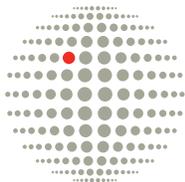




# **GROUND**

The High Cost of Air Traffic Congestion

**February 2009**



**Partnership for New York City**

# Partnership for New York City

With a mission to maintain the city's position as a global center of commerce, finance and innovation, the Partnership for New York City is an organization of the leaders of New York City's top corporate, investment, and entrepreneurial firms. Working with government, labor and civic groups, the Partnership provides business expertise and resources to inform public policy decisions and to promote regional economic growth and job creation. Through its affiliate, the New York City Investment Fund, the Partnership directly invests in economic development projects in all five boroughs of the city.

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# Introduction

The Partnership for New York City undertook this study in order to establish the full economic costs of air traffic congestion at the three major airports serving the New York Metropolitan Region: John F. Kennedy International Airport (JFK), Newark Liberty International Airport (EWR), and LaGuardia Airport (LGA). The Partnership wanted to determine whether investing in expansion of regional airport capacity and upgrading the air traffic control system to reduce flight delays would pay off for the region and the nation.

The findings of the study clearly show that such investment is more than justified by the cost burdens resulting from inefficient and unpredictable passenger and air freight service due to congestion. Moreover, the opportunity to correct these conditions is now — when the federal government is poised to invest in long-neglected infrastructure as a means of stimulating recovery from the global recession.

JFK, Newark Liberty and LaGuardia rank as the country's most congested airports. According to the U.S. Department of Transportation (DOT), only two-thirds of departures from these airports left on time in 2007, and even fewer arrivals met the schedule. Nearly three-quarters of nationwide delays are ultimately attributable to problems originating in the New York region's airspace, which handles about one-third of the nation's flights. These delays cascade and affect flights at airports throughout the global system.

Air traffic levels fell immediately following the 9/11 terrorist attacks, but have increased steadily since then. Today, more travelers board more flights in and out of the New York regional airports than at any point in history. Air freight activity has also reached historic volumes. This growth reflects an expanding economy, more competitive airline pricing and increased global interactions — phenomena that have slowed during the current recession but will rebound in the course of recovery.

New York's status as a thriving center of international business and finance puts tremendous demands on its airports, making some level of congestion inevitable. But current and projected levels of congestion in New York contribute to expensive delays, loss of productivity, wasted fuel, and pollution of the environment to a degree that should not be tolerated. This study concludes that air

traffic congestion is causing significant damage to the regional economy and requires intervention.

It would not be practical to build enough runways, taxiways and terminals to eliminate delays altogether, but clearly some facility expansion is required. Similarly, cuts in service and restriction on routes that connect New York to every corner of the world are undesirable, but some service adjustments may have to be made.

Investment in the country's infrastructure is a priority of the new Federal Administration and a component of the economic stimulus program. This investment should be targeted toward projects that will spur future job growth, not just short-term fixes. A comprehensive program to improve the efficiency and safety of the nation's airports is an example of how public investment can contribute to economic recovery and long-term growth. The Partnership produced this report to document the high costs of air traffic congestion, with the intent of generating citizen awareness and government action focused on upgrading the aviation system in this region and across the nation.

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# Executive Summary

The future of the New York Metropolitan Region as a center of global commerce, finance and innovation requires an air transportation system that is efficient and universally accessible. In 2008, New York's three major regional airports served about 107 million passengers, including 32 million business travelers. To accommodate continued economic growth in the region, these numbers will need to increase in the years ahead. Unfortunately JFK, LaGuardia and Newark Liberty airports are already over-utilized and suffering from severe conditions of air traffic congestion.

Flight delays caused by air traffic congestion at the three airports were responsible for more than \$2.6 billion in losses to the regional economy in 2008. If no action is taken, losses attributable to congestion will total a staggering \$79 billion over the eighteen-year span from 2008 to 2025. These are the conclusions of analyses conducted for this report by HDR | Decision Economics, with input from Accenture, the Port Authority of New York & New Jersey and other expert sources.

This report establishes the cost of congestion for three categories of system users: travelers, the airline industry, and shipping companies.

- The total value of lost time to the traveling public was \$1.669 billion in 2008 and is projected to total over \$50 billion from 2008–2025. For business travelers, the cost of the travel time lost to congestion delays at the three regional airports was \$676 million in 2008, and is projected to be over \$18 billion from 2008–2025. About half this cost is incurred by residents and businesses based in the region. The loss to leisure travelers in 2008 was \$993 million, with an estimated cumulative cost of over \$32 billion from 2008–2025.
- The airline industry incurred significant losses in fuel and staffing costs due to congestion, estimated at \$834 million in 2008, and a total of \$25 billion from 2008–2025.
- Shipping companies that utilize both passenger and freight aircraft also suffer losses from excessive delays. These losses were about \$136 million in 2008, and would be about \$4 billion between 2008 and 2025.

In addition to costs incurred by system users, the report identifies costs to the regional economy as a whole that result from productivity losses that are directly attributable to air traffic congestion. Losses

include 5,600 full-time jobs that will not be created, over \$16 billion in lost output and \$5.5 billion in lost labor income over the next 18 years.

Finally, the entire region must bear the impact of additional emissions generated by aircraft in on-the-ground delays. The long-term cost of these emissions is estimated to be \$1.7 billion in total for the eighteen-year period.

The flight delay estimates presented in this report are based on the full time loss resulting from congestion, including delay time that the airlines have built into their published schedules. They do not include delays due to unusual weather conditions or other extraordinary events. The findings are significant. For passengers flying during the peak season, delays at the regional airports due to congestion were 68 minutes for departures and 53 minutes for arrivals, on average, across the region in 2007.<sup>1</sup> By the end of day, delays frequently build up to 130 minutes or more. Freight-only flights are delayed 34 minutes on average, but exhibit the most variability and least predictability of all schedules. If left unabated, on average, across all three airports, per-passenger time loss due to congestion will rise from 60.6 minutes in 2008, to over 106 minutes in 2025.

Through 2025, the region will incur an aggregate loss of \$23 billion in output, earnings and environmental costs simply as a result of flight delays at three airports. This does not include the significant economic consequences of delays within the rest of the national system that are attributable to problems stemming from congestion at JFK, LaGuardia and Newark Liberty. It does not calculate the opportunity costs associated with regulatory flight caps and limitation on new routes. But it is reason enough to take action on modernization of the airports and air traffic control system.

Mitigating the negative impact of air traffic congestion by capping flights or other regulatory intervention or assessments may reduce delays, but it also reduces the number of flights, creating potentially greater economic losses for the Metropolitan Region. A study published by the Partnership for New York City in 2008 documented that 15 percent of economic growth in New York City between 2002–2004 was attributable to foreign companies setting up business operations here.<sup>2</sup> One in twenty New York City workers was employed by a foreign company in 2004, and that number is likely to have risen over the past five years. Continued foreign direct investment is a key to future economic growth and cannot be accommodated without increased connections with locations in emerging markets around the world.

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1 Congestion delays include both late arrivals and departures and time loss embedded in airline schedule that is not immediately visible to travelers.

2 Partnership for New York City, "Foreign Direct Investment: Bringing the Benefits of Globalization Back Home," 2008

Equally important to the City's economy is tourism. In 2008, a record 47 million tourists came to New York City, contributing \$30 billion to the local economy. International tourists accounted for 21 percent (9.8 million) of the total but for almost 50 percent of the spending. Even more striking is that New York City is the destination of nearly a third of all international tourists coming to the U.S. Leisure travelers have flexibility in planning their vacations and if airport delays begin to erode valuable vacation time, there is a distinct possibility that tourists will choose other destinations. Continuing to improve air transportation to and from the City is critical to maintaining this important segment of the City's economy. Similarly, thousands of New York region businesses import goods from international markets or use air freight to ship goods overseas and rely on the region's airports to maintain links with their customers and suppliers.

Solutions to congestion that allow for continued economic growth require a combination of capacity expansion, up-to-date technologies and industry initiatives to maximize efficiency.

- The Port Authority has identified initial actions at all three airports to provide some improvements in airfields, terminals and roadways that will create incremental capacity. More ambitious efforts will require leadership from business, civic and labor organizations in order to build political consensus in support of expansion in airport capacity.
- The Federal Aviation Administration (FAA) has initiated a program to completely restructure air traffic control services and air routes, based on what can be achieved with modern air navigation equipment and advances in technology. State of the art equipment could greatly improve air navigation accuracy, allowing redesign of routes to permit closer spacing and more options for avoiding weather conditions and accommodating peak aircraft traffic flows. The cost of modernizing the nation's air traffic control system and redesigning routes is estimated to cost \$22 billion, but this study proves that the cost is more than justified by the benefits that will come from reducing delays and inefficiencies that are causing such damage to the regional and national economies.
- The airline industry has already equipped their newly delivered aircraft with the advanced avionics and modern air navigation systems that would enable government investments in infrastructure to pay off. The remaining and far larger challenge will be convincing all aircraft owners to make the investments to re-equip their existing fleets. The next generation air traffic control system envisioned by the FAA only creates the new capacity needed when most of the aircraft can participate in the system.

# Airport Congestion in the New York City Region

New York's major airports [John F. Kennedy International Airport (JFK), Newark Liberty International Airport (Newark Liberty), and LaGuardia Airport (LaGuardia)] are at the top of the list of the country's most congested airports. According to the Department of Transportation, only two-thirds of the aircraft at these airports had an on-time departure in 2007, and only 60 percent of aircraft had on time arrivals, a performance decline of about 20 percent in fewer than 4 years. These delays cascade and affect flights at various airports in the system. Nearly three-quarters of nationwide delays originate in New York area airspace, which handles about one-third of the nation's flights.

The congestion problem at New York's major airports constitutes a crisis of national proportions. But it is also a major drag on the regional economy. Seventy-five million passengers use the region's airports for leisure travel, and about 40 percent of these stay, recreate and spend money within the region. Delays negatively impact the region's ability to attract tourists. In 2005, the Port Authority estimated that airport operations, investment and tourists arriving by air resulted in \$57 billion in regional economic activity.<sup>3</sup>

The Port Authority of New York and New Jersey's Flight Delay Task Force<sup>4</sup> noted that Newark Liberty, LaGuardia, and JFK are the most delay-prone airports in the country, representing one-third of the nation's delays. The Task Force found that each delay in New York results in more than two delays elsewhere in the country. Additionally, the Task Force found that nationally, all aircraft delays cost Americans over \$9 billion each year.<sup>5</sup> Our study estimates congestion-caused delays on flights only with direct links (origins, destinations or connections) in the New York City region and finds that the delay cost totals over 25 percent of the \$9 billion annual national cost.

Airport congestion in the New York region is largely a product of space limitations, including facilities on the ground and limited air space to accommodate the greatest concentration of aircraft movements in the world. Flight activity has increased by 20 percent in the past five years from just over 1.2 million annually in 2002 to 1.45 million in 2007, and has exceeded pre-9/11 levels every year since 2005.

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3 The Port Authority of New York and New Jersey, "The Economic Impact of the Aviation Industry on the New York-New Jersey Region," 2005.

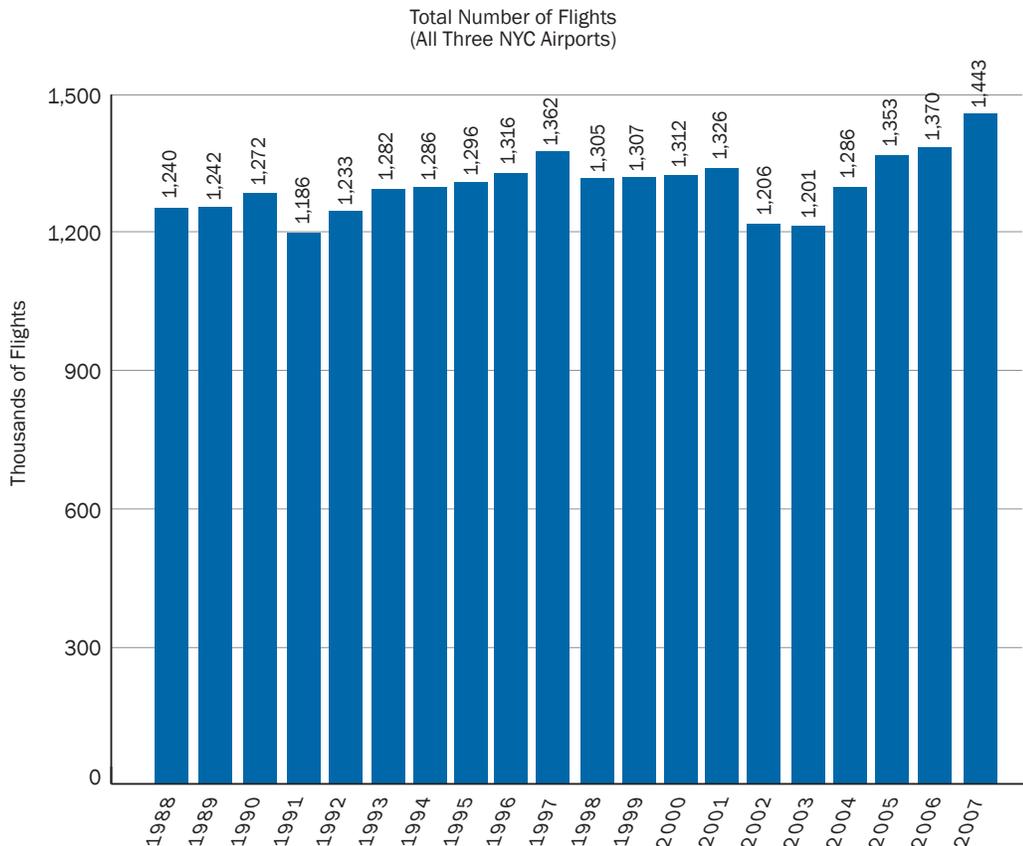
4 See Port Authority of New York and New Jersey, "Flight Delay Task Force Report," 2007.

5 Ibid.

The figure below illustrates annual flight volumes for the three airports evaluated for the years 1988–2007. While the global economic crisis has recently depressed demand, this is likely to be a temporary condition, assuming gradual national economic recovery.

Factors contributing to congestion problems include the level of shared airspace between the three major airports and smaller airports in the region; portions of New York’s airspace that were designed early in the jet age to protect residents from associated noise; use of obsolete ground-based air navigation technologies that can only define long and straight arrival paths as opposed to those that could be defined using upgraded on-aircraft equipment; and the variety of on-board equipment that prevents major portions of the airlines’ fleets from taking full advantage of satellite-based air navigation.

Figure 1: Annual Flight Volumes, New York City Airports, 1988-2007



Source: Federal Aviation Administration

## The Scale of the Problem

Previous attempts to quantify the cost of air traffic congestion have substantially underestimated its economic impact. Determining the real cost of delays is complicated by the fact that airlines, competing to attract and retain customers, adjust their published schedules to account for expected delays when flying into or out of New York. This complicates efforts to quantify the problem. Airlines have to carefully balance their need to keep published flight times as low as they can, with their efforts to avoid excessive delay statistics that scare off customers. The result has been a gradual lengthening of published flight times referred to as “schedule padding” or “block times.” Does a flight that should be achievable in three hours, but is scheduled for three and a half hours, and actually takes four hours represent a half hour or full hour delay?

Even though a passenger on such a flight may think they are only half an hour late, the true time loss (and resulting loss in welfare and, possibly, productivity) is the full hour. This analysis, in seeking to understand the full economic implications of congestion, focuses on the full time loss, regardless of schedule, when that time loss is a result of congestion. It seeks to clarify the true scale of the airport congestion crisis and estimate the economic costs congestion-related delays are imposing on the users of the air travel system and New York’s regional economy. To achieve this, the study looked at how much time is lost, how much worse the problem will get and who bears the costs when there is a delay.

This analysis indicates how flights throughout the day are performing, under congested conditions, relative to a benchmark based on consistently achieved “best times,” during normal operating hours, which are most likely achieved when air traffic is lightest — typically around 6 or 7 a.m. or 11 p.m. The benchmark is established based on the average fastest time a flight route achieves across a season. The benchmark is not established based on the absolute fastest time, which allows for a certain amount of congestion and queuing within the baseline. This widely accepted approach, based on work by Daniel and Harback in the *Journal of Economics*<sup>6</sup>, accounts for congestion delay irrespective of the padding built into airline schedules.

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6 Daniel, Joseph I. and Harback, Katherine Thomas, “(When) Do hub airlines internalize their self-imposed congestion delays?,” *Journal of Economics*, March 2007. See also, the discussion of the merits and detriments of various measurement approaches in the appendix to “Your Flight Has Been Delayed Again,” Joint Economic Committee Majority Staff, May 2008.

For example, for the flight route LaGuardia to Chicago O'Hare International (ORD), using A320 aircraft, the peak season benchmark time reflects the average for the 6:10 a.m. departure period. This benchmark route was routinely achieved in 126.5 minutes. The actual average flight time for this same route using the same equipment was 176 minutes. This represents 49.5 minutes of delay due to congestion. Using benchmarks for each route pair, for each equipment type across seasons, and controlling for extreme weather, mechanical problems, and other non-congestion related delay factors, our study calculates a congestion delay for 2008 and then develops a forecast through 2025.

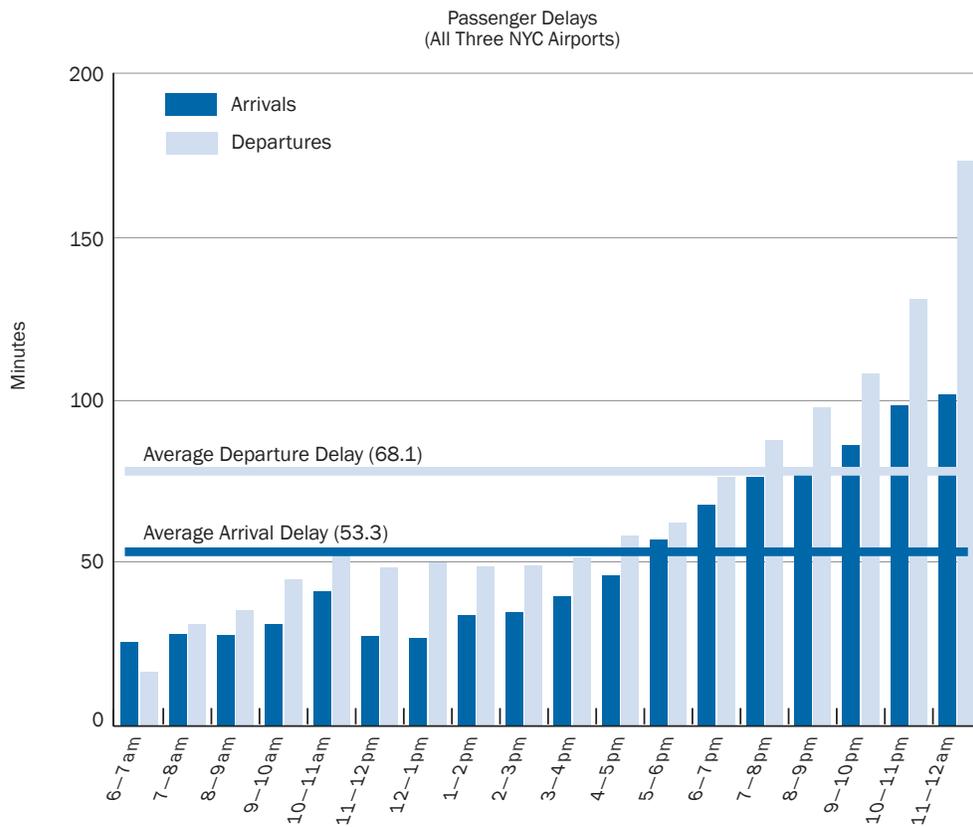
Because the method relies on a high number of observations, about 385,000 passenger flights and over 36,000 freight-only flights, and because the statistical technique boils those observations down to common experiences, the average delay estimates are reliable representations of the delay effects of congestion.

This approach to delay estimation is appropriate for identifying the impacts of congestion. Delay estimates exclude random delays — delays out of proportion with similar flights at similar times — typically caused by airline staffing problems, mechanical problems, and unique weather events. Weather issues that cause delays frequently because the airspace is typically too crowded to accommodate even routine deviations, are included in the delay estimates. Delay is measured for two, two-month periods during the year — an off-peak and a peak season, for both weekdays and weekends during 2007.

As this study illustrates, peak season travelers to New York airports are delayed about 70 minutes per flight on average. End of day delays (which is when the most delayed flights depart on any given day) can reach averages of 130 minutes. Delays due to congestion were 68 minutes for departures and 53 minutes for arrivals, on average, across the region in 2007. Freight-only flights were delayed 34 minutes on average, but exhibit more significant delay peaks and valleys across the day.

Figure 2 describes passenger delays for all three airports combined across the average day. It reports the combined three airport average passenger delay by hour of the day. Flights are recorded at the hour they actually depart or arrive (as opposed to when they were scheduled to depart), so flights departing at the end of the day are typically the most delayed. As indicated in the graph, passenger delays are high, on average, and there are no delay-free periods during the middle of the day.

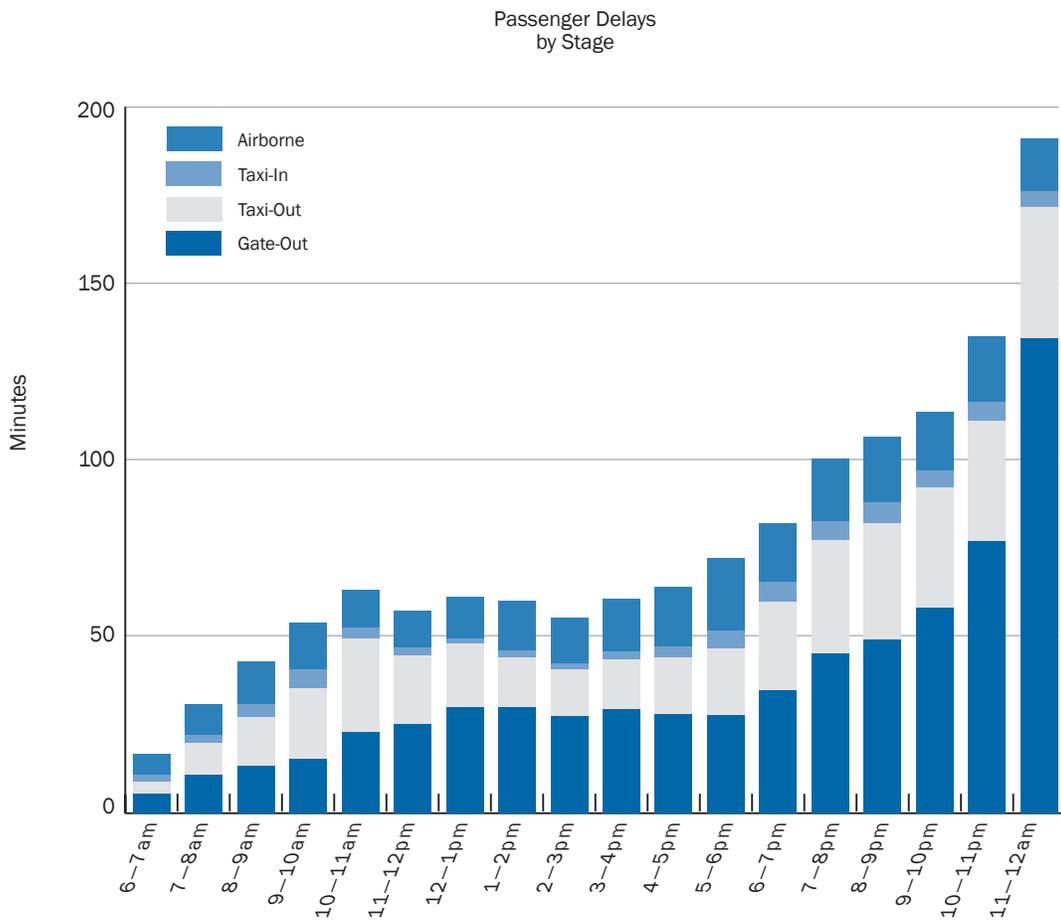
Figure 2: New York City Airports Passenger Delays by Time of Day, 2007



Note: This figure presents arrival and departure delays inclusive of gate time, taxiway time and flight time for all originating airports in the peak season.

Figure 3 presents similar data, but segmented into each stage of travel for which congestion delays are estimated. Flights listed for the end of the day demonstrate the highest level of gate delay as most long-delayed flights will not board passengers for the majority of the delay period. Aside from the scale of delay (about 45 minutes during mid-morning and about 55 minutes during mid afternoon), the chart reinforces the observation that there is not a significant opportunity during mid-day to clear morning delays.

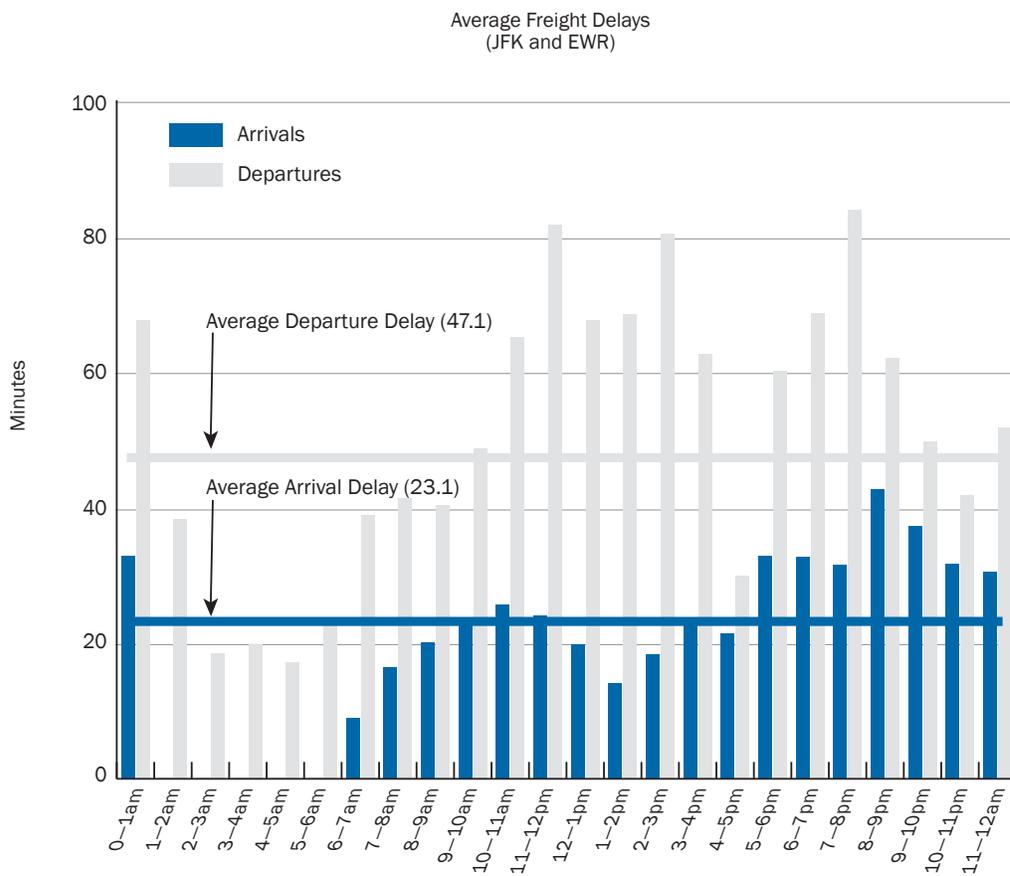
Figure 3: New York City Airports Passenger Delays by Travel Phase, 2007



Note: This figure presents delays by component as the sum of departures and arrivals, excluding gate delays at originating airports for arriving flights in the peak season.

As Figure 4 below indicates, freight-flight departures are congested throughout the day, but show more variability than passenger flights. Arrival delays fall off throughout the overnight period. Package delivery services typically have high volumes of flights departing for cross-continent trips in the late evening period.

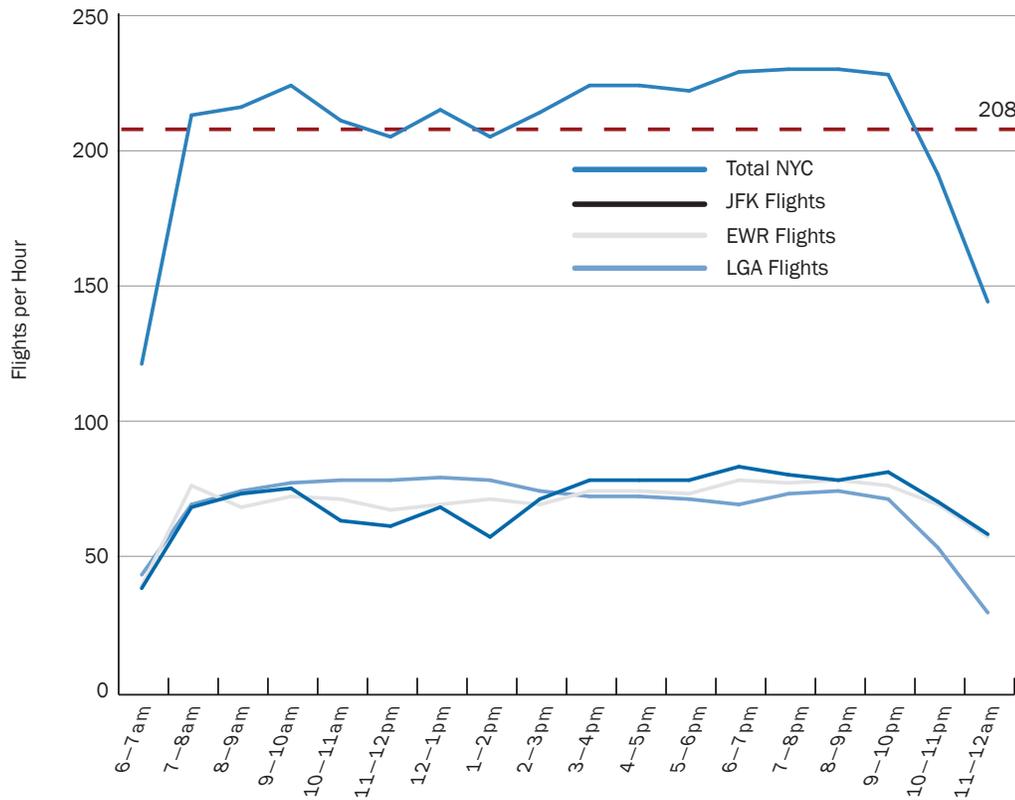
Figure 4: New York City Airports Freight Only Flights by Time of Day, 2007



Note: This figure is based on delays for departures and arrivals, excluding gate delays at originating airports for arriving flights in the peak season.

The analytical results in the charts on previous pages are reinforced by Figure 5 below, which shows the number of flights by hour at each airport and for all three airports combined. As the chart indicates, there are really no delay-clearing, low-activity times throughout the day at LaGuardia. Both JFK and Newark Liberty have limited additional capacity between 9 a.m. and 2 p.m., which allows a portion of the morning delays to dissipate. As demand grows, this ability to dissipate morning delays will gradually disappear and delays will increase throughout the day.

Figure 5: Flights Per Hour at Newark Liberty, JFK and LaGuardia, 2007

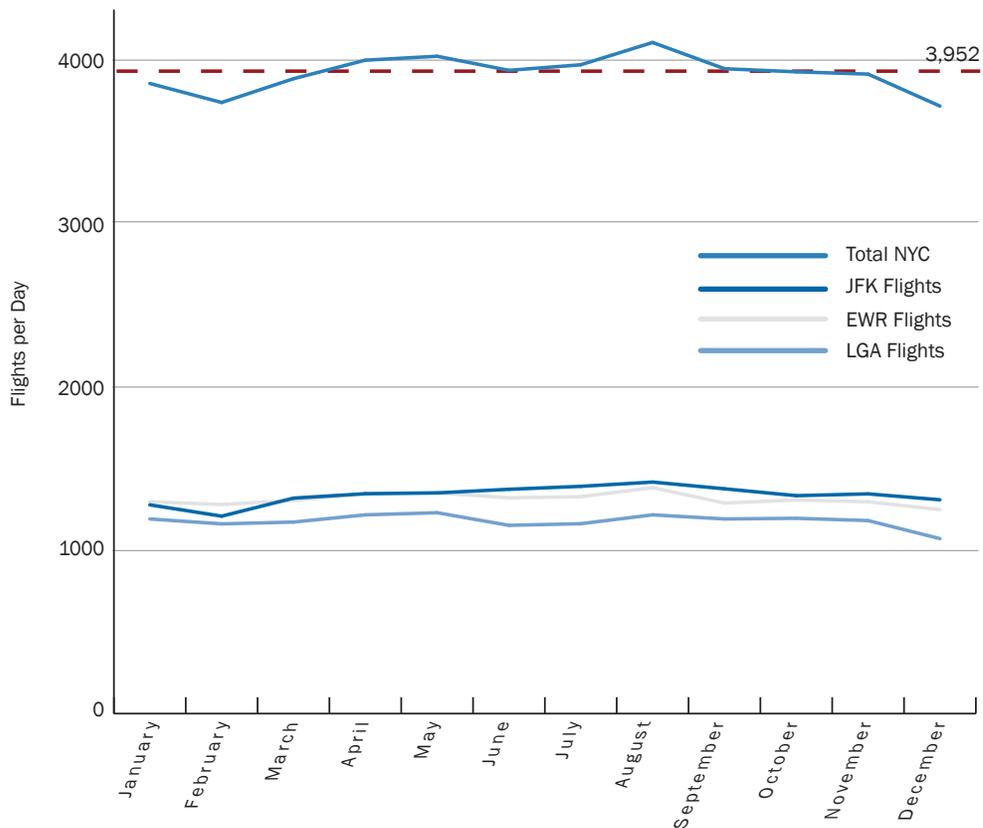


Source: Federal Aviation Administration flight database for 2007.

Likewise, demand for flight slots in the region does not vary highly between seasons. Other than February, which experienced cancellations due to bad weather, there was not a month with appreciably low flight activity in 2007. JFK has approximately a ten percent increase in daily demand during the summer months compared to the rest of the year. Newark Liberty and LaGuardia have less seasonal variability.

The peak tourism season should be the worst time for business travel, due to more flights and higher passenger load factors. However, evidence shows that New York’s airports are consistently fully utilized throughout the day and throughout the year. Figure 6 below represents flight volumes throughout the year.

Figure 6: Average Flights per Day by Month at Newark Liberty, JFK and LaGuardia, 2007



Source: Bureau of Transportation Statistics and Federal Aviation Administration flight databases.

Given the current delay levels, it is reasonable to conclude that all three airports are currently operating near or at functional capacity for many hours of the day. This study assumes that technological, policy, and organizational solutions may allow that functional capacity to increase marginally, even if the absolute capacity of the facilities does not change. However, each airport does have an absolute capacity — the number of flights that can physically take off and land given separation requirements and runways. The closer each airport gets to that absolute capacity, the worse the delays become. Given forecasts for future increases in flight demand, these increases in demand should result in exponential increases in delays. Forecasts of future delay levels for this study were developed based on this understanding, on Federal Aviation Administration (FAA) capacity forecasts by airport, FAA estimates of future operations-to-capacity ratios based on historical data, enplanements and operations per airport, and current flight and delay levels.

The delay forecasts reflect the constraints placed on the capacity of each of the airports, as well as expected improvements in the capacity of the runways.<sup>7</sup> The FAA responded in 2007 to the increasing delay levels that occurred between 2004 and 2007 by restoring and expanding the flight caps at JFK and imposing a new cap at Newark Liberty. In early 2008, the FAA announced that it would reduce the cap at LaGuardia from 75 to 71 operations per hour. This latest reduction in the cap is not part of this analysis of the cost of delays. However, this analysis does recognize the capacity constraints at each airport and modeled a reduction in total flight activity in response.

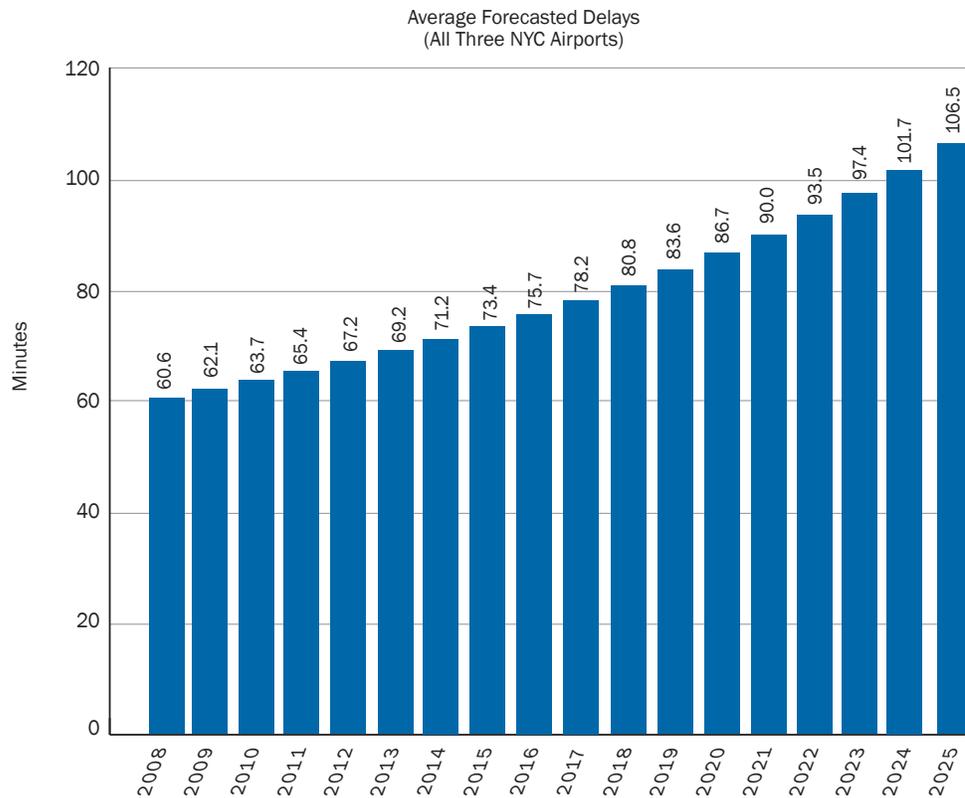
The passenger forecasts are limited by the capacity of each airport. The forecasts assume no major changes to airspace availability or significant navigational technology change affecting separation requirements between aircraft. As expected, this forecast, presented in Figure 7, demonstrates significant increases in delay through 2025, even with the capacity limitations. Further, the delay analysis in this study assumes that some incremental capacity gains could be made between 2008 and 2025 and that cap levels at JFK and Newark Liberty would be adjusted accordingly. Even with these actions to increase capacity and anticipating that the full forecast of future flight activity would not occur, delays are expected to rise as both JFK and Newark Liberty would evolve towards being fully utilized across the entire day.

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<sup>7</sup> Data on capacity expansion plans and expectations were obtained from the FAA Airport Capacity Benchmark reports, and from the Port Authority's Regional Air Service Demand Study.

As a result of the limitations, the forecast suggests that a certain portion of the demand for air travel will go unserved. Estimates by Landrum & Brown for the Port Authority indicate passenger demand will exceed supply of flights by 2012 and that the shortfall of supply may be as high as 39 million unserved passengers by 2025.<sup>8</sup> Regardless, flight delays will grow dramatically in the region if left unaddressed.

Figure 7: New York City Airports Flight Delay Growth Forecast



Note: Figure presents delay per passenger and is therefore weighted by passenger volumes at each a

8 Landrum & Brown 2008, based on FAA Terminal Area Forecasts for 2007 and 2008.

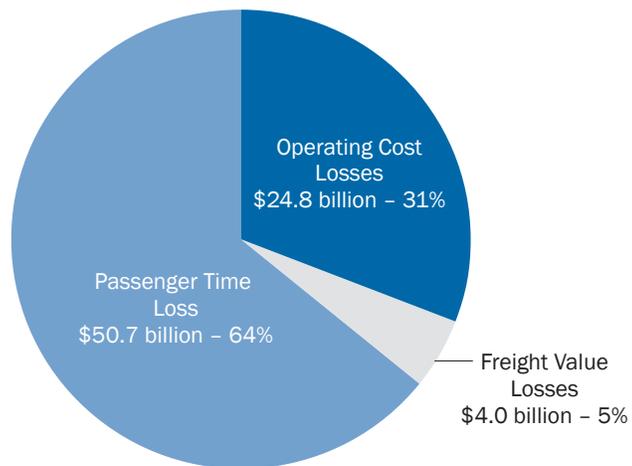
# The Cost of Delay to System Users

The economic impact to aviation system users of congestion-generated delays at LaGuardia, JFK and Newark Liberty, is projected to be \$79 billion if left unaddressed through 2025. This represents time-loss costs for passengers, additional cost to airlines in staffing and fuel consumption, and the cost to shippers of additional shipment transit time, equating to an average annual cost of \$4.4 billion through 2025.<sup>9</sup> About 64 percent of the costs are related to the valuation of the time losses to passengers, 31 percent represent operating costs to carriers, and 5 percent are losses experienced by shippers.

Cost of Delay to:	(in \$Billions)	
	2008	2008–2025
Travelers	\$1.7	\$50.7
Airlines	\$0.8	\$24.8
Shipping Companies	\$0.1	\$4.0
<b>Total</b>	<b>\$2.6</b>	<b>\$79.5</b>

Figure 8: Airport Congestion Cost Forecast, 2008–2025

Total Costs of Delays in the Three Airports 2008–2025 (\$79.5 Billion)



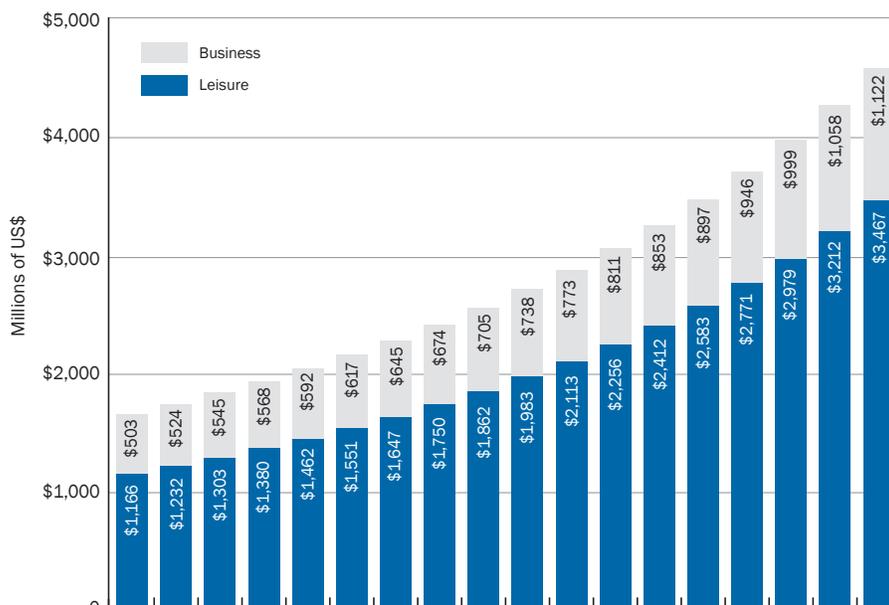
<sup>9</sup> Unless otherwise noted, cost figures in this report are cited as undiscounted, real values — no discounting is applied to future values, and no inflation is applied to the underlying present-day values used to estimate future costs.

Of the \$79 billion cost, it is estimated that \$39.1 billion affects residents and businesses located within the region, and the remainder are losses to travelers and businesses from outside of New York. Because congestion effects are both local and national issues of significance, mitigation will require strong cooperation and coordination between federal and local policy makers.

## The Cost of Congestion to Passengers

Passenger time loss represents the single most significant economic effect of congestion. The congestion delay estimates from this analysis indicate that in 2008 travelers using the three airports lost almost 60 million hours in total, representing \$1.7 billion in time value. Locally-based travelers and travelers conducting business within the region represent \$815 million of this total. Due to the forecast of increasing delays over time, the time lost annually is expected to rise continuously. The cumulative cost from today to 2025 will be \$50.7

Figure 9: Travel Time Losses – Economic Impacts by Passenger Type



billion, of which \$25 billion represents costs to local residents and travelers doing business in the region.

The theoretical starting point is that all travelers, other things being equal, would prefer to arrive at their destinations more quickly, and almost all would be willing to pay something to make that happen. The value of the time lost due to congestion delays is estimated by utilizing values of time by passenger type as published by the FAA. To estimate the willingness to pay to save time, the FAA time value figures are used. These values of time are also segmented by trip purpose and calculated based on traveler profiles and wage rates.

The cost to passengers grows at increasing rates through the period 2008 through 2025. Although business travelers do not account for more than 30 percent of the total number of passengers, they account for over 40 percent of the cost in 2008. Current forecasts of future passenger volumes indicate higher growth in leisure travel, relative to business travel. Business travel is expected to increase at a lower rate as communication technologies become less costly and more efficient.<sup>10</sup> Nearly two thirds of the total cost of passenger delays impact leisure passengers.

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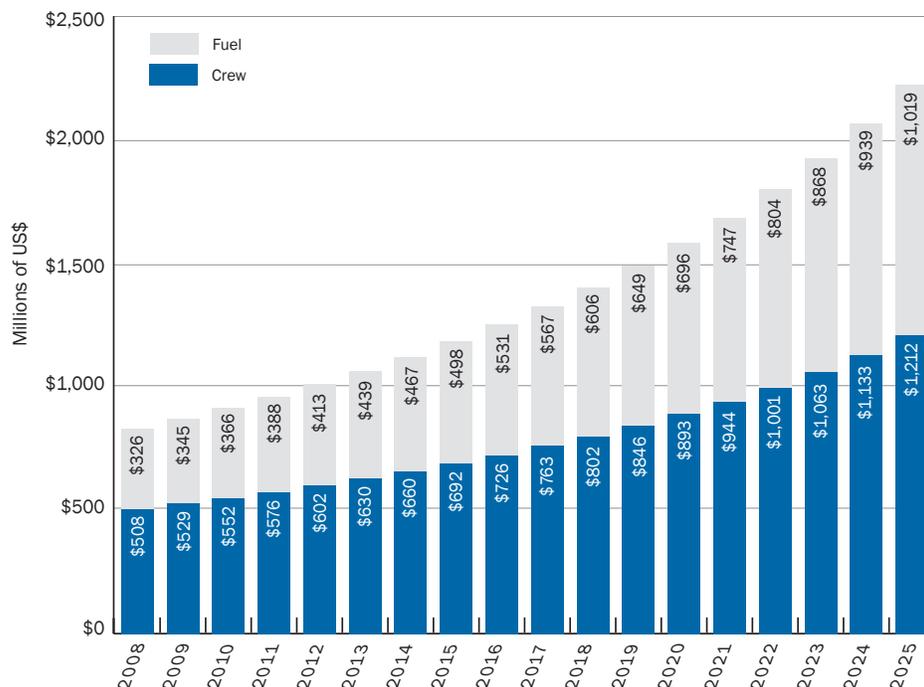
<sup>10</sup> A survey of New York City businesses conducted for this study by the Partnership for New York City indicates that many businesses are investing heavily in travel-avoiding technologies and systems.

## The Cost of Congestion to Carriers

Air carriers are also users of the aviation system — a system composed of airport facilities, air traffic control services, and usable air space — and are the second most significantly affected users of New York’s aviation system. Though air carriers have more direct control of congestion levels than passengers, the majority of air carriers can do little independently to impact congestion levels. Though reduced congestion would benefit all air carriers, there is little incentive for an individual air carrier to act, particularly in any way that increases costs or reduces revenues.

Delay negatively impacts airline operations in several ways. Delays during “engines on” periods require additional fuel, all delays require additional crew time, delays require airlines to adjust flight plans, possibly impacting crews and schedules on subsequent flights and airlines must maintain sufficient logistics staffing to respond to regular delays. All of these things impose expenses on airlines,

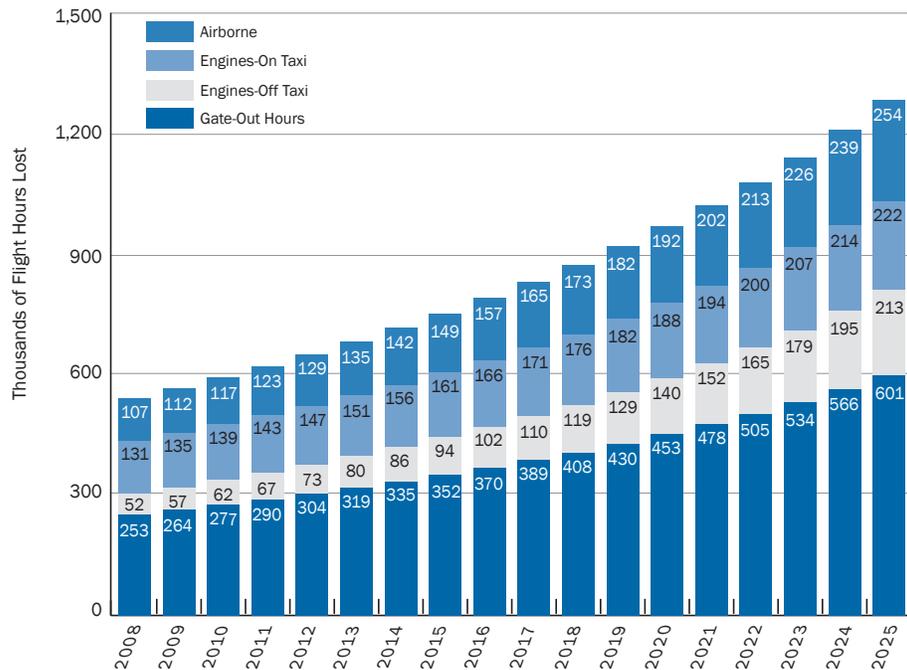
Figure 10: Carrier Costs of Congestion by Cost Category



which they, as much as possible, pass on to travelers in ticket prices and additional fees.<sup>11</sup> To estimate the incremental cost of congestion delays to airlines, the types of delays must be matched to the types of expenses incurred.

Costs are estimated for each category of delay, for each type of aircraft delayed, based on jet fuel consumption rates by type of aircraft, current jet fuel costs, minimum crew requirements by type of aircraft and the average hourly cost of pilot and cabin crew time including salary and benefits. Total 2008 operating losses to airlines, due to congestion delays, will be \$834 million, of which \$326 million represents fuel costs and \$508 million is staffing costs. Cumulatively, airlines will lose nearly \$25 billion between 2008 and 2025 to congestion delays in New York if congestion is left unaddressed.

Figure 11: Excess Fuel Consumption Costs by Travel Phase<sup>12</sup>



11 This is not to imply that travelers flying on delayed flights, or even from chronically delayed airports specifically bear these expenses. Airlines seek to make total revenues meet or exceed total expenses, but typically price each route based on route competition.

12 Engine-off delays are difficult to quantify since even in this phase of flight the aircraft burns fuel for the auxiliary power unit. In addition, policies about delays with engines-off will vary by carrier.

There is a lack of publicly available data on the residences of airline crew members flying in and out of New York. It also remains unclear what portion of fuel transactions for flights from New York actually occur in New York, especially for short-haul flights. To estimate a regional share of operation cost impacts described above, it is assumed that half of the crew flying to and from New York are paid within the region and that half of the excess fuel consumed is purchased and delivered in New York. In truth, most airlines make bulk purchases of fuel, so it is difficult to apportion these costs geographically. Likewise, certain staffing costs are local and some, like federal employment taxes, are less so. Since arrivals and departures are nearly equal, it is reasonable to apportion a “regionally incurred share” of these operating costs. It is estimated that the local share is \$12.4 billion through 2025.

Crew costs account for almost 57 percent of total congestion costs to carriers. Crew costs are generally higher than fuel costs because carriers have to maintain a crew during most delays, while excess fuel consumption costs are only accrued during engines-on delays. The total fuel costs for arrivals exceed the cost of maintaining a crew due to the high fuel costs of airborne delays. During departure delays, which are dominated by gate delays, the cost of the crew is more than twice the cost of fuel.

## The Cost of Congestion to Shippers

Congestion delays cost shippers over \$135 million in 2008. Based on projected congestion increases, the cumulative impact of regional airport congestion on shippers will be \$4 billion through 2025.

In 2007, 3.15 million tons of freight were moved by air through the region’s three principal airports, of which almost 900,000 tons were international shipments. The international portion of the shipments through LaGuardia, JFK and Newark Liberty<sup>13</sup> alone is valued at \$175 billion. This represents less than 0.25 percent of regional freight movements by ton, but over 10 percent by value.

The most common types of goods shipped through New York’s airports are electronics, transportation equipment, manufactured

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<sup>13</sup> There is no freight service at LaGuardia, but freight is carried in the cargo hold (“belly”) of many passenger flights. In fact, belly cargo represents about 41 percent of air freight in New York.

products, machinery, and precision instruments. Business documents often appear low on lists of freight movements by value, because value of such documents is often left undeclared. However, it is clear, particularly for regions like New York, with high concentrations of finance, insurance and real estate industries, that the ability of local airports to accommodate timely shipments of business documents is very important to regional economic health.<sup>14</sup>

## The Cost to the Regional Economy

The economy of New York City and its 26-county region is fundamentally tied to its transportation networks, including its air service. A Port Authority study reports that in 2004, \$23 billion in collective spending on New York's airports in facilities, tickets, services, and associated professional and legal support, led to \$57 billion in total economic activity and supported over 5 percent of the region's jobs.<sup>15</sup> There is multiplying effect to economic activity directly occurring at the airports as that revenue circulates through the local economy. This occurs in two ways: (1) A variety of businesses support or supply the businesses earning revenue through air-transit; and (2) The airports bring visitors that spend money on additional businesses and those companies do business with other suppliers and producers.

Not all congestion costs described earlier constitute spending reductions or revenue losses, and not all of the revenue impacts are local. But those that are local will amount to an additional \$7.4 billion loss to the broader regional economy.

Further, there is economic impact resulting from the negative environmental consequences of excess fuel consumption. It is estimated that over \$1.7 billion in real economic losses are due to the 35.5 million metric tons of CO<sub>2</sub> emitted through 2025 as a result of congestion delays.

These figures do not include the significant losses in economic activity the city will incur if congestion delays cause tourists to stop visiting the region, or businesses to relocate or reduce functions. A Partnership survey of large, New York-based businesses indicates that

<sup>14</sup> Freight volume and value figures from 2007 Provisional FAF data, Federal Highway Administration.

<sup>15</sup> Port Authority of New York and New Jersey, "The Economic Impact of the Aviation Industry on the New York — New Jersey Metropolitan Region," October 2005.

most find current delays problematic, but not a cause to relocate. But almost all firms surveyed could identify a level of delay that would force them out of the region. Firms are already cutting back on meetings in favor of non-travel alternatives. The potential economic impact of the projected increase in airport delays is a significant decline in regional competitiveness and output.

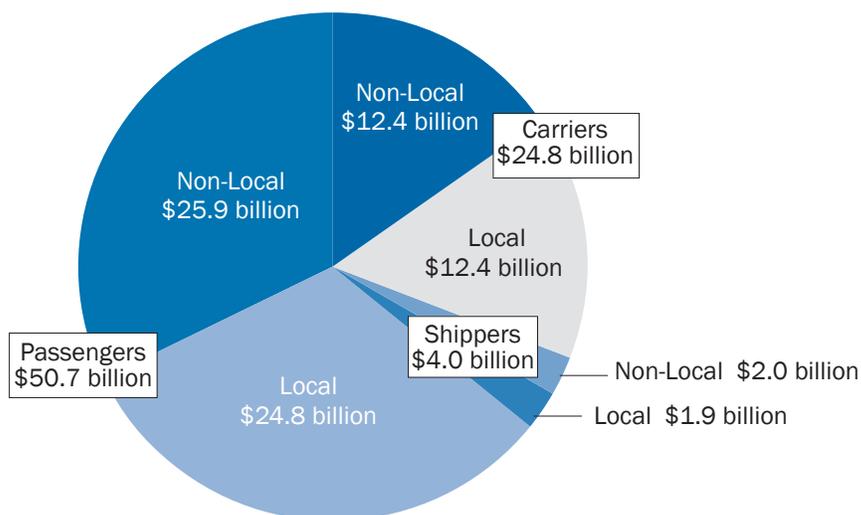
## Local User Costs

Many of the impacted system users either reside or do business in the New York City region. The approach for valuing the loss of economic welfare to these users allows assignment of the loss to the user, but also interprets it as a cost, or loss, to the regional net welfare. In other words, losses to these users are net economic losses to the region.

These local costs are about 49.2 percent of total user costs, or \$39.1 billion directly to New York City region businesses and residents. This represents an average annual cost of \$2.2 billion. Figure 12 below shows the costs of congestion to businesses and residents in the New York City region who use the airport system.

Figure 12: Airport Congestion User Costs by User and Location

Total Costs of Delays in the Three Airports 2008–2025 (\$79.5 Billion)



# Congestion Losses to the Connected Regional Economy

New York businesses will lose over \$16 billion through 2025 due to congestion, a cost borne even by those that do not use the system itself. Airport congestion is a drag on the regional economy. When system users lose revenue or face increased expenses due to delay, this translates into losses for other regional businesses that are not directly using the airport system. That is, when a shipper’s revenue is lowered because it cannot reliably move goods as quickly, it has less revenue to spend on locally produced goods and services. This loss is multiplied along the supply chain. According to this analysis, the New York region will lose over \$16 billion in potential output due to airport congestion. Over \$7 billion of this is related to a decrease in spending by system users.

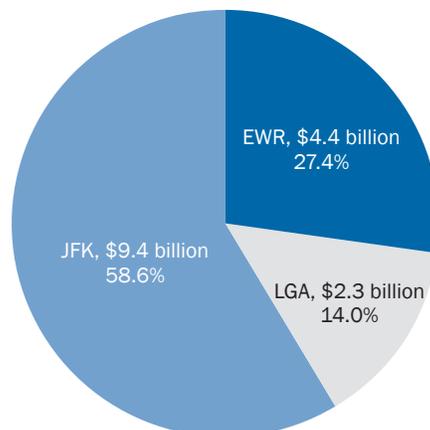
## Output Lost

There are direct and indirect output losses associated with airport delays, both in relation to the airlines and shippers. The total economic impact of delays is presented in the chart below, classified by airport.

The total output loss forecasted for the period 2008–2025 exceeds \$16.1 billion, with 58.6 percent of these output losses related to delays generated at JFK, 27.4 percent to Newark Liberty delays, and 14 percent to LaGuardia delays. Direct impacts account for \$8.7 billion and indirect impacts account for \$7.4 billion.

Figure 13: Share of Economic Output Losses Due to Congestion by Airport

Economic Impact of Delays on Total Output: 2008–2025 (\$16.1 Billion)



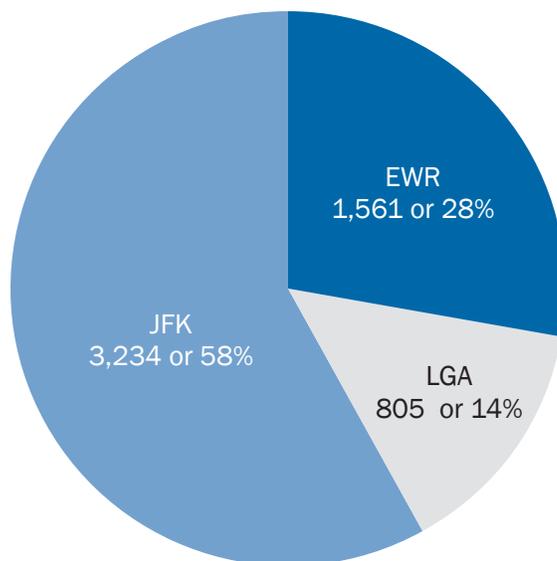
## Employment Lost

Losses caused by congestion also reduce the number of jobs available in the economy. Every year that congestion is not addressed, over 5,600 jobs that would otherwise exist are not created. Employment losses related to delays have a direct impact on the airline industry and additional impacts on other sectors as well. The following chart summarizes these effects.

The total employment losses during the period 2008-2025 reached more than 100,000 Full Time Equivalent (FTE) years, or an average of about 5,600 jobs each year that would otherwise be available to job seekers.

Figure 14: Share of Employment Losses Due to Congestion at Each Airport, Average Annual Impact

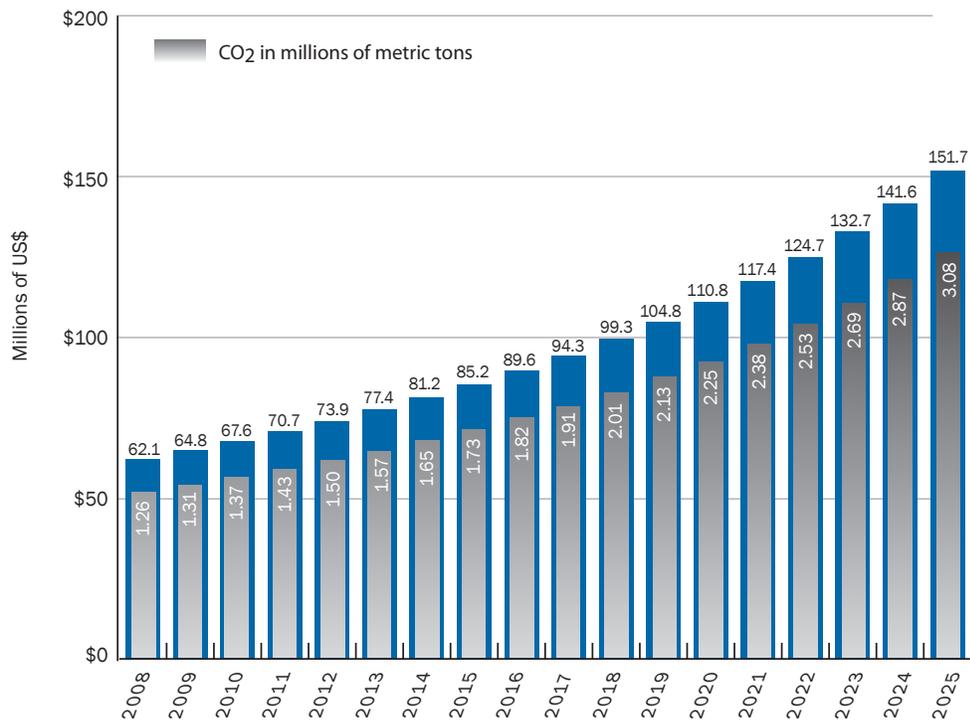
Economic Impact of Delays on Employment: 2008–2025



# The Cost of Congestion-Caused Emissions to All New Yorkers

In addition to imposing additional costs on carriers, engines-on delays also impose a \$1.7 billion cost on society as additional greenhouse gases are emitted based on CO<sub>2</sub> market values established under the widely accepted EU emissions trading scheme. These costs include the cost to residents' health and well-being due to emissions created during on-the-ground, engines-on delays. Figure 15, below, presents the annual volumes of emissions in metric tons of CO<sub>2</sub> due to congestion delay, and the related economic cost in each year of our forecast. As Figure 15 shows, on-ground congestion delays engender additional emissions, imposing \$62 million in costs on residents of the region in 2008 and \$1.7 billion in costs through 2025.

Figure 15: Forecast of Emissions and Emissions Costs Due to Congestion



Emissions are created during on-ground and in-air delays, but the impact of emissions at altitude and on the ground is thought to be quite different. Significant work has been done in New York to understand the relationship of air transportation and emissions volumes. In 2006, the Port Authority completed an inventory of greenhouse gas emissions for aircraft and ground support equipment. This inventory was estimated following the guidelines established by the EPA, and accounted for greenhouse gasses (GHG) generated by aircraft in a direct proportion to the number of landing and take-off cycles. The greenhouse emission inventory estimates do not include the environmental effects associated with extended taxi-in and taxi-out delays.

The taxi-in and taxi-out periods are those with the highest levels of CO<sub>2</sub> generation, which constitutes the main component of aircraft pollution. The valuation of congestion delay pollution effects only considers these two types of delays, since airborne pollution to the city itself is not highly significant in terms of direct health effects and associated healthcare costs. To estimate these costs, taxi-way delays were matched to an emissions rate average for all aircraft, and assigned costs representing the full social cost of additional CO<sub>2</sub> to each additional ton of CO<sub>2</sub> produced. CO<sub>2</sub> production rates are taken from the Port Authority study.

The cumulative cost of pollution is projected to be about \$1.8 billion or a little less than \$100 million per year, a relatively small number compared to the direct costs to users described above. Departure delays represent a higher portion of costs because taxi-out delays are more extended than taxi-in delays. Because all of the measured emissions costs represent local emissions (all occur at the New York airports), 100 percent of this cost is locally incurred.

## Congestion as an Impediment to Doing Business in New York

In an effort to assess the broader impact of flight congestion on the ability of New York City firms to effectively and efficiently do business, the Partnership conducted a survey of its membership. The survey asked a series of questions about the impact of delays on business and about decisions the firms had or would take in response to worsening delays.

Almost all respondents reported experiencing some negative effects due to airport congestion, but not sufficient to influence business location decisions. On the other hand, about half of the respondents could imagine a “tipping point” at which air travel became so problematic that they would be forced to relocate at least some current functions out of New York City. Delays that would represent a tipping point ranged from as low as 40 minutes to greater than 75 minutes. Most firms indicated that delays would need to be 60 minutes or greater to influence location decisions. Some firms noted that actual delays and associated productivity losses were greater than published delay statistics due to schedule padding, an issue discussed elsewhere in this report.

The most common impact of air travel delays cited by responding firms was decisions already made, or being considered, to reduce New York-based meetings and either replace them with meetings held elsewhere or with video conferencing and conference calls. Reduced meetings mean fewer hotel stays, restaurant meals and other business traveler purchases from within the regional economy and the follow on economic activity that those purchases engender. These comments suggest the regional economy is experiencing real losses due to passenger time lost due to congestion. As discussed above, the regional impact assessment considered only economic losses to shippers of freight and operating losses to the airlines. Passenger time losses were deemed to be largely absorbed into personal time and not as a direct loss to the city economy. The survey responses suggest that some portion of the passenger time loss does represent a real economic loss to the economy. While this study does not capture the impact of passenger time losses on the regional economy, the survey suggests that this is a source of additional loss.

## Policy Implications and the Search for Solutions

New York’s aviation congestion crisis has been widely discussed and considered, particularly as delays have mounted. A variety of solutions have been proposed, including airport expansion, technological upgrades, changes in airspace policy management and additional regulation.

## The Federal Response

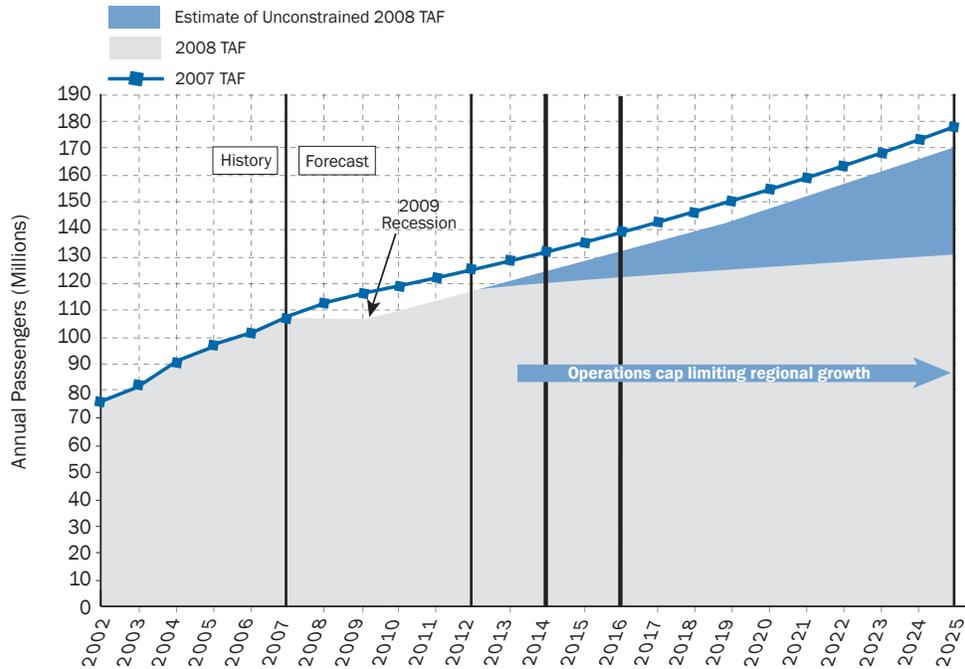
During the 2007 holiday travel season, the U.S. Department of Transportation opened certain military flight routes to and from the region to relieve air travel congestion. The experience was deemed successful enough to repeat for the 2008 Memorial Day and the Thanksgiving/Christmas travel periods. Unfortunately, this additional airspace, while helpful, is insufficient to address year-round, routine flight delays and does little to reduce congestion at the take-off and landing points.

The initial Federal response to the increases in congestion at JFK and Newark Liberty between 2004 and 2007 was to re-impose and extend the cap on hourly operations at JFK and to impose a similar cap at Newark Liberty. LaGuardia already has a system of caps in place, however in early 2008, the FAA announced that they would reduce the cap at LaGuardia from 75 to 71 operations per hour. This latest reduction in the cap is not part of this analysis of the cost of delays. However, this analysis does recognize the capacity constraints at each airport and modeled a reduction in total flight activity in response. Though caps at LaGuardia had effectively reduced crowding there, JFK and Newark Liberty had previously served as a relief valve for passenger flight demand.

The cap regulations contain provisions that allow the Federal government to raise the cap in response to increases in capacity, or lower the cap in response to increasing congestion. FAA forecasts of passenger demand established prior to the introduction of caps at JFK and Newark Liberty and reestablished since the regulation indicate that the FAA expects the caps to begin to constrain the expected growth in passengers starting in 2012. By 2015, six million passengers that would have flown in the absence of caps will be displaced and that number could rise to 39 million by 2025. Based on the Port Authority's 2005 study of the economic impact of airport operations to the 26 county region, the annual cost of the caps to the regional economy may rise to over \$3 billion in 2015, \$11 billion by 2020, and \$21 billion by 2025. The cumulative impact of the caps for the study period is estimated by Landrum & Brown to be over \$130 billion.

FIGURE 16: Passengers Served and Lost Because of Flight Caps

Comparison of FAA New York Region Forecasts  
2007 versus 2008 Terminal Area Forecasts (TAF)



Source: Landrum & Brown 2008, based on FAA Terminal Area Forecasts for 2007 and 2008.

Note: The 2007 TAF represents the FAA forecast of demand without cap restraints, the 2008 TAF is FAA's forecast of passengers served with the caps in place.

Flight caps at the New York Region’s airports limited the number of flights available at the airports, forcing airlines to limit the number of destinations available or frequency of service. Flight caps limit the ability of new entrant airlines to initiate service to the New York Region and provide new competition. Ultimately this could lead to higher fares for air transportation to and from the New York Region. The Federal government continues to evaluate mechanisms that would create some turnover in airline marketplace at each airport and promote competition. However, a final rule has not been made.

# The Regional Task Force Recommendations

In July 2007, the Port Authority of New York and New Jersey convened the Flight Delay Task Force. The Task Force's Technical Working Group developed 77 recommendations aimed at improving throughput and customer service while reducing delay. These included procedural, technological and capital improvements.

The Task Force recommendations include<sup>16</sup>:

## 1. The improvement of ground traffic movement

Improvements to ground surveillance systems would enable improved mapping precision for controllers to plan and move aircraft along ramps, gates, runways and taxiways. If implemented, this should result in improved ground traffic management, promote fewer conflicts and ultimately reduce delay. In addition to improved surveillance, the Task Force identified a variety of capital improvements at the existing airports aimed at improving ground traffic flow.

## 2. Development and use of RNAV

Area Navigation or "RNAV" is an advanced point-to-point navigational technique that allows an aircraft to choose any course within a network of beacons and or satellites, rather than navigating directly to and from the beacons. RNAV could reduce controller interaction time and allow closer spacing of departure routes. At Dallas Fort Worth International Airport, the implementation of RNAV has increased departures capacity by 20 percent and improved overall airport capacity by 14 percent.<sup>17</sup>

## 3. Improvement of flight routes

The Task Force issued a variety of recommendations for improving the use of existing air space and opening up additional routes to improve departure spacing, reduce conflicts between airports and improve the ability to fly around weather.

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<sup>16</sup> Details on recommendations taken from the Flight Delay Task Force Report, November 2007.

<sup>17</sup> Ibid.

#### **4. Implementation of Data Link and Net-Centric technologies**

The Task Force believes that enhancing and improving communications systems will improve operational decision-making and thereby reduce delay. They have proposed a non-voice communications system linking controllers and flight crew (Data Link) and a network-wide communications system linking controllers, pilots and airlines (Net-Centric) to achieve this vision.

#### **5. Reduction of excess spacing through improved satellite surveillance systems**

Spacing requirements between airplanes on approach greatly restricts the number of planes that can land in a given hour. The Task Force believes that spacing has increased beyond safety requirements, and that implementation of satellite technologies, better pinpointing exact plane locations, could enable a reduction in current spacing structures.

The Task Force's recommendations are framed by five simple objectives: improved ground movement of airplanes, better techniques for navigation, flight routes that respond to current air traffic demands, clearer communications between pilots and controllers, and improved departure and arrival capacity. All are likely to contribute to improving efficiency and reducing airport delays, but fall short of the expansion of airport capacity and replacing the national flight control system that most experts consider essential to the future of globally competitive airports.

## Conclusion

This study spells out the costs and consequences of failing to invest in comprehensive modernization of the regional airport system. Current and projected delays are among the biggest threats to continued growth of the regional economy. Business and leisure travelers lose valuable time, the already-fragile airline industry loses money, shipping companies lose time and profits and pass on costs to consumers, the regional economy as a whole loses productivity and jobs, and area residents feel the environmental impact in the form of greenhouse gas emissions.

The future of New York City and the region depends on the efficient movement of people and goods, the attraction of significant foreign business investment, continued growth in international and national tourism, and expanding the export of regional goods and services to destinations throughout the globe.

Inaction, or short-term band-aid solutions, are no longer viable options. There is a high price for inaction, as documented in this report. What is required is bold action by policy makers to restructure the way the system moves airplanes and passengers through the region. Transportation officials and state and federal leaders must work cooperatively to update an antiquated twentieth-century system, keep people and businesses moving through the region, and maintain the region's position as a global center of commerce, finance and innovation.