the best fit was 2.8. This exponent was adjusted to 2.5 for the travel between JFK and the five boroughs. For travel between EWR and the

TABLE C-1

All 59 General Aviation Airports (sorted by State)

Airport Name	Airport Code	County	State
Igor Sikorsky Memorial	BDR	Fairfield	CT
Danbury Municipal	DXR	Fairfield	CT
Waterbury-Oxford Airport	OXC	New Haven	CT
Meriden Markham Municipal Airport	MMK	New Haven	CT
Eagles Nest Airport	31E	Ocean	NJ
Flying W. Airport	N14	Burlington	NJ
Hammonton Municipal Airport	N81	Atlantic	NJ
Pemberton Airport	3NJ1	Burlington	NJ
Robert J. Miller Air Park	MJX	Ocean	NJ
South Jersey Regional Airport	VAY	Burlington	NJ
Red Lion Airport	N73	Burlington	NJ
Teterboro Airport	TEB	Bergen	NJ
Old Bridge Airport	3N6	Middlesex	NJ
Trinca Airport	13N	Sussex	NJ
Marlboro (closed in 2002)	2N8	Monmouth	NJ
Monmouth Executive Airport	BLM	Monmouth	NJ
Morristown Municipal Airport	MMU	Morris	NJ
Lakehurst NAES/ Maxfield Field	NEL	Ocean	NJ
Essex County	CDW	Essex	NJ
Trenton-Robbinsville	N87	Mercer	NJ
Linden Airport	LDJ	Union	NJ
Solberg Hunterdon Airport	N51	Hunterdon	NJ
Central Jersey Regional (formerly Kupper)	47N	Somerset	NJ
Princeton Airport	39N	Somerset	NJ
Sussex	FWN	Sussex	NJ
Trenton-Mercer	TTN	Mercer	NJ
Greenwood Lake Airport	4N1	Passaic	NJ
Blairstown	1N7	Warren	NJ
Lincoln Park Airport	N07	Morris	NJ
Lakewood	N12	Ocean	NJ
Sky Manor Airport	N40	Hunterdon	NJ
Somerset Airport	SMQ	Somerset	NJ
Alexandria Airport	N85	Hunterdon	NJ
Newton	3N5	Sussex	NJ
Hackettstown Airport	N05	Warren	NJ
Aeroflex-Andover	12N	Sussex	NJ
McGuire Air Force Base	WRI	Burlington	NJ
Redwing Airport	2N6	Burlington	NJ
Francis S Gabreski Airport	FOK	Suffolk (L.I.)	NY
Calverton Executive	3C8	Suffolk (L.I.)	NY
East Hampton	HTO	Suffolk (L.I.)	NY
Lufker	49N	Suffolk (L.I.)	NY
Spadaro	1N2	Suffolk (L.I.)	NY
Brookhaven Airport	HWV	Suffolk (L.I.)	NY
Bayport Aerodrome	23N	Suffolk (L.I.)	NY
Republic Airport	FRG	Suffolk (L.I.)	NY
Mattituck	21N	Suffolk (L.I.)	NY
Montauk	MTP	Suffolk (L.I.)	NY
Elizabeth Field	0B8	Suffolk (Fishers Island)	NY
Sullivan County Int'l Airport	MSV	Sullivan	NY
Wurtsboro-Sullivan County Airport	N82	Sullivan	NY
Dutchess County	POU	Dutchess	NY
Sky Acres Airport	44N	Dutchess	NY
Stormville	N69	Dutchess	NY
Orange County Airport	MGJ	Orange	NY
Randall Airport	06N	Orange	NY
Warwick Municipal	N72	Orange	NY
Allentown Queen City Municipal Airport	XLL	Lehigh	PA
Braden Airpark	N43	Northampton	PA

Source: RPA & Landrum & Brown analysis

central and northern New Jersey counties, the exponent was adjusted to 2.6. For the outlying counties containing an outlying airport, and for some adjacent counties, the adjustments were set at either 2.5 or 2.65.

For the international model, the exponent with the best fit was 1.8. For JFK the exponent was set at 1.6 for travel to and from the five boroughs and 1.7 for the other counties. For EWR, the exponents for travel to and from the northern and central New Jersey counties were also set at 1.6. For this model, eight counties were dropped from the analysis because they had such low samples of trips that the shares were unreliable.

The lower exponents for the international model are consistent with the fact that international travelers have less choice as to which airport to use and will be more willing to travel further since their destinations are more likely to be unique to a particular airport.

Example of How Estimates of Shifts Were Calculated

Suppose an outlying airport now (as of 2005) has 1.0 MAP. As a first approximation, the airport is assumed to grow to 2.8 MAP. Using the 2.8 MAP assumption, the accessibility model is applied and yields a shift of 0.8 MAP from the three major airports. The original volume can be expected to grow naturally (say by 30 percent by the time the three major airports reach 130 MAP). Thus, the base passenger level is 1.0 MAP plus 30 percent or 1.3 MAP. Adding this to the shift of 0.8 MAP from the major airports brings the total to 2.1 MAP. Now the four additive factors – outside / induced /connecting / international passengers – are applied. Suppose these added factors when applied to the 2.1 million add another 0.4 MAP bringing the total to 2.5 MAP. This is 0.3 MAP short of the original assumption of 2.8 MAP. This suggests that 2.8 MAP is not achievable with the assumptions for the factors. Since these factors are likely to be small, it is unreasonable to double them to reach the 2.8 MAP level. Rather, it suggests that the original 2.8 MAP was an unreasonably high estimate. By selecting a lower value, say 2.4 MAP, and recalculating the shift from the major airports and then applying the additive factors, the new estimate and the assumed original level will be converged on quickly.

In this manner, each of the nine outlying airports was tested for the shift they might reasonably expect to cause if they develop into more significant airports than they currently are. The assumptions used and the resulting estimates of air passengers are show in Table C-2. The estimated future volumes assume both a basic set of factors for outside region, induced travel, connecting and international passengers (first row) and a more aggressive one (last row). These latter estimates of air passengers were used for the estimates of passenger shifts. Table C-3 shows the resulting passenger estimates for the three projections levels and their components.

For future years, the distribution of trips generated in each county was adjusted to account for differential population and job growth using the methodology developed in the RASDS study.

TABLE C-2

Input Factors for Projected Passenger Volumes at Outlying Airports and Resulting Passenger Volumes

Airport	2005 Air Pass. (mil)	% Outside Region	% Induced	% Int'l/Connecting	Air Passengers (mil) 115 MAP	130 MAP	150 MAP	% Growth 150 MAP over 2005
SWF	0.4	20	10	5	1.3	1.8	3.3	725
ISP	1.8	0	10	5	3.0	4.0	4.7	161
ACY	0.9	0	10	5	1.5	1.7	2.0	122
ABE	0.8	20	5	2	1.3	1.6	1.9	138
Mon	0.0	10	10	5	1.6	2.0	2.7	NA
BDL	7.2	7	2	2	6.3	7.2	8.6	19

Source: Regional Plan Association

TABLE C-3

Detailed Estimates of Passenger Volumes at Outlying Airports (000's)

		Base	Shift from Major Airports	Additive Factors	Total
115 MAP	SWF	460	515	342	1,317
	ISP	2,070	646	271	2,987
	MON	0	1,393	247	1,640
	NHV	150	363	106	619
	Mercer	0	249	41	290
	BDL	5,775	56	517	6,348
	Princeton	0	120	35	155
	ABE	920	84	336	1,340
	ACY	1,035	62	353	1,450
130 MAP	SWF	520	740	505	1,765
	ISP	2,340	1,096	515	3,951
	MON	0	1,676	335	2,011
	NHV	169	468	134	771
	Mercer	0	360	70	430
	BDL	6,325	101	791	7,217
	Princeton	0	150	38	188
	ABE	1,040	114	466	1,620
	ACY	1,170	85	415	1,670
150 MAP	SWF	600	1,692	1,032	3,324
	ISP	2,700	1,407	616	4,723
	MON	0	2,168	542	2,710
	NHV	169	565	155	889
	Mercer	0	507	123	630
	BDL	7,150	194	1,292	8,636
	Princeton	0	189	46	235
	ABE	1,200	165	495	1,860
	ACY	1,350	110	500	1,960

Source: Regional Plan Association

Greenfield Site Analysis

Greenfield Site Geospatial Analysis

RPA performed a geospatial analysis to determine if there were sites large enough within the region to the support the development of a new commercial airfield that could offer, ideally, international air service. The analysis incorporated 59 counties in NY, NJ, CT, and PA. Two different types of land use data were sourced for this analysis – Nature Conservancy preserved land areas shapefile and land coverage data raster for all four states. The land coverage data was manipulated using algorithms to interpret the raster file (aerial imagery) and crudely classify land uses – urbanized, undeveloped land, rural, agricultural and open space/parkland. A seven-step process was taken to refine these data to develop output for the final site analysis; these steps are listed below along with their associated spatial outputs.

The first step in the analysis was to import the raw land coverage data into GIS and to reclassify the land data as useable and unusable (VALUE: 11,12,21,22,23,24 as "0" or unusable land, all others as "1" or potentially usable land). At this level of the analysis usable land consisted of open space, which includes parks, agricultural lands and some sprawl development. Unusable land was mostly in urban area and higher density suburban developments.

In step two the raster pixels/spatial resolution was reduced from 30x30 m to 300x300 m to decrease stray isolated specks of land. A minimum value was used so that new cells with *any* unusable land would be reclassified as all unusable land.

In step three a 'Majority Filter' was used, it replaced cells based on the majority of their contiguous neighboring cells. This filter was applied three times to further reduce the occurrence of isolated specks of land. These last two steps (#2 and #3), further refined the land coverage dataset, accounting for less dense residential and commercial developments that are prevalent throughout the region.

FIGURE D-1

Step 1: Raw Land Coverage Data (developed & undeveloped)

Source: Regional Plan Association analysis

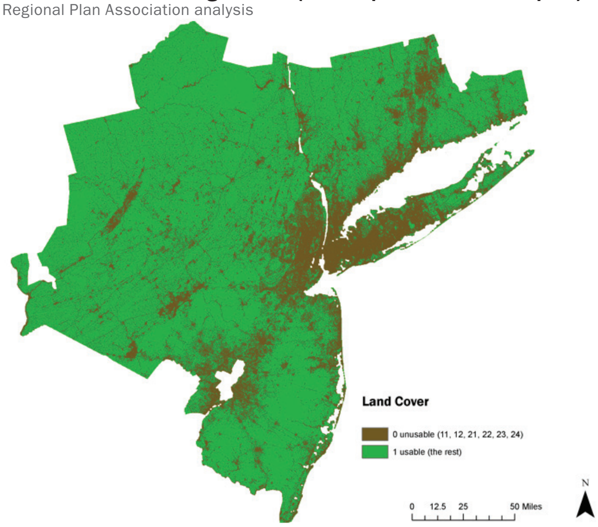


FIGURE D-2

Step 2: Aggregate Land Coverage Data

Source: Regional Plan Association analysis

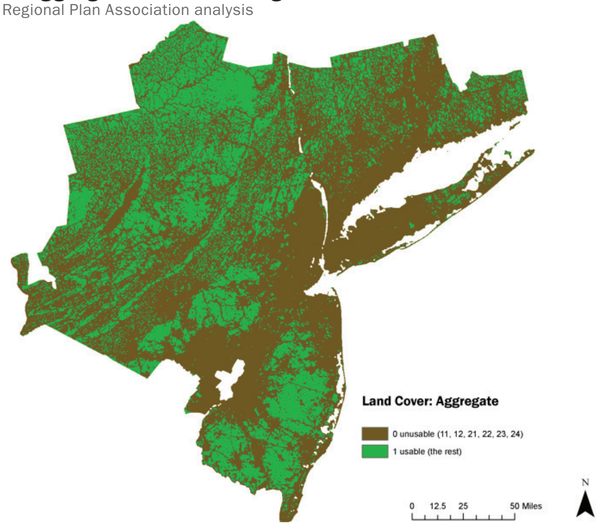


FIGURE D-3

Step 3: Apply Majority Filter to Land Coverage Data

Source: Regional Plan Association analysis

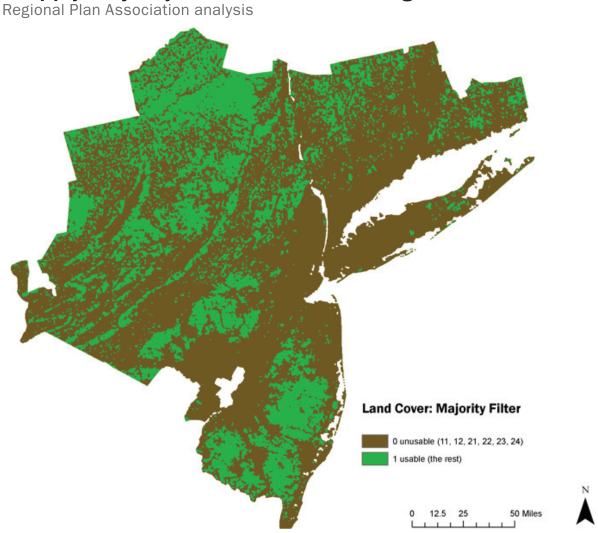


FIGURE D-4

Step 4: Overlay Protect Layers

Source: Regional Plan Association analysis

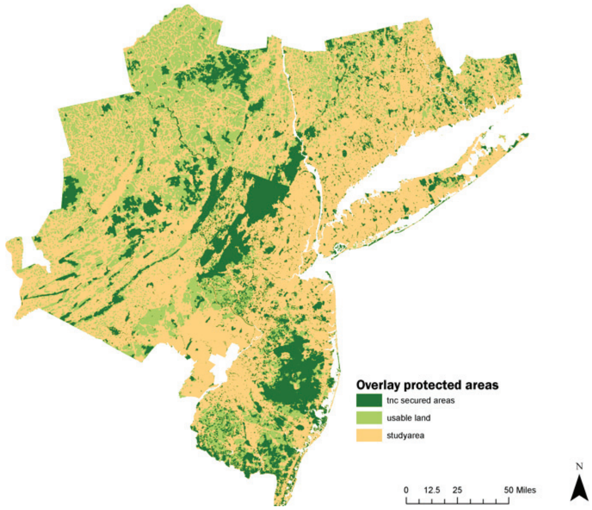


FIGURE D-5

Step 5: Erase Parcels That Are Within Protect Areas

Source: Regional Plan Association analysis

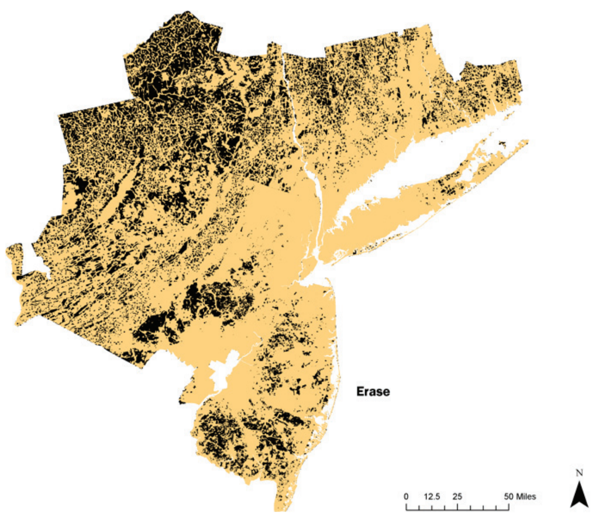
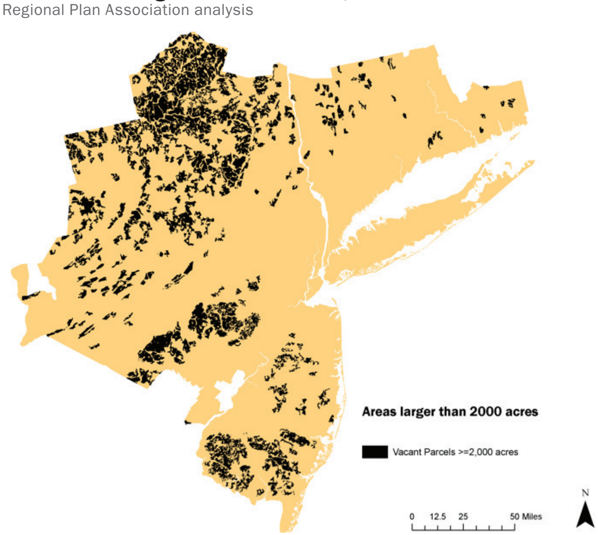


FIGURE D-6

Step 6: Select Contiguous Parcels ≥ 2,000 acres

Source: Regional Plan Association analysis



Step four overlaid the protected lands spatial file compiled by the Nature Conservancy and converted the land coverage data to polygons, creating a land coverage shapefile. This was required to perform the spatial query between the protected lands shapfile and the land coverage data. The "usable" parcels from step three that were within the "secured areas" were removed from the land coverage dataset in step five.

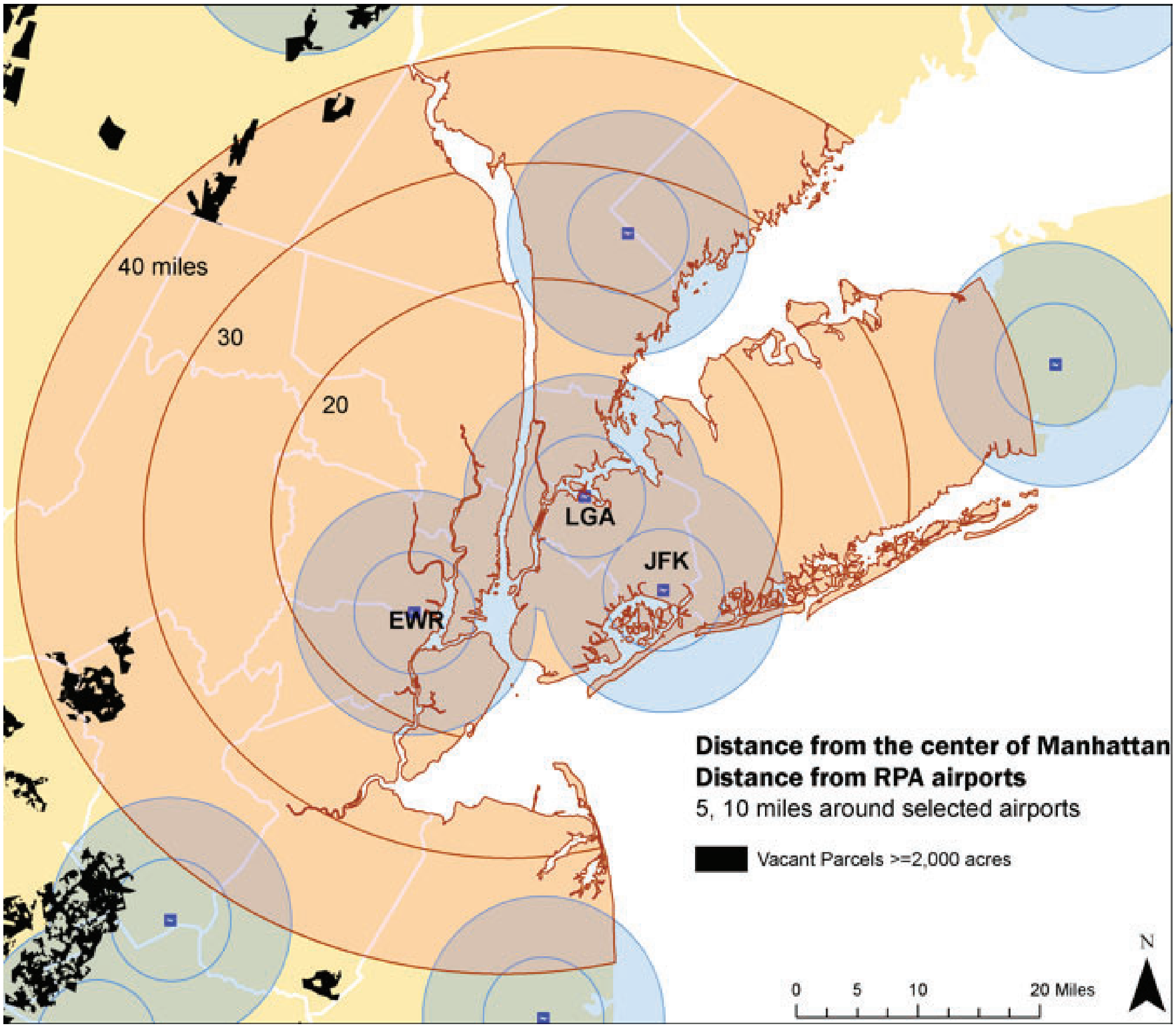
The final step in refining the land coverage data was to select contiguous parcels that were equal to or greater than 2,000 acres – the minimum amount of land required to construct a new airport. In step seven a 40-mile buffer, radiating from the Manhattan central business district, was applied to these remaining parcels and only parcels within this buffer were selected for further analysis.

Land coverage maps were created for each of the five remaining study areas, these maps included other spatial layers (water bodies, highways, etc...) that might limit development of these sites as an airport. Aerial imagery and topographic maps were also used, this part of the analysis and the results are detailed in Chapter 7.

FIGURE D-7

Step 7: Create Buffer and Select Parcels within 40 Miles of CBD

Source: Regional Plan Association analysis



New Capacity and Noise Analyses

New Runway Capacity Analysis

This study uses the runway capacity estimates presented here to derive the annual aircraft operations benefit for each alternative airfield development option. While this analysis presents the analysis for a peak hour, this peak hour represents a single condition, when actual conditions vary considerably due to mix of aircraft, the split between arriving and departing traffic and weather. It is assumed that the mix of aircraft types will be similar to those observed today, approximately a 50/50 mix of arrivals and departures, and wind conditions that allow runway operations in two directions.

The volumes shown also do not reflect any restrictions in the airspace that could result from weather or other constraints on the en route air traffic system. Future studies should refine these capacity estimates to confirm them across a wider range of demand conditions, and to consider more nuanced information about the airspace design and air traffic control operations.

Hourly capacities are presented for the four most common runway operating combinations at each airport. While the FAA uses other combinations of runways from time to time, these most common runway combinations represent at least 80 to 90 percent of annual usage.

Runway combinations that use converging arrival runways are not usable in poorer weather conditions. In these cases, the FAA uses a non-converging operation that has a lower capacity. Thus, this analysis presents two capacity values for these combinations with converging arrivals – a VFR capacity for good weather conditions, and an IFR capacity for poorer weather conditions.

With runway combinations where aircraft must cross active runways to reach the terminal (arrivals) or another runway (departures), the runway flow rates are discounted to reflect the crossing activity. This analysis assumes that multiple crossing points would be available in the final airfield design.

All of the new runway capacity analyses assume that the FAA has implemented one of the four airspace design options described in Chapter 10. The existing airspace analyses also assume that the FAA has completed its current airspace redesign program. Future airspace designs create new airspace or alter existing airspace as necessary. The airspace designs presented in this report are conceptual in nature and do not reflect any detailed analysis of routes and traffic volumes.

The hourly volume estimates presented in this analysis reflect existing operations and were calibrated to data from the FAA Aviation System Performance Metrics (ASPM) database for July 2009. Estimates of future runway performance using NextGen were based on previous simulation analyses from the Port Authority's 1999 Airspace Study and a statistical analysis of anticipated Time Based Flow Metering benefits. The following sections detail assumptions made in the capacity analyses for each of the 14 airport expansion options.

FIGURE E-1

JFK Runway Operating Combinations for Options 1 and 2 with Existing Airspace and Air Traffic Control Technology

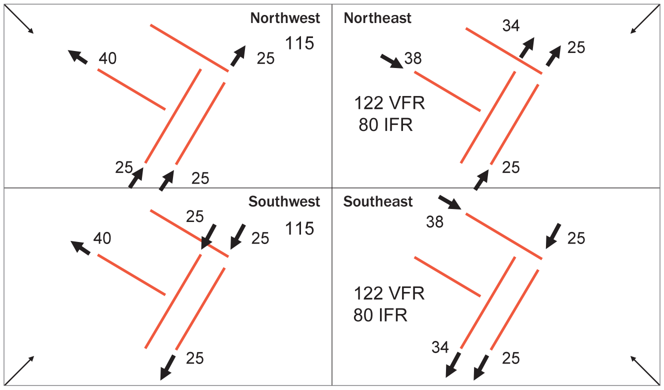
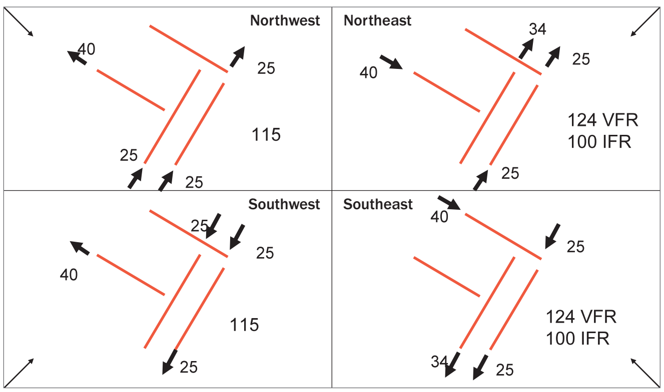


FIGURE E-2

JFK Runway Operating Combinations for Options 1 and 2 with NextGen Airspace and Air Traffic Control Technology

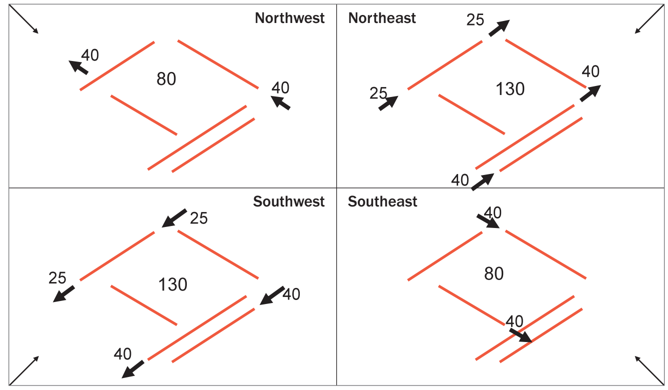


JFK Options 1 and 2 Notes

1. Southwest and northeast flow require allocation of Belmont Airspace to JFK. It will likely result in modification of departure routes from LGA Runway 13. NextGen technology will improve navigation precision which will ease the separation of LGA and JFK traffic north of JFK and east of LGA.
2. NextGen airspace improvements increase the flow rate for independent arrival or departure runways. Flow rates for intersecting or mixed use runways will likely remain unaffected since the rate depends on the coordination of arrivals and departures.
3. Departure flow rates from Runway 4L/22R in northeast and southeast flow were reduced to accommodate runway crossings.

FIGURE E-3

JFK Option 3 with NextGen Airspace and Air Traffic Control Technology



JFK Option 3 Notes

1. Requires "7-25" airspace
2. NextGen airspace required to conduct independent arrival operations in northeast flow (segmented approaches with altitude separations)
3. Northwest and southeast flow have minimal (two to four percent) annual use for high wind conditions only
4. NextGen airspace improvements increase the flow rate for independent arrival or departure runways.

FIGURE E-4

JFK Option 4 with Existing Airspace and Air Traffic Control Technology

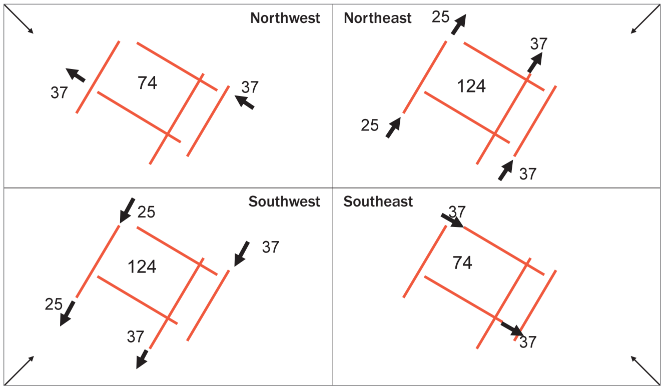


FIGURE E-6

JFK Option 5 with Existing Airspace and Air Traffic Control Technology

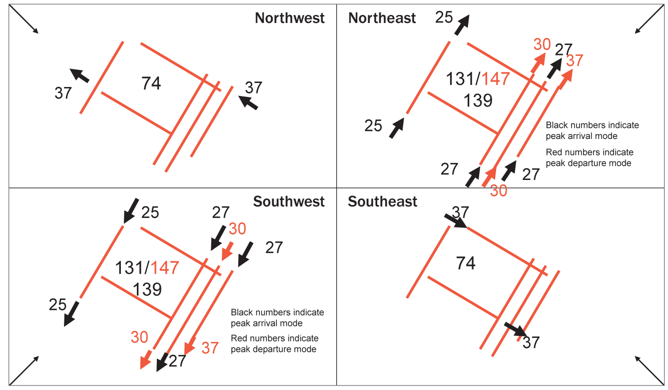


FIGURE E-5

JFK Option 4 with NextGen Airspace and Air Traffic Control

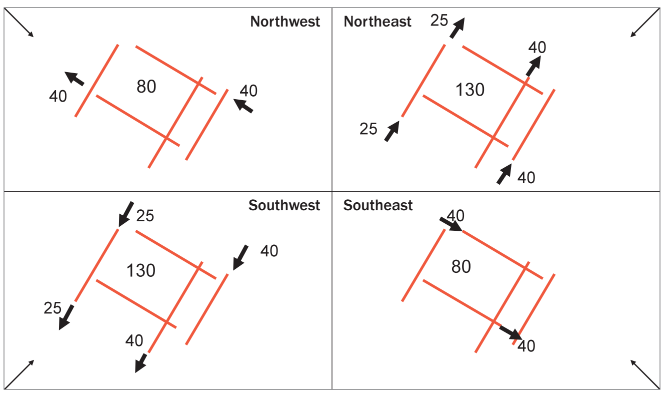
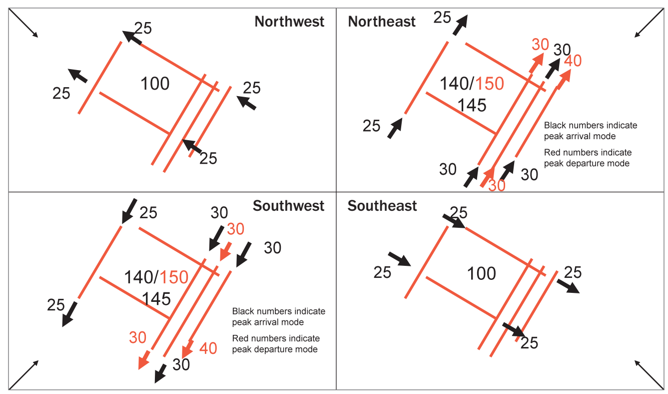


FIGURE E-7

JFK Option 5 with NextGen Airspace and Air Traffic Control Technology



JFK Option 4 Notes:

1. Requires "4-22" airspace
2. NextGen airspace required to use both runways at LGA and the new west 4-22 runway at JFK
3. Northwest and southeast flow have minimal (two percent) annual use for high wind conditions only
4. NextGen airspace improvements increase the flow rate for independent arrival or departure runways

Option 5 Notes:

1. Requires "4-22" airspace
2. NextGen airspace required to use both runways at LGA and the new west 4-22 runway at JFK
3. Northwest and southeast flow have minimal (two percent) annual use for high wind conditions only
4. NextGen airspace improvements increase the flow rate for independent arrival or departure runways. Flow rates for intersecting or mixed use runways will likely remain unaffected since the rate depends on the coordination of arrivals and departures.
5. Departure flow rates from Runway 4L/22R in northeast and southeast flow reduced to accommodate runway crossings.

FIGURE E-8

JFK Option 6 with NextGen Airspace and Air Traffic Control Technology

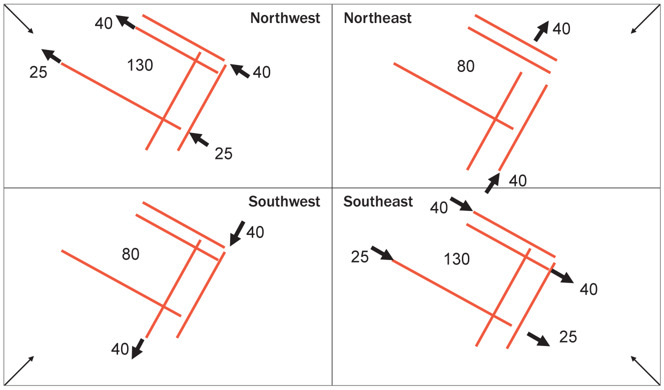
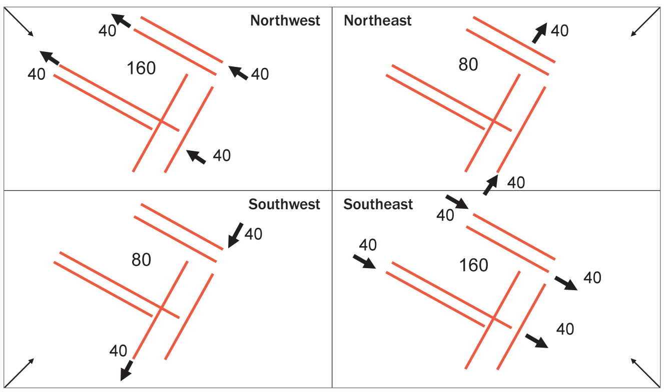


FIGURE E-9

JFK Option 7 with NextGen Airspace and Air Traffic Control Technology



JFK Option 6 Notes:

1. Requires "13-31" airspace and NextGen I
2. NextGen II airspace required to use both runways at LGA and three 13-31 runways at JFK
3. Northeast and southwest flow have minimal (four percent) annual use for high wind conditions only

JFK Option 7 Notes:

1. Requires "13-31" airspace and NextGen I
2. NextGen II airspace required to use both runways at LGA and four 13-31 runways at JFK
3. Northeast and southwest flow have minimal (four percent) annual use for high wind conditions only

FIGURE E-10

EWR Runway Operating Combinations for Options 1 and 2 with Existing Airspace and Air Traffic Control Technology

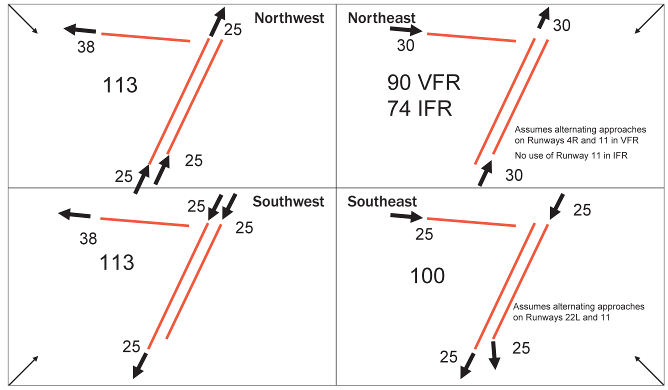
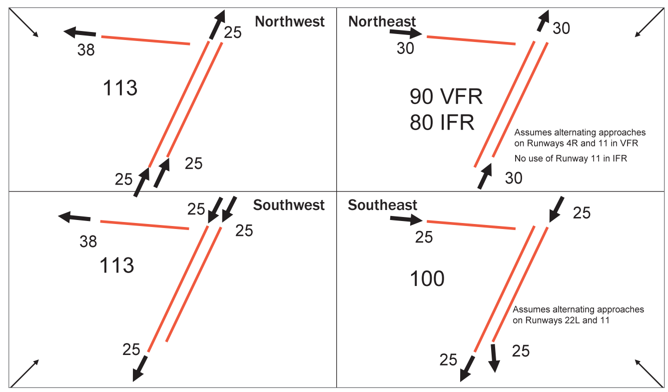


FIGURE E-11

EWR Runway Operating Combinations for Options 1 and 2 with NextGen Airspace and Air Traffic Control Technology



EWR Options 1 and 2 Notes:

1. NextGen airspace improvements increase the flow rate for independent arrival or departure runways. Flow rates for intersecting or mixed use runways will likely remain unaffected since the rate depends on the coordination of arrivals and departures.

FIGURE E-12

EWR Runway Operating Combinations for Option 3 with Existing Airspace and Air Traffic Control Technology

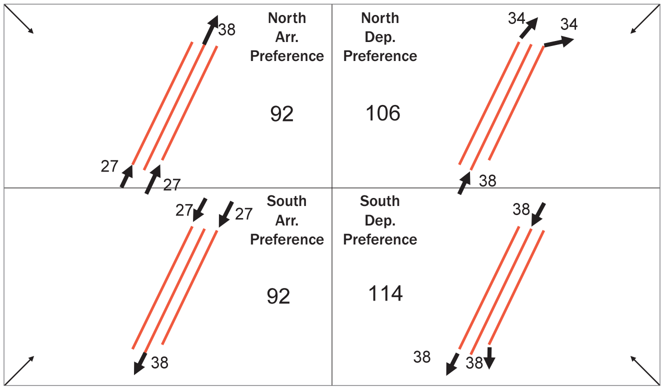
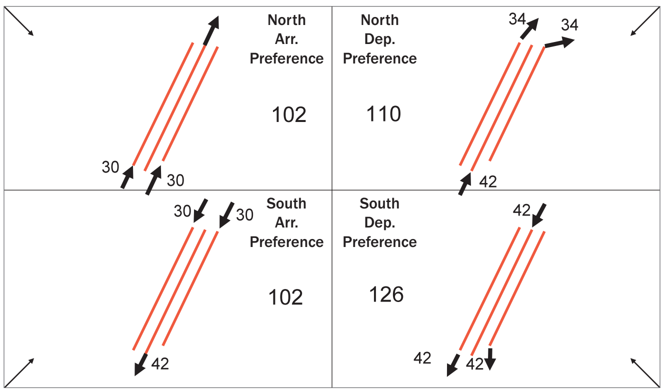


FIGURE E-13

EWR Runway Operating Combinations for Option 3 with NextGen Airspace and Air Traffic Control Technology

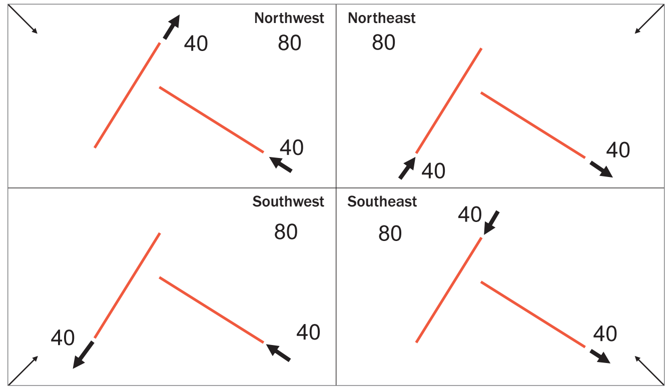


EWR Option 3 Notes:

1. NextGen airspace improvements increase the flow rate for independent arrival or departure runways. Flow rates for intersecting or mixed use runways will likely remain unaffected since the rate depends on the coordination of arrivals and departures.
2. Runway flow rates assume taxiways around end of runways to avoid aircraft crossing runways

FIGURE E-14

LGA Runway Operating Combinations for Option 1 with Existing Airspace and Air Traffic Control Technology



LGA Option 1 Notes:

1. Assumes existing airspace or "7-25" airspace
2. Requires NextGen I to maintain operations on both runways for "4-22" airspace
3. Requires NextGen II to maintain operations on both runways for "13-31" airspace
4. Departures on Runway 13 and arrivals on Runway 31 limited by tall buildings in Flushing
5. Northwest flow operations have lower capacity in IFR conditions due to the need to coordinate arrivals and departures on both runways (missed approach)

FIGURE E-15

LGA Runway Operating Combinations for Option 1 with NextGen Airspace and Air Traffic Control Technology

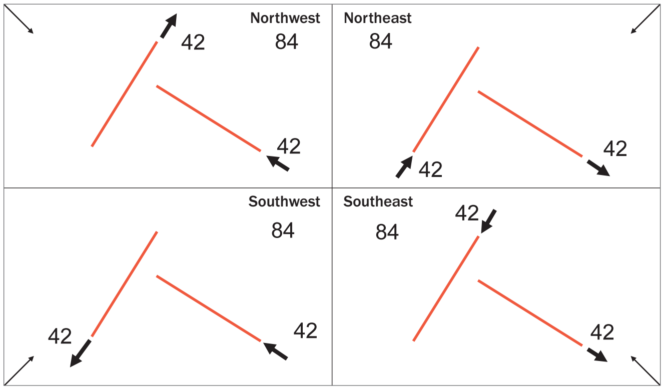


FIGURE E-16

LGA Runway Operating Combinations for Option 2 with Existing Airspace and Air Traffic Control Technology

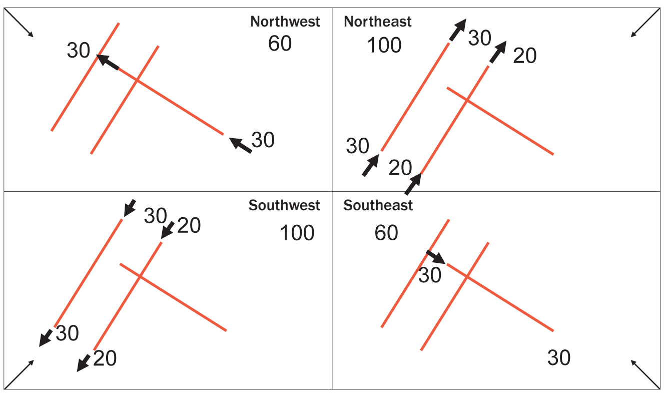
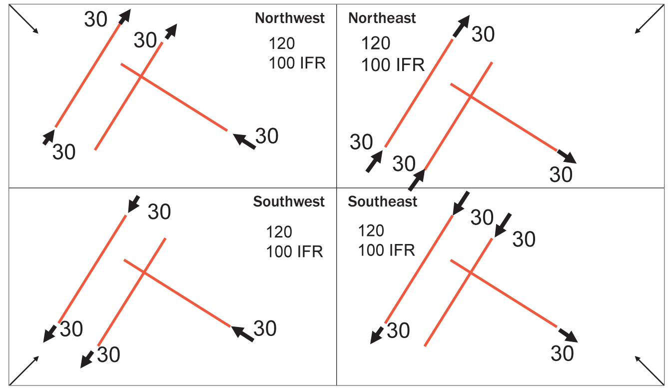


FIGURE E-17

LGA Runway Operating Combinations for Option 2 with NextGen Airspace and Air Traffic Control Technology



LGA Option 2 Notes:

1. Assumes "4-22" airspace
2. Requires NextGen I to maintain operations in both runway directions for "4-22" airspace
3. Crosswinds force single runway operations on Runway 13-31 in two percent of annual weather
4. Operations levels on Runway 4R/22L discounted for runway crossings

FIGURE E-18

LGA Runway Operating Combinations for Option 3 with Existing Airspace and Air Traffic Control Technology

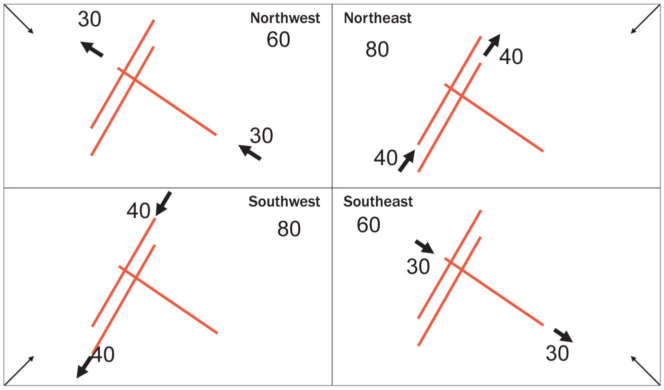
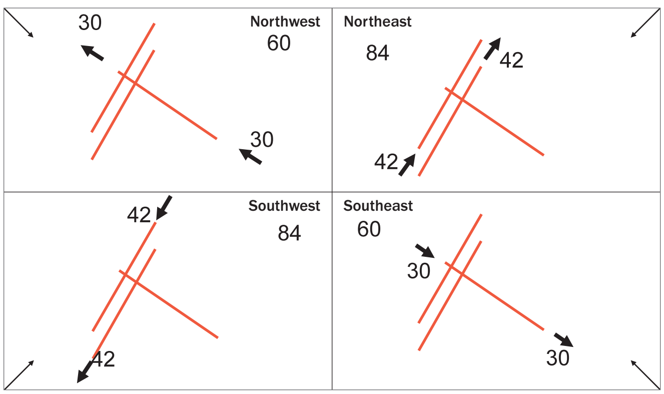


FIGURE E-19

LGA Runway Operating Combinations for Option 3 with NextGen Airspace and Air Traffic Control Technology

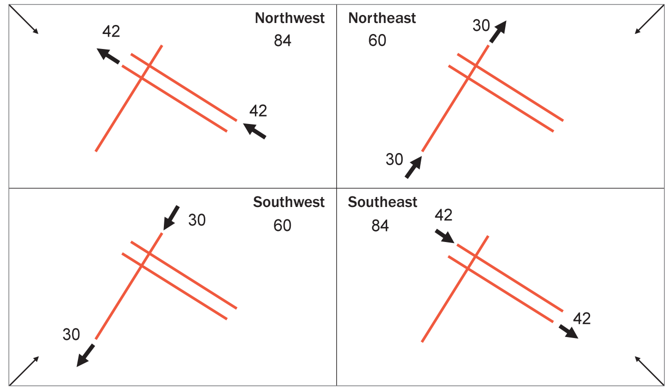


LGA Option 3 Notes:

1. Assumes "4-22" airspace
2. Requires NextGen I to maintain operations on both runway directions for "4-22" airspace
3. Crosswinds force single runway operations on Runway 13-31 in two percent of annual weather

FIGURE E-20

LGA Runway Operating Combinations for Option 4 with NextGen Airspace and Air Traffic Control Technology



LGA Option 4 Notes:

1. Requires "13-31" airspace and at least NextGen I Airspace and Air Traffic Control Procedures and Technology
2. Requires NextGen II or more to maintain operations on both runways within "13-31" airspace configuration
3. Single direction operations on Runway 4-22 required for four percent of annual weather conditions due to high winds

Geospatial Noise Analysis

Typically, as part of a public Environmental Impact Study (EIS) for airport expansion, a noise analysis is completed using the FAA's Integrated Noise Model (INM) or Noise Integrated Routing System (NIRS) when impacts to the surrounding areas increase by 1.5dB or more or are above 65dB. While this study does not adhere to the stringent regulatory framework of a formal EIS, it was important to gain an understanding of the order of magnitude of the noise impacts for each of the proposed expansion options. This was accomplished through a spatial analysis using the existing 65dB+ noise contour profile for each airport and then overlaying these shapes over 2000 US Census "tract-level" spatial data that contained the population and number of housing units in each tract. All census tracts that were "intersected" by this buffer were included. It is important to note that even if most of the tract was outside of the 65dB+ buffer, the entire population and all of the housing units within that tract were still captured. A proportional split was not performed because the census tracts were small enough that this was not considered to be an issue in the majority of cases, additionally this method can also be problematic because it does not account for variation in population and housing density. This initial step determined the population and number of housing units currently impacted by 65dB+ levels of noise, shown in Table E-1, which will be used to determine the incremental increase in surrounding population and housing units impacted by the new or modified runways

The next step was to develop crude noise contour buffers for each of the 14 expansion options. These 65dB+ "block" buffers were developed by Landrum and Brown and were used in a spatial query that was essentially identical to the one detailed above. The number of housing units and population was then summarized for each option. The specific geographies (or properties) where noise impacts would be the greatest were not documented. Only the incremental increase in the number of housing units and population impacted between the base noise condition and individual expansion options was captured. Chapter 10 discusses the final steps of the noise analysis, with Table 10.1 detailing the scores (ranging from 0 to 4) that were applied to the incremental noise impacts that are shown in Table E-2. These breaks were determined using the quartile function in Excel.

TABLE E-1

Base/Existing Noise Impacts

Airport	Housing Units	Population
EWR 65 DNL	14,068	44,288
JFK 65 DNL	32,505	95,053
LGA 65 DNL	12,986	50,107
Total	59,559	189,448

Source: Regional Plan Association

TABLE E-2

Incremental Housing Units and Surrounding Population Within Noise Buffers for Each Expansion Option

Airport	Option	Name	Incr Housing Units	Incr Population
LGA	1	Decouple	24,024	70,272
LGA	2	Parallel Dependent 4/22s	28,272	78,263
LGA	3	Parallel Independent 4/22s	33,404	93,990
LGA	4	Parallel 13/31s	12,159	36,925
EWR	1	Decouple - 11/29	24,745	67,092
EWR	2	New 9/27	33,006	90,295
EWR	3	New 5/23 - OnSite	11,383	32,094
JFK	1	Decouple - 4/22 Shift Only	10,863	33,575
JFK	2	Decouple - 4/22 and 13/31 Shift	13,530	41,944
JFK	3	New Triple 7/25s - Three Parallels	15,658	44,356
JFK	4	Modified 4/22s & New 5/23 Single Western Runway - Three Parallels	15,047	49,687
JFK	5	Triple 4/22s & Western 5/23 - Four Parallels	38,512	123,175
JFK	6	Northern 14/32 Parallels & Existing Bay Runway - Three Parallels	14,745	47,357
JFK	7	Northern 14/32 Parallels and Southern 13/31 Parallels - Four Parallels	20,294	61,464

Source: Regional Plan Association

Listing of Airport Stakeholders Group and Better Airports Alliance Members

Regional Plan Association would like to thank the following organizations and individuals for their participation on the Airports Stakeholders Group and Better Airports Alliance:

Members of FOTRA Stakeholder Group

(participated/invited)

ACEC
Air Line Pilots Association, Int'l
Air Traffic Control Association
Aircraft Owners and Pilots Association
Airline Dispatcher Federation
AKRF Consulting
America 2050
American Institute of Architects, New York
American Library
American Planning Association, New York Metro Chapter
Association for a Better Long Island
ATTAP Technologies
Bank of New York Mellon
Barclays Capital
Baruch College/ CUNY Center for Logistics and Transportation
Bergen County, Department of Planning
Brookfield Financial Properties
Brown Brothers Harriman & Co.
Building Trades Employers' Association
Business Council of Fairfield County
Cablevision
Canon USA, Inc.
CIGNA Corp.
Citibank Inc.
Citizens Union of the City of New York
City of New York
City of Newark
Congresswoman Carolyn McCarthy
Connecticut Department of Transportation
Construction Industry Council
Cooper Union Infrastructure Institute
Corporate Development at DMJM+HARRIS, (AECOM)
Coty, Inc.
County of Essex, New Jersey
CUNY Aviation Institute
Department of Economic and Housing Development
District Council 37
Downtown Alliance
Edison Properties, LLC
Empire State Development Corporation
Empire State Future
Environmental Defense Fund
Fairfield County Community Foundation
Federal Aviation Administration
Fedex Corporation
Fiscal Policy Institute
Forum of Regional European Airports
Goldman Sachs
Guardian Life Insurance Company
HarperCollins Publishers, LLC
Hearst Corporation
HNTB
Hudson County Board of Freeholders
Hudson Valley Economic Development Corporation
IBM Corporation
IGC Group (International Government Relations)
International Air Transport Association
Jimmy Choo, Ltd.
Jones Lang LaSalle
JP Morgan
M & T Bank
Memorial Sloan-Kettering Cancer Center
Metropolitan Transportation Authority
Metropolitan Waterfront Alliance
Milbank, Tweed, Hadley & McCloy
Moody's Investors Service
Nassau County, Office of County Executive
National Air Traffic Controllers Association
National Business Aviation Association
Natural Resources Defense Council
New Jersey Alliance for Action
New Jersey Department of Transportation
New Jersey Future
New Jersey State Chamber of Commerce
New Jersey State League of Municipalities
New World Capital Group
New York City Department of Transportation
New York City Economic Development Corp.
New York City Environmental Justice Alliance
New York League of Conservation Voters
New York Metropolitan Transportation Council
New York State Department of Transportation
New York State Laborers Union
Nicholas & Lence Communications
NJDOT Division of Aeronautics
NJTPA
NJTransit
North Jersey Transportation Planning Authority, Inc.
NRG Energy, Inc
NY League of Conservation Voters
NYC Labor Council AFL/CIO
NYC Mayor's Office of Long Term Planning and Sustainability
NYCEDC
Office of the Queens Borough President

OppenheimerFunds, Inc.
Orange County Citizens Foundation
Orange County, New York
Parsons Brinckerhoff
Partnership for Sustainable Ports, Inc.
Paul, Weiss and Associates
Penn School of Design
Pfizer, Incorporated
Pitney Bowes
Port Authority of New York and New Jersey
PricewaterhouseCoopers
Princeton Management Associates LLC
Queens Chamber of Commerce
Raytheon Company
Real Estate Board of New York, Inc.
Rockland County
Rutgers University Alan M. Voorhees Transportation Center
Scenic Hudson Inc.
Senator Frank R. Lautenberg
Siemens USA
Skidmore, Owings & Merrill LLP
Somerset County Business Partnership
South Jersey Transportation Authority
Stantec Consulting
State of New York
Staten Island Chamber of Commerce
Sustainable Long Island
The Business Council of Westchester
The Orange County Partnership
Tonio Burgos and Associates
Town of Pound Ridge
UBS
Unilever United States, Inc.
United Parcel Service
Urbanomics
US Airways
UTRC
Verizon
Vision Long Island
Wall Street Journal
Warrington, Fox & Shuffler Strategic Counselors
Weber Law Group
Westchester County Association, Inc.
Westchester County Department of Transportation

Members of Better Airports Alliance

AAA New Jersey Automobile Club
Accenture
AECOM, Inc.
A-1 Limousine
Air Carrier Association of America
Air Transport Association of America, Inc.
American Airlines
Arup
Association for a Better New York
Atlantic City International Airport
Aviation Development Council
Broadway Association
The Business Council of New York State
CH2MHILL
City College of the City University of New York
 Institute for Urban Systems
City College of the City University of New York
 Transportation Research Center
Clear Channel Spectacolor
Continental Airlines
Corgan Associations Architects PC
Delta Airlines
Davler Media Group
General Contractors Association of NY
Greater Jamaica Development Corporation
Hotel Association of New York City
International Brotherhood of Teamsters Joint Council 16
Jacobs Engineering
JetBlue Airways
Landrum & Brown
Long Island Association
Manhattan Chamber of Commerce
Meadowlands Regional Chamber of Commerce
Newark Regional Business Partnership
NYC & Company
The Steven L. Newman Real Estate Institute
New York Building Congress
PARSONS
Partnership for New York City
Pattern for Progress
Permanent Citizens Advisory Committee to the MTA
Regional Plan Association
Rudin Center for Transportation Policy and Management
STV, Inc.
Times Square Advertising Coalition
Tri-State Transportation Campaign
Vaughn College of Aeronautics and Technology