Office of Inspector General

Audit Report

MORE COMPREHENSIVE DATA ARE NEEDED TO BETTER UNDERSTAND THE NATION'S FLIGHT DELAYS AND THEIR CAUSES

Office of the Secretary of Transportation
Research and Innovative Technology Administration
Federal Aviation Administration

Report Number: AV-2014-016
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Memorandum

U.S. Department of Transportation
Office of the Secretary of Transportation
Office of Inspector General

Subject: **ACTION:** More Comprehensive Data Are Needed To Better Understand the Nation's Flight Delays and Their Causes
Office of the Secretary
Research and Innovative Technology Administration
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From: Jeffrey B. Guzzetti
Assistant Inspector General for Aviation Audits

Reply to Attn. of: JA-10

To: Assistant Secretary for Administration
Deputy Administrator, Research and Innovative Technology Administration
Federal Aviation Administrator

The causes and impacts of flight delays and cancellations continue to be a key concern for Congress, the Department of Transportation (DOT), the airline industry, and the flying public. In 2000, we issued our report[1] assessing the extent of flight delays and their nationwide impact. Our report and subsequent testimony[2] also highlighted concerns with how the Federal Aviation Administration (FAA) and Bureau of Transportation Statistics (BTS)[3] tracked and reported flight delays and cancellations and their respective causes, as well as air carriers' scheduling practices at major airports. Since then, FAA and BTS have taken a number of steps to address these concerns, including improving data collection, tracking flight delay causal factors, and developing capacity benchmarks for the major airports.[4]

Given our previous findings and the significant changes to the aviation industry in the past decade, Congress directed us in the FAA Modernization and Reform Act of 2012[5] to update our 2000 report, as well as examine various delay statistics, air carrier

[1] *Air Carrier Flight Delays and Cancellations* (OIG Report No. CR-2000-112), July 25, 2000. OIG reports are available on our Web site: http://www.oig.dot.gov.
[2] *Flight Delays and Cancellations* (OIG Report No. CR-2000-122), September 25, 2000.
[3] In 2005, BTS was incorporated into DOT's Research and Innovative Technology Administration (RITA).
[4] Capacity benchmarks are the Agency's determinations of the maximum number of flights an airport can routinely and safely accommodate in an hour for the Nation's largest airports.
[5] Pub. L. No. 112-95, February 14, 2012.

scheduling practices, and airport capacity benchmarks. Accordingly, our audit objectives were to (1) analyze recent flight delay and cancellation trends, (2) examine air carrier scheduling practices and their relative impact in causing flight delays and cancellations, and (3) review FAA's use of capacity benchmarks to assess airport capacity and monitor airline scheduling practices at the Nation's largest airports.

We conducted this review in accordance with generally accepted Government auditing standards. In conducting our analyses, we relied on information from BTS and FAA databases containing flight delay, cancellation, and air carrier scheduling data for 2000 to 2012. We also used data from FAA, such as capacity, performance, and forecast reports. Exhibit A details our complete scope and methodology.

RESULTS IN BRIEF

Although the trends in flight delays,[6] cancellations, and long taxi times have significantly improved over the last decade, data limitations hinder the Department's ability to track some of these delays or fully understand their causes. Overall, delays fell by 33 percent from 2000 to 2012, and the number of cancellations nationwide has decreased by 56 percent at the 55 major airports.[7] Various factors have contributed to these downward trends, including a significant reduction in the number of scheduled flights, favorable weather patterns, airport infrastructure improvements, and air traffic control (ATC) procedural changes. While the Department has improved its process for tracking flight delays and their causes since our 2000 report, further enhancements are needed to provide the public with more complete information, as well as assist aviation stakeholders in identifying the root causes of delays. For example, although BTS does collect data on approximately 76 percent of all domestic flights, it lacks information on the remaining 24 percent because only certain carriers are required to report delays.[8] Moreover, while BTS now collects causal data for those flights with reported delays, nearly 40 percent of these flights do not indicate the initial cause of the delay. Instead, the air carriers report such flights as involving a "late arriving aircraft," without specifying why the aircraft arrived late. Addressing these data problems would go far in giving key aviation stakeholders and the flying public a fuller understanding of air carrier flight delays and their causes.

Air carrier scheduling practices also have had a major impact on reducing the number of flight delays both nationwide and at specific airports. To help reduce reported delays, air carriers expanded their schedules (that is, gate-to-gate times) on many of their routes between 2000 and 2012. In 2000, for example, scheduled gate-to-gate times exceeded actual flight times on 73 percent of air carrier routes we analyzed. By

[6] A flight is considered delayed when it arrives 15 minutes or more after its scheduled arrival time.
[7] Although FAA currently tracks 77 airports, our analysis focused on the 55 large and medium airports that the Agency started tracking in 2000.
[8] Air carriers accounting for 1 percent or more of the total domestic scheduled-service passenger revenues are required to report.

2012, scheduled times exceeded actual flight times on 98 percent of the flights we analyzed. In some cases, air carriers increased their scheduled times to compensate for routes where the actual flight time had been longer than previously scheduled. However, for other routes, air carriers increased their scheduled flight times more substantially. For example, on the LaGuardia-to-Indianapolis route, the average scheduled gate-to-gate times increased 12 minutes even though the actual flight time decreased 8 minutes.[9] As a result of these schedule increases, the number of delayed flights on this route dropped from 58 percent to about 15 percent between 2000 and 2012. Similarly, the number of flights arriving 15 minutes or more ahead of schedule rose from 7 percent in 2000 to 50 percent in 2012. While air carriers have helped to reduce delays by increasing scheduled gate-to-gate times and reducing flight volume by 18 percent at the 55 airports, over-scheduling and congestion remain a problem at several major airports. For example, at New York's Kennedy, LaGuardia, and Newark airports, air carriers continue to schedule daily flights in numbers near or above the airports' capacity, particularly during certain peak periods. As a result, the likelihood of delays at these airports is significantly increased, even though FAA has established limits on the number of arrival and departure slots at all three airports.[10]

In response to our recommendations, FAA has established capacity benchmarks (the maximum number of flights that can be routinely and safely accommodated in an hour) at the Nation's largest airports. While FAA's benchmarks have proven useful for assessing capacity needs at these airports, the Agency has not shared them with the public since 2004 (even though an internal update was performed in 2007). Regularly published updates are critical to reflect changes in technology, air traffic control procedures, and infrastructure at the major airports for stakeholders, including Congress, airlines, airports, and the general public. Yet, FAA lacks a formal policy for how often the benchmarks should be updated or published. FAA also has never used the benchmarks for assessing air carrier scheduling practices because the Agency considers them to be too static. Instead, FAA uses more real-time capacity measures—known as "called rates"[11]—to identify those airports at risk of over-scheduling. However, this information is not published outside the Agency. As a result, stakeholders may not be fully aware of current capacity constraints and instances of over-scheduling at key airports.

We are making several recommendations to the Office of the Secretary of Transportation (OST), FAA, and the Research and Innovative Technology Administration (RITA) to improve the collection, reporting, and communication of

[9] In 2000, the average scheduled gate-to-gate time on this route was about 4 minutes less than the average actual time, demonstrating that scheduling was not realistic. By 2012, the average schedule gate-to-gate time had been increased by 21 minutes, resulting in it being 17 minutes greater than the actual time.

[10] Currently in effect at Kennedy, LaGuardia, and Newark, slot controls entail the maximum number of hourly arrivals and departures that air carriers can schedule. While slot controls help lessen the magnitude of flight delays, these three airports continue to experience some of the highest delay rates in the Nation.

[11] "Called rates" are the maximum hourly number of arriving and departing flights an airport can safely handle as determined by air traffic control given existing operational conditions, such as wind direction, weather, and volume.

flight delay and other related data, including airport capacity benchmarks and air carrier over-scheduling.

BACKGROUND

Since July 2000, we have issued a number of reports and testified before Congress on flight delays, air carrier customer service, and air traffic congestion nationwide (see exhibit B). In doing so, we have made multiple recommendations to the Department for improving on-time performance data collection and analysis, capacity benchmarks, and tracking ground times (taxi times) once the aircraft departed the gate.

BTS is responsible for collecting aviation performance data from reporting air carriers. The data are available to the public and comprise the Department's official source of flight data, including the rankings of air carrier on-time performance, flight delays by airport and air carrier, and significant taxi times. FAA, in contrast, is responsible for managing the Nation's ATC system. Building upon the BTS data (which captures approximately 76 percent of domestic flights), FAA is able to create—using estimates of taxi times—flight information for those air carriers not reporting to BTS. FAA uses these data for assessing the performance of the ATC system, identifying and monitoring delay problem areas, and devising corrective actions. Since our 2000 report, both BTS and FAA have significantly improved their processes for collecting data on flight delays and their causes (see exhibit C).

FLIGHT DELAYS AND CANCELLATIONS HAVE SIGNIFICANTLY DECLINED, BUT DATA LIMITATIONS PREVENT A FULL UNDERSTANDING OF THEIR TRUE NUMBER AND CAUSES

Since 2000, the number of flight delays, cancellations, and long taxi-out times has improved, due to factors such as relatively favorable weather conditions in recent years, airport infrastructure improvements, ATC procedural changes at major airports, and a significant reduction in the number of scheduled flights. However, data limitations hinder complete visibility into the extent of delays and their causes. For example, BTS lacks information on nearly one-quarter of all commercial flights. While FAA data are somewhat more comprehensive, FAA still relies mostly on BTS data, augmented with estimates of non-reporting air carriers' flight times.[12] In addition, BTS causal data do not provide sufficient detail on the root causes of nearly 40 percent of flight delays.

[12] FAA calculates a flight's length (gate-to-gate) for non-reporting air carriers by supplementing recorded takeoff and landing times with estimated taxi-out and taxi-in times. These estimates are based on the median hourly taxi times by airport, as calculated by FAA.

Trends for Delays, Cancellations, and Long Taxi Times Have Improved; However, the Average Delay Is Longer

Between 2000 and 2012, air travel significantly improved in terms of the number of delays and cancellations, as well as fewer flights experiencing long taxi in and out times (that is, in excess of 1 hour). As table 1 illustrates, over the last 12 years, the number of flight delays (15 minutes or more) and cancellations have declined 33 percent and 56 percent, respectively.

Table 1. Changes in Delay and Cancellation Key Indicators, 2000–2012[13]

Indicator	*Trend*	*2000*	*2012*	*Percent Change*
Delays	↓	2,094,078	1,405,863	-33%
Cancellations	↓	205,122	89,974	-56%
Long Taxi Times (1+ hrs)	↓	50,200	26,041	-48%
Extreme Taxi Times (3+ hrs)	↓	1,630	30	-98%
Average Length of a Delayed Flight	↑	51:04	54:37	+7%

Source: OIG Analysis of FAA (i.e., 55 airports) and BTS data.

Likewise, long taxi times[14] in excess of 1 hour have declined 48 percent. Larger reductions in taxi times of more than 3 hours also occurred, especially after the adoption of DOT's tarmac rule in April 2010 that imposed stiff penalties if an air carrier permitted an aircraft to remain on the tarmac for more than 3 hours without providing passengers an opportunity to deplane.[15] For example, in 2000, the number of flights with taxi times of more than 3 hours was 1,630 flights. Once the tarmac rule went into effect in 2010, flights with taxi times over 3 hours dropped dramatically to 30 in 2012—a 98 percent reduction.[16]

In contrast, the average length of flight delays did not improve over the last 12 years. Specifically, for flights delayed 15 minutes or more, the average length of the delays increased from 51 to 54 minutes. Therefore, even though flight delays had declined overall, delays that did occur tended to be slightly longer in 2012 than they were in 2000.[17]

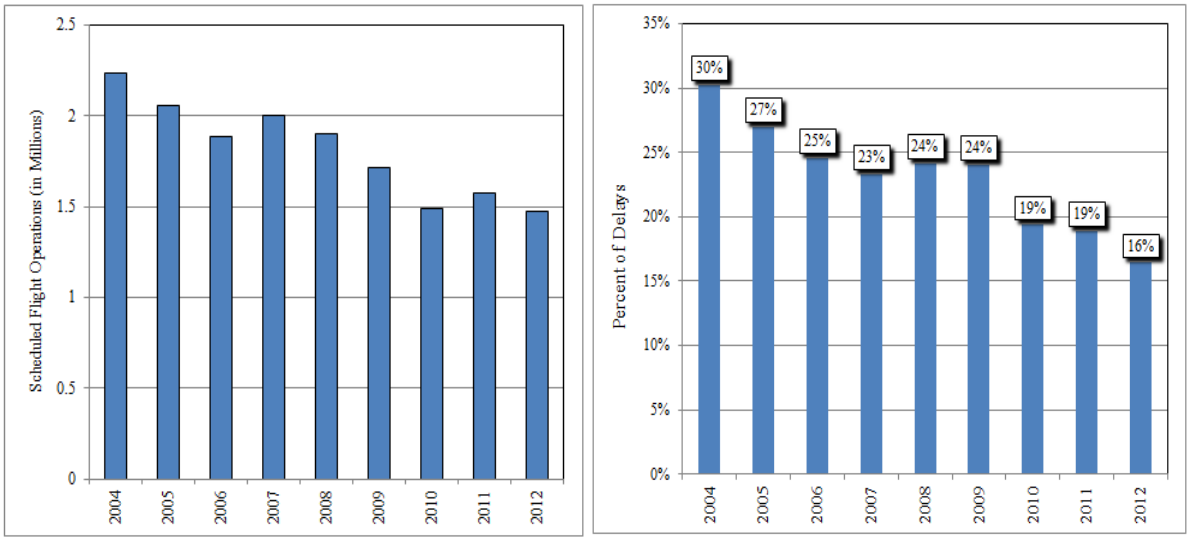
[13] During this same time period, the number of scheduled flights declined by 18 percent.
[14] This calculation involved both aircraft taxi-out and taxi-in times.
[15] This rule, entitled "Enhancing Airline Passenger Protections," became effective on April 29, 2010. An air carrier's failure to comply with this rule subjects the carrier to civil penalties of up to $27,500 per passenger.
[16] In accordance with the tarmac rule, DOT investigates each case in which a tarmac time exceeds 3 hours or more. Of the 30 flights with taxi-out or taxi-in times that exceeded 3 hours, DOT found 21 were in violation or are still pending investigation. As part of a separate audit, we are reviewing DOT's implementation of the tarmac rule and its effects on causing cancellations.
[17] The growth in the average length of a delay reflects a greater drop in the number of flights with shorter delays versus those that arrived excessively late (3 or more hours).

Good Weather, New Infrastructure, Revised ATC Procedures, and Reduced Flight Schedules Have All Helped Reduce Flight Delays

Favorable Conditions Have Reduced the Impact of Weather on Flight Delays

Weather has always been a major factor in causing flight delays and cancellations—as most recently emphasized by Hurricane Sandy in 2012, which shut down many of the major airports in the northeast United States, resulting in more than 20,000 cancelled flights. Notwithstanding this event,[18] relatively favorable weather conditions over the last few years have contributed to the reduced number of delays across most of the country. For example, as illustrated in figures 1 and 2, over 2.2 million scheduled operations (that is, arriving and departing flights) were impacted by poor weather[19] in 2004, compared with approximately 1.5 million scheduled operations in 2012—a decline of 34 percent.[20] Likewise, as shown in figure 2, the percent of flight delays due to poor weather also declined from a high of 30 percent in 2004 to the current low of only 16 percent in 2012.

Figures 1 and 2. Number of Scheduled Flight Operations and Percent of Flight Delays Impacted by Poor Weather, 2004 Through 2012



Source: OIG analysis of FAA (i.e., 55 airports) and BTS data.

Nevertheless, BTS believes weather has a larger impact on delays than currently reported by air carriers, and has recently conducted a study to determine the extent that weather causes delays. As part of this effort, BTS is working with FAA to include

[18] Other notable exceptions include, but are not limited to: Hurricanes Katrina and Rita (2005), Hurricane Ike (2008), and "Snowmageddon"—the first North American blizzard of 2010.

[19] FAA records weather conditions (that is, none, minor, moderate, and severe) for each of the major airports. For our analysis, we included only those flight operations impacted by moderate and severe weather conditions, such as high wind speeds, poor visibility, and thunderstorms.

[20] While our other analyses for this report compare 2000 through 2012, causal data related to weather first became available in June 2003. Therefore, this analysis begins with 2004, the first full year of available data.

the results of their research in an expanded version of publicly available causal delay statistics. BTS reports it has completed its initial study; however, more work is needed before any information can be presented to the public. Moreover, according to BTS, additional funding will be necessary to complete development and deployment of these data, and given current budget limitations, the project is not likely to move forward at this time.

New Airport Infrastructure and ATC Procedures Have Helped Reduce Flight Delays

New infrastructure has helped reduce flight delays at many of the Nation's busiest airports. Since 2000, 20 major airports previously designated by FAA as most critical to improving the capacity and efficiency of the National Airspace System (NAS) have completed substantial runway or taxiway projects that have served to increase capacity or improve traffic flows.[21] For example, Atlanta—which added a fifth runway in 2006 and a new taxiway in 2007—experienced a 37 percent decrease in delays between 2000 and 2012.[22] Similarly, Denver opened a new runway in September 2003 and experienced a 21 percent decrease in delays, even though the number of scheduled flights increased 22 percent between 2000 and 2012. While these numbers illustrate the beneficial impacts of infrastructure improvements on flight delays, several of the Nation's major airports with continuing congestion concerns (i.e., LaGuardia, Newark, San Francisco, and Boston) face significant challenges in adding new airfield infrastructure because of factors such as space constraints and environment concerns.

Air traffic control improvements have also helped reduce delays. For example, at Atlanta Hartsfield airport, a number of procedural changes have been implemented. These improvements, such as increased runway separation procedures, allow for the departure of three aircraft, whereas previously only two could depart simultaneously. Similarly, the Port Authority of New York/New Jersey has implemented a departure metering system that has helped decrease taxi times and reduced air carrier fuel costs.

Reduced Number of Flights Has Also Helped Reduce Delays

One of the most significant factors in the decrease in delays has been a significant reduction in scheduled flights. With fewer flights, there are fewer opportunities for delays to occur, specifically at congested airports. For example, the number of flights at the 55 major airports that FAA tracked in 2000 dropped by 18 percent between 2000 and 2012, representing a decline of more than 3 million flights, while the overall number of delays decreased by 33 percent. As table 2 shows, many of the larger

[21] These 20 airports were included in the Agency's 35 Operational Evolution Partnership (OEP) airports. According to FAA, more than 70 percent of passengers move through the OEP 35 airports. Since 2011, FAA has shifted its focus to tracking capacity and efficiency needs at the Core 30 airports (a subset of the OEP 35).

[22] This project required extensive property acquisition and landfill to construct the runway and cost over $1 billion.

airports have experienced major reductions in both scheduled flights and delays, including Pittsburgh, Cincinnati, St. Louis, Memphis, and Cleveland. (See exhibit D for the changes in scheduled flights and delays at FAA's OEP 35 airports.)

Table 2. Five Airports With Largest Percentage Decreases in Scheduled Flights and Delays, 2000 Through 2012

Airport	*Percent Change in Scheduled Flights*	*Percent Change in Number of Delays*
Pittsburgh	-75%	-71%
Cincinnati	-72%	-78%
St. Louis	-63%	-67%
Memphis	-50%	-43%
Cleveland	-44%	-48%

Source: OIG Analysis of FAA data.

The drop in scheduled flights is due to various factors, the most significant being the long-term impact of the 2008 economic recession on both major air carriers and the flying public, and the consolidation of the domestic airline industry. For example, table 2 shows that all five airports experienced significant declines in scheduled flights due to one or more air carriers significantly reducing operations as a result of air carrier mergers. These developments, coupled with significant changes in airline business operations, have raised questions as to when (and if) the number of scheduled flights and delays will return to previous highs.

FAA's most recent projections predict that aviation will grow by 2.3 percent per year from 2012 to 2040. However, the future of aviation growth remains unclear, despite these projections. The Department's primary means of forecasting future aviation demand is FAA's Terminal Area Forecast (TAF). Published annually, the TAF provides both short- and long-term projections that FAA uses to help meet planning, budgeting, and staffing requirements. The projections also provide inputs to the Future Airport Capacity Task (FACT) assessment,[23] and contribute to the business case for the Next Generation Air Transportation System (NextGen).[24]

The TAF, however, generally does not factor in an airport's capacity limitations, but instead predicts demand in air traffic independent of the airports' and ATC's ability to meet this need. While this information may be useful to support the need for new airport infrastructure, it cannot be relied upon as a realistic forecast of airport traffic growth. For example, in 1997, FAA projected Newark would reach 590,000 flights in

[23] The FACT report is an assessment of the future capacity of the Nation's airports and metropolitan areas. Its goal is to determine which airports and metropolitan areas have the greatest need for additional capacity.
[24] NextGen is FAA's transformational plan to address congested airspace, longer travel times, and increased flight delays. "Next Gen: The Business Case for the Next Generation Air Transportation System," August 2012.

2010. Due to the September 11, 2001, terrorist attacks and the resulting downturn in flights, FAA revised the 2010 projections in 2006 to 497,000. However, Newark only experienced 409,000 actual flights in 2010, significantly below both the 1997 and 2006 TAF forecast.[25] In the end, none of the projections were realized, due to capacity restrictions and unforeseen reductions in air traffic at Newark.

BTS Data Do Not Capture the True Number and Causes of Delays and Cancellations

Nearly One-Fourth of All Domestic Flights Are Unreported

Information regarding air carrier performance is available to the public through data provided by BTS—but not for all flights.[26] Currently, BTS captures data relating to the domestic scheduled flights for only 16 of 76 U.S. air carriers. Under BTS's current reporting requirements, only those carriers whose domestic scheduled passenger revenues account for 1 percent or more of the industry's total are required to report delays. (See exhibit E for a list of reporting air carriers.) While these 16 carriers are among the largest carriers with flights that carry about 80 percent of domestic scheduled passengers, they only account for 76 percent of all such flights.[27] BTS does not collect or publish data (and associated delay statistics) for the remaining 24 percent, which are primarily operated by regional air carriers and/or involve code share operations.[28]

Many regional air carriers—which are not required to report to BTS—operate more flights and have a greater impact on the ATC system and airport congestion than several of the reporting air carriers. Regional carriers often do not meet the reporting threshold since they generally operate smaller aircraft and fly shorter distances with fewer passengers (thereby generating less revenue) than the 16 carriers that are required[29] to report delays. For example, Chautauqua Airlines, a non-reporting regional carrier that partners with several mainline carriers, scheduled nearly 62,000 more flights than Hawaiian Airlines, which reports to BTS. Moreover, FAA's flight data indicate that Chautauqua may have had almost 26,000 delays in 2012—none of which were reported to BTS—as compared to about 4,800 delays for Hawaiian. However, since many regional carriers operate on behalf of mainline air carriers—but do not meet BTS's reporting requirements—their performance is not factored into the overall performance of the mainline carriers in BTS's published statistics.

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[25] According to FAA officials, events such as 9-11 and the economic downturn of 2008 have short term impacts on passenger demand, but over the longer term, these kinds of events have less impact on their forecasts.

[26] BTS data are available on the Web via the monthly "Air Travel Consumer Report" at http://www.dot.gov/airconsumer/air-travel-consumer-reports. Individual data are available at http://www.transtats.bts.gov/.

[27] The primary cause for the difference is that the mainline carriers use larger aircraft than their regional partners.

[28] Code share operations consist of a marketing arrangement in which flights are operated on behalf of the mainline air carrier by a smaller regional air carrier. Under these arrangements, mainline carriers contract for services of a regional carrier to fly passengers to or from their larger hub airports.

[29] Of the 16 reporting carriers, 15 meet the reporting threshold and one carrier reports voluntarily. Moreover, once a carrier volunteers to report, DOT requires it to continue to do so for at least 12 consecutive months.

As a result of these limited data reporting requirements, BTS's published flight delay data present the public with an incomplete picture of the number of delays that actually occur at a given airport or are generated by all carriers. For example, the reporting carriers at Philadelphia International Airport recorded 13,794 delays in 2012 to BTS. However, using FAA flight data,[30] we estimate that Philadelphia had significantly more delays than were reported due to the exclusion of regional carrier data. When regional carrier data are factored in, the number of total delays for Philadelphia grows to 38,111—a 64 percent increase over the number of delays in BTS's database. Table 3 illustrates the extent flight delays are being underreported at Philadelphia as well as at four other airports, according to FAA internal data. (See exhibit F for the number of reported and unreported delays at FAA's OEP 35 airports.)

Table 3. Examples of Reported and Unreported Delays at Selected Airports in 2012

Airport	*Delays*			*Percent of Delays Unreported*
	Reported	**Unreported**	**Total**	
Philadelphia	13,794	24,317	38,111	64%
Detroit	12,992	13,483	26,475	51%
Cincinnati	4,302	3,916	8,218	48%
Charlotte	17,417	14,724	32,141	46%
Washington Reagan	12,287	9,600	21,887	44%

Source: OIG analysis of FAA data.

FAA relies heavily on the flight data BTS collects from air carriers to monitor flight delays, taxi times, and system performance. However, because BTS does not collect data on approximately 24 percent of the domestic scheduled passenger flights, FAA supplements BTS data with estimates for gate arrival and departure times based on FAA's own internal data systems. In doing so, FAA is able to expand flight data from the roughly 76 percent collected by BTS to 91 percent of all domestic scheduled passenger traffic. Nevertheless, this data expansion is based on estimates, not actual data, making it less precise than if the air carriers were reporting the missing flight data. Therefore, if the number of carriers required to report to BTS increased, FAA would be able to reduce the percentage of flights for which it estimates data and improve the accuracy of its analyses using these data.

To improve published data on flight delays, DOT is considering the adoption of a rule to lower the reporting threshold, as well as requiring mainline carriers to report on-time performance for their code share operations. For example, we estimate that if

[30] FAA's data captures all flights departing from or arriving at one of the Agency's designated 77 ASPM airports, as well as 22 ASPM air carriers operating at the non-ASPM airports.

DOT lowered the reporting threshold from the current 1 percent to .5 percent, as well as required the reporting air carriers to include their code share operations, DOT would increase the percent of domestic scheduled passenger flights it captured from 76 percent to 92 percent.[31]

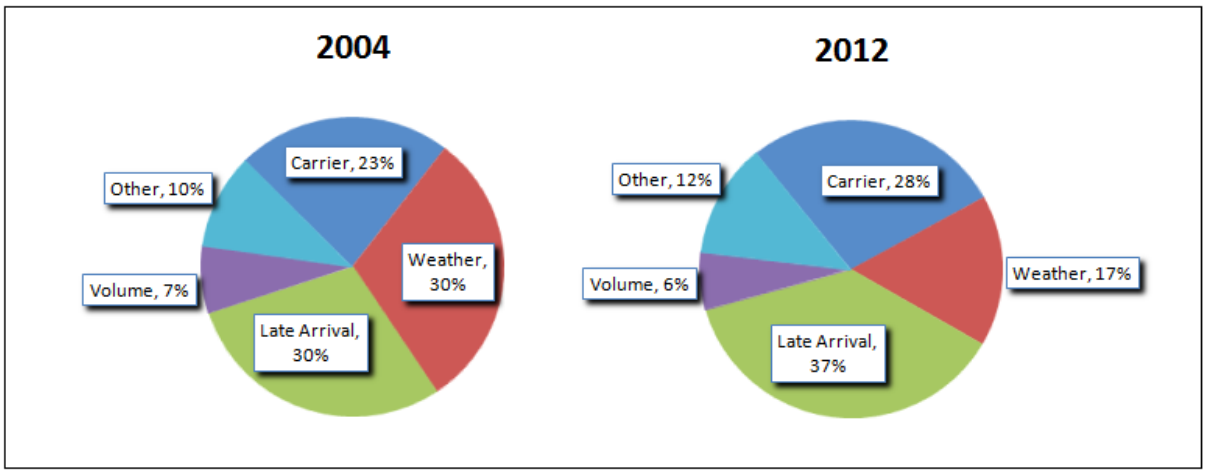
Causal Data Lack Sufficient Detail on Over One-Third of All Reported Flight Delays

BTS's data on flight delays are also limited by a lack of information on the root causes of many delays. While DOT requires air carriers to report the causes for flight delays and cancellations in their data submissions to BTS, one of the causal categories—late arriving aircraft—does not provide sufficient detail on the initial cause of the delays.[32]

Starting in 2003, BTS began requiring air carriers to report the causes of flight delays and cancellations, using broad categories such as air carrier, weather, NAS,[33] and security, as well as late arriving aircraft. Delays are categorized as "late arriving aircraft" when the previous flight operated with the same aircraft arrives late, resulting in the current flight departing late. This creates a ripple effect that propagates to all later flights using that aircraft. However, unlike the other causal categories, late arriving aircraft is a secondary cause of delays—as the initial delay was due to one of the other primary factors, such as poor weather or aircraft problems. Moreover, since the categories were developed in 2003, the number of delays reported by the air carriers as "late arriving" has grown to represent the largest number of all flight delays. As a result, BTS lacks data on the initial causes of more than a third of reported flight delays. As figure 3 illustrates, 37 percent of all delays at the Nation's major airports were attributed to late arriving aircraft in 2012.

[31] According to DOT officials, they are currently in the process of issuing a Notice of Proposed Rulemaking on lowering the threshold and requiring reporting carriers to include their code share operations.
[32] BTS began collecting causal data in June 2003. For a year-to-year comparison, we selected data for 2004 to 2012.
[33] Causes attributed to the broad category of the "NAS" include non-severe weather, volume, runway closures, ATC equipment, and other.

Figure 3. Change in Delay Cause Reporting, 2004 vs. 2012



Source: OIG Analysis of FAA (i.e., 55 airports) and BTS data.

Similarly, in our 2010 report on New York flight delays and their causes,[34] we reported that FAA and other agencies had in part been hampered by the limitations of existing flight data and analytic methods in their attempts to measure the impact of late arriving aircraft on delay propagation. BTS also recognizes the limitations of the existing causal categories. As a result, the Agency has undertaken an effort to distribute delays attributed to late arriving aircraft into the other four primary delay categories: carrier, weather, security, and NAS. While BTS's undertaking is a step in the right direction, it remains to be seen whether this will result in a more accurate portrayal of the root causes of late arriving aircraft delays.

AIR CARRIER SCHEDULING PRACTICES CONTINUE TO AFFECT DELAY RATES

Air carrier scheduling practices have affected the delay rate nationwide and at individual airports. To help reduce reported delays, air carriers expanded their *schedules* (gate-to-gate times) on many of their routes between 2000 and 2012. In 2000, scheduled gate-to-gate times exceeded actual flight times on 73 percent of routes we analyzed. By 2012, this had grown to 98 percent.[35] While we found that some of this increase was needed to address prior scheduling shortfalls, the practice of adjusting scheduled gate-to-gate times alone does not mitigate the congestion air carriers sometimes create through over-scheduling. In particular, we found over-scheduling and congestion remain a problem at eight major airports, particularly during peak periods.

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[34] *New York Flight Delays Have Three Main Causes, but More Work Is Needed To Understand Their Nationwide Effect* (OIG Report No. AV-2011-007), October 28, 2010.

[35] Our analysis included 2,021 routes flown between large or medium hub airports within the contiguous United States. In selecting these routes, we focused only on those that included 15 flights or more per year in 2000, 2007, and 2012. We also excluded outliers from our analysis, such as those flights that had arrived more than 1 hour early or were delayed more than 4 hours beyond their scheduled time as well as those flights to or from Alaska and Hawaii.

Air Carriers Continue To Adjust Flight Schedules To Reduce Delays

Adding extra minutes to schedules allows air carriers to better reflect actual flight times as well as reduce delays by leaving themselves a margin to compensate for unanticipated events. Expanding flight schedules has also contributed to more flights arriving early than in the past.[36] In 2000, we reported that air carriers' average scheduled flight times exceeded their actual flight times in 9 of the prior 11 years. Since 2000, air carriers have continued this practice. In our analysis of 2,021 routes flown in 2000 and 2012, we found that air carriers had increased their scheduled flight times (gate-to-gate times) from 73 percent of these routes to 98 percent. For example, the published schedule for LaGuardia to Indianapolis in 2000 was on average 4 minutes less than the actual average flight time—creating a scheduling shortfall and increased likelihood of delays. By 2012, air carriers had scheduled nearly 17 minutes more than the actual gate-to-gate time (scheduling cushion), an overall change of nearly 21 minutes.[37] Similarly, the number of flights arriving at least 15 minutes early rose from 7 percent in 2000 to 50 percent in 2012. Table 4 lists those routes with the largest changes in scheduled versus actual gate-to-gate times in 2000 and 2012. All five of these routes had started out with significant scheduling shortfalls in 2000, but by 2012 they had acquired fairly sizeable cushions.

Table 4. Routes With Largest Changes in Scheduled Over Actual Gate-to-Gate Times, 2000 vs. 2012

	Scheduled Time Versus Actual Time in Minutes		
Routes Between Large and Medium Hub Airports	**2000 (Shortfall)**	**2012 (Cushion)**	**Change**
LaGuardia, NY to Indianapolis, IN	-3.71	16.81	20.52
Boston, MA to Indianapolis, IN	-5.02	15.09	20.11
Kennedy, NY to Dallas-Ft. Worth, TX	-5.25	13.69	18.94
Kennedy, NY to Minneapolis, MN	-4.52	13.96	18.48
Washington Dulles, VA to Las Vegas, NV	-4.34	13.75	18.09

Source: OIG analysis of FAA data.

Increasing scheduled flight times corresponds with a decrease in delays on these routes. For example, as a result of the increasing gate-to-gate time on the LaGuardia to Indianapolis route, the delay rate dropped from about 58 percent to nearly 15 percent.[38] See table 5 for additional examples of large reductions in the delay rate between 2000 and 2012.

[36] For all domestic passenger flights in the United States, those arriving 15 minutes or more early rose from 9 percent in 2000 to 20 percent in 2012.
[37] Not all flights flown in 2012 experienced these large increases in excess scheduled versus actual flight time. The average excess scheduled versus actual flight time for the routes we analyzed was 4.81 minutes.
[38] Nationally, the delay rate dropped 7 percentage points (i.e., from 28 percent to 21 percent) between 2000 and 2012.

Table 5. Routes With Largest Increases in Scheduled Over Actual Gate-to-Gate Times and Change in Percent of Flights Delayed

	Percent Delayed		
Routes Between Large and Medium Hub Airports	**2000**	**2012**	**Change**
LaGuardia, NY to Indianapolis, IN	58.32%	14.81%	-43.51%
Boston, MA to Indianapolis, IN	59.21%	11.84%	-47.37%
Kennedy, NY to Dallas-Ft. Worth, TX	39.64%	23.65%	-15.99%
Kennedy, NY to Minneapolis, MN	37.55%	16.57%	-20.99%
Washington Dulles, VA to Las Vegas, NV	45.20%	20.67%	-24.53%

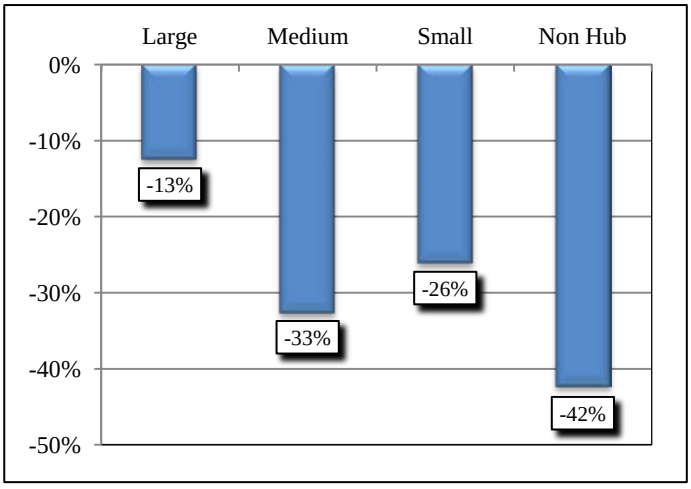
Source: OIG analysis of FAA data.

Increasing scheduled flight times when necessary can improve on-time performance as air carriers provide themselves with more flexibility to handle any issues that might impact a flight's arrival time. However, this practice of adjusting scheduled gate-to-gate times alone does not mitigate the congestion air carriers sometimes create through over-scheduling.

Despite Schedule Reductions Nationwide, Congestion and Significant Delays Continue at the Largest Airports

Since we reported in 2000, there has been a significant reduction in scheduled flights nationwide. However, some airports were affected much more heavily. In particular, while medium, small, and non-hub airports[39] lost between 26 and 42 percent of scheduled flights, large hub airports only experienced a 13 percent reduction (see figure 4). Air carriers continued to heavily schedule flights at large airports, especially during peak periods. As a result, congestion and delays still persist at several of the Nation's largest hub airports.

Figure 4. Percent Change in Flights, by Hub Size, 2000–2012

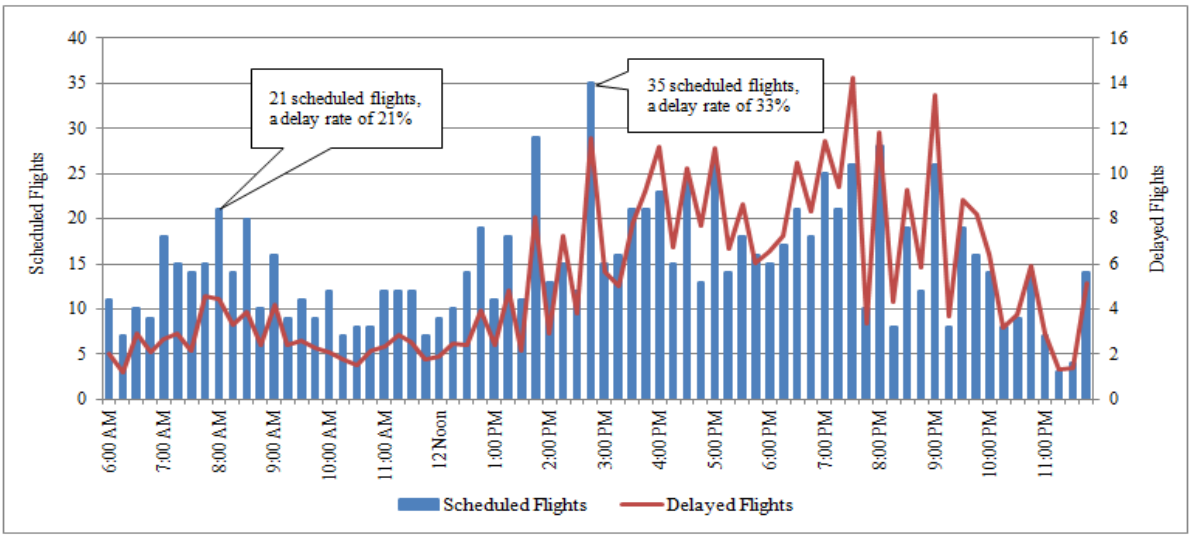


Source: OIG analysis of FAA data.

[39] FAA categorizes airports by the percent of annual passenger enplanements. Medium Hub airports have less than 1 percent but at least .25 percent, Small Hubs have less than .25 percent and at least .05%, Non-Hub airports are those with less than .05% and at least 2,500 annual passengers.

FAA is monitoring 30 major airports and has placed eight of these on a "watch list" due to their likelihood of experiencing increased delays. These include Atlanta, Boston, Chicago, Kennedy, LaGuardia, Newark, Philadelphia, and San Francisco. Figure 5 illustrates the close relationship between increases in scheduled flights and delays at Kennedy.[40] For example, during certain peak periods, the number, rate, and average length of flight delays increases significantly once the number of scheduled flights exceeds 20 flights per quarter hour over an extended period. At 8 a.m., when air carriers scheduled 21 flights, 21 percent of flights were delayed. Later in the day, delays build as scheduling grows. For example, at 2:45 p.m. when 35 flights were scheduled, the delay rate increased to 33 percent.

Figure 5. Kennedy Weekday Average Scheduled Flights and Delays by Quarter Hour, June Through August 2012



Source: OIG analysis of FAA data.

Similarly, at Newark, delays vary throughout the day, but they increase as the number of scheduled flights rise. For example, at 8 a.m. the delay rate is 28 percent. However, shortly after 5 p.m. until after 10 p.m., Newark's delay rate reaches around 50 percent. The third New York airport, LaGuardia, also suffers from congestion and delays. However, delays are consistently high, regardless of time. Overall, air carrier scheduling practices significantly increased the likelihood of delays at all three New York airports, even though FAA has instituted slot controls to limit the number of hourly flights.[41] (Exhibit G contains additional figures and descriptions of activity at each of the watch list airports.)

[40] This analysis included all flights scheduled to arrive at or depart from Kennedy, as well as associated delays.

[41] Although these slot controls are scheduled to expire on October 24, 2014, according to officials in FAA's Office of General counsel, FAA is in the process of issuing a notice of proposed rulemaking to seek comments on how or whether the slot controls will be continued at the New York airports.

FAA'S BENCHMARKS ARE USED TO ASSESS AIRPORT CAPACITY, BUT NOT TO MONITOR AIR CARRIER SCHEDULING PRACTICES

Although FAA's capacity benchmarks have proven useful for measuring airport capacity, they have not been updated since 2004. While FAA plans to publish new benchmarks later this year, the Agency lacks a formal policy for how regularly the benchmarks should be updated or published. Moreover, FAA has never used them for assessing air carrier scheduling practices. Instead, each month, FAA's Air Traffic Organization (ATO) assesses schedules using a different airport capacity measure—known as "called rates"—which represent the maximum number of arriving and departing flights an airport can safely handle. However, FAA does not make these assessments available outside the Agency, even though they provide valuable information that could encourage collaboration among stakeholders—including Congress, airlines, airports, and the general public—to reduce over-scheduling and delays.

Benchmarks Have Proven Useful for Measuring Airport Capacity

In 2000, we recommended that FAA develop a set of capacity benchmarks for the Nation's 30 largest airports.[42] Our intent was for FAA to use these benchmarks to identify capacity benefits from operational and infrastructure improvements and measure excess volume (over-scheduling). In response, FAA established benchmarks in 2001 for 31 airports and defined the benchmarks as the maximum number of flights an individual airport runway can routinely handle in an hour under two weather scenarios. In 2004, FAA updated these benchmarks and used them as key inputs to the Agency's first FACT study. FAA's FACT studies involve an in-depth evaluation of capacity, and identify those airports in greatest need of improvements to mitigate future delay and congestion at a system wide level. The 2004 update also expanded the benchmarks to consider capacity in 3 varying weather conditions and increased the airports covered from 31 to 35.

However, since 2004, FAA has not issued updated benchmarks. According to FAA, updates are necessary due to changes in aviation trends and new runways that have been added at some major airports. Publishing updated information, therefore, is important not only for internal FAA purposes, but also to provide key aviation stakeholders, such as air carriers, airports, and passengers, with the current capacity limits of the Nation's major airports. In 2007, FAA issued a FACT 2 report that used updated benchmarks and increased the number of airports covered to 56. While these benchmarks were used as source data for FACT 2, they were never made public. To the Agency's credit, FAA officials told us that they are in the process of completing a new benchmark report and expect to publish it later this year. For the longer term, FAA also plans on updating the benchmarks every 3 years.

[42] *Flight Delays and Cancellations* (OIG Report No. CR-2000-122), September 25, 2000.

Instead of Benchmarks, FAA Uses "Called Rates" To Monitor Over-Scheduling at the Nation's Largest Airports

Beyond measuring capacity, we also recommended in 2000 that FAA use benchmarks to monitor air carrier schedules for excess volume (over-scheduling). However, FAA considered the benchmarks to be too limited for assessing over-scheduling. In particular, the benchmarks provide only a static measure of hourly arrival and departure rates, which only considers the optimum runway configuration.[43] The benchmarks also do not account for real-time conditions that can change daily or even hourly, such as visibility, wind direction, and runway availability.

To avoid these limitations, FAA's ATO elected in 2008 to start using dynamic measures of real-time conditions known as "called rates," which represent the maximum number of arriving and departing flights an airport can safely handle, to make comparisons with airline schedules.[44] Under this approach, ATO has produced an internal monthly report[45] showing those airports at greatest risk of over-scheduling and delays—with the most recent report identifying eight "watch list" airports: Atlanta, Boston, Newark, Kennedy, LaGuardia, O'Hare, Philadelphia, and San Francisco. According to FAA officials, if the ATO's results show an air carrier is over-scheduling, the Agency will negotiate schedule changes with the air carriers.[46] For example, in 2010, FAA successfully negotiated revised schedules with air carriers at San Francisco to reduce congestion and avoid significant growth in delays.

While the ATO's monthly report satisfies the intent of our 2000 benchmark recommendation to monitor excess volume, FAA currently does not make this report available to Congress, air carriers, airports, or the general public. Incorporating the results of this analysis into the benchmark report would benefit aviation stakeholders by providing a valuable tool for helping reduce over-scheduling and prevent delays.

CONCLUSION

Flight delays impact millions of passengers each year, prompting attention from Congress, DOT, and other stakeholders interested in increasing the efficiency of the NAS. In recent years, significant changes to the airline industry have had a positive impact on reducing flight delays, and both FAA and BTS have significantly improved their collection of data on delays and their causes since 2000. However, the usefulness of these data will remain limited until DOT increases the number of reporting carriers

[43] Based on computer modeling, the optimum configuration represents the maximum number of arriving or departing flights a runway can handle during good, moderate, or poor weather conditions.
[44] The main impetus for FAA's decision to monitor airport congestion grew out of the significant increase in flights and delays at Kennedy in 2007. In this instance, the Agency was caught off-guard by the rapid increase in scheduled flights and resulting delays which propagated across the country,
[45] *Scheduled Operations and Delays at the Core 30 Airports.*
[46] In the FAA Modernization and Reform Act of 2012 (Pub. L. No. 112-95), Congress authorized the FAA Administrator to take action as necessary to ensure that reductions are implemented if air carriers are found to be exceeding hourly maximum departure and arrival rates.

and collects more robust data on the initial causes of delays. In addition, FAA will need to continue to monitor air carriers' scheduling practices at the Nation's largest airports, especially those most congested airports on its watch list. Only then will FAA be able to determine the best ways to meet traffic demand and provide transparent congestion and delay information to stakeholders.

RECOMMENDATIONS

To improve the completeness and the reliability of aviation industry data collected by BTS, a component of RITA, and FAA, we recommend that OST:

1. Expand the required reporting of on-time performance data to include flights by the code share partners of the reporting carriers.

2. Increase the number of carriers required to report on-time performance data by reducing the reporting threshold below 1 percent of all domestic passenger revenues.

We recommend that RITA:

3. Complete ongoing efforts to identify the underlying causes of delays attributed to late arriving aircraft and make them available on BTS's public Web site.

We recommend that FAA:

4. Establish and implement a policy to periodically update and publish the capacity benchmarks.

5. Establish and implement a policy to ensure the consistent preparation, publication, and appropriate distribution of the ATO's Core 30 Monthly Delay Report.

AGENCY COMMENTS AND OFFICE OF INSPECTOR GENERAL RESPONSE

We provided OST, RITA, and FAA with our draft report on September 6, 2013, and received their formal combined response on December 2, 2013. The response is included in its entirety as an appendix to this report.

In its response, OST partially concurred with recommendations 1 and 2, stating that the implementation of both these recommendations requires a rulemaking that OST is currently initiating. We support OST's efforts and therefore consider these recommendations resolved but open pending the completion of the rulemaking.

For recommendation 3, RITA concurred with our recommendation and stated that it will work with OST and FAA in determining the priority and resources needed to

identify the underlying causes of flight delays due to late arriving aircraft. We therefore consider this recommendation resolved but open pending development of a system for identifying the initial causes of late arriving aircraft.

Finally, FAA concurred with recommendations 4 and 5, and its proposed actions are responsive. Therefore, we consider these recommendations resolved but open pending completion of planned actions.

ACTIONS REQUIRED

OST, RITA, and FAA's planned actions for recommendations 1 through 5 are responsive, and we consider them resolved but open pending completion of the planned actions.

We appreciate the courtesies and cooperation of OST, RITA, and FAA representatives during this audit. If you have any questions concerning this report, please call me at (202) 366-0500 or Darren Murphy, Program Director, at (206) 220-6503.

#

cc: DOT Audit Liaison (M-1)
FAA Audit Liaison (AAE-100)
RITA Audit Liaison (RTC-1)

EXHIBIT A. SCOPE AND METHODOLOGY

We conducted this performance audit between April 2012 and September 2013 in accordance with generally accepted Government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

To analyze flight delay and cancellation trends, we relied on FAA's Aviation System Performance Metrics (ASPM)[47] database as well as the Bureau of Transportation Statistics (BTS)[48] on-time performance data for the years 2000 through 2012. In many instances, we compared the results of our analysis from each of these different databases to identify any limitations or inconsistencies. We also met with officials from FAA's Air Traffic Performance Analysis and Strategy Office, Air Traffic Control System Command Center, and the Office of Aviation Policy and Plans. In addition, we met with officials from DOT's Office of Aviation Enforcement and Proceedings and BTS's Office of Airline Information.

To determine air carrier scheduling practices and their impact on flight delays and cancellations, we relied on FAA's Flight Schedule Data System (FSDS)[49] database to identify the trends in scheduled flights both nationally and by individual airport as well as by size of airport. We used FAA's ASPM database to determine the change in scheduled and actual gate-to-gate times for all U.S. domestic routes flown between the years 2000 and 2012. Where possible, we compared our results using FSDS, ASPM, and BTS on-time performance databases to determine the reliability and accuracy of our findings and conclusions. We also met with or contacted officials from Airlines for America, Regional Airline Association, JetBlue Airways, Alaska Airlines, and Delta Air Lines. Finally, we examined FAA's Terminal Area Forecast (TAF)[50] reports to determine the reliability and reasonableness of FAA's forecasting related to air carrier scheduling growth. To gain a better understanding of the methodology used to create the TAF, we met with officials from FAA's Forecast and Performance Analysis Division who are specifically responsible for developing and reporting TAF data.

[47] ASPM is an FAA database of air traffic control performance measures that includes flight delays, cancellations, actual flight operations, taxi times, weather impact, and delay rates at 77 of the busiest U.S. airports.
[48] BTS on-time performance data includes information on, flight delays, cancellations, delay rates, taxi-in and -out delays, scheduled flights, and causes of delays. They are based on data filed each month by the 16 reporting air carriers with BTS' Office of Airline Information as described in 14 CFR Part 234 of DOT's regulations.
[49] FSDS is an FAA database of published air carrier flight schedules and includes all U.S. domestic and international air traffic. From January 2000 through November 2008, FAA obtained flight schedule data from the Official Airline Guide. Starting in December 2008, FAA uses published data from Innovata.
[50] TAF includes historical and forecasted flight operations by airport. The TAF is used by FAA and airport sponsors as a basis for planning airport improvements.

To assess FAA's use of capacity benchmarks, we obtained and analyzed FAA's Capacity Benchmark Reports for the years 2001, 2004, and the 2012 draft version. For each of these reports, we compared the methodology and results to identify any differences that may have impacted the benchmarks' usefulness. We obtained and reviewed FAA airport planning documents, such as FACT reports, as well as ATO's analysis of air carrier scheduling at select airports (Scheduled Operations and Delays at the Core 30 Airports Report) to determine if the benchmarks were used as a source for these reports. We also met with officials from FAA's Office of Airport Planning and Programming, Air Traffic Performance Analysis and Strategy Office as well as officials from MITRE Corporation to obtain their insight on how the benchmarks are used.

We did not systematically audit or validate the data contained in any of the databases nor did we perform sufficient tests to draw conclusions or form an opinion on the completeness or accuracy of the data sources. However, for this audit as well as in previous audits that included these databases, we conducted trend analyses and random data checks to assess reasonableness and comprehensiveness of our results. When we identified anomalies or apparent limitations in the data, we conducted additional analysis to better understand the data and, if necessary, exclude some of the data or disclose the existing limitations. Finally, we held discussions with managers responsible for maintaining the databases to understand and attempt to resolve any noted inconsistencies. As a result of these efforts, we determined that the data were sufficiently reliable for our purposes.

EXHIBIT B. OIG REPORTS AND TESTIMONIES ADDRESSING FLIGHT DELAYS AND CANCELLATIONS

- *Air Carrier Flight Delays and Cancellations* (OIG Report No. CR-2000-112), July 25, 2000.
- *Flight Delays and Cancellations* (OIG Report No. CR-2000-122), September 25, 2000.
- *Flight Delays and Cancellations* (OIG Report No. CR-2001-050), April 3, 2001.
- *Actions To Improve the Performance of the National Aviation System* (OIG Testimony No. CC-2001-171), May 3, 2001.
- *Actions To Enhance Capacity and Reduce Delays and Cancellations* (OIG Report No. CR-2001-075), August 17, 2001.
- *Short- and Long-Term Efforts To Mitigate Flight Delays and Congestion* (OIG Report No. CR-2004-066), June 17, 2004.
- *Outlook for Aviation Delays in the Summer of 2005 and Actions Needed To Mitigate Congestion in the Short- and Long-Term* (OIG Testimony No. CC-2005-043), May 26, 2005.
- *Report on the Audit of Small Community Aviation Delays and Cancellations* (OIG Report No. CR-2006-049), May 19, 2006.
- *Status Report on Actions Underway To Address Flight Delays and Improve Airline Customer Service* (OIG Testimony No. CC-2008-058), April 9, 2008.
- *Progress and Remaining Challenges in Reducing Flight Delays and Improving Airline Customer Service* (OIG Testimony No. CC-2009-067), May 20, 2009.
- *New York Flight Delays Have Three Main Causes, But More Work Is Needed To Understand Their Nationwide Effect* (OIG Report No. AV-2011-007), October 28, 2010.

Note: OIG reports are testimonies are available on our Web site at http://www.oig.dot.gov/.

EXHIBIT C. KEY OIG 2000 REPORT RECOMMENDATIONS AND RESULTING CORRECTIVE ACTIONS

Report Recommendations	Resulting Corrective Actions
Recommendation 1: FAA, in coordination with BTS, DOT's Office of Aviation Enforcement & Proceedings (C-70), and air carriers, continue development of a common system for tracking delays, cancellations, and causes, such as improving Aviation System Performance Metrics (ASPM).	✓ Since our 2000 report, FAA has significantly enhanced ASPM to include all air carrier reported delays and cancellations, and associated causal data at 77 domestic airports.
Recommendation 2: FAA ensure future performance plans include one or more measures for assessing ATC performance that are based on ASPM (not OPSNET)[51] data.	✓ FAA relies on ASPM to measure all aspects of ATC system performance. For example, in its FY 2012 Business Plan, FAA's ATO states that it will continue to use, improve, and enhance ASPM as a means to monitor system performance.
Recommendation 3: BTS, in coordination with FAA and C-70, provide consumers the following information on a monthly basis: (a) major causes of delays and cancellations by airport, (b) routes with high cancellation rates by air carrier, and (c) an improved measure for tracking ground times once the aircraft has departed the gate.	✓ BTS has expanded the data it collects from the major air carriers. These data are then published in the monthly Air Travel Consumer Report or made available on its public Web site. Examples include the causes of delays and cancellations, flights (including the route) that are chronically delayed or cancelled, and taxi times spent on the tarmac.
Recommendation 4: BTS, in coordination with FAA and C-70, report on a quarterly basis the Consumer Flight Delay Indicator (CFDI) or a comparable measure to more accurately portray system-wide increases or decreases in travel time.	✓ Neither BTS nor FAA publicly report any specific measure that identifies system-wide increases or decreases in travel time. However, both BTS and FAA databases collect sufficient information that a user could identify such increases or decreases.
Recommendation 5: Develop Capacity Benchmarks for the 30 largest airports.	✓ In 2001, FAA completed development of capacity benchmarks for 31 of the Nation's largest airports. In 2004, the Agency updated and expanded the benchmarks to consider capacity in varying weather conditions, and increased the airports covered from 31 to 35.

[51] FAA's Operations Network (OPSNET) is the official source of NAS air traffic operations and delay data.

EXHIBIT D. CHANGE IN SCHEDULED FLIGHTS AND DELAYS AT 35 OEP AIRPORTS, 2000-2012

Airport	Change in Scheduled Flights	Change in Number of Delays
Atlanta	3%	-37%
Baltimore	-11%	-28%
Boston	-32%	-53%
Charlotte	31%	7%
Chicago Midway	-6%	-31%
Chicago O'Hare	-6%	-40%
Cincinnati	-72%	-78%
Cleveland	-44%	-48%
Dallas	-23%	-32%
Denver	22%	-21%
Detroit	-13%	-31%
Ft. Lauderdale	7%	0%
Honolulu	-27%	252%[52]
Houston	6%	23%
Kennedy	7%	15%
LaGuardia	-6%	-47%
Las Vegas	4%	-28%
Los Angeles	-25%	-39%
Memphis	-50%	-43%
Miami	-19%	-9%
Minneapolis	-16%	-37%
Newark	-9%	1%
Orlando	-13%	-30%
Philadelphia	-2%	-21%
Phoenix	-17%	-52%
Pittsburgh	-75%	-71%
Portland	-29%	-48%
Salt Lake City	-6%	-40%
San Diego	-13%	-31%
San Francisco	-1%	-5%
Seattle	-30%	-58%
St. Louis	-63%	-67%
Tampa	-29%	-44%
Washington Dulles	-34%	-32%
Washington Reagan	7%	-10%

Source: OIG analysis of FAA data.

[52] Data on Honolulu is skewed because in 2000, only 12 percent of scheduled flights were captured by FAA data.

Exhibit D. Change in Scheduled Flights and Delays at 35 OEP Airports

EXHIBIT E. LIST OF BTS REPORTING AIR CARRIERS (JANUARY 2013)

Air Carriers Required to Report:

1. AirTran Airways
2. Alaska Airlines
3. American Airlines
4. American Eagle Airlines
5. ExpressJet Airlines
6. Delta Air Lines
7. Frontier Airlines
8. Hawaiian Airlines
9. JetBlue Airways
10. Pinnacle Airlines
11. SkyWest Airlines
12. Southwest Airlines
13. United Airlines
14. US Airways
15. Virgin America

Air Carriers Voluntarily Reporting:

16. Mesa Airlines

EXHIBIT F. REPORTED AND UNREPORTED DELAYS AT 35 OEP AIRPORTS IN 2012

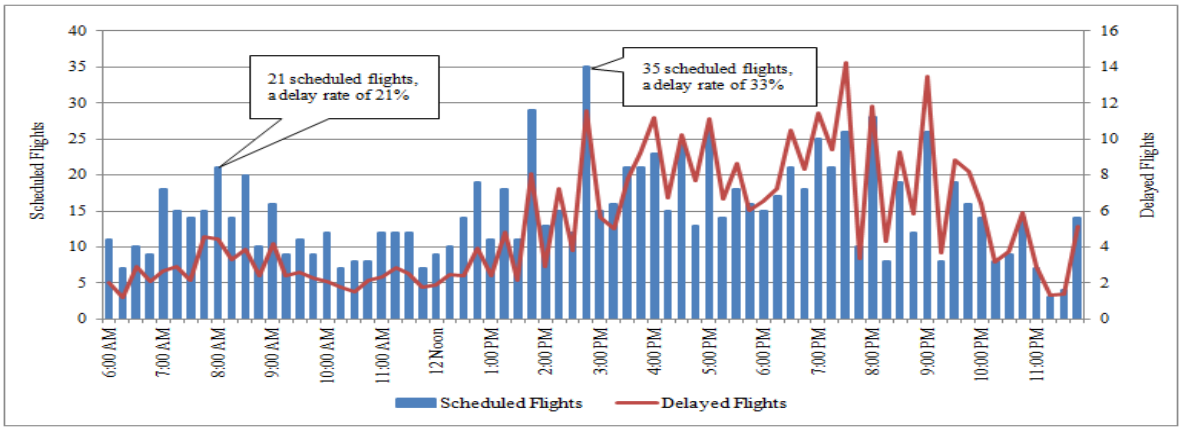
Airport	Delays			Percent of Delays Unreported
	Reported	*Unreported*	*Total*	
Atlanta	56,995	4,007	61,002	7%
Boston	18,192	4,134	22,326	19%
Baltimore	17,557	1,839	19,396	9%
Cleveland	8,599	5,582	14,181	39%
Charlotte	17,417	14,724	32,141	46%
Cincinnati	4,302	3,916	8,218	48%
Washington Reagan	12,287	9,600	21,887	44%
Denver	37,282	6,875	44,157	16%
Dallas	43,013	2,751	45,764	6%
Detroit	12,992	13,483	26,475	51%
Newark	32,898	7,911	40,809	19%
Ft. Lauderdale	12,381	3,862	16,243	24%
Honolulu	6,471	476	6,947	7%
Washington Dulles	14,117	5,506	19,623	28%
Houston	33,269	3,685	36,954	10%
Kennedy	17,303	4,192	21,495	20%
Las Vegas	21,278	4,260	25,538	17%
Los Angeles	39,567	1,924	41,491	5%
LaGuardia	19,610	14,046	33,656	42%
Orlando	20,191	1,282	21,473	6%
Chicago Midway	12,630	443	13,073	3%
Memphis	4,493	2,556	7,049	36%
Miami	14,167	430	14,597	3%
Minneapolis	13,255	8,630	21,885	39%
Chicago O'Hare	56,439	12,085	68,524	18%
Portland	7,930	1,627	9,557	17%
Philadelphia	13,794	24,317	38,111	64%
Phoenix	23,382	517	23,899	2%
Pittsburgh	5,466	3,953	9,419	42%
San Diego	12,833	277	13,110	2%
Seattle	14,389	2,012	16,401	12%
San Francisco	47,199	220	47,419	0%
Salt Lake City	11,875	883	12,758	7%
St. Louis	9,218	3,938	13,156	30%
Tampa	11,171	1,676	12,847	13%

Source: OIG analysis of FAA and BTS data.

Exhibit F. Reported and Unreported Delays at 35 OEP Airports in 2012

EXHIBIT G. FAA'S EIGHT WATCH LIST AIRPORTS, AVERAGE SCHEDULED FLIGHTS AND DELAYS BY QUARTER HOUR, JUNE THROUGH AUGUST 2012[53]

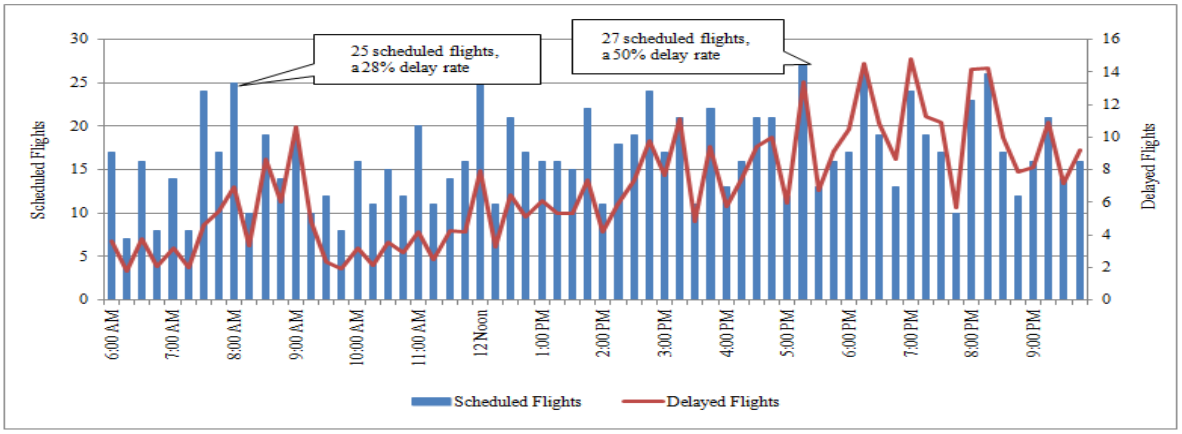
Figure G-1. Kennedy



Source: OIG analysis of FAA data.

As figure G-1 shows, at 8 a.m., when air carriers scheduled 21 flights, 21 percent of flights were delayed. Later in the day, delays increased as scheduling grew. For example, at 2:45 p.m. when 35 flights were scheduled, the delay rate increases to 33 percent.

Figure G-2. Newark



Source: OIG analysis of FAA data.

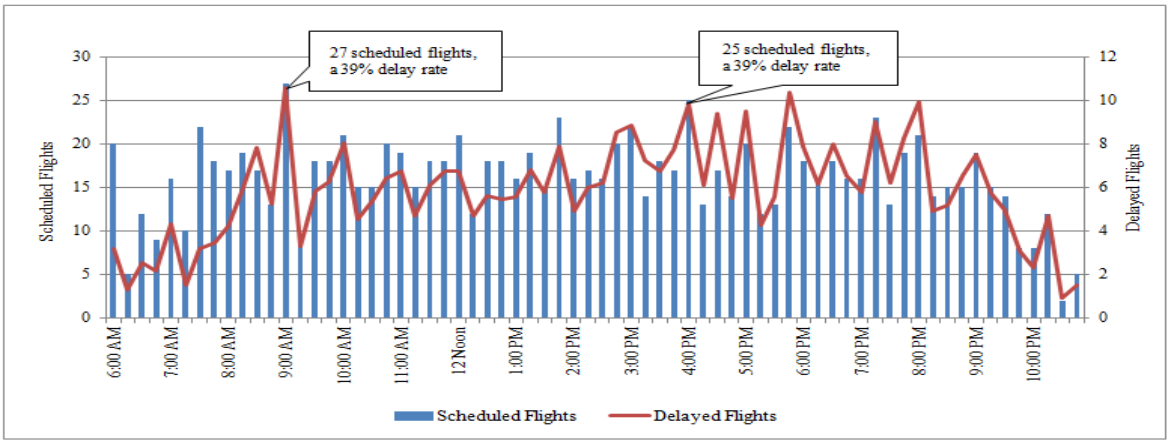
As figure G-2 shows, at 8 a.m. at Newark airport, when air carriers scheduled 25 flights, 28 percent of flights were delayed. Later in the day, delays increased as

[53] We relied on FAA data—even though some of the Agency's delay statistics are based on estimates—to present a more complete picture of congestion at the eight watch-list airports. Analysis included both arrivals and departures.

Exhibit G. FAA's Eight Watch List Airports, Average Scheduled Flights and Delays by Quarter Hour, June Through August 2012

scheduling grew. For example, at 5:15 p.m. when 27 flights were scheduled, the delay rate reaches 50 percent.

Figure G-3. LaGuardia

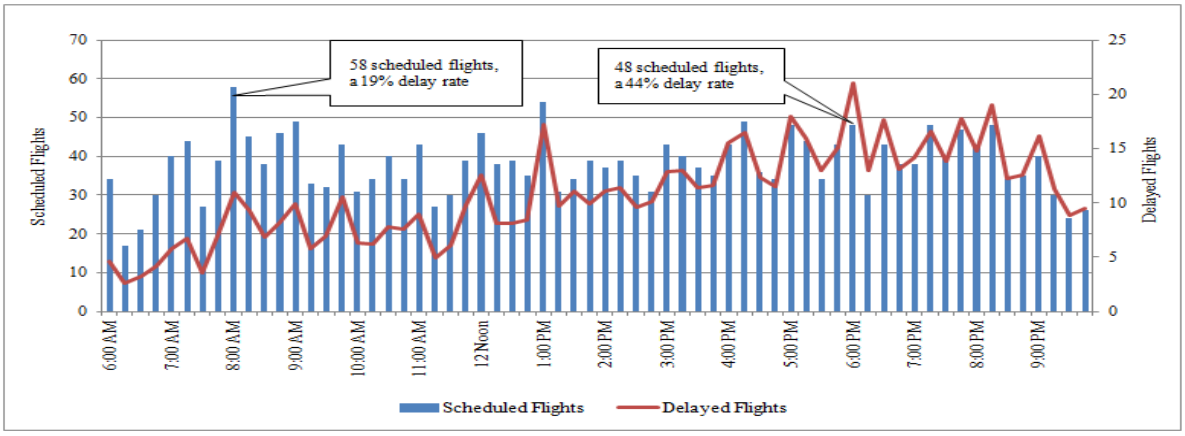


Source: OIG analysis of FAA data.

Figure G-3 shows that LaGuardia sees chronic delays throughout the day. At 9 a.m., when air carriers scheduled 27 flights, 39 percent of flights were delayed. At 4 p.m. when slightly fewer flights were scheduled (25), the delay rate remains at 39 percent.

Kennedy, Newark, and LaGuardia are all slot controlled airports that limit the maximum number of hourly arrivals and departures that air carriers can schedule.[54] While slot controls help lessen the magnitude of flight delays, these three airports continue to experience some of the highest delay rates in the Nation. Moreover, FAA officials note that congestion and delays could become worse at these airports if these controls are allowed to expire on October 24, 2014.

Figure G-4. O'Hare



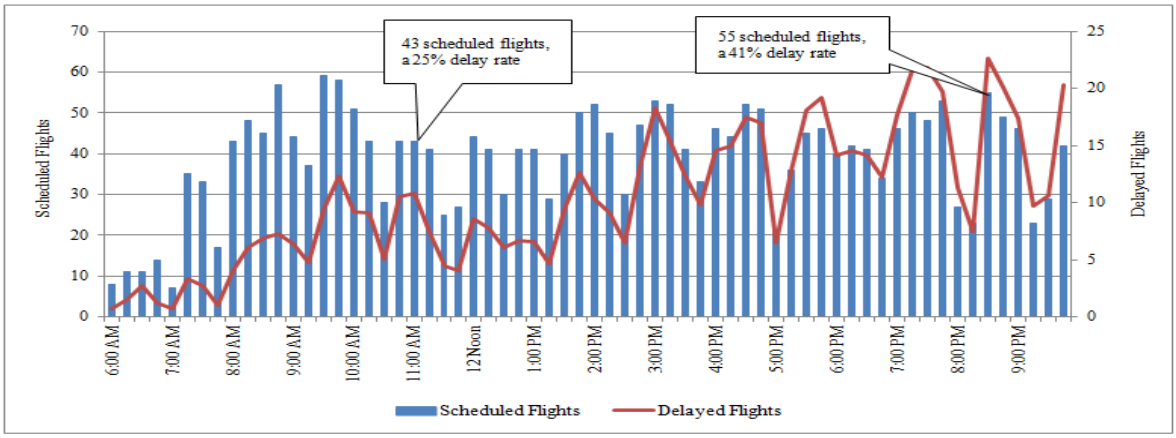
Source: OIG analysis of FAA data.

[54] In addition to maximum numbers of flights per hour, carriers are required to use their slots 80 percent of the time or risk losing them.

Exhibit G. FAA's Eight Watch List Airports, Average Scheduled Flights and Delays by Quarter Hour, June Through August 2012

As shown in figure G-4, O'Hare is another congested airport experiencing frequent delays, which begin early in the morning and continue throughout the day. For example, at 8 a.m., when air carriers scheduled 58 flights, 19 percent of flights were delayed. In the afternoon and into the evening, delays increased. At 6 p.m., when air carriers scheduled 48 flights, the delay rate peaked at 44 percent. Such congestion continues at O'Hare although the airport has benefited from a major capital improvement program in the past decade, which added additional runways and taxiways.

Figure G-5. Atlanta

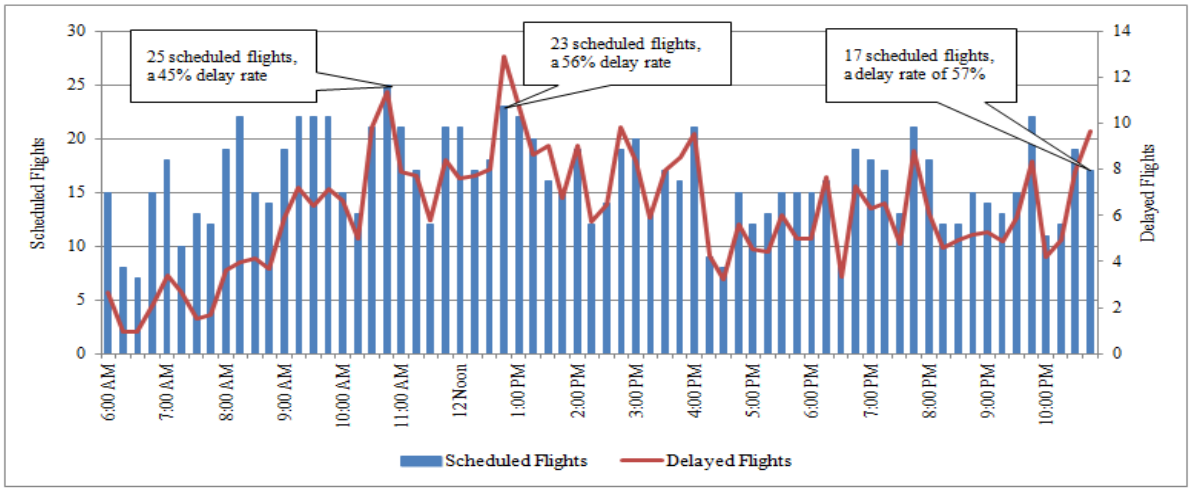


Source: OIG analysis of FAA data.

Atlanta is the world's busiest airport with nearly one million flights per year, and despite recent capital improvements including a fifth runway, an end-around taxiway, and a new terminal, congestion remains a problem. As shown in figure G-5, by 11 a.m., Atlanta had already experienced congestion, when air carriers scheduled 43 flights and 25 percent of flights were delayed. The delay rate continued to climb throughout the afternoon and into the evening. By 8:30 p.m., when air carriers scheduled 55 flights, the delay rate peaked at 41 percent.

Exhibit G. FAA's Eight Watch List Airports, Average Scheduled Flights and Delays by Quarter Hour, June Through August 2012

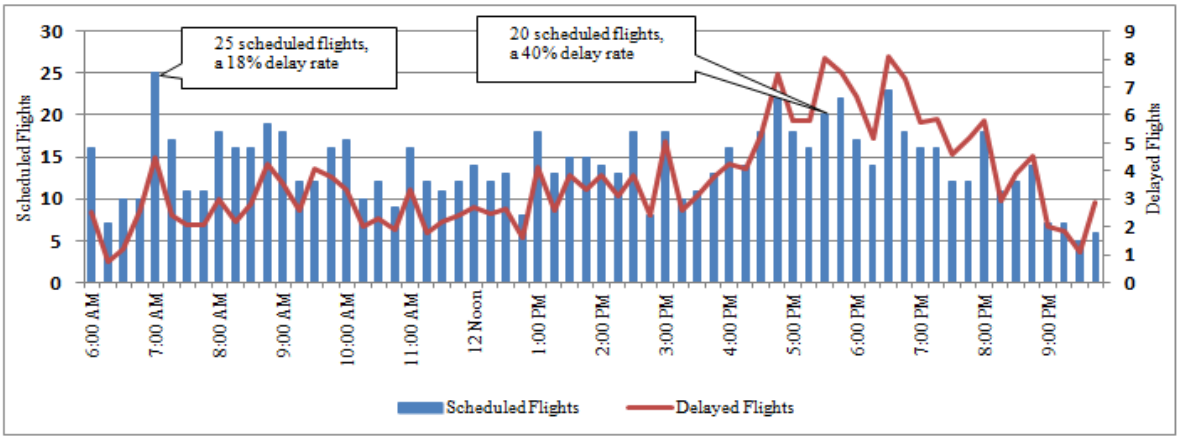
Figure G-6. San Francisco



Source: OIG analysis of FAA data.

At San Francisco, the number of delays reached very high rates several times throughout the day as shown in figure G-6. For example, at 10:45 a.m., when air carriers scheduled 25 flights, 45 percent of flights were delayed. By 12:45 p.m., the delay rate rose to 56 percent. As congestion continued to build throughout the day and into the evening, even as the number of scheduled flights dropped to 17 at 10:45 p.m., the delay rate remained extraordinarily high at 57 percent. Congestion remains a problem at San Francisco for several reasons. These include inclement weather and physical limitations on adding capacity, such as the San Francisco Bay and a major highway that borders the airport.

Figure G-7. Boston

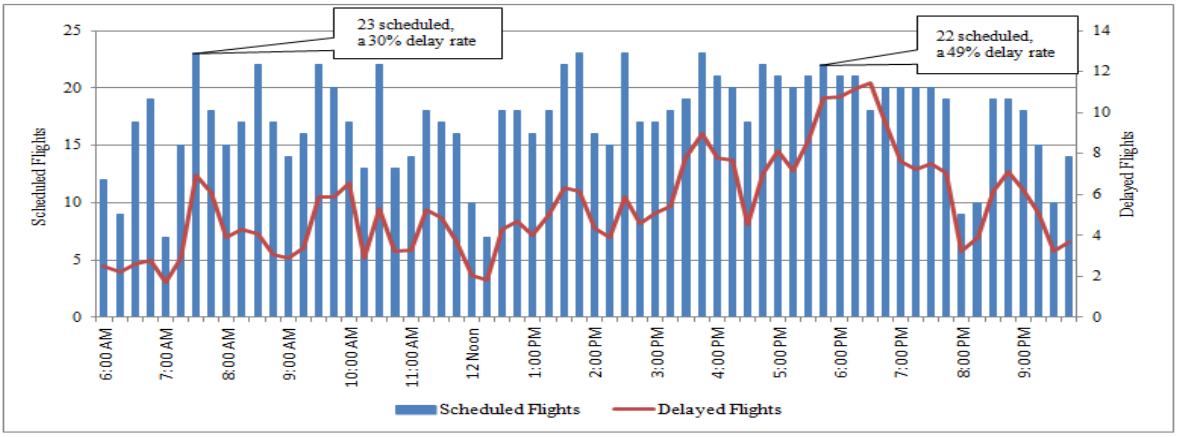


Source: OIG analysis of FAA data.

As shown in figure G-7, at Boston, when the peak number of scheduled flights approaches 20 or more per quarter hour, the delay rate also increases. Between the hours of 7 to 10 a.m., there was only one peak above 20 flights per quarter hour with an average delay rate of 18 percent. Having only one peak gave the airport added time

to recover when flight volume dropped. In comparison, with more peak periods during the evening hours, the delay rate climbed to 40 percent. Like San Francisco, the harbor and surrounding urban development limit Boston's ability to expand.

Figure G-8. Philadelphia



Source: OIG analysis of FAA data.

As figure G-8 shows, like several other of the watch list airports, Philadelphia experienced a delay rate that rose to a fairly high level relatively quickly and continued to rise throughout the day. For example, by 7:30 a.m., when air carriers scheduled 23 flights, the delay rate was already 30 percent. At 5:45 p.m., although air carriers scheduled a similar number of flights (22), the delay rate rose to 49 percent. This shows the impact of how congestion can grow although the number of scheduled flights remains relatively constant. To help address congestion, Philadelphia is planning to add another runway.

EXHIBIT H. MAJOR CONTRIBUTORS TO THIS REPORT

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APPENDIX. AGENCY COMMENTS

U.S. Department of Transportation

Office of the Secretary of Transportation

Assistant Secretary for Administration

1200 New Jersey Ave., SE
Washington, DC 20590

December 2, 2013

MEMORANDUM TO: Jeffrey B. Guzzetti,
Assistant Inspector General
for Aviation and Special Program Audits

FROM: Brodi Fontenot
Assistant Secretary for Administration

SUBJECT: Department of Transportation's (DOT) Response to Office of Inspector General (OIG) Draft Report: More Comprehensive Data are needed To Better Understand the Nation's Flight Delays and Their Causes

Chronic flight delays in the National Airspace System (NAS) today are less common than they were a decade ago. The Federal Aviation Administration (FAA) has successfully addressed the most significant contributors to chronic delays in years past through sustained improvements to runway infrastructure, as well as improved air traffic control (ATC) procedures. The overall reduction in flight schedules during the last few years has also been a major factor in the overall reduction of flight delays.

The Research and Innovative Technology Administration (RITA), through the Bureau of Transportation Statistics (BTS), supports this effort to better understand the causes of U.S. commercial flight delays and to make the associated data as readily available as possible. BTS believes the effort will contribute to the overall safety and efficiency in the NAS, and will benefit the flying public by providing easier access to widely requested information.

Going forward, the FAA will continue to focus on improving capacity where necessary, including further runway development, as well as efficiency and reliability improvements accompanying NextGen implementation. Improved causality data and ongoing schedule monitoring are useful for identifying systemic delays, but there will likely be diminishing opportunities for further reducing chronic delays until significant NextGen capacity enhancements begin to come online. It is also important to note that some delays will always be necessary for the NAS to operate safely and

efficiently. Nonetheless, the agency will continue to focus upon improving delay causality data and the development of corrective actions whenever such opportunities are identified.

RECOMMENDATIONS AND RESPONSES

Recommendation 1: To improve the completeness and the reliability of aviation industry data collected by BTS and FAA, we recommend that DOT expand the required reporting of on-time performance data to include flights by the code share partners of the reporting carriers.

DOT Response: Concur-in-part. Implementation of this recommendation requires a rulemaking. Part 234 of the Department's rules requires carriers to file, among other data, on-time performance information, which is publicized on the Department's website, in its monthly Air Travel Consumer Report, and by airlines. The Department intends to institute a rulemaking that would expand the required reporting of on-time performance data to include flights by code share partners of the reporting carriers. Our target action date for a notice of proposed rulemaking is December 2013. In order to avoid prejudging the outcome of the rulemaking process, the Department is concurring in part.

Recommendation 2: To improve the completeness and the reliability of aviation industry data collected by BTS and FAA, we recommend that DOT increase the number of carriers required to report on-time performance data by reducing the reporting threshold below 1 percent of all domestic passenger revenues.

DOT Response: Concur-in-part. Implementation of this recommendation requires a rulemaking. Currently, a reporting carrier which is defined as an air carrier that accounts for at least one percent of domestic scheduled-passenger revenues is required to submit to DOT its domestic scheduled passenger on-time performance data. The Department is considering amending the definition of "reporting carrier" under Part 234 to include carriers that account for less than 1 percent of all domestic scheduled passenger revenue. Our target action date for a notice of proposed rulemaking is December 2013. In order to avoid prejudging the outcome of the rulemaking process, the Department is concurring in part.

Recommendation 3: We recommend that RITA complete ongoing efforts to identify the underlying causes of delays attributed to late arriving aircraft and make them available on BTS's public Web site.

RITA Response: Concur. The effort to identify the underlying causes of delays is important, but the timeline for completing and posting this work is uncertain due to limited resources. RITA will work with its Office of the Secretary (OST)/Office of Aviation Analysis and FAA partners to determine the priority of this work, and the importance of investing both in the initial analysis and the ongoing maintenance of this information, in the context of the entire Airline Information portfolio. Our efforts should be complete by February 28, 2014.

Appendix. Agency Comments

Recommendation 4: Establish and implement a policy to periodically update and publish the capacity benchmarks.

FAA Response: Concur. The FAA plans to complete publication of the existing benchmarks, which are also known as airport capacity profiles, for the Core 30 airports[1] by December 31, 2013. Thereafter, the FAA plans to publish updates on the FAA's public website including: updates to specific airport capacity profiles when changes are identified, such as new runway capacity projects or new ATC procedures that affect capacity. The first update to the profiles will be posted to the FAA public website by August 31, 2014. With ongoing periodic updates, the FAA expects the airport capacity profiles to be kept current with no profile being older than five years.

Recommendation 5: Establish and implement a policy to ensure the consistent preparation, publication, and appropriate distribution of the Air Traffic Organization's (ATO) Core 30 Monthly Delay Report.

FAA Response: Concur. The FAA agrees to continue with the consistent preparation, publication, and appropriate distribution of the ATO's Core 30 Monthly Delay Report. The ATO's fiscal year 2014 business plan, available by November 30, 2013, will explicitly include this report. The Delay Report will continue to be published at the beginning of each month, and because of potentially sensitive information routinely contained in the report, the agency intends to distribute this report internally.

[1] Core airports are identified as having significant levels of passengers or itinerant operations. Specifically, airports with 1% or more of total enplanements (defined as large hubs) or airports with 0.75% or more of total non-military itinerant operations are identified as Core airports. These airports have a significant impact on the overall performance of the NAS. Currently, 30 airports in the NAS meet the criteria to be designated as a Core airport.

The following pages contain textual versions of certain complex graphs and charts published in this document. These pages were not a part of the original document but have been added here to accommodate assistive technology.

Figure 5. Kennedy Weekday Average Scheduled Flights and Delays by Quarter Hour, June Through August 2012

Figure 5 shows the number of scheduled flights by quarter hour versus the number of delayed flights starting at 6:00 am and continuing through 11:45 pm.

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
6:00 AM	11	2	19%
6:15 AM	7	1	17%
6:30 AM	10	3	29%
6:45 AM	9	2	24%
7:00 AM	18	3	15%
7:15 AM	15	3	19%
7:30 AM	14	2	16%
7:45 AM	15	5	30%
8:00 AM	21	4	21%
8:15 AM	14	3	23%
8:30 AM	20	4	19%
8:45 AM	10	2	24%
9:00 AM	16	4	26%
9:15 AM	9	2	26%
9:30 AM	11	3	24%
9:45 AM	9	2	25%
10:00 AM	12	2	17%
10:15 AM	7	2	26%
10:30 AM	8	2	19%
10:45 AM	8	2	27%
11:00 AM	12	2	19%
11:15 AM	12	3	24%
11:30 AM	12	3	21%
11:45 AM	7	2	25%
12:00 PM	9	2	21%
12:15 PM	10	2	25%
12:30 PM	14	2	17%
12:45 PM	19	4	21%
1:00 PM	11	2	22%
1:15 PM	18	5	27%
1:30 PM	11	2	19%
1:45 PM	29	8	28%
2:00 PM	13	3	22%
2:15 PM	15	7	48%
2:30 PM	12	4	32%
2:45 PM	35	12	33%
3:00 PM	15	6	38%
3:15 PM	16	5	32%
3:30 PM	21	8	37%

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
3:45 PM	21	9	44%
4:00 PM	23	11	49%
4:15 PM	15	7	45%
4:30 PM	24	10	43%
4:45 PM	13	8	59%
5:00 PM	26	11	43%
5:15 PM	14	7	48%
5:30 PM	18	9	48%
5:45 PM	16	6	38%
6:00 PM	15	7	43%
6:15 PM	17	7	43%
6:30 PM	21	10	50%
6:45 PM	18	8	46%
7:00 PM	25	11	46%
7:15 PM	21	9	45%
7:30 PM	26	14	55%
7:45 PM	10	3	34%
8:00 PM	28	12	42%
8:15 PM	8	4	54%
8:30 PM	19	9	49%
8:45 PM	12	6	48%
9:00 PM	26	13	52%
9:15 PM	8	4	46%
9:30 PM	19	9	46%
9:45 PM	16	8	51%
10:00 PM	14	6	46%
10:15 PM	8	3	40%
10:30 PM	9	4	41%
10:45 PM	14	6	42%
11:00 PM	7	3	42%
11:15 PM	3	1	45%
11:30 PM	4	1	34%
11:45 PM	14	5	37%

Source: OIG analysis of FAA data.

Figure G-1. Kennedy

Figure G-1 compares the number of Kennedy airport scheduled and delayed flights starting at 6:00 am continuing through 11:45 pm.

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
6:00 AM	11	2	19%
6:15 AM	7	1	17%
6:30 AM	10	3	29%
6:45 AM	9	2	24%
7:00 AM	18	3	15%
7:15 AM	15	3	19%
7:30 AM	14	2	16%
7:45 AM	15	5	30%

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
8:00 AM	21	4	21%
8:15 AM	14	3	23%
8:30 AM	20	4	19%
8:45 AM	10	2	24%
9:00 AM	16	4	26%
9:15 AM	9	2	26%
9:30 AM	11	3	24%
9:45 AM	9	2	25%
10:00 AM	12	2	17%
10:15 AM	7	2	26%
10:30 AM	8	2	19%
10:45 AM	8	2	27%
11:00 AM	12	2	19%
11:15 AM	12	3	24%
11:30 AM	12	3	21%
11:45 AM	7	2	25%
12:00 PM	9	2	21%
12:15 PM	10	2	25%
12:30 PM	14	2	17%
12:45 PM	19	4	21%
1:00 PM	11	2	22%
1:15 PM	18	5	27%
1:30 PM	11	2	19%
1:45 PM	29	8	28%
2:00 PM	13	3	22%
2:15 PM	15	7	48%
2:30 PM	12	4	32%
2:45 PM	35	12	33%
3:00 PM	15	6	38%
3:15 PM	16	5	32%
3:30 PM	21	8	37%
3:45 PM	21	9	44%
4:00 PM	23	11	49%
4:15 PM	15	7	45%
4:30 PM	24	10	43%
4:45 PM	13	8	59%
5:00 PM	26	11	43%
5:15 PM	14	7	48%
5:30 PM	18	9	48%
5:45 PM	16	6	38%
6:00 PM	15	7	43%
6:15 PM	17	7	43%
6:30 PM	21	10	50%
6:45 PM	18	8	46%
7:00 PM	25	11	46%
7:15 PM	21	9	45%
7:30 PM	26	14	55%
7:45 PM	10	3	34%
8:00 PM	28	12	42%
8:15 PM	8	4	54%

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
8:30 PM	19	9	49%
8:45 PM	12	6	48%
9:00 PM	26	13	52%
9:15 PM	8	4	46%
9:30 PM	19	9	46%
9:45 PM	16	8	51%
10:00 PM	14	6	46%
10:15 PM	8	3	40%
10:30 PM	9	4	41%
10:45 PM	14	6	42%
11:00 PM	7	3	42%
11:15 PM	3	1	45%
11:30 PM	4	1	34%
11:45 PM	14	5	37%

Source: OIG analysis of FAA data.

Figure G-2. Newark

Figure G-2 compares the number of scheduled and delayed flights at Newark airport from 6:00 am continuing through 9:45 pm.

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
6:00 AM	17	4	21%
6:15 AM	7	2	25%
6:30 AM	16	4	24%
6:45 AM	8	2	26%
7:00 AM	14	3	23%
7:15 AM	8	2	25%
7:30 AM	24	5	19%
7:45 AM	17	5	32%
8:00 AM	25	7	28%
8:15 AM	10	3	33%
8:30 AM	19	9	45%
8:45 AM	14	6	43%
9:00 AM	19	11	56%
9:15 AM	10	5	48%
9:30 AM	12	2	19%
9:45 AM	8	2	24%
10:00 AM	16	3	20%
10:15 AM	11	2	20%
10:30 AM	15	4	24%
10:45 AM	12	3	24%
11:00 AM	20	4	21%
11:15 AM	11	2	22%
11:30 AM	14	4	31%
11:45 AM	16	4	26%
12:00 PM	26	8	31%
12:15 PM	11	3	29%
12:30 PM	21	6	31%

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
12:45 PM	17	5	30%
1:00 PM	16	6	38%
1:15 PM	16	5	33%
1:30 PM	15	5	35%
1:45 PM	22	7	34%
2:00 PM	11	4	38%
2:15 PM	18	6	33%
2:30 PM	19	7	39%
2:45 PM	24	10	41%
3:00 PM	17	8	45%
3:15 PM	21	11	53%
3:30 PM	11	5	44%
3:45 PM	22	9	43%
4:00 PM	13	6	44%
4:15 PM	16	7	46%
4:30 PM	21	9	45%
4:45 PM	21	10	48%
5:00 PM	12	6	49%
5:15 PM	27	13	50%
5:30 PM	13	7	52%
5:45 PM	16	9	57%
6:00 PM	17	11	62%
6:15 PM	26	15	56%
6:30 PM	19	11	57%
6:45 PM	13	9	67%
7:00 PM	24	15	62%
7:15 PM	19	11	59%
7:30 PM	17	11	64%
7:45 PM	10	6	57%
8:00 PM	23	14	61%
8:15 PM	26	14	55%
8:30 PM	17	10	59%
8:45 PM	12	8	66%
9:00 PM	16	8	51%
9:15 PM	21	11	52%
9:30 PM	14	7	51%
9:45 PM	16	9	58%

Source: OIG analysis of FAA data.

Figure G-3. LaGuardia

Figure G-3 compares the number of scheduled and delayed flights at LaGuardia airport from 6:00 am and continuing through 10:45 pm.

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
6:00 AM	20	3	16%
6:15 AM	5	1	25%
6:30 AM	12	3	21%
6:45 AM	9	2	24%

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
7:00 AM	16	4	27%
7:15 AM	10	2	15%
7:30 AM	22	3	14%
7:45 AM	18	3	19%
8:00 AM	17	4	25%
8:15 AM	19	6	31%
8:30 AM	17	8	46%
8:45 AM	13	5	40%
9:00 AM	27	11	39%
9:15 AM	9	3	37%
9:30 AM	18	6	32%
9:45 AM	18	6	35%
10:00 AM	21	8	38%
10:15 AM	15	5	30%
10:30 AM	15	5	36%
10:45 AM	20	6	32%
11:00 AM	19	7	35%
11:15 AM	15	5	31%
11:30 AM	18	6	34%
11:45 AM	18	7	38%
12:00 PM	21	7	32%
12:15 PM	12	5	39%
12:30 PM	18	6	31%
12:45 PM	18	5	30%
1:00 PM	16	6	35%
1:15 PM	19	7	36%
1:30 PM	15	6	38%
1:45 PM	23	8	34%
2:00 PM	16	5	31%
2:15 PM	17	6	35%
2:30 PM	16	6	39%
2:45 PM	20	9	43%
3:00 PM	22	9	40%
3:15 PM	14	7	52%
3:30 PM	18	7	37%
3:45 PM	17	8	45%
4:00 PM	25	10	39%
4:15 PM	13	6	47%
4:30 PM	17	9	55%
4:45 PM	14	6	39%
5:00 PM	20	10	48%
5:15 PM	12	4	35%
5:30 PM	13	6	43%
5:45 PM	22	10	47%
6:00 PM	18	8	44%
6:15 PM	16	6	39%
6:30 PM	18	8	44%
6:45 PM	16	7	41%
7:00 PM	16	6	36%
7:15 PM	23	9	39%

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
7:30 PM	13	6	48%
7:45 PM	19	8	44%
8:00 PM	21	10	47%
8:15 PM	14	5	35%
8:30 PM	15	5	35%
8:45 PM	15	7	44%
9:00 PM	19	8	40%
9:15 PM	15	6	38%
9:30 PM	14	5	36%
9:45 PM	8	3	38%
10:00 PM	8	2	29%
10:15 PM	12	5	39%
10:30 PM	2	1	47%
10:45 PM	5	2	31%

Source: OIG analysis of FAA data.

Figure G-4. O'Hare

Figure G-4 compares the number of scheduled and delayed flights at O'Hare airport from 6:00 am and continuing through 9:45 pm.

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
6:00 AM	34	5	14%
6:15 AM	17	3	15%
6:30 AM	21	3	15%
6:45 AM	30	4	14%
7:00 AM	40	6	14%
7:15 AM	44	7	15%
7:30 AM	27	4	13%
7:45 AM	39	7	18%
8:00 AM	58	11	19%
8:15 AM	45	9	21%
8:30 AM	38	7	18%
8:45 AM	46	8	18%
9:00 AM	49	10	20%
9:15 AM	33	6	18%
9:30 AM	32	7	22%
9:45 AM	43	11	25%
10:00 AM	31	6	20%
10:15 AM	34	6	18%
10:30 AM	40	8	19%
10:45 AM	34	8	22%
11:00 AM	43	9	21%
11:15 AM	27	5	18%
11:30 AM	30	6	20%
11:45 AM	39	10	25%
12:00 PM	46	13	27%
12:15 PM	38	8	21%
12:30 PM	39	8	21%

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
12:45 PM	35	8	24%
1:00 PM	54	17	32%
1:15 PM	31	10	31%
1:30 PM	34	11	33%
1:45 PM	39	10	25%
2:00 PM	37	11	30%
2:15 PM	39	11	29%
2:30 PM	35	10	28%
2:45 PM	31	10	33%
3:00 PM	43	13	30%
3:15 PM	40	13	32%
3:30 PM	37	11	31%
3:45 PM	35	12	33%
4:00 PM	43	15	36%
4:15 PM	49	16	34%
4:30 PM	36	12	34%
4:45 PM	34	12	34%
5:00 PM	48	18	37%
5:15 PM	44	16	36%
5:30 PM	34	13	38%
5:45 PM	43	15	35%
6:00 PM	48	21	44%
6:15 PM	30	13	43%
6:30 PM	43	18	41%
6:45 PM	38	13	34%
7:00 PM	38	14	37%
7:15 PM	48	17	35%
7:30 PM	40	14	35%
7:45 PM	47	18	38%
8:00 PM	43	15	34%
8:15 PM	48	19	40%
8:30 PM	34	12	36%
8:45 PM	35	13	36%
9:00 PM	40	16	40%
9:15 PM	30	11	38%
9:30 PM	24	9	37%
9:45 PM	26	10	37%

Source: OIG analysis of FAA data.

Figure G-5. Atlanta

Figure G-5 compares the number of scheduled and delayed flights at Atlanta airport from 6:00 am and continuing through 9:45 pm.

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
6:00 AM	8	1	9%
6:15 AM	11	1	13%
6:30 AM	11	3	25%
6:45 AM	14	1	9%

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
7:00 AM	7	1	10%
7:15 AM	35	3	9%
7:30 AM	33	3	8%
7:45 AM	17	1	6%
8:00 AM	43	4	9%
8:15 AM	48	6	13%
8:30 AM	45	7	15%
8:45 AM	57	7	13%
9:00 AM	44	6	14%
9:15 AM	37	5	13%
9:30 AM	59	9	16%
9:45 AM	58	12	21%
10:00 AM	51	9	18%
10:15 AM	43	9	21%
10:30 AM	28	5	18%
10:45 AM	43	11	24%
11:00 AM	43	11	25%
11:15 AM	41	7	18%
11:30 AM	25	4	18%
11:45 AM	27	4	15%
12:00 PM	44	9	19%
12:15 PM	41	8	19%
12:30 PM	30	6	20%
12:45 PM	41	7	16%
1:00 PM	41	7	16%
1:15 PM	29	5	16%
1:30 PM	40	9	24%
1:45 PM	50	13	25%
2:00 PM	52	10	20%
2:15 PM	45	9	20%
2:30 PM	30	6	22%
2:45 PM	47	13	28%
3:00 PM	53	18	34%
3:15 PM	52	15	30%
3:30 PM	41	12	30%
3:45 PM	33	10	30%
4:00 PM	46	15	32%
4:15 PM	44	15	34%
4:30 PM	52	17	34%
4:45 PM	51	17	33%
5:00 PM	21	7	31%
5:15 PM	36	13	36%
5:30 PM	45	18	40%
5:45 PM	46	19	42%
6:00 PM	40	14	35%
6:15 PM	42	15	35%
6:30 PM	41	14	34%
6:45 PM	34	12	36%
7:00 PM	46	18	39%
7:15 PM	50	22	43%

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
7:30 PM	48	22	45%
7:45 PM	53	20	37%
8:00 PM	27	11	42%
8:15 PM	23	7	32%
8:30 PM	55	23	41%
8:45 PM	49	20	41%
9:00 PM	46	17	38%
9:15 PM	23	10	42%
9:30 PM	29	11	36%
9:45 PM	42	20	48%

Source: OIG analysis of FAA data.

Figure G-6. San Francisco

Figure G-6 compares the number of scheduled and delayed flights at San Francisco airport from 6:00 am and continuing through 10:45 pm.

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
6:00 AM	15	3	18%
6:15 AM	8	1	12%
6:30 AM	7	1	13%
6:45 AM	15	2	14%
7:00 AM	18	3	19%
7:15 AM	10	3	27%
7:30 AM	13	2	12%
7:45 AM	12	2	14%
8:00 AM	19	4	19%
8:15 AM	22	4	18%
8:30 AM	15	4	27%
8:45 AM	14	4	26%
9:00 AM	19	6	31%
9:15 AM	22	7	33%
9:30 AM	22	6	29%
9:45 AM	22	7	33%
10:00 AM	15	7	44%
10:15 AM	13	5	38%
10:30 AM	21	10	47%
10:45 AM	25	11	45%
11:00 AM	21	8	38%
11:15 AM	17	8	45%
11:30 AM	12	6	48%
11:45 AM	21	8	40%
12:00 PM	21	8	36%
12:15 PM	17	8	45%
12:30 PM	18	8	44%
12:45 PM	23	13	56%
1:00 PM	22	11	48%
1:15 PM	20	9	43%
1:30 PM	16	9	56%

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
1:45 PM	15	7	45%
2:00 PM	19	9	48%
2:15 PM	12	6	48%
2:30 PM	14	6	46%
2:45 PM	19	10	52%
3:00 PM	20	8	42%
3:15 PM	13	6	45%
3:30 PM	17	8	47%
3:45 PM	16	9	53%
4:00 PM	21	10	45%
4:15 PM	9	4	47%
4:30 PM	8	3	40%
4:45 PM	15	6	38%
5:00 PM	12	5	38%
5:15 PM	13	4	34%
5:30 PM	15	6	40%
5:45 PM	15	5	33%
6:00 PM	15	5	33%
6:15 PM	16	8	48%
6:30 PM	8	3	42%
6:45 PM	19	7	38%
7:00 PM	18	6	35%
7:15 PM	17	7	38%
7:30 PM	13	5	37%
7:45 PM	21	9	42%
8:00 PM	18	6	34%
8:15 PM	12	5	38%
8:30 PM	12	5	41%
8:45 PM	15	5	34%
9:00 PM	14	5	38%
9:15 PM	13	5	38%
9:30 PM	15	6	39%
9:45 PM	22	8	38%
10:00 PM	11	4	38%
10:15 PM	12	5	41%
10:30 PM	19	8	42%
10:45 PM	17	10	57%

Source: OIG analysis of FAA data.

Figure G-7. Boston

Figure G-7 compares the number of scheduled and delayed flights at Boston airport from 6:00 am and continuing through 9:45 pm.

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
6:00 AM	16	3	16%
6:15 AM	7	1	11%
6:30 AM	10	1	12%
6:45 AM	10	3	26%

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
7:00 AM	25	4	18%
7:15 AM	17	2	14%
7:30 AM	11	2	19%
7:45 AM	11	2	19%
8:00 AM	18	3	17%
8:15 AM	16	2	14%
8:30 AM	16	3	18%
8:45 AM	19	4	22%
9:00 AM	18	4	20%
9:15 AM	12	3	22%
9:30 AM	12	4	34%
9:45 AM	16	4	24%
10:00 AM	17	3	20%
10:15 AM	10	2	20%
10:30 AM	12	2	19%
10:45 AM	9	2	21%
11:00 AM	16	3	21%
11:15 AM	12	2	15%
11:30 AM	11	2	20%
11:45 AM	12	2	20%
12:00 PM	14	3	19%
12:15 PM	12	2	21%
12:30 PM	13	3	21%
12:45 PM	8	2	20%
1:00 PM	18	4	23%
1:15 PM	13	3	20%
1:30 PM	15	4	26%
1:45 PM	15	3	22%
2:00 PM	14	4	28%
2:15 PM	13	3	24%
2:30 PM	18	4	21%
2:45 PM	8	2	30%
3:00 PM	18	5	28%
3:15 PM	10	3	26%
3:30 PM	11	3	28%
3:45 PM	13	4	29%
4:00 PM	16	4	26%
4:15 PM	14	4	29%
4:30 PM	18	5	29%
4:45 PM	22	7	34%
5:00 PM	18	6	32%
5:15 PM	16	6	36%
5:30 PM	20	8	40%
5:45 PM	22	8	34%
6:00 PM	17	7	39%
6:15 PM	14	5	37%
6:30 PM	23	8	35%
6:45 PM	18	7	40%
7:00 PM	16	6	36%
7:15 PM	16	6	36%

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
7:30 PM	12	5	38%
7:45 PM	12	5	43%
8:00 PM	18	6	32%
8:15 PM	11	3	26%
8:30 PM	12	4	32%
8:45 PM	14	5	32%
9:00 PM	7	2	29%
9:15 PM	7	2	26%
9:30 PM	5	1	22%
9:45 PM	6	3	48%

Source: OIG analysis of FAA data.

Figure G-8. Philadelphia

Figure G-8 compares the number of scheduled and delayed flights at Philadelphia airport from 6:00 am through 9:45 pm.

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
6:00 AM	12	3	21%
6:15 AM	9	2	25%
6:30 AM	17	3	15%
6:45 AM	19	3	15%
7:00 AM	7	2	24%
7:15 AM	15	3	19%
7:30 AM	23	7	30%
7:45 AM	18	6	34%
8:00 AM	15	4	26%
8:15 AM	17	4	25%
8:30 AM	22	4	19%
8:45 AM	17	3	18%
9:00 AM	14	3	21%
9:15 AM	16	3	21%
9:30 AM	22	6	27%
9:45 AM	20	6	29%
10:00 AM	17	7	39%
10:15 AM	13	3	22%
10:30 AM	22	5	24%
10:45 AM	13	3	25%
11:00 AM	14	3	23%
11:15 AM	18	5	29%
11:30 AM	17	5	29%
11:45 AM	16	4	23%
12:00 PM	10	2	20%
12:15 PM	7	2	26%
12:30 PM	18	4	24%
12:45 PM	18	5	26%
1:00 PM	16	4	25%
1:15 PM	18	5	28%
1:30 PM	22	6	29%

Quarter Hour	Scheduled Flights	Delayed Flights	Delay Rate
1:45 PM	23	6	27%
2:00 PM	16	4	27%
2:15 PM	15	4	26%
2:30 PM	23	6	25%
2:45 PM	17	5	27%
3:00 PM	17	5	30%
3:15 PM	18	5	30%
3:30 PM	19	8	41%
3:45 PM	23	9	39%
4:00 PM	21	8	37%
4:15 PM	20	8	38%
4:30 PM	17	5	27%
4:45 PM	22	7	32%
5:00 PM	21	8	39%
5:15 PM	20	7	36%
5:30 PM	21	9	41%
5:45 PM	22	11	49%
6:00 PM	21	11	51%
6:15 PM	21	11	53%
6:30 PM	18	11	64%
6:45 PM	20	9	47%
7:00 PM	20	8	38%
7:15 PM	20	7	36%
7:30 PM	20	8	38%
7:45 PM	19	7	37%
8:00 PM	9	3	36%
8:15 PM	10	4	39%
8:30 PM	19	6	32%
8:45 PM	19	7	37%
9:00 PM	18	6	35%
9:15 PM	15	5	34%
9:30 PM	10	3	32%
9:45 PM	14	4	26%

Source: OIG analysis of FAA data.