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United States Government Accountability Office  
Washington, DC 20548

September 17, 2008

The Honorable Ted Stevens  
United States Senate

Subject: *Commercial Aviation: Impact of Airline Crew Scheduling on Delays and Cancellations of Commercial Flights*

Dear Senator Stevens:

Media coverage of airline service problems, combined with congressional hearings on these problems, has put flight delays and cancellations in the spotlight. Department of Transportation (DOT) data show that flight delays and cancellations have generally increased over the last decade. Since 1998, the number of flight delays and cancellations has increased 62 percent nationwide, while the number of scheduled flight operations<sup>1</sup> has increased about 38 percent. Also, a May 2008 report by the Joint Economic Committee found that, collectively, passengers were delayed 320 million hours in 2007. The report also estimated that domestic flight delays last year cost the U.S. economy as much as \$41 billion and raised airlines' operating costs by \$19 billion.<sup>2</sup>

In 2007, airlines reported to DOT that 73 percent of flights were on time, while 24 percent were delayed and 2 percent were canceled.<sup>3,4</sup> Of those flights that were delayed, airlines reported the majority of flight delays were caused by 3 categories of delays: a previous aircraft arriving late; the national aviation system—a category of delays that encompasses a broad set of circumstances, such as congestion or bad weather; and air carrier—a category of 42 potential causes of delay that includes, but is not limited to,

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<sup>1</sup>"Flight" means any nonstop scheduled passenger flight segment with a specific flight number scheduled to be operated pursuant to a published schedule within a specific origin-destination city pair, other than transborder or foreign air transportation. See 14 C.F.R. § 234.2.

<sup>2</sup>Joint Economic Committee Majority Staff, *Your Flight Has Been Delayed Again: Flight Delays Cost Passengers, Airlines, and the U.S. Economy Billions* (Washington, D.C.: May 2008).

<sup>3</sup>Federal regulations require that domestic air carriers that account for at least 1 percent of domestic scheduled passenger revenues submit scheduled domestic flight performance data, including the cause of delays and cancellations, to DOT. See 14 C.F.R. §§ 234.1-234.4. In 2007, 20 carriers, operating about 70 percent of all scheduled departures and serving about 90 percent of all domestic passengers, reported these data.

<sup>4</sup>Less than 1 percent of flights were diverted.

problems associated with how the airline schedules its flight crews.<sup>5</sup> With demand pushing more flights into an already congested airspace, one delayed or canceled flight can create ripples in the system, causing other flights to be delayed or canceled. In such an environment, the effective scheduling of available flight crews is key to better ensuring the on-time performance of flights.

You asked that we assess commercial airline policies and practices for crew scheduling. Accordingly, this report addresses the following questions: (1) How do airlines schedule flight crews? (2) To what extent, if any, does crew scheduling contribute to flight delays and cancellations? (3) What steps do stakeholders report might reduce delays and cancellations due to crew scheduling?

To respond to these objectives, we reviewed scheduling practices and related information about flight delays and cancellations. We requested interviews with the 12 largest domestic airlines, as measured by passenger volume in 2007. We conducted semistructured interviews, and gathered and analyzed data from 11 of these airlines as well as data from DOT.<sup>6</sup> Data on crew-scheduling-related delays and cancellations are not publicly reported, and we were not able to independently verify the accuracy of these data. However, we asked airlines about steps they take to verify the accuracy and reliability of their data and corroborated the findings arising from these data with aviation stakeholders and academic experts. In addition, the data from the airlines may not be comparable due to internal differences in how they gather these data. We also interviewed officials from the Federal Aviation Administration (FAA) and other stakeholders, including professional associations representing airlines and crew members, academics, and an airline passenger consumer advocacy group. (See enc. I for additional information on our scope and methodology.)

We conducted this performance audit from March 2008 to September 2008 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.

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<sup>5</sup>Flight crews include the pilots and, in some cases, a flight engineer in the cockpit (cockpit crew) and the flight attendants in the cabin (cabin crew). In this report, “flight crew” pertains only to the cockpit crew, unless otherwise specified. In addition, this report references both the national aviation system—a formal category of DOT data to which flight delays and cancellations are attributed—and the national airspace system—the complex, interconnected, and interdependent network of systems, procedures, facilities, aircraft, and people that must work together to ensure safe and efficient operations.

<sup>6</sup>We requested data from and interviewed officials representing AirTran Airways, Alaska Airlines, American Airlines and American Eagle, Continental Airlines, Delta Air Lines, JetBlue Airways, Northwest Airlines, Southwest Airlines, United Airlines, and US Airways. SkyWest Airlines did not respond to our request.

## Results in Brief

Airlines use computerized optimization models to schedule flight crews while adhering to federal regulations and contractual agreements. As a fundamental safety tenet, all airlines are subject to Federal Aviation Regulations that establish maximum crew flight times and minimum rest requirements.<sup>7</sup> For example, a commercial pilot can fly a maximum of 8 hours during a duty period (or workday).<sup>8</sup> In addition, airlines must adhere to conditions in their collective bargaining agreements, which they negotiate with the labor organizations representing their employees. The collective bargaining agreements often address the crews' work conditions; nonunionized airlines often have company policies that address similar work conditions. Labor is generally one of an airline's largest costs, along with fuel. Consequently, airlines use computerized models to schedule crews in a manner that helps to minimize these costs, while adhering to the Federal Aviation Regulation limitations and to collective bargaining agreement conditions.

Flight delays and cancellations caused by crew scheduling alone appear to be rare and frequently arise from other problems. According to the 11 airlines with whom we spoke, flight delays and cancellations attributed to crew scheduling are minimal. Detailed data provided by 6 of the airlines indicated that, in 2007, delays due to crew scheduling accounted for no more than about 3 percent of any airline's flights, and that cancellations due to crew scheduling were less than one-quarter of 1 percent of all flights for any airline. Most other stakeholders similarly indicated that crew scheduling is not a major contributor to delays and cancellations. Airlines and other stakeholders identified other problems as being more significant causes of flight delays and cancellations, including aircraft maintenance and problems with the national airspace system, such as congestion or bad weather. Additionally, airlines reported that delays and cancellations due to crew scheduling are often the result of other delays, which can create a "ripple effect" when crews and aircraft needed for subsequent flights are not available on time. For example, if an incoming flight arrives at an airport late and the aircraft and its crew are scheduled for two separate subsequent flights, then the first delay can cause two additional flights to be delayed.

Stakeholders identified several ongoing and potential actions that airlines and the government could take to reduce delays and cancellations attributable to crew scheduling. Airlines have taken several steps to reduce the potential for delays and cancellations due to crew scheduling, including adding time to flight schedules to account for delays, using reserve crews, positioning crews in anticipation of expected weather, and scheduling crews to stay with the same aircraft between flights. Additionally, several of the airlines reported taking steps to avoid delays in the New York area—a region known for airspace congestion—such as not scheduling crews on often-delayed flights scheduled to leave New York at later times in the day, and avoiding scheduling connecting flights out of New York to an airline's hub airport. Stakeholders

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<sup>7</sup>14 C.F.R. § 121.471.

<sup>8</sup>"Duty period" means the period of elapsed time between reporting for an assignment involving flight time and release from that assignment by the certificate holder conducting domestic, flag, or supplemental operations. See 14 C.F.R. § 121.467.

also suggested a number of steps that the federal government could take, including modernizing the air traffic control system; improving East Coast operations, particularly in the New York region; and revising the Federal Aviation Regulations pertaining to duty and rest hours. Finally, in July 2008, the federal government began a test program designed to evaluate expedited access to secure areas of airports for properly credentialed commercial flight crew members, which could reduce the time that flight crew members spend in security screening lines.

## Background

Since June 2003, DOT has required domestic airlines with at least 1 percent of the industry's annual revenue to report the reasons that flights are delayed or canceled using the following five broad categories:

- *Late-arriving aircraft* means that a previous flight using the same aircraft arrived late, thereby causing the subsequent flight to depart late. This category comprises delays (not cancellations) and does not provide the original source of delay for the late-arriving aircraft, such as a delay in the national aviation system.
- *National aviation system* delays and cancellations refer to a broad set of circumstances attributable to the national airspace system, such as airport operations, heavy traffic volume, and air traffic control. This category also includes any nonextreme weather condition that slows the operation of the system, such as wind or fog, but does not prevent flying.
- *Air carrier* includes 42 potential causes of delay and cancellation that are within the control of the airlines, such as maintenance, awaiting the arrival of connecting passengers, baggage loading, and crew issues.
- *Extreme weather* delays and cancellations occur when serious weather conditions prevent the operation of an aircraft. Examples of this kind of weather include tornadoes, snowstorms, and hurricanes.<sup>9</sup>
- *Security* includes evacuation of an airport, reboarding due to a security breach, and long lines at the passenger screening areas.

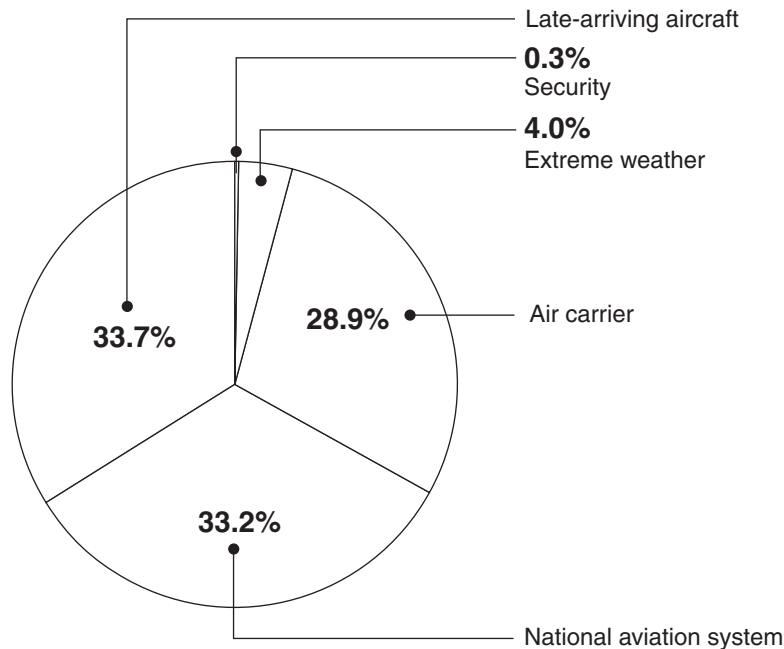
Airlines reported to DOT that the majority of delays during 2007 were attributed to the late-arriving aircraft, national aviation system, and air carrier categories. As illustrated in figure 1, delays reported under the air carrier category accounted for nearly 29 percent of

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<sup>9</sup>Weather delays are captured in several categories and, according to DOT, a true picture of total weather-related delays requires several steps. First, DOT combines the extreme weather category and the weather delays from the national aviation system category. Second, DOT performs a calculation to determine the weather-related delays included in the late-arriving aircraft category. Airlines do not report the causes of late-arriving aircraft, but DOT makes an allocation using the proportion of weather-related delays to total flights in the other categories. Finally, DOT adds these three sources of weather-related delays to determine the share of all flight delays attributable to weather. DOT estimates that, in 2007, about 44 percent of all delays as measured in minutes were because of weather.

flight delays last year, just below the 33 percent of delays attributed to the national aviation system and about 34 percent of delays attributed to late-arriving aircraft.<sup>10</sup>

**Figure 1: Causes of Flight Delays, 2007**



Source: DOT.

Note: Total may not add up to 100 percent due to rounding. Percentages are based on the number of flight operations reported under each category.

In July 2008, we reported that the data collected by DOT on the sources of delays provide information about where delays occurred and what caused the delay, but that these data are incomplete.<sup>11</sup> Specifically, the DOT-reported categories are too broad to provide meaningful information on the root causes of delays. For example, delays attributed to the airlines could consist of various causes, such as a late crew, aircraft maintenance, or baggage loading, but these more specific causes are not captured in DOT data. In addition, the largest source of systemwide delays—late-arriving aircraft, which represents about 34 percent of delayed flights (see fig. 1)—masks the original source of delay. For example, the original source of delay for a late-arriving aircraft could be because of the air carrier, security, extreme weather, or the national aviation system—or a combination of one or more of these sources.

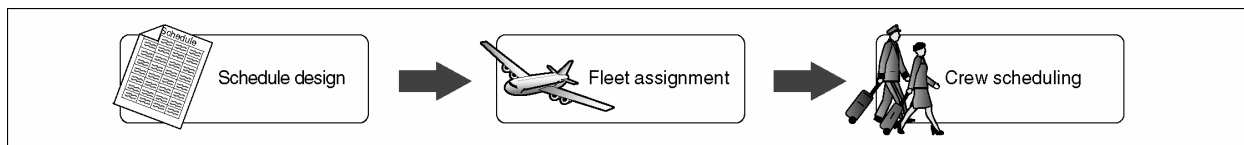
<sup>10</sup>Airlines report data to DOT in both minutes and the number of flight operations (flights). In our July 2008 testimony, we reported delays on the basis of the minutes of delay. In addition to delayed flights, crew-scheduling problems can result in canceled flights, which cannot be presented in number of minutes. Therefore, in this report, we report delays on the basis of the number of flights. As a result, the percentages in this report differ slightly from our July 2008 testimony. See GAO, *National Airspace System: DOT and FAA Actions Will Likely Have a Limited Effect on Reducing Delays during Summer 2008 Travel Season*, [GAO-08-934T](#) (Washington, D.C.: July 15, 2008).

<sup>11</sup>[GAO-08-934T](#).

## Airlines Schedule Flight Crews Using Optimization Models While Adhering to Federal Regulations and Contractual Agreements

Crew scheduling is part of a larger airline scheduling process. Airlines we interviewed reported a similar scheduling process that goes through chronological phases (see fig. 2).

Figure 2: Airline Scheduling Process



Source: GAO.

First, the marketing department of the airline designs a schedule by determining the flights to be flown and departure times during a given time period, such as a month. Subsequent planning decisions are based on this schedule. Second, the airline assigns the aircraft to each flight to maximize revenues and minimize costs. The type of aircraft assigned determines the qualifications and quantity of crew needed. The final step—crew scheduling—assigns crews (pilots, and flight engineers, if needed, in the cockpit and flight attendants in the cabin) to the aircraft.

Airlines use computerized optimization models to develop crew schedules and allow flight crews to bid on the schedules. Labor is generally one of an airline’s largest costs, along with fuel. Consequently, airlines use computerized models to schedule crews in a manner that helps to minimize these costs. Five of the 11 airlines we interviewed use a preferential bidding system (PBS) to produce monthly crew assignments based on crew member preferences. PBS incorporates a crew member’s preplanned activities, such as vacations, training, medical appointments, and military leave, when developing the crew member’s schedule for the month. Four airlines reported using a “bid line” system, while the remaining 2 airlines reported using a bid line system as well as a PBS. In bid line systems, the airline develops monthly schedules and crew members bid to work those schedules. This system does not take into account conflicts that may arise with preplanned activities, such as vacations, training, medical appointments, and military leave. As such, conflicts may arise, and those conflicting trips must then be assigned to other crew members. Regardless of the approach selected, the airline will have schedule-holding crews and reserve crews. Schedule-holding crews have a known schedule of flights for the month. In contrast, reserve crews do not have a schedule of flights, but are “on call” to fly during certain days throughout the month when the airline needs crew members for particular flights.

As they develop crew schedules, airlines must adhere to federal regulations and collective bargaining agreements (CBA). All 11 airlines we interviewed cited Federal Aviation Regulation (FAR) requirements as the primary constraint in building a crew schedule. As a fundamental safety tenet, all airlines are subject to FAR flight time limitations and rest requirements and must work within these primary constraints when

designing schedules.<sup>12</sup> The current FAR limits a commercial pilot's flight time to 8 hours in a duty period, 100 hours in a calendar month, and 1,000 hours in a calendar year, with certain exceptions.<sup>13</sup> The FARs also specify the minimum number of hours of rest that pilots must have between duty periods.<sup>14</sup> Furthermore, pilots can only fly those aircraft types for which they are qualified.<sup>15</sup> Each airline must also consider the crews' work conditions, which are established in its CBA, or in its company policies if the airline is nonunionized and does not have a CBA. For example, the airlines we interviewed reported that these requirements cover monthly flight time; time between flights; and any leave, training, vacation requests, or trip preference requests. The airlines reported monthly flying hours from a low of 60 to 63 hours a month to a high of 90 to 92 hours a month. Stakeholders noted that the closer pilots are scheduled to the FARs' monthly maximum of 100 hours, the greater the reduction in scheduling flexibility. This limits the airlines' use of pilots to make schedule adjustments when there is a delay from a major disruption, because pilots would no longer have room in their schedules for additional hours. However, all of the airlines we interviewed have reserve crews that can fly during these disruptions to help get the airline get back on schedule.

### **Delays and Cancellations Caused by Crew Scheduling Appear Rare and Frequently Stem from Other Problems**

According to the airlines, most aviation industry associations, and academic experts we interviewed, crew scheduling is not a major source of flight delays and cancellations. Stakeholders pointed to other problems as being more significant causes of delays and cancellations, including aircraft maintenance and problems with the national airspace system, such as congestion or bad weather. Additionally, airlines reported that delays and cancellations due to crew scheduling are often the result of other delays, which can create a "ripple effect" when crews and aircraft scheduled for subsequent flights are not available on time.

### Stakeholders Report That Crew Scheduling Is Responsible for Few Delays and Cancellations

According to officials at the 11 airlines we interviewed, crew scheduling causes few flight delays and cancellations.<sup>16</sup> Six airlines provided detailed information on flight

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<sup>12</sup>14 C.F.R. § 121.471.

<sup>13</sup>14 C.F.R. § 121.471.

<sup>14</sup>14 C.F.R. § 121.471.

<sup>15</sup>Cabin crews have much more flexibility. For example, they have fewer limitations on the type of aircraft to which they can be assigned and can be scheduled up to 14 hours in a duty period.

<sup>16</sup>The results presented in this section pertain to 11 airlines that collectively served just over 75 percent of all airline passengers in 2007 and reported flight delay and cancellation data to DOT. As such, these data are illustrative of recent delays and cancellations due to crew scheduling at these airlines and do not necessarily represent results for the broader industry.

delays and cancellations. This detailed information showed that for each of these airlines in 2007, crew scheduling caused delays for less than about 3 percent of flights and cancellations for less than one-quarter of 1 percent of flights. The other 5 airlines we interviewed did not provide detailed data, but officials for those airlines also stated that crew scheduling causes few delays and cancellations. Two of these airlines told us that, on the basis of their data, about 5 to 6 percent of delays and/or cancellations were due to crew scheduling, while 2 other airlines estimated that crew scheduling accounted for less than 10 percent of delays within the air carrier category.

Among the other factors within the airlines' control, airlines reported that aircraft maintenance and time needed to board passengers are greater causes of delay than problems with crew scheduling. DOT data show that air carrier delays accounted for about 7 percent of flights in 2007.<sup>17</sup> The percentages of flights delayed due to air carrier causes were about the same for the 11 airlines we interviewed, affecting about 6 percent of flights in 2007. According to the DOT data, cancellations due to the air carrier represented about 1 percent of all U.S. carrier flights in 2007;<sup>18</sup> among the 11 airlines we interviewed, cancellations due to the air carrier were slightly less than 1 percent of flights in 2007.

Most other stakeholders we interviewed, including academic experts and almost all aviation industry associations, shared the view that crew scheduling was not a major cause of flight delays and cancellations. Like the airlines, these stakeholders identified other causes as being more prominent in this area, such as problems with the national airspace system related to congestion or weather. Conversely, one aviation industry association characterized crew-scheduling problems as common and often leading to delays and cancellations, although this association also indicated that other issues are more prevalent causes of air carrier delay, such as maintenance and problems with the national airspace system.

#### Airlines Report That Crew-Scheduling Delays Are Often the Result of Other Delays in the National Airspace System

According to the airlines, when delays associated with crew scheduling do occur, they are frequently the result of other types of delays in the national airspace system, such as those caused by congestion or bad weather. As we have previously mentioned, crew scheduling is a complex process that puts crews in position to serve flights. In some instances, crew scheduling can respond to problems, but other problems will disrupt the airlines' crew schedules. A ripple effect may occur when delayed or canceled flights create problems for subsequent flights because the crew or equipment for those flights is delayed or out of position. This problem can propagate further delays when the crew

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<sup>17</sup>Recently, the national aviation system and late-arriving aircraft categories both accounted for higher percentages of delays than air carrier: that is, about 8 percent for both categories in 2007 and about 9 percent for both categories during the first 3 months of 2008. Delays for all reasons accounted for 24 percent of flights in 2007 and 26 percent of flights during the first 3 months of 2008.

<sup>18</sup>Cancellations accounted for about 2 percent of flights in 2007 and about 3 percent of flights during the first 3 months of 2008.

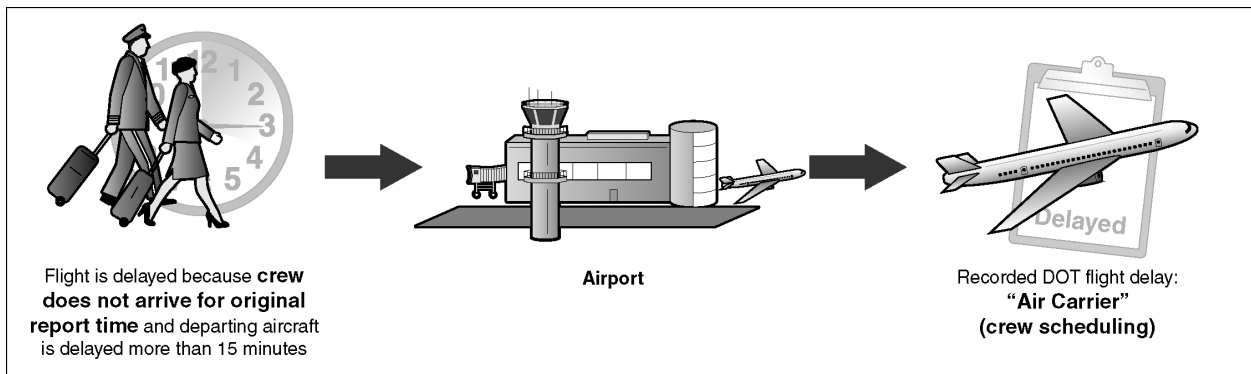


and plane from a delayed or canceled flight are needed for separate subsequent flights but are not available on time. When such crew-related delays are linked to previous flights where the aircraft arrived late, then the underlying cause of delay may not be known. The following text and figures 3 through 5 illustrate various delay scenarios and their potential causes and results:

*Scenario 1: Crew Arrives Late*

In the scenario depicted in figure 3, the crew arrives late for its first flight, which causes a delay. This delay is reported to DOT as an air carrier delay, since it is considered within the control of the airline. According to the airlines, this scenario is relatively rare, although they reported some isolated instances of such crew-related problems, such as crews calling in sick during labor disputes or crews being out of position because of schedule disruptions caused by severe weather. This type of delay could also arise if crews arrive late the previous day and have to extend their rest time to comply with federal requirements for pilot rest, as we have previously discussed. Airlines reported having varying percentages of crew members who commute from outside the area where they are based, with estimates ranging from 19 to 55 percent, although these percentages vary greatly by city. Although commuting problems for crews that live outside the area where they are based can contribute to this type of delay, airlines and the aviation industry associations that represent pilots and flight attendants told us that such problems were not a major issue, and several airlines reported taking steps to lessen the potential for such delays, such as getting crews in position early if they expect bad weather to disrupt commuting.<sup>19</sup>

**Figure 3: Scenario 1 - Crew Arrives Late**



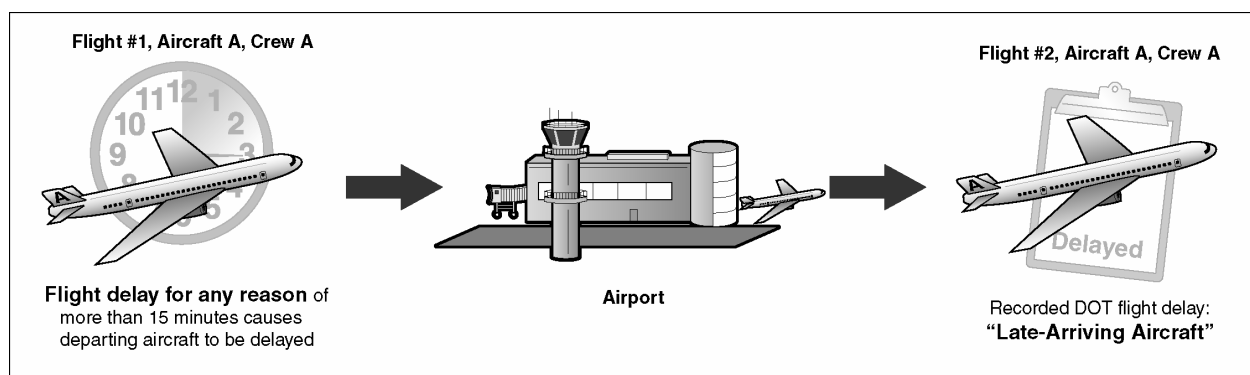
Source: GAO.

<sup>19</sup>Some airlines we interviewed, as well as the industry association that represents airlines, explained to us that crew members are expected to report for work on time, and if a crew member is consistently late for duty because of commuting problems, this would be considered a performance problem, not a crew-scheduling problem. Pilots, like other professionals, are expected to report for work on time and rested, no matter where they choose to live.

### Scenario 2: Aircraft Arrives Late

In the second scenario, depicted in figure 4, a previous flight (flight #1) is delayed, which causes a later flight (flight #2) to be delayed; the crew remains with the airplane for both flights. Since flight #2 is delayed because flight #1 arrived late to the airport, the flight #2 delay would be attributed to late-arriving aircraft and not to the reason that flight #1 was delayed. For example, if the flight #1 delay was due to the air carrier, the flight #2 delay would not be attributed to the air carrier, but would rather be reported as a delay due to late-arriving aircraft. When airlines report flight delays due to late-arriving aircraft, the underlying cause of the delay—whether it is the air carrier, the national aviation system, or any other source—is not reported. Some of the stakeholders we interviewed pointed out, and we have previously reported, that the late-arriving aircraft delay category effectively masks the underlying cause of delay.<sup>20</sup> While four airlines told us they could track the underlying cause of delay, two other airlines said they do not track the underlying cause of delay.

Figure 4: Scenario 2 - Aircraft Arrives Late



Source: GAO.

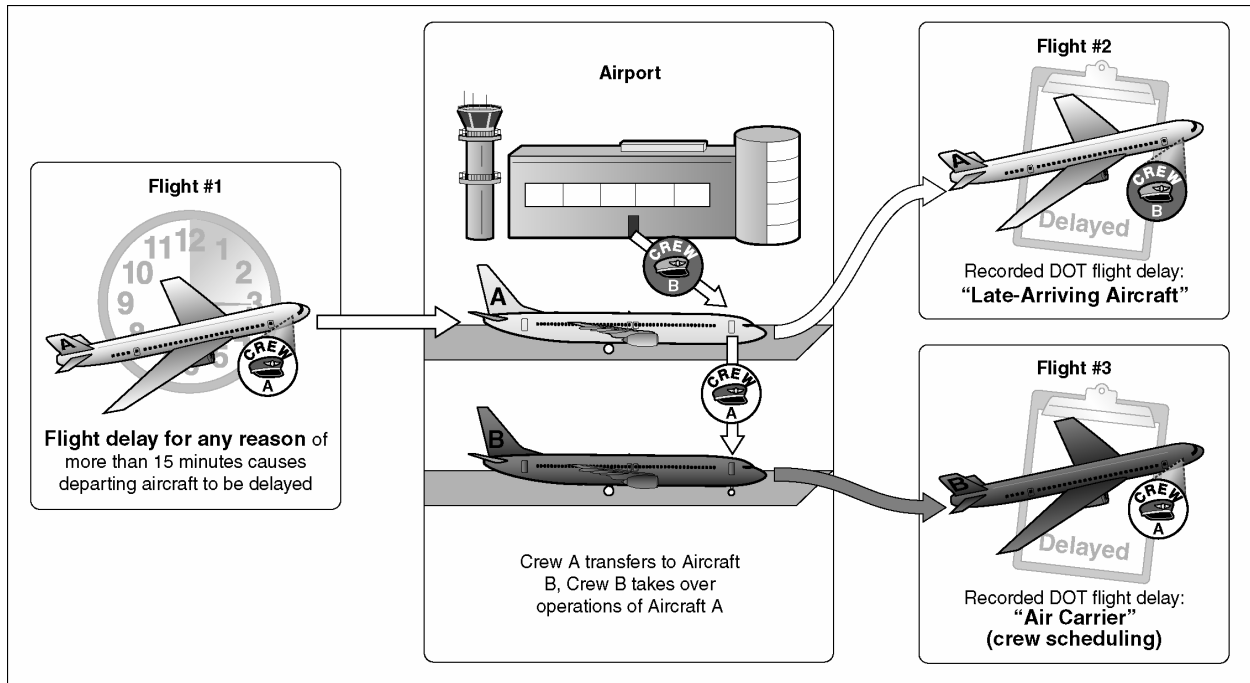
### Scenario 3: Aircraft Arrives Late and Crew Changes Planes

In the third scenario, depicted in figure 5, two flights are delayed because a previous flight arrives late, potentially creating a ripple effect. The aircraft (aircraft A) from flight #1 is scheduled to be flown by a different crew (crew B) for flight #2. Therefore, flight #2 is delayed because the aircraft is not available, and the delay is reported to DOT as being due to late-arriving aircraft. Additionally, the crew (crew A) from flight #1 is scheduled to switch planes (from aircraft A to aircraft B) and fly flight #3. Therefore, flight #3 is also delayed, although this delay would be due to a late crew and reported to DOT as an air carrier delay, regardless of the reason that flight #1 was delayed. If, as a result of earlier delays, crew A could not fly flight #3 because it would exceed their maximum allotted duty time, the flight might be canceled if no reserve crew was available to fly the aircraft. Depending on the severity of the delay, there is a potential for these delayed flights to create additional downstream delays, thereby propagating delays throughout

<sup>20</sup>GAO-08-934T.

the air travel system. According to the airlines we interviewed, these types of delays and cancellations—those caused by earlier problems—are the most frequent reason for crew scheduling delays and cancellations.

**Figure 5: Scenario 3 - Aircraft Arrives Late and Crew Changes Planes**



Source: GAO.

### **Stakeholders Identified Several Ongoing and Potential Actions That Airlines and the Government Could Take to Reduce Crew-Scheduling Delays and Cancellations**

Airlines have taken several steps to reduce the potential for delays and cancellations due to crew scheduling, including adding time to flight schedules to account for delays, using reserve crews, positioning crews in anticipation of expected weather, and scheduling crews to stay with the same aircraft between flights. Additionally, several of the airlines reported taking steps to avoid delays in the New York region—a region known for airspace congestion—such as not scheduling crews leaving New York for later flights and avoiding scheduling connecting flights out of the New York region to an airline’s hub airport. Most stakeholders also reported that modernizing the national airspace system would further reduce both crew-scheduling delays, and flight delays and cancellations overall.

## Airlines Have Implemented Several Methods to Reduce Crew-Scheduling Delays and Cancellations in Problem Areas

The 11 airlines with whom we spoke reported taking a number of common actions to reduce delays and cancellations associated with crew scheduling. These airlines track delays and cancellations to identify patterns, underlying causes, and solutions to delays and cancellations. The 11 airlines identified the following actions:

- Eight airlines reported that they added time in their schedules for flights or connections, particularly in congested areas, to account for expected delays. This added time creates a buffer, thereby reducing the likelihood of a delay.
- Seven airlines reported using their reserve crews to fly during schedule disruptions to help get the airline back on schedule. The reserve crews take the place of the crew members delayed on a previous flight, thereby helping to reduce a departure delay.
- Five airlines reported scheduling crews and aircraft together to reduce delays associated with crews changing planes, such as when making a connection at a congested hub (see fig. 5). In general, however, airlines noted that since pilots are not allowed to fly as many hours during a duty day as flight attendants or the aircraft, limiting the schedules of flight attendants and aircraft to fly with the same cockpit crew during the day would be inefficient and more expensive.

Other actions that airlines reported included making last-minute changes in crew schedules to use available crews for flights when scheduled crews are delayed or otherwise unavailable, and getting crews in position early if the airline expects poor weather.

Six airlines reported taking specific measures to address delays in the New York region, which is known to be a major source of delays in the United States.<sup>21</sup> For example, one airline told us that crews on flights originating in the New York region and other East Coast airports, particularly later in the day, will not be scheduled to fly a connecting flight, thereby reducing the potential for flight delays and cancellations from these airports to cause later flights in the system to be delayed, as depicted in figures 4 and 5. Another airline avoided scheduling connecting flights from New York through its major hub. Officials at one airline said they intentionally do not serve the New York region, since doing so is known to cause operational problems. For example, one airline reported over 60 percent of its delayed flights were attributable to problems in the New York region, such as a lengthy ground delay that could potentially disrupt the pilot's schedule if such a delay might cause the pilot to exceed the daily limit on duty time.

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<sup>21</sup>In July 2008, we reported that, for the past 10 years, the three principal commercial passenger airports in the New York region—Newark Liberty International, John F. Kennedy International, and LaGuardia—have consistently ranked at or near the bottom of DOT's list of airport on-time arrivals and departures. Since flights in and out of the New York region typically account for about one-third of the total daily flights flown throughout the national airspace system, delays in this region can have a disproportionate impact on delays experienced throughout the rest of the system. See [GAO-08-934T](#).

## Stakeholders Identified Several Government Actions to Reduce Crew-Scheduling-Related Delays and Cancellations

The majority of the airlines, aviation industry associations, and academic experts we interviewed stated that the national airspace system was the major source of delays and cancellations, and many told us that the federal government should take steps to improve the system. These stakeholders attributed many crew-scheduling delays to a precursor event in the system—such as a ground, weather, or air traffic control delay—as opposed to a crew not getting to the airplane for its first flight of the day. To help reduce crew-scheduling-related and other delays and cancellations, the stakeholders suggested a number of actions the federal government could take, which included modernizing the national airspace system and improving East Coast operations, particularly in the New York region. As we have previously reported, FAA faces significant challenges in keeping the nation’s current airspace system running as efficiently as possible, given the increasing demand for air travel.<sup>22</sup> DOT and FAA were implementing several actions that are intended to reduce flight delays for the summer 2008 travel season, but these actions will likely have a limited effect on reducing delays. Due to the high proportion of delays at the three major New York area airports, many of these actions are specifically designed to address congestion in the New York area. In fact, one-third of aircraft in the national airspace system move through the New York area at some point during a typical day, and delays in this region can have a disproportionate impact on delays experienced throughout the rest of the system. However, these ongoing and planned initiatives are not intended to significantly boost capacity, but rather to enhance efficiency and better manage delays.<sup>23</sup>

Most aviation experts believe the long-term solution to reducing delays depends largely on expanding capacity through the Next Generation Air Traffic Management System (NextGen)—a complicated effort to modernize the air traffic control system by 2025. NextGen will use satellite-based technologies and state-of-the-art procedures to handle the increasing volume of air traffic, while further improving safety and security. The transformation of the national airspace system is one of the federal government’s most complex undertakings. Although NextGen is a collaborative effort, the bulk of the responsibility for successful implementation and transition belongs to FAA. As we have reported, the agency faces a number of management challenges as it begins implementing NextGen systems and procedures.<sup>24</sup> These challenges include funding NextGen, hiring and retaining the right skill set within FAA, developing a facility plan for NextGen, meeting the research and development needs of NextGen, and establishing credibility with stakeholders regarding the agency’s NextGen efforts.

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<sup>22</sup>GAO, *Federal Aviation Administration: Challenges Facing the Agency in Fiscal Year 2009 and Beyond*, [GAO-08-460T](#) (Washington, D.C.: Feb. 7, 2008).

<sup>23</sup>As we reported in July 2008, to address delay and cancellation problems beginning in summer 2008, DOT and FAA were implementing several actions intended to reduce delays that we have categorized as capacity-enhancing initiatives and demand management policies. Capacity-enhancing initiatives are intended to increase the efficiency of existing capacity by reducing delays and maximizing the number of takeoffs and landings at an airport, while demand management policies influence demand through administrative measures or economic incentives. See [GAO-08-934T](#).

<sup>24</sup>[GAO-08-460T](#).

Another action the airlines suggested that the federal government could take to add flexibility to the crew-scheduling process was to review the federal regulations on pilot duty and rest requirements. The FARs currently limit a pilot to 8 hours of flying during a duty period for safety reasons. Five airlines we interviewed reported that the federal aviation regulations regarding pilot duty time should be revised. For example, one airline told us that it would be more efficient for them and increase their scheduling flexibility if a pilot's schedule was limited to 12 hours of duty time, rather than 8 hours of flight time, which could allow a pilot to fly across the country and back within one duty period. The Air Line Pilots Association (ALPA), an airline pilot union, also supports overhauling current flight and duty time regulations for commercial airline pilots, but for different reasons. ALPA stated it is opposed to any flight time increase beyond 8 hours in a duty day, citing concerns about current flight-crew-scheduling practices. ALPA also stated that pilots are flying more hours and working more days with longer duty hours since September 11, 2001, and that this change, along with contract revisions resulting in pay reductions, has already forced pilots to fly increased hours.

Finally, the federal government has recently begun a test program designed to evaluate expedited access to secure areas of airports for properly credentialed commercial flight deck crew members at three test airports. The Transportation Security Administration launched a 60-day test program in July 2008 called Crew Personnel Advanced Screening System, or CrewPASS,<sup>25</sup> which allows uniformed eligible flight deck crew members to enter the secure area of these checkpoints via the exit lane of the security checkpoint after presenting their airline-issued identification and another form of identification to transportation security officers (TSO). TSOs will check these credentials via a secure, real-time flight deck crew member database that includes a picture and other information to verify the individual's identity. Flight deck crew members who use this program are subject to random screening, observation by behavior detection officers, and other layers of security. ALPA stated that it supports this program because it should reduce the time that flight crew members spend in security screening lines, among other reasons.

## **Concluding Observations**

While safety is paramount to the airlines, containing costs is a fundamental goal for any industry. The airlines use computerized optimization models to schedule crews in a manner that helps minimize costs within the requirements of federal safety regulations, collective bargaining agreements, and flight schedules. Flight delays cost the airlines money. Therefore, it is in their best interest to avoid these problems, where feasible, particularly if they stem from situations within the control of the airlines, such as crew scheduling. As flight delays and cancellations have become more pervasive, airlines have taken steps to adjust their crew-scheduling practices to partially address this problem, such as by building extra time into flight schedules or keeping crews and aircraft together when flying in and out of congested airports where scheduled aircraft or crew changes compound delays. While such measures may help reduce problems with

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<sup>25</sup>CrewPASS is expected to enhance security by providing flight crew members with a dedicated portal for access to airport secure areas. CrewPASS incorporates biometric processes with a secure database to verify pilot identity and employment status.

delays and cancellations, they alone cannot solve this problem. The majority of the stakeholders with whom we spoke told us that, in general, flight delays and cancellations are mostly rooted in systemic problems with the national airspace system. Ultimately, the necessary upgrades to the national airspace system infrastructure will require a broad-based effort on the part of government and nonfederal stakeholders. As we have previously reported, the current approach to managing air transportation is becoming increasingly inefficient and operationally obsolete.

### **Agency Comments**

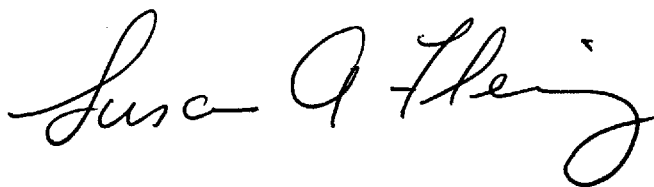
We requested comments from the Secretary of Transportation, the 11 airlines with whom we spoke, and the Air Line Pilots Association, but none were provided.

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We are sending copies of this report to the Senate Committee on Science, Commerce, and Transportation, the House Committee on Transportation and Infrastructure, other interested congressional committees, the Secretary of Transportation, and the 11 airlines with whom we spoke. We will make copies available to others upon request. In addition, this report will be available at no cost on the GAO Web site at <http://www.gao.gov>.

Should you or your staff have any questions about this report, please contact me at (202) 512-2834 or [flemings@gao.gov](mailto:flemings@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report were Mike Clements (Assistant Director), Lauren Calhoun, Bess Eisenstadt, Colin Fallon, Andrew Huddleston, Maren McAvoy, Sara Ann Moessbauer, and Josh Ormond.

Sincerely yours,



Susan Fleming  
Director, Physical Infrastructure Issues

Enclosure

## Scope and Methodology

To respond to the objectives of this report, we reviewed scheduling practices and related information about flight delays and cancellations. We requested interviews with the 12 largest domestic airlines as measured by passenger volume in 2007 reported by the Department of Transportation (DOT).<sup>26</sup> We conducted semistructured interviews with 11 of these airlines, which included a mix of legacy, low-cost, and regional airlines.<sup>27</sup> We also interviewed officials from the Federal Aviation Administration; representatives of the Air Line Pilots Association, the Air Transport Association, the Association of Flight Attendants, the Regional Airline Association, and the Air Travelers Association; and academic experts from George Mason University, the Massachusetts Institute of Technology, and the University of Michigan.

To describe how airlines schedule crews and the policies and requirements that this process follows, we reviewed relevant federal regulations and collective bargaining agreements between airlines and pilots available from the National Mediation Board. We also discussed these policies and requirements with the airlines.

To evaluate the extent to which crew scheduling may contribute to flight delays and cancellations, we reviewed available data from DOT and gathered and analyzed data from the 11 airlines we interviewed. We interviewed DOT about the accuracy and reliability of its data on airlines' on-time performance, which include data on flight delays and cancellations, and determined that these data were sufficiently reliable for the purposes of this report. Additionally, the airlines from which we received data assured us that their data were audited and reviewed; therefore, we determined that these data were sufficiently reliable for the purposes of this report. Data on crew-scheduling-related delays and cancellations are not publicly reported, and we were not able to independently verify their accuracy. However, we asked the 11 airlines that we interviewed about the steps they take to verify the accuracy and reliability of their data. We also corroborated the findings arising from these data with aviation stakeholders and academic experts who confirmed that the magnitude of delays and cancellations were consistent with the data provided by the 6 airlines. In addition, the data from different airlines may not be comparable because of differences in how the airlines gather these data. Finally, these data are illustrative of recent delays and cancellations due to crew scheduling at the 11 airlines we interviewed and do not necessarily represent the entire industry.

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<sup>26</sup>We requested data from and interviewed officials representing AirTran Airways, Alaska Airlines, American Airlines and American Eagle, Continental Airlines, Delta Air Lines, JetBlue Airways, Northwest Airlines, Southwest Airlines, United Airlines, and US Airways. Skywest Airlines did not respond to our request.

<sup>27</sup>Legacy airlines predate airline deregulation of 1978 and all have adopted a hub-and-spoke network model that can be more expensive to operate than a simple point-to-point service model. Low-cost airlines have generally entered the market since 1978, are smaller, and generally employ a less costly point-to-point service model. Regional airlines generally employ much smaller (under 100 seats) aircraft and provide service under code-sharing arrangements with larger legacy airlines for which they are paid on a cost-plus or fee-for-departure basis to provide capacity. Many regional airlines are owned by a legacy parent, while others are independent.



## Enclosure I

We conducted our work from March 2008 to September 2008 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the study to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our study objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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