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Office of Aviation Policy and Plans
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FINAL REGULATORY EVALUATION

CONGESTION MANAGEMENT RULE FOR NEW YORK LAGUARDIA AIRPORT

Office of Aviation Policy and Plans
Aircraft Regulatory Analysis Branch

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EXECUTIVE SUMMARY

This final regulatory evaluation examines the benefits and costs from implementing the final rule which addresses congestion at New York's LaGuardia Airport (LaGuardia or LGA). The rule grandfathers the majority of operations at the airport and will stimulate a secondary market by annually auctioning off a limited number of slots; the FAA plans to use the proceeds from the auctions to mitigate congestion and delay in the New York City area. The hourly cap on scheduled operations will be reduced from 75 to 71 per hour during the regulated hours. This rule also addresses use-or-lose, unscheduled operations, and withdrawal for operational need. The rule will sunset in ten years.

As a result of public comment, this final regulatory evaluation incorporates two baselines (the original no cap in the proposal and the continuation of the FAA order as suggested by the commenters). When we evaluate this final rule using the same baseline as in the SNPRM, the net total benefits are $3.2 billion. When we use the alternative baseline, as suggested by the commenters, the total estimated net benefits are $1.3 billion.

Who Is Potentially Affected By This Rulemaking

- Operators of scheduled and non-scheduled, domestic and international flights, and new entrants who do not yet operate at LGA.
- All communities, including small communities with air service to LGA.
- Passengers of scheduled flights to LGA.
- The Port Authority of New York and New Jersey, who operates the airport.
- Passengers on scheduled and unscheduled flights in New York airspace.

Key Assumptions

- Baseline 1: No operating authorizations or caps (the rule will generate $3.2 billion in net benefits compared to this case, of which $65.4 million is due to reallocation benefits associated with the auctions and the balance due to the caps)

- Baseline 2: Indefinite extension of the current temporary order (the rule will generate $1.3 billion in net benefits compared to this case, of which $65.4 million is due to reallocation benefits associated with the auctions and the balance due to the reduced cap)

- A reduced cap on operations from 75 to 71 scheduled operations plus three unscheduled operations per hour provides additional delay improvement, which features:
    - 100 percent of slots[1] held by carriers with fewer than 21 slots will be reassigned to the carrier with 10 years of life;
    - For holders with 21 or more slots, 85 percent of slots above the baseline of 20 slots will be reassigned to the carrier with leases of 10 years, of which five percent will be retired immediately and ten percent will be assigned shorter leases and then auctioned over five years.
    - Approximately 4 currently unused slots will be retired so that a total of 64 slots (including those from holders with 21 or more slots) will be withdrawn from service at LGA.
    - Twenty-four other unused slots will be auctioned.

- For the purposes of this evaluation, the effective date is (11/1/08).

Other Important Assumptions

- Discount Rates – 7%
- Period of Analysis – 2009 through 2019 (The rule will sunset in ten years)
- Assumes 2008 Constant Year Dollars
- Passenger Value of Travel Time -- $30.86 per hour[2]

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[1] A "slot" is defined as the right to land or depart (not both) in IFR conditions in a 30-minute time window.

[2] GRA, Incorporated "Economic Values for FAA Investment and Regulatory Decisions, A Guide", prepared for FAA Office of Aviation Policy and Plans, (October 3, 2007). Value weighted using LaGuardia shares of 55% leisure and 45% business travel.

Alternatives We Have Considered

- **No caps**: Based on past behavior, FAA expects that without regulatory caps, operators would expand operations above current levels, and hence further worsen airport delays.

- **2006 NPRM**: Our 2006 proposed rule would have instituted caps, provided for mandatory upgauging, and withdrawn slots for periodic reallocation; we are amending this proposal in favor of this final rule.

- **Caps without auctions**: This alternative would impose caps at 71 scheduled operations plus three unscheduled operations per hour; it would grandfather current holders of operating authorizations to operate at the airport.

- **Caps with auctions**: This alternative would permanently impose caps at 71 scheduled operations plus three unscheduled operations per hour; it would grandfather current holders of operating authorizations to operate at the airport; and would auction a small but consistent number of slots for the first five years of the rule. This alternative is the final rule without the ten year sunset.

BACKGROUND AND NEED FOR THE REGULATION

LaGuardia is one of the most congested airports in the United States. Given its proximity to mid-town Manhattan, LGA experiences a heavy flow of arrivals and departures throughout the day. This flow of traffic, when unconstrained, has historically created inefficient levels of congestion and delay that affect the entire National Airspace System.

The need for this final rule is driven by a market failure with regard to congestion at New York area airports. Markets are the most efficient method of allocating scarce goods and services. However, in the presence of a market failure, for example, a negative externality, markets are no longer an efficient method of allocating scare resources and goods. In the market for slots, at capacity constrained airports, some producers are able to avoid some of the costs of production attributable to their actions while continuing to capture the positive net benefits of their activities. In this case, a negative externality exits and the market no longer functions as an efficient allocation of scare resources. Without a cap on operations at LaGuardia Airport, an air carrier can over-schedule operations in a manner that creates delays for all other airport users, but incurs costs only for delays to its own aircraft. The costs to society in aggregate of such practices exceed the total of the benefits to individual air carriers. The existence of negative externalities often requires some type of governmental intervention, as in the caps and auctions proposed in this rulemaking. The recent congestion in the summer of 2007 serves as a stark reminder that the demand for access to New York City is exceptional. New York City is served by three major airports; however, while LaGuardia remained a constrained airport that summer, JFK and Newark were not constrained and carriers were allowed to add flights at will. As a result, the New York City area airports experienced nearly unprecedented delays, which affected the National Airspace System. The delay numbers at JFK were so high that the FAA initiated a Scheduling Reduction Meeting in October 2007 and announced a cap at the airport in January of this year. Concerned that carriers who could not obtain desired access at JFK would quickly oversubscribe Newark, the FAA proposed a cap there in March. FAA recognizes that maintaining a cap on all three major airports in the New York City area will be necessary to avoid high delay costs to the society.

This final rule is the latest action in a long history of congestion management at one of the most delayed prone airports in the United States. Although service at LaGuardia is almost exclusively domestic, service to the airport is highly sought after. These two factors have forced the FAA to address a dilemma: how can the agency address air traffic efficiencies while providing some measure of competitive access to carriers wishing to operate at the airport? While there are many factors contributing to the inefficiency of LaGuardia, demand for the associated airspace has long out-stripped supply.

The FAA believes that at least for the near future, LaGuardia will likely be oversubscribed in terms of its physical ability to handle aircraft. Simply put, expansion of the airport by adding runways is not a viable option given its location. Accordingly, a cap on operations at the airport along with a method to insure competitive access to the airport is necessary to provide for the efficient use of the National Airspace System.

RULE SUMMARY

This Final Rule will replace the temporary order governing airspace access at LGA. The FAA intends to address congestion at LGA by replacing the temporary Operating Authorizations with slot leases. On March 8, 2009, this final rule will imposes a cap on operations. Until that date, the cap on scheduled operations will remain at 75 per hour. This reduction in the cap (from 75 to 71 scheduled operations per hour) represents a five percent retirement of existing slots at the airport and should significantly improve delay statistics at the airport. Unscheduled operations continue to be capped at three per hour, with additional flights authorized when conditions permit.

Of the total number of slots currently in use at the airport, 85 percent will be "grandfathered" to carriers who hold the corresponding Operating Authorization under the LaGuardia Order pursuant to a cooperative lease agreement for a period of ten years. These slots are called "Common Slots". Carriers will not pay any monetary consideration for these slots. Of the remaining 15 percent of total slots, one-third (equivalent to 5 percent of total slots) will be retired at the end of the winter scheduling season as noted above. The remaining slots will be withdrawn for reallocation over a five year period, commencing March 8, 2009. The FAA intends to conduct the first auction of these slots in January 2009, but the affected carrier will be permitted to use the slot until the successful bidder acquires it in March. The reallocated slots, called "Unrestricted Slots", will be awarded to the successful bidder via a lease agreement that will last until the rule sunsets in March of 2019.

All slots may be transferred via a secondary market. While carriers may engage in direct negotiations with each other, all opportunities to sub-lease a slot must be advertised publicly and the Department will monitor transactions for anti-competitive behavior.

SUMMARY OF ECONOMIC RELATED COMMENTS

We requested comment on the proposal and our evaluation from interested parties during the SNPRM comment period. This final rule integrates our initial estimates with the new estimates and additional data that we have obtained since our previous evaluation. Technical and legal comments can be found in the preamble of the final rule. Below, we address those economic related comments not already addressed in the preamble.

Base Case

Comment: Several commenters questioned the choice of the baseline used as the base case in the Regulatory Evaluation, stating that the "uncapped" base case used in the Initial Regulatory Evaluation was unrealistic given the long-term presence of caps at LGA. Instead, the commenters argued that a capped base case, reflecting existing conditions, is more appropriate.

FAA: As a result of public comment, we have performed our analysis with two baselines. The first baseline assumption is that there are no operating authorizations or caps and the second baseline assumes an extension of the caps implemented by the LGA order (72 Fed. Reg. 63224, November 7, 2007).

Participation Costs

Comment: Several commenters questioned the format of the auction and the estimated participation costs in the auction. Specifically ATA points out that at the time of publication the FAA had not determined the type of auction it would hold, nor the vendor who would design and provide auction services, or the cost of such services. Other commenters challenged the ability of the FAA to develop and conduct auctions in the timeframe required by the rule.

FAA: Since publishing the SNPRM, the FAA has issued an order for supplies/services to develop and implement an auction program including the services, materials and software. Details were specified in that statement of work, and a contract has been awarded. As such, in our final regulatory evaluation, we estimate the costs of these known procedures. Much more detail on this issue is provided later in this regulatory evaluation (see "Auction Review and Summary" below).

Cost of Slots

Comment: United and American state that the SNPRM also does not take fair and proper account of the cost to carriers of purchasing slots at auction. The FAA's cost-benefit analysis should include the cost to all carriers of paying for all slots. The Initial Regulatory Evaluation that accompanied the SNPRM states that "it is not clear who would incur the cost of a slot." That statement is only true to the extent that it is unclear whether carriers would bear the entire cost or pass on at least a portion of it to passengers. In either event, the commenters state that the cost is not theoretical and should be included in the FAA's cost-benefit analysis.

FAA: The final rule facilitates the reallocation of slots among users. Payments for slot leases represent transfer payments in an economic sense, in that the monies paid by air carriers for slot leases (net of auction costs) will go to the public in the form of increased investment in the New York airport and airways system. Thus, for the society as a whole, there are no economic gains or losses from these transfer payments.

Other Costs

Comment: United commented that the regulatory evaluation failed to consider the following costs:

- Revenue from slot confiscations
- Loss of jobs due to service reductions
- Reduced utilization of airport assets
- Longer turn times for airplanes
- Network disruptions due to schedule changes
- Loss of passengers, accompanying revenue and profit
- Inability to meet volume targets in commercial agreements

FAA: As the slots will be sold to the carrier with the highest potential value, more revenue is likely the outcome. With the additional revenue, it is also expected any job losses will be offset by job gains. With increased operator competition to maximize profits at LGA, we expect quicker turn times leading to better utilization of aircraft and airport assets. In addition, fewer delays will result in less daily schedule disruptions. Ultimately the higher valued slot reflects passenger desires. Later in this analysis we provide an auction net benefit resulting from a larger airplane replacing a smaller airplane.

Auction Participation

Comment: One commenter questioned the auction and carriers' motivation to participate. The commenter suggested that airlines would speculate and sublease or hold, thus "gaming" the auction system for profit.

FAA: An auction, as designed, encourages truthful bidding which minimizes any potential gamming of the auction. Having carriers participate in the auction can only increase the competitive state of affairs relative to the status quo. This outcome of the auction will be to increase the efficient use of slots, not to decrease it.

Other NYC Airports Affected

Comment: One commenter believes that the rule will affect operations, services and prices at other NYC airports and that these should be examined.

FAA: The commenters concern focused on the ability of air carriers to shift flights to other, uncapped New York airports. However, all three New York airports will be capped with auction provisions. JFK and Newark will be covered under a final rule. Therefore, there is little or no incentive to move flights between airports based solely on the caps and auction provisions of this rule.

Reallocation

Comment: One commenter challenges the FAA's assertion that welfare improvement due to reallocation (e.g., from small to larger aircraft) will occur, stating that mainline carriers already operate to maximize profits at LGA. The commenter asserts that the FAA is assuming that carriers are not allocating their own scarce slot resources at LGA optimally and that the enhancement will be due to reallocation of slots from legacy to LCC carriers.

FAA: Under the current slot allocation system, incumbents treat slots as semi-permanent assets. Because few slots are ever sold, and the ability to acquire new slots is uncertain, we assume that some holders prefer to fly smaller or less efficient aircraft rather than to sell the slots to other carriers for higher value uses. We note and are joined by Department of Justice in observing that some incumbents choose not to sell because they fear the competitive consequences. Because a slot is necessary for new entrants to compete or for other incumbents to increase operations, incumbents can effectively block new competitors by choosing not to sell. The auctions in the final rule will make available 10 percent of eligible capacity (slots above up-to-20 slot per carrier base) to all competitors (current and potential). Incumbents are free to bid and indeed have the advantage of having recent information on the likely profitability of the service they will provide with the slots.

All new and expanding carriers are free to bid based upon their individual business models. Although they have less information on the likely profitability than the incumbents, they have the incentive to bid based on their potentially most profitable routes. The outcome of the auction is unknown, but clearly there are incentives for improvement in the allocation of resources because new entrants might offer service with larger or more efficient aircraft and replace incumbent services offered with smaller or less efficient aircraft.

Slot Values

Comment: One commenter questions the reasoning why the value of slots lost is not counted as costs to incumbents even though they may have paid millions for them. If incumbent pursue legal claims these would be real economic costs to the taxpayer.

FAA: While we note the distributional consequences of the final rule in the regulatory evaluation, the costs the commenter is referring to are transfer costs and not real economic costs properly counted in measures of economic efficiency. Moreover, as noted in the preamble to the final rule, the air carriers have no property rights to the operational authorities they currently operate under. Slots purchased before January 1, 2007 were eliminated as part of AIR-21. In addition, there is nothing in this rule that precludes a carrier from bidding in the auctions to acquire the same or a comparable slot for the purpose of maintaining the status quo. A regulatory evaluation estimates the direct costs and benefits of a regulation. A threatened legal action at this point is speculative, we believe without merit and in any case not a direct cost of the rule.

Willingness to Invest

Comment: The FAA received several comments regarding carriers' willingness to invest in developing services and facilities at LGA. The commenters indicate willingness to invest will be adversely affected by the rule, thereby reducing efficiency.

FAA: This final rule will not have a negative effect on investment in developing facilities and services at LGA. Defining the life of an investment clarifies its value, and in this case, will spread out investments over the long term and also ensures well defined property rights, as operating authorizations are a form of property that may be leased or traded for consideration, and used as collateral. The creation of 10-year slot leases will reduce uncertainty about the tenure of slot holdings, which has been debated for many years.

Equipment Usage

Comment: One comment indicated that the FAA ignores public interest in different sized aircraft.

FAA: This final rule does not dictate or require carriers to fly any particular size or type of aircraft. Carriers will be able to continue to allocate equipment of any size or type as a business decision.

Market Efficiency

Comment: One commenter questioned the "faith based assessment" of the market.

FAA: This final rule will allow the market to dictate the most efficient outcome. Our society distributes scarce resources through a market system. If anything, people trust a market process before trusting any other means to distribute resources.

Effects on Unscheduled Operators

Comment: In the comments on the SNPRM, some observers expressed concern about the effect of the Final Rule on unscheduled operations at LGA. One carrier believes that the FAA did not demonstrate congestion reduction benefits for unscheduled operations. They further comment that there was no analysis of the impact on business if unscheduled flights are rescheduled.

FAA: The FAA notes that unscheduled flights produce roughly the same delay costs as scheduled flights, but believes that existing unscheduled flights can be accommodated if operators are flexible in their arrival times. Thus, if an unscheduled flight adjusts its flight plan slightly, it will be accommodated and this operator might not incur costs.

To make this determination, the FAA undertook an analysis of ETMS data for the year-ended May 31, 2008 and found there were 6,374 total unscheduled operations at LGA in that year. The analysis found that there were only 174 of 8,760 hours (2.0%) when unscheduled operations exceeded the three slots to be available in the Final Rule. Because these are unscheduled flights, they likely can move more easily to adjacent hours without unduly affecting operations. Of these flights, if they could move to an adjacent hour, there are only 16 hours and 28 operations where timing could have been affected. Finally, FAA evaluated the weather to determine if the airport was in visual meteorological conditions (VMC) or instrument meteorological conditions (IMC) conditions; in the former, FAA has indicated a willingness to accommodate additional unscheduled flights if capacity is available. Once we account for weather conditions, FAA finds that only 10 operations in the entire year ending May 31, 2008 might not have been be easily accommodated within an adjacent one-hour period at LGA had the final rule been in place.[3] If flights are moved by two hours, none are affected. The results are tabulated in Exhibit 1. We find that because any affected unscheduled flights can been accommodated or rescheduled, therefore this final rule will not have a material impact on the unscheduled operations.

Exhibit 1: Impact of Final Rule on Unscheduled Operators

Unscheduled Operations YE May 31, 2008 vs. Proposed Slots

	Number of Hours Where Unscheduled Operations Exceeded Available Slots	Number of Hours Where There Was Insufficient Capacity in Adjacent Hours to Handle Excess Demand	Unscheduled Operations Affected After Accounting for Extra Capacity in VMC Conditions
LGA	174	16	10.0
LGA Pct	2.0%	0.2%	0.2%
Avg per Day	0.5	0.0	0.0

Source: ETMS and National Weather Service

SLOT AUCTIONS

Slot auctions are a market-based solution to the slot allocation problem. The rationale that auctions will improve the economic efficiency of slot use is straightforward. Air carriers and their customers are principal stakeholders in how slots are allocated and used. During the auctions, however, only air carriers will be active participants. Accordingly, air carriers act as economic agents for consumers during the auctions. It is reasonable to assume that air carriers' bids on slots will be motivated primarily by profit potential. Consumers, on the other hand,

[3] We've performed analysis to provide an illustrative example of the potential cost of ten unscheduled flights being diverted to Teteroboro airport. Although the flights could most certainly be rescheduled and accommodated within a two hour window, we have analyzed the illustrative case and found an economic impact of less than $1,500 per year. The additional annual cost (including value of time, surface transportation and the difference in landing fee) approaches zero because the lower landing fee at Teterboro offsets the other costs to users.

benefit primarily from higher valued flights arriving in LaGuardia. This higher value could manifest itself in many ways: service and schedule quality, more efficient aircraft, and potentially lower prices. While the motives of air carriers and their customers are not perfectly aligned we believe they coincide closely in this case. The demand for slots is ultimately derived from the demand for air travel. The best uses of the slots are likely to be the most profitable among the set of alternative slot uses, at least in part because they are valued the most highly or are demanded by the most potential air travelers. As a result, if an air carrier submits bids on slots motivated by their own profits, they serve as efficient economic agents for their customers.

Carriers may still have incentives to hold slots to prevent competitive entry. However, under an auction, carriers will have to pay cash to preserve this strategy. When a slot lease expires, if a holding carrier's potential loss of network profits exceeds the willingness of the next highest bidder to pay for a slot, then the holding carrier may succeed in preserving its position. However, at a minimum, the rule should increase the opportunity cost of holding slots to prevent entry.

In addition to causing a reallocation of slots among uses and/or air carriers currently serving LGA, the auctions are also likely to afford new carriers opportunities for entry at the airport. The turnover of slots should create opportunities for actual or potential entry by new carriers, thus reducing barriers to entry and stimulating competition in markets served by LGA carriers. Slot turnover will also promote efficiency as it accommodates market dynamics. As markets for air transport services change over time, the best or most efficient uses of slots change accordingly. The auctions will create opportunities for carriers to react to fluid markets.

Some have commented that there will be little benefit from the auction because many origin and destination (O&D) markets from LGA already have lower cost carrier competition.

Other comments have observed that the allocation of resources at LGA must be correct because regional jet (RJ) participation at LGA looks like RJ activity at other airports.

While some comparisons among airports or operators might be instructive, we note that the distribution of slots among competitors has largely been dictated by an administrative and not a market mechanism since 1968, despite FAA efforts to stimulate the secondary market. No one can tell if the allocation of slots among airlines and among aircraft types is appropriate until these scarce assets are allocated in a market setting. As we noted earlier, given the long history of the HDR, it is very unlikely that slots are efficiently allocated today.

CHARACTERIZING BENEFITS FROM REALLOCATION

No one can say for sure how many slots will change hands and what the net effects will be from the auction. However, for the reasons discussed, we believe there will be some improvements in economic efficiency. Exhibit 2 shows the characteristics of commercial air service at LGA during the base period studied for this rulemaking – January 2007. Operations at the airport are dominated by legacy carriers (flying standard jets) and their code share regional partners (operating turboprops and RJs). Legacy, prop and RJ operators offer more frequency in markets than do low cost carriers (LCCs), which have a relatively small share of scheduled operations (seven percent), when compared with the nation. Standard jet operations by legacy and LCCs produce more seats and passengers per slot-use, fly longer distances and have lower costs per seat-hour than either prop or RJ operators. Load factors for all operations at LGA were relatively low in January of 2007.

Exhibit 2: Air Service Characterisics at LaGuardia in January 2007

	Legacy	Prop	RJ	LCC
Weekday Scheduled Flights	506	164	442	88
Pct of Daily Schedule	42%	14%	37%	7%
Total Seats Offered (roundtrip)	71306	5612	21842	12826
Pct of Seats Offered	64%	5%	20%	11%
Number of Markets	29	16	44	11
Pct of Markets	29%	16%	44%	11%
Avg. Roundtrips	8.72	5.13	5.02	4.00
Avg Passengers per Operation	91	11	25	104
Total Passengers per day	45850	1863	11074	9145
Pct of Total Passengers	67%	3%	16%	13%
Avg. Block Time	2.27	1.45	1.82	2.57
Avg, Variable Cost per Blk Hour	$3,428	$1,027	$1,482	$3,075
Avg. Segment Fare	$155	$88	$131	$117
Avg Load Factor (January 2007)	64%	33%	51%	71%
Avg. Seat Size	141	34	49	146
Avg. Cost per Seat Hour	$24.33	$30.02	$29.99	$21.10

Source: OAG, DB1a third quarter 2007, Form 41 reports by carrier

Because this service pattern is largely a product of the regulatory and administrative allocation of slots, it is likely to change when some access rights are auctioned off. Carriers will have to pay cash for some portion of LGA capacity and make their business cases work in competition with other bidders. The auction encourages the most efficient use of the slots made available, resulting in an increase in societal benefits.

To give some dimension to the potential size of these benefits, Exhibit 3 shows the average surplus (consumer and producer) for operations at LGA in January of 2007 using the methodology applied in the regulatory evaluation of our earlier proposal published August 29, 2006.[4] These estimates are offered only as indicative of the relative value to society of different types of air services at LGA. Any one service may be far different than the average. Details on the methodology are available in that document and in Appendix A. The method accounts for

[4] 2006 Initital Regulatory Evaluation, Initial Regulatory Flexibility Determination, Trade Impact Assessment and Unfunded Mandate Reform Act Assessment, Congestion Management Rule for LaGuardia Airport. Prepared by GRA Incorporated. There are some differences in approach discussed in Appendix A.

delay and cancellation costs, cash outlays and time expended by both consumers and operators at LGA in the average markets described in Exhibit 2 in a so-called full price of travel framework.[5]

The exact values of the estimates are less important than their relative size. What is of interest is that the reallocation of even a few slots is likely to offset the entire costs to society of running the auction. Given the estimates of the costs of the rule (discussed below) and the accompanying benefits generated, we conclude that this final rule is cost beneficial. On average, a reallocation of one operation from lower valued flying to higher valued flying results in net benefits to society of almost $3.4 million annually.

Exhibit 3: Indicative Average Surplus to Society Produced by a Flight at LGA

From	To	
RJ	Legacy	$3,010,273
RJ	LCC	$2,696,243
Turboprop	Legacy	$3,985,950
Turboprop	LCC	$3,671,920
Average		$3,341,096

[5] See Appendix A for a discussion of the full price of travel.

This analysis is simply meant to be illustrative of the potential efficiency gains of an auction. There is no way to be sure how slots will be reallocated; indeed, the whole point of the auction is to unleash market forces in the pursuit of a better allocation for society. The market will cause the scarce slot resources to go to the highest valued users, regardless of the size of aircraft.

Exhibit 3 shows average, not marginal, values. Some small aircraft operations are doubtless extremely valuable and will compete well for the scarce slot assets (see our discussion of small community service below). However, the values do give some dimension to the possible benefits of reallocation that result from higher valued flying at LGA. If only a few slots move from lower valued to higher valued flying, just the reallocation benefits to society are likely to exceed the costs of the rule (discussed below). Higher valued users should acquire some slots in the auction and our numerical estimates in Exhibit 3 can be used to illustrate the benefits of this process. Whether those higher valued operations will be with larger or smaller aircraft is not known.

At LGA, a carrier's current slot portfolio may or may not be big enough to fully implement its best business plan; our intent is also to give carriers the opportunity to adjust their slot portfolios and to allow the market to test the associated business case via the auction, thus improving the allocation of resources.

Again, the main purpose of this rule is to reduce delays and increase consumer and air carrier value. The main action of this rule is to reduce LGA operations and in the process increase consumer well being through auctions**.**

COST BENEFIT SUMMARY

The primary benefits of this rulemaking will be the delay reduction from the caps on operations and the improvement in the allocation of scarce slot resources. When we evaluate this final rule under the first baseline where there are no assumptions on authorizations or caps, the net benefits are $3.2 billion. When we evaluate the rule using the current temporary LGA order as the baseline, the combined net benefits are $1.3 billion.

The FAA is confident that the final rule will be cost beneficial. For example, the final rule calls for the retirement of five percent of current commercial slots at LGA. The delay benefits will offset the lost surplus from flights eliminated even if the expected percentage reduction in delay per operation was only five percent. The reason is that airlines will have incentives to cut the least valuable flights from their schedules and maintain the most valuable ones under the new rule. In addition, there will be further benefits realized via reallocation in the auction, which are unaffected by the delay-related benefits. Finally, there will be further benefits due the implementation of caps versus having no caps at all.

ECONOMIC EFFICIENCY

Implementing an auction of some slots at LGA will likely result in some reallocation of scarce resources at the airport. The economic efficiency resulting from this reallocation is an important consideration in assessing the desirability of slot auctions. Carriers with the best uses for slots will have the highest willingness-to-pay and win the auction. Winning bidders will be conveyed a well-defined property right to schedule operations at LGA over the life of the lease. Note that this result, allocation by willingness-to-pay, is consistent with our earlier criterion for the preferred or most economically efficient resource allocation.

Air carriers and their customers (i.e., consumers of passenger and cargo services) are two of the principal stakeholders involved in slot use at LGA. While increasing total welfare, a change in slot use at the airport is also likely to improve the welfare of some of these stakeholders at the expense of others. For example, the slot auctions are likely to result in some new air transport services and the termination of some existing services. As a result, consumers of the new transport services are likely to benefit from the new resource allocation, partly at the expense of consumers of terminated services. Similarly, some air carriers who acquire slot rights during the auctions are likely to benefit from the new regime, while carriers who lose slots might suffer losses.

The airport authority, the New York area and outlying communities are also stakeholders in slot use but will not directly participate in the auction. Their welfare may also be affected by the change in air service patterns that result from slot reallocation.

The scenario described above is typical of most public policies affecting resource use: some members of society benefit, others are made worse-off, while the total social welfare of society increases (assuming that the policy is cost-beneficial as measured through economic analysis). There is a commonly adopted standard for economic efficiency in these cases. Specifically, a change in resource allocation is said to improve economic efficiency if the beneficiaries can potentially compensate the losers for loses and still be better off.[6]

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[6] A different, arguably stricter standard states that a reallocation of resources improves efficiency if the welfare of at least one member of society is made better-off, and no member of society is made worse-off. However, because losers

DELAY AND COST CONSEQUENCES IN THE ABSENCE OF A CAP AND AUCTION PLAN

This section describes how FAA has estimated the delay benefits of having a cap at LGA versus the first baseline case of having no cap.

In our August 29, 2006 Initial Regulatory Evaluation we provided estimates of the benefits of a cap at LGA. The estimate is based on net benefits. While the cap reduces delay and therefore other operating costs, it also reduces consumer choice and thus social welfare. The benefits of the cap are estimated taking both into account. While the NPRM included an upgauging provision, that provision is not part of this Final Rule because in the initial year of the NPRM there was no effective upgauging. We have updated that year's estimate of benefits to reflect the limited inflation that has ensued since that estimate was made. We have also adjusted our estimate to exclude the downstream costs of delay that are avoided due to the cap and take into account the effective dates of this final rule. Using the adjusted one-year net benefit estimate over the time horizon of the rule, we conclude that the final rule cap and auction plan relative to the first base case of no cap provides net discounted benefits of approximately \$3.2 billion. Relative to the second base case of perpetuating the existing order, the cap and auction plan creates net benefit of \$1.3 billion. The details of these calculations can be found below and in Appendix A.

are rarely compensated for losses, this strict standard would almost never be satisfied in any regulation, which often by definition is an attempt by the government to use its power to impose costs on one group for the benefit of others. As a result, most policy evaluations adopt the standard of potential compensation, and then describe how benefits and costs are distributed among various members of society. We describe the distributional impacts of the slot auctions elsewhere in this report.

LONGER TERM COSTS OF INSTITUTING A CAP

Under this rulemaking, there will be a reduction in flights into LGA compared to what would occur without the rule. The 2006 Initial Regulatory Evaluation estimated societal costs of these flight reductions and deducted them from the delay benefits of the caps to calculate overall net benefits.[7]

Some have observed that there are some longer-term costs of a cap unless there are provisions made to create opportunities for entry. If slots are allocated on a semi-permanent basis to carriers, then adverse incentives may come into play. Incentives exist for incumbents to hold slots for competitive reasons (to prevent entry) and because slots can be difficult to replace. In the long run, air service at the airport is hindered because potential entry is slowed or halted entirely. There is little basis for exchange between slot holders and those who want to increase their slot holdings to compete with the slot holders. These matters are discussed in detail below.

In this Final Rule, FAA hopes to avoid at least some of these longer-term costs by instituting a periodic auction of some slots. The intent is to better define the property rights, to remove some of the disincentives to the trade of slot leases and to make at least some slot leases available periodically to allow for potential entry and changes in air service. In addition, holders of Limited Slots may find it advantageous to sublease them knowing that these assets will be subject to reallocation via auction.

[7] See Appendix A for more information.

BENEFITS AND COSTS

Since publishing the NPRM and the SNPRM, we have updated the costs and benefits estimated in this final regulatory evaluation. A detailed discussion of on the applied methodology as related to consumer and producer surplus can be found in the NPRM regulatory evaluation. The total net benefits of this final rule are summarized in Exhibit 4. Depending on what baseline is used, net benefits are $3.2 billion or $1.3 billion.

Exhibit 4- Net Benefits

Net Benefits of the Rule ($2008 mil)	
Net Benefit of a Cap: 75 scheduled; 6 Unscheduled	1,862.5
Net Benefit of Reducing Cap: 71 scheduled; 3 unscheduled	1226.7
Net Benefit of the Auction	65.4
TOTAL NET BENEFITS of CAP + CAP Reduction + Auction	3,154.6
TOTAL NET BENEFITS of CAP Reduction + Auction	1,292.1

FAA has relied on extensive modeling undertaken by MITRE on the consequences of reducing scheduled slots from 75 to 71 at LGA.[8] MITRE's queuing model was run using August 30, 2007 OAG data together with information on the number of unscheduled operations at LGA. MITRE determined that by reducing scheduled slots from 75 to 71 per hour, there would be an average delay savings of 41 percent. Note before 7am, the airport has had excess capacity and

[8] The UMD model is still used to compute the delays in the no cap vs current (temporary) cap case

we expect this to continue. The detailed approach that was used to measure performance at congested airports is shows in Appendix B. Applying the MITRE results to the economic surplus model described in Appendix A of this evaluation shows an annual benefit of $178 million due to the reduction in slots at LGA. It is important to note that these net benefits include consideration of the lost surplus due to some flights being eliminated at LGA. Our aggregate analysis is continued to be carried out at the segment level, i.e., each non-stop destination from LGA is considered to be a separate market but results are based upon two baselines and the MITRE Queing Model.[9]

As suggested by the commenters, when we evaluate this final rule relative to the current slot caps, the net benefits are $1.3 billion. Of this total, we estimate $65.4 million in net benefits from auction implementation (the reduction of slots by five percent and the implementation of an auction assuming only one slot is upgauged in each of five years). The remainder is attributable to cap reductions.

In both of the previous regulatory evaluations conducted in 2006 and earlier this year, the FAA provided estimates of expected delays if a cap did not exist at LGA.

<u>Total Surplus</u>

Consumer surplus is the value to consumers (e.g., passengers) of air transportation in excess of the full price of travel. Producer surplus is the amount producers (e.g., air carriers) benefit by selling at a market price that is higher than they would be willing to sell for. The total

[9] Trends observed in the MITRE simulation are based on the theory of queuing delay, and are consistent with earlier model runs. These earlier model runs have been compared to observed delay data, and were found to be indicative of actual performance. The queuing model was used to estimate performance levels at LGA given a demand and capacity profile and a set of candidate constraints. The model results can be used to evaluate the trends and relative differences of performance impacts of constrained schedules for LGA.

estimated present value of consumer and producer surplus for the 10 year period of analysis is $995 million and is shown in Exhibit 5.

Exhibit 5 – Annual Impact **Present Value Annual Benefits (CY $2008 mil)**

	Current $	2008 $
2009(Mar)	133	124.5
2010	178	155.1
2011	178	144.9
2012	178	135.5
2013	178	126.6
2014	178	118.3
2015	178	110.6
2016	178	103.3
2017	178	96.6
2018	178	90.3
2019 (Mar)	44	21.1
	1776	1227

The 10 year estimate is comprised of annual surplus changes of $177.6 million and is shown in Exhibit 6. It incorporates both consumer surplus and producer surplus. We analyze each category separately.

Exhibit 6**Benefits and Costs of Reducing Cap: 71 scheduled; 3 unscheduled**

Annual Impacts ($ mil)	
Consumer surplus lost due to reduced flying	-24.9
Consumer surplus gained due to reduced delays	94.1
Total Consumer Surplus Change	69.2
Change in Producer Surplus due to reduced flying	1.0
Change in Producer Surplus due to reduced delays	107.4
Total Producer Surplus Change	108.4
Total Change in Surplus	177.6

Consumer Surplus

This regulatory analysis evaluates consumer surplus in the context of the full price of travel. The full price of travel also includes the value of schedule delay (the difference between the ideal time of departure/arrival versus the actual schedule offered).

Consumer surplus is defined as the difference between what consumers must pay for a given level of service and what they would be willing to pay.[10] Overall this final rule will have a positive affect on consumer surplus which equates to $69.2 million annually.

A consumer would not choose to purchase a transportation service unless it was worth more than the sum of the ticket price plus the value of the consumer's time, including airport and schedule delay. Consumer surplus is the value of air transportation in excess of the full price of travel, up to the price they are willing to pay.

The total consumer surplus associated with the 71 scheduled operations and three unscheduled operations per hour cap is comprised of consumer surplus lost from discontineud flights and consumer surplus gained from overall delay reduction.

The total estimated consumer surplus lost due to reduced flying is $24.9 million annually. This equates to 113 reallocated flights (relative to the first base case) with a total daily impact of roughly $68,000. In contrast to the consumer surplus lost from flight reductions, there will be an overall positive impact from the gains in delay reduction. The delay reduction equates to roughly $257,765 daily and $94.1 million annually.

[10] The full price of travel includes the monetary fare that a consumer must pay and the value of his or her time in transit (including both the scheduled time and any expected delays).

Producer Surplus

In addition to the consumer benefits, air carriers will benefit from delay reductions because air carriers incur significant operating costs when operations are delayed due to congestion. These costs include fuel consumption and crew costs. In addition, there is a higher probability of scheduled flights being cancelled as delays increase. These delays lead to downstream effects (and costs) at other airports. These impacts on carriers are measured using the economic concept of "producer surplus". Producer surplus represents the additional economic profit obtained by carriers above and beyond the full cost to all air carriers of providing their service (which includes both a “normal” profit and the airport delay costs imposed on other carriers). Changes in carrier profits from these effects are estimated and incorporated into this regulatory evaluation.

Overall, this final rule will have affect producer surplus by $108.4 million annually. This number is comprised of flying reductions of $1.0 million and delay reductions of $107.4 million annually.

BENEFITS AND COSTS OF THE AUCTION

Instead of an administrative procedure, this rule will rely on auctions to allocate scarce operating rights at LGA. In an exchange of an arrival and departure of an airplane with another, the market will determine who most values the available slots. The slots will be sold to those carriers willing to pay the most. The receiver of the slot anticipates its flight will have a higher profit, thus higher social value than can the other bidders.

The total net benefit over a ten year period from auction implementation is $65.4 million. The benefits will be realized when reallocation occurs. The allocation of slots will be determined by airline willingness to pay, which should be closely linked to consumer demand. The greater the demand, the higher the bid for a slot. As a result, the slots available in the auction go to those with the highest and best use.

The costs of the auction (that are not transfer costs) relate to the public and private sectors costs of creating, operating and participating in the auction. The price paid for a slot in an auction is not an economic cost of the rule, but rather is a transfer payment from the buyer. The auction itself does not create slots or provide other services. It is merely a reallocation mechanism, which is by definition a transfer process. The rule will substitute a market mechanism for an administrative/regulatory one. The only resource costs are related to the cost of the auction itself, and the foregone surplus of the slots that are retired.[11]

[11] There is a requirement for GA operators to acquire a reservation (beyond any flight plan they might file) at LGA; this process is already automated and should not add appreciably to either private or public sector costs. The costs to private charter operators of acquiring a reservation in advance should be little changed from today.

AUCTION OVERVIEW AND SUMMARY

The auction format will consist of a single-round, second-price, combinatorial auction. This type of auction imposes fewer administrative or processing costs on auction participants than other auction formats. This design significantly reduces the preparation and participation costs for bidders when compared to alternative designs. The single-round format reduces participation costs because bidders are not required to react to published prices in an ascending auction format. This contrasts with a multiple-round auction format; the FCC, for example, has used a simultaneous multiple-round auction to award many spectrum licenses. The most recent of these, involving licenses in the 700 MHz band, resulted in 216 rounds of bidding that lasted for 38 bidding days, or nearly eight business weeks.

The term "second-price" auction is one in which the highest bidder wins, but is required to pay an amount only slightly above the highest competing bid (*i.e.*, the "second price"). A "combinatorial" auction is one in which bidders are allowed to assign and bid an amount on an all-or-nothing combination or package of items, as opposed to just individual items.

A second-price auction also dramatically simplifies a bidder's strategy, and therefore reduces participation costs, because bidders have incentives to express their true valuation for the product up for sale, without the risk of paying too much and being subject to the winner's curse.[12] This is in contrast to first-price auctions, where bidders have incentives to shield their true values to avoid paying more than they need to, making the determination of their desired bid amount a tricky process.

A combinatorial format that includes all-or-nothing packages also reduces auction participation costs because bidders may assign and bid amounts for combinations or packages

[12] The winner's curse is a phenomenon that occurs in common value auctions with incomplete information. In short, the winner's curse says that in such an auction, the winner will tend to overpay.

that have a unique value that is different from that for the individual items. Non-combinatorial methods, by contrast, create exposure risks for bidders, and require development of strategies to minimize these risks.[13]

Exhibit 7 summarizes the estimated benefits and costs of the auction. The benefits assume that only one slot is reallocated from a smaller aircraft to a larger aircraft in each of the five auctions.

Exhibit 7

Benefits and Costs of the Auction (CY $2008 mil)

	Slot Years Reallocated Via Auction	Current Dollar Value of surplus @$3.41 M	Discounted Present Value of Benefits	FAA Auction Costs	Carrier Auction Costs	Total Auction Costs	Discounted Present Value of Costs
2008				1.7	3.83	5.53	5.53
2009(Mar)	0.75	2.5	2.3	0.9	3.58	4.48	4.19
2010	2	6.7	5.8	0.9	3.58	4.48	3.91
2011	3	10.0	8.2	0.9	3.58	4.48	3.66
2012	4	13.4	10.2	0.9	3.58	4.48	3.42
2013	5	16.7	11.9	0.9	3.58	4.48	3.19
2014	5	16.7	11.1				
2015	5	16.7	10.4				
2016	5	16.7	9.7				
2017	5	16.7	9.1				
2018	5	16.7	8.5				
2019 (Mar)	1.25	4.2	2.0				
TOTALS	41.0	137.0	89.3	6.2	21.7	27.9	23.9

Net Benefits	65.39

Auction Benefits

As discussed earlier and demonstrated in Exhibit 3, a slot resulting in larger airplane service on average nets the society $3.341 million annually. The auction benefits are based on one operation resulting in larger airplane service per year. We estimate that by 2013, five such operations have will be allocated and will remain in service until the leases expire. When

[13] For example, bidders in FCC SMR auctions without combinatorial bidding face in exposure risk of winning some but not all of their complementary licenses to support their business plan. Likewise, takeoff and landing slots may be worth more in combinations or bundles than the sum of the individual slots.

expressed in present value terms (using a 7 percent rate) and summed, the total present-value benefits are $89.3 million.

Government Auction Costs

A contract has been awarded by the FAA to implement the auction. Based on past experience, we believe there will be few if any slots returned to the FAA under the use/lose provisions of the rule; carriers will be better off subleasing slots in the secondary market. Therefore, the agency has not made provisions for reallocating returned slots in years six through ten in the cost estimates. However, even if the costs were identical to those in years one through five, the rulemaking would be more than justified.

To manage the auction process, the agency has assumed that FAA will devote two full person-years of effort in each of the auction years, at a GS-14 rate for a total of $0.5 million in annual cost. The total nominal cost to the government cost is $6.2 million, with initial costs of $1.7 million and recurring costs of roughly $0.9 million.[14]

Carrier Auction Cost

In response to comment, we have re-estimated and thoroughly examined the auction participation costs to carriers. Following are the details regarding the carrier auction costs. We expect carriers to dedicate an auction team to focus their efforts and conduct their due diligence to participate most effectively in a government auction. In this case, a carrier will likely assemble a multidisciplinary team of existing staff that might consist of an auction manager, an operations research specialist, and a corporate lawyer. The assembled team resources involved

[14] We have included $0.2 million for the one-time "fair allocation" of slot lives.

in the auction would not be dedicated entirely to the auction process and could continue to work on existing projects and responsibilities. In addition to staff resources, company executives would be involved on an as-needed basis to approve bidding strategies, final bids, and secure any necessary financing.

In the following table, the auction process activities are described and the associated costs with each activity are estimated. For purposes of this analysis, a blended rate of $100/hour is used to estimate carrier costs of in-house auction preparation activities. Shown below in Exhibit 8 we summarize the estimated cost per carrier. The annual total costs are based on 50 carriers participating and the estimated carrier administrative costs of participation in the chosen format for a given bidder is approximately $76,000 initially and $71,500 for recurring years[15].

Exhibit 8 – Carrier Auction Costs

Activity	**Description of Activity**	**Hours and Expenses**	**Labor Costs**
Review Final Rules	Each team member reviews the final rules to fully understand the bidder obligations and auction procedures	24	$2,400
Determine least profitable slots to include in the auction	Operations research personnel determines least profitable existing slots at each airport using existing software tools and models	40	$4,000
Review Bidder Information Package	Each team member reviews the Bidder Information Package that includes a full set of auction procedures	24	$2,400
Submit Auction Expression of Interest	Auction Manager submits Auction Expression of Interest and certification to the FAA through web-based form. Legal reviews form for rules compliance	8	$800
Develop bidding strategy assumptions	Auction team develops strategy assumptions based on existing operations and long-range, strategic plans	120	$12,000

[15] These costs are the maximum expected carrier costs from participating in the auction. We expect that the number of participating carriers will be substantially less than 50, especially after the first year.

Obtain bidding strategy approval	Auction team coordinates with applicable executive level employees to obtain bidding strategy approval	80	$8,000
Determine values of most profitable slot combinations	Operations research personnel determine most profitable packages of auction slots and corresponding values at each airport based on carrier's existing slot portfolio and private and common value assumptions and gate availability (if applicable) using existing software tools and models	160	$16,000
Obtain final approval of bids	Auction team coordinates with applicable executive level employees to obtain bid approval	40	$4,000
Secure necessary financing	Auction manager coordinates with CFO to secure any necessary financing and upfront payment deposit requirements	40	$4,000
Attend bidder seminar	Auction team travels to and attends government sponsored bidder seminar event in Washington, DC	48 +$3,000 travel expenses	$4,800 $3,000
Deposit upfront payment and lost interest	Auction manager coordinates with Finance department to deposit auction upfront payment	8	$800
Mock Auction	Auction team participates in government sponsored mock auction including creating a fictitious bid in the required format and reviewing auction system confirmation.	48	$4,800
Prepare final bid	Operations research specialist prepares final bid; Auction Manager and Legal reviews final bid to verify and validate package contents, prices and to ensure that file format is compliant	48	$4,800
Submit bid on Auction Day	Auction Manager submits file to FAA auction system, Operations Research and Legal reviews confirmation and compares it to final approved bid	24	$2,400
Post auction	Auction Manager requests refund of upfront payment or coordinates final payment of winning bid amounts	24	$2,400
	Total:	736	$76,600

In this case, the airlines will likely use existing in-house resources in their operations research departments to determine the value of each slot and the values of different combinations of slots such that they can find the most (and least) profitable slots/packages for their specific businesses. Since schedule optimization is already a core competency of the airline industry and all carriers have existing software tools and models to determine optimal schedules and the potential revenue that can be realized by using those schedules, the slot valuation process is an inherent part of their ongoing operations.

SLOT VALUES

Although not a cost of this rule, we provide this slot value discussion as some carriers have expressed an interest in the valuation or cost of a slot. As explained earlier, carriers will also be affected by the payments made for auctioned slots in the form of transfer payments. Funds will be collected by the FAA to offset the cost of the auction and to undertake capacity enhancements in New York. The net revenue impacts on individual carriers will depend on the outcome of the auction and we acknowledge these transfers.

No one knows how much slot leases will trade for in the auction. FAA understands that slot leases have traded in the range of $3,000 to $20,000 per month at LGA under the HDR. Slots have been sold in the range of $230,000 to over $1 million at LGA. Of course, historically HDR slots were treated as quasi-permanent assets with indefinite lives whereas under the rule they will have at most 10 years of life. One of the most important features of the rule is to define more precisely the property rights of the FAA and slot holders. Some observers have noted that in the past the indeterminate nature of slot property rights may have adversely affected the secondary market under the HDR. Slot holders may have been reluctant to sell slots for fear of never having an opportunity to regain them in the future if their business prospects changed.

The most recent lease transactions of which we are aware were in the range of about $7500 per month. Using a 12 percent private cost of capital over the slot lives ranging from 6 to 10 years provides one way to estimate potential slot values in an auction.[16] Exhibit 9 summarizes these values and the implied auction proceeds. We stress that these are indicative values and the actual values in an auction may be different.

Exhibit 9: Example of a Slot Value and Resulting Daily Seat Value

Average Monthly Value of a Slot	$	7,500
Seat Configuration	Value per Seat Day	
200	$	1.25
150	$	1.67
135	$	1.85
100	$	2.50
70	$	3.57
50	$	5.00
35	$	7.14
19	$	13.16

Assumes 30 day month

One way to gauge the effect of slot-related cash outlays on carriers is to compute the slot value on a per seat-day basis. This is the amount that carriers will have to amortize per seat offered in the marketplace. Clearly operators of larger aircraft have an advantage in this comparison. Exhibit 10 shows the potential proceeds of the auction.

[16] This cost of capital is based on information from GRA Incorporated, the preparer of this Regulatory Evaluation. The 12 percent cost of capital is used to estimate what an airline would pay for a slot; the airline will look at its own weighted cost of capital (not the average for the economy in the long run). This is not used to discount the benefits and costs of the rule. It is used to make an average valuation of a private asset based on other valuations of slots that have used rates approximtedly equal to 12 percent. It might be argued that this is low given the cost of capital in today's aviation environment.

Exhibit 10: Value of a Slot per Seat Offered per Day

Indicative Slot Values and Implied Auction Proceeds

Average Monthly Value of a Slot………… $ 7,500

Private Cost of Capital……………………. 12%

Year	Slot Life (yrs)	Lease Value	Slots Sold	Auction Proceeds
2009	10	$ 522,754	23	$12,023,342
2010	9	$ 493,933	23	$11,360,459
2011	8	$ 461,458	23	$10,613,534
2012	7	$ 424,863	22	$ 9,346,986
2013	6	$ 383,628	22	$ 8,439,816
		TOTALS	113	$51,784,137

The FAA recognizes that carriers will look at the cost of a slot on a network basis, and as part of the cost of their entire service offer in New York.

APPENDIX A

A complete discussion of the methodology for estimating net benefits to society of the cap provisions of the proposed rule can be found in the earlier Initial Regulatory Evaluation dated August 29, 2006, which is a part of the record in this rulemaking. This appendix shows three new estimates made for the Final Rule. First, the original estimates of the benefits of a cap have been adjusted. Second, some indicative estimates of the benefits to society of different types of flying at LGA are provided. Third, estimates are made regarding the net benefits of retiring approximately five percent of LGA capacity.

Updating Estimates of Net Surplus Due to a Cap

In the August 29, 2006 Initial Regulatory Evaluation there are estimates of the benefits of a cap at LGA. While the original proposal included an upgauging provision that is not part of this Final Rule, in the initial year there was no effective upgauging. The initial year's estimate of benefits has been updated to reflect limited inflation that has ensued since. According to the latest data on passenger air carrier costs published by ATA, unit costs increased by 0.2% from the third quarter of 2006 to the third quarter of 2007. This index was applied to adjust operator benefits of the cap.

In evaluating the benefits and costs of a cap at LGA, the 2006 Regulatory Evaluation took account of the benefits to consumers and producers of the additional flying that would occur if the cap were not imposed. It identified from carrier filings the additional proposed flights that would have been undertaken as a result of Air-21.[17] The additional flying increased the average

[17] See the "Background and Need for the Regulation" section of this Regulatory Evaluation for additional information on carrier filings of proposed filghts under AIR-21.

frequency, average number of seats offered, costs, revenues, delays and cancellations incurred at LGA. The 2006 Regulatory Evaluation then estimated the net change in consumer and producer surplus due to the additional flying. The results suggested that operations beyond the cap impose a net cost to society, even though some consumers and producers might benefit from them.

There are also estimates of consumer benefits due to a cap; about half of these benefits can be adjusted as they relate to changes in money fare; the remainder relatse to passenger delay costs, which we do not adjust in our cost benefit studies.[18] According to the BTS Air Fare Index, airfares actually fell by 0.8% from the third quarter of 2006 to the third quarter of 2007. This index was applied to adjust consumer benefits of the cap.

The benefits of a cap have been adjusted downward to exclude the downstream costs of delay that are avoided due the cap. The FAA is in the process of revising the methodology on these types of costs and prefers to exclude them pending completion of the work in this area.

Using the adjusted one year net benefit estimate over the 10 year time horizon of the rule, the cap provides discounted benefits of approximately $1.863 billion. We adjusted this number based upon the 10 year period of analysis and effective dates of the final rule and carry it forward in our final analysis. The details of these calculations are shown in Exhibit 11.

[18] These are based on the passenger value of time which is not escaslated each year.

Exhibit 11: Adjusted Net Benefits of a Cap at LaGuardia

Adjusted Annual Benefits of a Cap at LaGuardia ($mil)		
Annual Estimate ($2007)		303.4
	less Downstream Delay Costs	-34.7
Revised Annual Estimate ($2007)		268.7
	Consumer Surplus ($2007)	-57.8
	BTS Air Fare Inflation Adj. -0.8% x 50%	-0.2
(a)	Consumer Surplus ($2008)	-57.6
	Other Operators ($2007)	326.5
	ATA Cost Index Inflation Adj. +.02%	0.7
(b)	Other Operators ($2008)	327.2
Annual Estimate ($2008) (a+b)		269.6

Sources: Regulatory Evaluation (August 29,2006) Ex. 12
ATA Passenger Airline Cost Index YE 3Q 2007; BTS Air Fare Index
BTS Air Fare Index YE 3Q 2007

Estimated Net Benefits of a Cap ($mil)	Annual Benefits	Present Value Benefits
2009	202.2	189.0
2010	269.6	235.5
2011	269.6	220.1
2012	269.6	205.7
2013	269.6	192.2
2014	269.6	179.6
2015	269.6	167.9
2016	269.6	156.9
2017	269.6	146.6
2018	269.6	137.0
2019	67.4	32.0
Total Discounted Value		1862.5

Estimating Illustrative Benefits and Costs of Different Types of Flying

The empirical analysis described below is based on estimating the full price of travel and social marginal costs for representative markets at LGA. Estimates are provided for average legacy (standard jet), regional jet (RJ), turboprop and LCC[19] (standard jet) markets. The estimates are meant to be illustrative of the consumer and producer surplus produced by an average operation over a year. Comparison of the surplus produced by the four types of markets gives some feel for the consequences for society if one type of service is traded for another as a result of an auction.

The consumer benefits related to a reallocation of slots can be estimated using the economic concept of consumer surplus, defined as the difference between what consumers must pay for a given level of service and what they would be willing to pay. In passenger transportation markets, consumer surplus is usually defined in the context of the full price of travel. The full price of travel includes the money fare that a consumer must pay and the value of his or her time in transit (including both the scheduled time and any expected delays) and the value of schedule delay (the difference between the ideal time of departure/arrival versus the actual schedule offered weighted by the probability of being accommodated on the desired flight). The common sense interpretation of the full price of travel model is that consumers prefer to fly at a time closest to their desired departure (or arrival) time, at the lowest possible price and in a manner that minimizes the expected time in transit, including the risk of delays and cancellations.

Interpretation of the full price of travel in the context of consumer surplus is straightforward. A consumer would not choose to purchase a transportation service unless it was worth more to him or her than the sum of the money price plus the value of his or her time, including airport and schedule delay. Consumer surplus is the value of air transportation in excess of the full price of travel. Although it is not always the case, larger aircraft would tend to

[19] LCC is low cost carrier.

exhibit more consumer surplus per operation because there are more passengers on-board who tend to fly longer distances, expend more time traveling, and pay more for the service, than on a smaller aircraft. Smaller aircraft will tend to exhibit less consumer surplus per operation for the same reasons and in addition, to the extent smaller aircraft are used for shorter haul flights, their use may be less advantageous to consumers at a highly delayed airport with high cancellation rates. Consumers can more easily elect to take other forms of transportation, such as rail, in shorter haul markets if they are confronted with less reliable air service.

It is also important to account for producer surplus, or the amount carriers earn per flight in excess of marginal cost (including delay and cancellation costs at LGA). Carriers will tend to focus on their own delay costs, and not worry about the costs they impose on other operators. At LGA, a carrier does not and would not have an opportunity to earn producer surplus in the absence of a slot. A reallocation of slots might increase producer surplus for some carriers and reduce it for others. By adding producer and consumer surplus together, the FAA derives an estimate of the benefits to society of the air service at LGA. A reallocation via auction should increase these benefits.

The analysis is carried out at the segment level, i.e., each non-stop destination from LGA is considered to be a separate market. To implement the analysis, estimates are needed for the full price of travel and social marginal costs as of January 2008.

The full price of travel (FPT) in each case is defined as:

FPT = money fare + value of scheduled time in transit + value of airport delay and cancellations + value of schedule delay

For the sample schedule day (January, 2008), data are available to estimate each term in the above equation:

- Money fare: Average segment fare[20] for each of the four types of service

- Average time in transit: Weighted average block time from the OAG sample day

- Expected airport delay and cancellations:[21] From a UMD analysis described above

- Value of travel time applied to transit time, delay and cancellations: GRA, Incorporated" Economic Values for FAA Investment and Regulatory Decisions, A Guide", prepared for FAA Office of Aviation Policy and Plans, (October 3, 2007) weighted using LGA shares of 55% leisure and 45% business reported internally by FAA – $30.86 per hour

- Schedule delay: Computed from the OAG data using a method described below

- Value of time in schedule delay: $2.70 per hour from a study by Morrison and Winston[22]

For each segment, there are e data on the level of service by the four types of aircraft operations (legacy, LCC, regional jet and turboprop). These data are aggregated up to the segment level, to estimate an average money fare, passengers per day each way, and measures of travel time, airport delay and schedule delay. The resulting sample day full price of travel and number of passengers together represent a point on the segment FPT demand curve. The

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[20] Based on DB1B third quarter 2007. The calculation includes "zero fare" observations (frequent flyers) and all O-D trips with 2 or less connect points involving LaGuardia as an endpoint or a connect point. It is important to include frequent flyers in order to avoid overestimating carrier revenues (calculated as total passengers x average fare). To derive the segment fare observations, the total itinerary fare for each DB1B record is first allocated to separate O-D trips using the DB1B trip break indicators and a weighting factor of W = exp(2.485+0.720668*ln(miles)) – this represents an approximation to ICAO formula prorates. The O-D trip fare is then further allocated to individual segments based on direct segment distance.

[21] Passenger delay costs are estimated as the product of expected delay time and the value of time. Cancellation costs are calculated the same way. In estimating expected passenger time lost due to a cancellation, we assume that a passenger is reaccommodated on the next flight out with enough available seats, where available seats are estimated as (1- load factor) x seat capacity. In some cases, passengers can be reaccommodated on the next flight out; in others, they might have to wait for the second flight.

[22] Morrison and Winston, "Enhancing the Performance of the Deregulated Air Transportation System," *Brookings Papers on Economic Activity, Microeconomics*, 1989, p. 66, use the ratio of value of schedule delay/value of travel time applied to current estimate of travel time value. The results of this study suggest that consumers place a lower value on schedule delay than on travel time. The rationale is that while consumers will prefer to fly at precisely the time that fits their schedules, deviations from the schedule do not generally result in large losses of consumer benefits because they are able to use any deviations in other productive or leisure pursuits. For example, a business person who would prefer to leave at 4pm but is forced to leave at 5 PM because of the schedule of available service may find ways to productively use the extra hour at work.

corresponding point on the money demand curve can be found by substituting the money fare for the FPT.

One additional point is required to identify the two demand curves in mathematical terms. To do this, one additional roundtrip with the average load (for each type of service) on the segment is assumed. The FAA's suggested money elasticity is applied to estimate change in the money price at the increased level of service.[23] This procedure provides another point on the (assumed) linear money demand curve for the flight segment. With this information, we recalculate the other components of the full price of travel and thus another point on the FPT curve. Finally we calculate the intercept point for the FPT demand curve assuming it is linear and, with the fully identified function, estimate the total consumer surplus for the segment (the so-called welfare triangle).[24]

In order to attribute consumer surplus to the different types of flying on a segment, we calculate average segment consumer surplus per passenger (that is, passengers were indifferent between the types of flying – legacy, LCC, regional jet and turboprop). Then we multiply average consumer surplus by the number of passengers per flight for each type of flying to estimate consumer surplus per flight for a segment. For each type of flying, we calculate total consumer surplus on a segment by multiplying by the number of flights.

To calculate the average consumer surplus per flight across all segments for each type of flying, we sum the surplus across segments and divide by the total number of daily flights.

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[23] The elasticity estimate is based on a weighted average of the recommended values from FAA's "Airport Benefit-Cost Analysis Guidance," 1999 – -2.0 for leisure travel ≤ 500 miles, -1.0 for leisure travel > 500 miles, -1.6 for business travel ≤ 500 miles, -0.8 for business travel > 500 miles. The April 19 baseline schedule indicates 42.7% of seats were offered in markets ≤ 500 miles; 57.3% were in markets > 500 miles. The leisure/business split is assumed to be 55/45 based on internal FAA estimates.

[24] Note, the full prive of travel demand curve is not linear. But we assume it is to calculate surplus. This tends to understate consumer surplus.

Assuming each flight is offered daily, we multiply the average per flight figure by 365 to obtain an estimate of average consumer surplus per flight for legacy, LCC, regional jet and turboprop operations at LGA.

Estimating Schedule Delay

One of the important differences that need to be accounted for between the cases is the effect of frequency and average seat capacity on consumer benefits. In general, consumers prefer more frequent flight opportunities and larger aircraft so that they can more easily accommodate their own schedules. For example, one reason consumers value legacy carrier operations at LGA so highly is that legacy carriers fly relatively large aircraft with high frequency. In contrast, LCC's fly larger aircraft on average but much less frequently, perhaps in part because they have less access to slots. Economists measure the value of frequency using a concept termed "schedule delay." The idea is that consumers can reduce schedule delay when there are more frequent flights and more seats. For example, a businessperson can more precisely plan a business trip when there are more opportunities to fly to a distant city to make a meeting at a particular time. In contrast, when service is relatively infrequent, the traveler might incur wasted time or even have to stay overnight to accommodate a meeting schedule. Personal travelers also benefit from increased frequency.

For valuation purposes, schedule delay is broken into two components – frequency delay and stochastic delay. Frequency delay measures the average difference between a passenger's preferred departure time and the closest scheduled departure time. Frequency delay (FD) in minutes for a given market segment is parameterized as:

$$\mathrm{FD} = 92F^{-0.456}$$

where F is daily flight frequency.[25]

Stochastic delay measures the expected delay due to the probability that a passenger would not be able to obtain a seat on his or her most preferred departure because of capacity limitations of the aircraft. Stochastic delay (SD) is parameterized as:[26]

$$\mathrm{SD} = \frac{12010}{F} \times P^{0.5725} \times (S - P)^{-1.79}$$

where F = daily flight frequency
P = passengers per flight
S = seats per flight

The sum of frequency delay and stochastic delay yields total schedule delay. Estimates of schedule delay from these equations for various values of F and S are shown below in Exhibit 12 below (using the observed average LGA system load factor of 68.6%):

Exhibit 12: Equation Estimates of Schedule Delay (minutes)

Daily Frequency	Average Seatsize				
	50	75	100	125	150
4	213	149	120	103	92
6	150	108	88	77	69
8	118	86	71	63	57
10	98	72	60	54	49

Schedule delay is valued at $2.70 per hour based on estimates developed by Morrison and Winston cited earlier.

Estimating Carrier Impacts

This analysis also includes estimated producer surplus impacts. For each type of flying (legacy, LCC, regional jet or turboprop) carrier revenues are computed based on the estimated

[25] Douglas and Miller (1974). Economic Regulation of Domestic Air Transport: Theory and Policy, p. 105.
[26] Morrison and Winston, *op. cit.*, p. 63. This is based on a parameterization of the Douglas and Miller (*op. cit.*) schedule delay equation.

number of passengers served and the money fare (net of passenger taxes, segment and security fees, and PFCs). For present purposes, carrier costs include scheduled aircraft variable block-hour costs, airport delay costs, and cancellation costs.

Variable block-hour costs are taken from the FAA "Economic Values" study completed in 2007.[27] Estimated airport delay costs are computed as average delay minutes per operation multiplied by the average variable block-hour costs summed across all operations, and cancellation costs.

Cancellation costs are difficult to measure because some portion of crew and other costs may still be incurred, and downstream operations may be affected. Ignoring downstream effects, one can estimate a ceiling on such costs based on the delays discussed above. Clearly, a carrier will cancel a flight only when the net costs of doing so are less than those that would be incurred by operating it and accepting the consequent delays. So a ceiling on (own-airport) cancellation costs can be estimated by taking the difference between (1) net operating profits with no cancellations (and therefore very high delay costs) and (2) net profits with cancellations. For this analysis, incurred cancellation costs were assumed to be 50 percent of the profit estimate difference.[28] This is likely to be a conservative estimate of cancellation costs since it does not include downstream effects.

Estimating Impacts on Non-Scheduled Operators

Delay effects on non-scheduled operations are also taken into account. The FAA assumed that non-scheduled operations remain constant at 48 per day in all three cases. Non-

[27] FAA, "Economic Values for FAA Investment and Regulatory Decisions, A Guide", op cit; Table 4-3.

[28] In estimating carrier revenues when there are no cancellations, it was assumed that each 1-point reduction in cancellations from the current value would lead to an increase in passengers equivalent to about 0.14 load factor points; this value was obtained from a comparison of T-100 load factors and cancellations rates at LaGuardia for December 2000 (when cancellations were very high) and April 2001 (when cancellations had returned to more normal historical rates.)

scheduled passenger delay costs are estimated assuming 2.8 passengers per flight[29] and using the same value of time as for scheduled passengers. Non-scheduled aircraft delay costs are estimated assuming an average cost of $1,108 per block hour.[30]

Illustrative Estimates of Surplus for Different Types of Operations at LGA

Exhibit 13 shows the illustrative average surplus per day and per year for operations at LGA. We stress again that these are illustrative. They are rough estimates of the relative benefits to society of alternative types of service at LGA. The relative values are of primary interest. It should not be surprising, given the economic methodology for calculating society benefits, that more frequent service with larger aircraft produces more surplus. On average, consumers as a group are willing to pay more for such service than they are for less frequent service with smaller aircraft.

[29] FAA, "Economic Values for FAA Investment and Regulatory Decisions, A Guide", 2007; Table 3-15, average passengers in operations involving Turboprop 1-9 seats multi-engine and Turbojet ≤12,500 lbs aircraft, the prevalent operators at LaGuardia.
[30] FAA, *op. cit*, Table 4-10.

Exhibit 13: Illustrative Estimates of Surplus for Different Types of Flying at LGA

	LCC	LEGACY JET	PROP	RJ	TOTAL
Daily Results					
Consumer Surplus	$428,695	$2,572,271	$75,371	$674,579	$3,750,916
Producer Surplus	$466,729	$3,011,755	-$56,477	$557,849	$3,979,856
Non-Scheduled Passenger Delay Costs					-$1,081
Non-Scheduled Aircraft Delay Costs					-$13,928
TOTAL SURPLUS	$895,423	$5,584,025	$18,895	$1,232,429	$7,715,763
Annual Results					
Consumer Surplus	$156,473,538	$938,878,760	$27,510,571	$246,221,420	$1,369,084,290
Producer Surplus	$170,355,997	$1,099,290,481	-$20,614,049	$203,615,011	$1,452,647,440
Non-Scheduled Passenger Delay Costs					-$394,660
Non-Scheduled Aircraft Delay Costs					-$5,083,722
TOTAL SURPLUS	$326,829,535	$2,038,169,241	$6,896,523	$449,836,431	$2,816,253,348
Scheduled Operations	88	506	164	442	1200
Avg Seat Size per Scheduled Operation	145.8	140.9	34.2	49.4	93.0
Avg Pax per Scheduled Operation	115.7	102.4	16.8	33.7	66.4
Per Operation (excluding Non-Scheduled)					
Consumer Surplus	$4,872	$5,084	$460	$1,526	$3,126
Producer Surplus	$5,304	$5,952	-$344	$1,262	$3,317
TOTAL SURPLUS	$10,175	$11,036	$115	$2,788	$6,442
Annual Surplus	$3,713,972	$4,028,002	$42,052	$1,017,729	$2,351,443

Exhibit 14 shows the estimated net surplus due to reducing operations by roughly five percent. This estimate assumes that airlines delete some or all of the service in low operating profit markets, which may include one or more round-trips per day to the same airport. The FAA also assumes that carriers delete an even number of operations so that a total of 48 operations are deleted if 45 slots are retired.

Exhibit 14

EFFECT OF CANCELLED OPERATIONS	LCC	LEGACY JET	PROP	RJ	TOTAL
Daily Results					
Change in Consumer Surplus for Cancelled Flights:					
CMH	$0	$0	$0	-$14,474	-$14,474
CLT	$0	$0	$0	-$7,854	-$7,854
MSY	$0	$0	$0	-$2,985	-$2,985
RDU	$0	$0	$0	-$7,512	-$7,512
JAX	$0	$0	$0	-$11,693	-$11,693
GRR	$0	$0	$0	-$2,664	-$2,664
ORD	$0	-$8,904	$0	$0	-$8,904
BTV	$0	$0	-$3,850	$0	-$3,850
ROC	$0	$0	-$980	$0	-$980
RIC	$0	$0	$0	-$2,432	-$2,432
IAD	$0	$0	$0	-$2,451	-$2,451
ALB	$0	$0	-$630	$0	-$630
ITH	$0	$0	-$1,095	$0	-$1,095
MHT	$0	$0	-$785	$0	-$785
Change in Consumer Surplus for Remaining Flights:					
OTHER	$33,759	$171,169	$8,148	$44,689	$257,765
CHANGE IN CONSUMER SURPLUS	$33,759	$162,265	$808	-$7,377	$189,455

Sample Calculations

The following table shows the individual calculations applied to data at the segment level. In the analysis, consumer and producer surplus estimates are developed at the segment level and then summed across segments. The segment shown is LGA – Atlanta, which was selected because it has a variety of different types of flying.

The general assumptions are shown at the top of the table; the calculations for the segment then follow below.

Sample Calculations of Surplus at the Segment Level[31]

INPUTS		
Unscheduled Daily Ops	48	
% Leisure traffic	55%	
Value of Travel Time per Hr	$30.86	Source: Business and leisure values from FAA critical values, LGA shares from www.jcdecauxna.com
Value of Schedule Delay per Hr	$2.70	Source: Morrison and Winston, "Enhancing the Performance...", Brookings 1989.
Passenger/Segment/A&H Tax Rate	8%	Source: G Helledy, FY04 scheduled domestic pax svc (airline rev % ticket rev)
PFC and Security Fee per Segment	$7.00	$4.50 PFC + $2.50 Security Fee
Money Fare Arc Elasticity	-1.372	Arc elasticity assumed to apply between current P,Q and that which would occur with 1 additional flight in the market
Downstream delay multiplier	0	
Chg in LF with 1 pt incr in completion rate	0.14	T-100 LF and completion rates, Dec. 2000 vs. Apr 2001
Cancellation cost factor	50%	
Include cancellation effects?	Y	
Avg Blkcost per Hour for GA	$1,108	Source: FAA critical values Table 4-10, avg. of Multi-Engine Turboprop 1-9 seats and Turbojet <=12,500 lbs variable operating costs
Passengers per GA flight	2.8	op. cit., Table 3-15
Annualization Factor	365.0	
		With Cancellations
Total Scheduled Operations	1200	1138
Cancellation Rate	5.9%	4.8%
Realized Operations incl Unscheduled	1177	1131
Airport Delay per Op (min)	15.7	9.3
Airport Delay Cost per Pax	$8.09	$4.77

CANCELLATIONS	LCC	LEGACY J	PROP	RJ	TOTAL
CMH	0	0	0	14	14
CLT	0	0	0	6	6
MSY	0	0	0	2	2
RDU	0	0	0	6	6
JAX	0	0	0	8	8
GRR	0	0	0	2	2
ORD	0	2	0	0	2
BTV	0	0	10	0	10
ROC	0	0	2	0	2
RIC	0	0	0	2	2
IAD	0	0	0	2	2
ALB	0	0	2	0	2
ITH	0	0	2	0	2
MHT	0	0	2	0	2
TOTAL	0	2	18	42	62

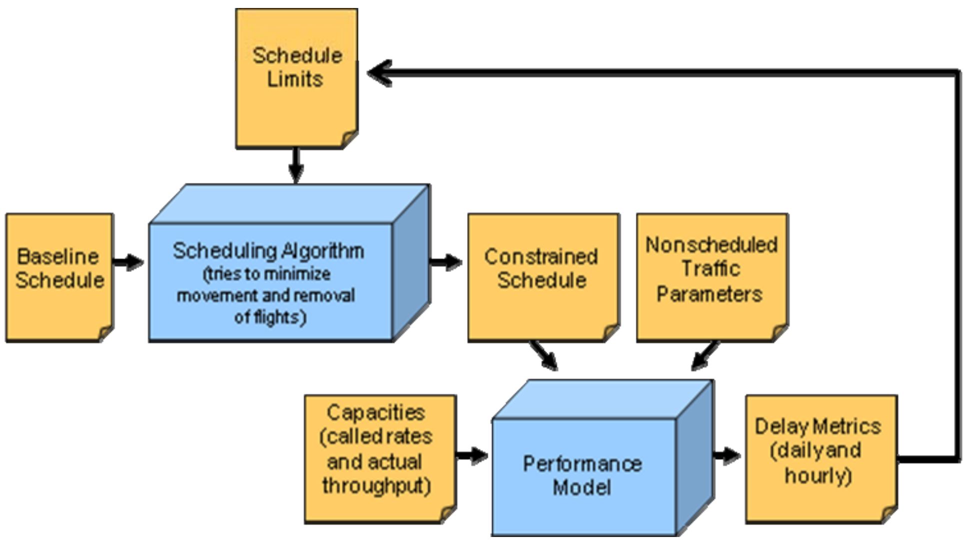
[31] The first table in Exhibit 18 contains assumptions used for model calculations, including Option 1 slot retirement presented as segment cancellations by equipment type. The second table presents sample calculations for the LGA-Atlanta segment.

LGAMKT	ATL				
	group2				
Data	LCC	LEGACY JET	PROP	RJ	Grand Total
Sum of FLTCOUNT	18	38	0	4	60
Sum of seatsize2	2412	6525	0	176	9113
Sum of TIME	2599	5697	0	620	8916
Sum of totcost2	106604	361700	0	15087	483391
Sum of pax2	1915.128	4743.675	0	120.032	6778.835
Sum of totrev2	279972.5623	693477.8483	0	17547.47808	990997.8887

	LCC	LEGACY JET	PROP	RJ	TOTAL
Scheduled Operations	18	38	0	4	60
Scheduled Roundtrips	9.0	19.0	0.0	2.0	30.0
Scheduled RT Seats	1206.0	3262.5	0.0	88.0	4556.5
Avg Seatsize	134.0	171.7	0.0	44.0	151.9
Cancellation Rate	5.9%	5.9%	0.0%	5.9%	5.9%
Realized Roundtrips	8.47	17.88	0.00	1.88	28.23
Realized RT Seats	1134.67	3069.54	0.00	82.80	4287.00
Segment PDEWs	957.56	2371.84	0.00	60.02	3389.42
Pax per Operation	106.40	124.83	0.00	30.01	112.98
Avg Load Factor	79.4%	72.7%	0.0%	68.2%	74.4%
BlkHrs/Operation	2.41	2.50	0.00	2.58	2.48
VarCost	$106,604	$361,700	$0	$15,087	$483,391
VarCost/Hr	$2,461	$3,809	$0	$1,460	$3,253
PASSENGERS					
Avg Segment Fare					$146.19
Money Fare Arc Elasticity					-1.372
Travel Time Cost per Pax					$76.43
Airport Delay Cost per Pax					$8.09
Avg Time between Flights (hrs)					0.60
# Flights needed to Accommodate All Cancelled Pax					5.15
Total Passenger Hours Incurred					371.56
Cancellation Cost per Pax					$3.38
Frequency Delay (min)					19.51
Stochastic Delay (min)					8.54
Schedule Delay Cost per Pax					$1.26
Avg Full Price of Travel					$235.35
With 1 Additional Scheduled Flight:					
Segment PDEWs	1063.96	2496.67	0.00	90.02	3650.66
Intermediate calculation					-18.487
Avg Segment Fare					$138.49
(ignore marginal changes in airport delay and cancellation costs)					
Frequency Delay (min)					18.68
Stochastic Delay (min)					7.77
Schedule Delay Cost per Pax					$1.19
Avg Full Price of Travel					$227.58
Money slope					-0.029
Money intercept					$246.09
FPT Slope					-0.030
FPT Intercept					$336.19
Total Daily Consumer Surplus	$96,556	$239,165	$0	$6,052	$341,773
Annual Consumer Surplus	$35,243,036	$87,295,214	$0	$2,208,882	$124,747,132
CARRIERS					
Airline Revenue	$244,169	$604,794	$0	$15,303	$864,266
Variable Block Costs (before delays)	$100,299	$340,307	$0	$14,195	$454,801
Airport Delay Costs	$10,920	$35,683	$0	$1,440	$48,043
Downstream Delay Costs (deps only)	$0	$0	$0	$0	$0
Daily Airline Profit (before cancellations)	$132,950	$228,804	$0	-$331	$361,423
Cancellation Costs	-$12,307	-$25,659	$0	-$787	-$38,753
Daily Airline Net Profit	$145,258	$254,462	$0	$456	$400,176
Annual Airline Net Profit	$53,018,991	$92,878,792	$0	$166,468	$146,064,250

APPENDIX B – MITRE QUEING MODEL

MITRE has developed a performance modeling and analysis approach for estimating airport performance given various levels of demand, capacity, and potential scheduling limits. This is the process the FAA will follow to determine if additional capacity has become available. See the following figure for a depiction of this approach.



Performance Modeling and Analysis Approach

To evaluate the performance impact of various schedules and other factors on an airport of interest, an airport queuing simulation model is utilized. Modeling the performance impact involves a multi-step process. The first step is to determine the appropriate level of capacity to model. This is done by evaluating airport arrival and departure rates called by the facility, as well as actual throughput experienced. Capacity is constantly changing and is subject to many factors, including weather, fleet mix, and many others. Because of this, it is important to evaluate the airport's capacity over a period of time.

The second step involved developing a demand profile for the airport. This needs to include both scheduled and nonscheduled operations. Information about scheduled operations are typically obtained from the Official Airline Guide (OAG), but may also be obtained through a scheduling conference, from airline submittals, or other sources as well. To accurately account for nonscheduled operations, an analysis of an individual airport needs to be performed in order to determine the appropriate level of nonscheduled operations to analyze. Data collected from the Enhance Traffic Management System (ETMS) is often used to collect this information.
The third step includes modeling the representative demand profile (that includes scheduled and nonscheduled operations), along with the historical capacity levels, day by day, and hour by hour, to baseline performance. This is done before any schedule limits are applied to the modeling. Modeled results are compared to actual recorded performance as measured by the FAA's ASPM system. Past analyses have shown the trends observed from the model results follow the theory of queuing delay and are consistent with the trends from observed delay data, and thus were found to be indicative of actual performance.

The fourth step involves developing constraints that could be applied to the representative demand profile in order to achieve target levels of performance. Many different approaches can be analyzed and include tradeoffs such as impacting scheduled operations only, or scheduled and nonscheduled operations. Implementation of basic single-hour and half-hour constraints can be analyzed, along with multi-hour constraints that allow more peaking in the demand profile but also consist of a recovery period. As the various types of constraints are applied by a scheduling algorithm, operations are moved or removed from the baseline demand profile as necessary to meet the constraints. If possible, operations are moved to times where capacity is available. If operations cannot be accommodated close to their original scheduled time, they are removed from the model (past analyses have used a two-hour window).

The fifth step involves remodeling the airport's performance using constrained schedules from the scheduling algorithm, along with nonscheduled operations and the collected capacity data. Performance metrics are analyzed to understand if the target levels of performance have been satisfied. If not, the constraints are adjusted to alternative levels, the scheduling algorithm is rerun, and the model's output is again analyzed until the targets are reached.

Performance estimates from this model are accumulated for each minute of delay, not just delays greater than 15 minutes. The resulting performance measures are sensitive to a number of factors; therefore, the model is run hundreds of times randomizing various elements to account for stochastic variations that may exist. This may include randomizing when scheduled or nonscheduled operations take place, depending on the information available at the time of the analysis.

Differences between actual and modeled delays can be expected due to factors such as airport and en route weather, airport fix loading, airline response to delays and other factors, and traffic flow management actions. Nonetheless, the model results can be used to evaluate the trends and relative differences of performance impacts of constrained schedules at individual airports.