Office of Inspector General

Flight Delays and Cancellations

Federal Aviation Administration

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Memorandum

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

Subject: **ACTION**: Flight Delays and Cancellations
CR-2000-122

Date: September 25, 2000

From: Alexis M. Stefani
Assistant Inspector General for Auditing

Reply to Attn. of: JA-50

To: Federal Aviation Administrator

On September 14, 2000, at a hearing of the Commerce, Science and Transportation Committee, U.S. Senate, we provided testimony on key issues facing the Federal Aviation Administration (FAA) with respect to flight delays and cancellations and the implications of airline scheduling, Air Traffic Control (ATC) modernization, airport infrastructure, and safety. Our statement addressed several areas that need special management attention in the immediate term (1 to 2 years), the intermediate term (4 to 5 years), and the long term (8 to 10 years). A copy of our statement is attached.

A key issue we addressed at the hearing was the need for benchmark measurements of the capacity of the Nation's top 30 airports. A set of capacity benchmarks is essential in helping understand the true impact of airline scheduling practices and what relief can realistically be provided—without compromising safety—by new technology, revised ATC procedures, and runway and airport infrastructure enhancements. We are not suggesting in any way that there should be scheduling controls, but FAA, the airlines, and the public need benchmarks to determine what can reasonably be expected of the system, in the near and long term, including what level of inconvenience. Beyond establishing benchmarks, FAA needs to explain, in clear terms, the extent to which the ATC modernization effort can be expected to provide material relief to the current problem of delays and cancellations. This is needed because much of the ATC modernization effort is not geared to making quantum leaps in increasing capacity.

At the hearing, FAA agreed with the need for capacity benchmarks and for measuring the capacity benefits of new ATC technology. To that end, FAA is developing capacity rates for the Nation's largest airports. In addition, FAA has been working closely with the major airlines in developing the Aviation System Performance Metrics (ASPM). This system, which became operational in April 2000, measures the

extent to which departure and arrival demand exceeds airport capacity based on adjustable rates. With some minor modifications, ASPM could serve as the platform for measuring excess volume—after reasonable benchmarks are developed for the major airports.

Accordingly, we recommend that FAA:

1. Complete development of capacity benchmarks for departures and arrivals by time of day at the Nation's 30 largest airports.

2. After the benchmarks are completed, use ASPM (or a comparable system) to regularly measure and report on the extent of excess volume.

3. Incorporate benchmarks into future strategic and performance plans to measure system-wide improvements in capacity.

4. Identify in clearer terms the capacity benefits expected from new ATC technology (for example, Free Flight).

In accordance with DOT Order 8000.1C, we would appreciate receiving your written comments within 30 days. If you concur with our recommendations, please indicate the specific action taken or planned and the target date for completion for each recommendation. If you do not concur, please provide your rationale. Furthermore, you may provide alternative courses of action that you believe would resolve the issues.

We appreciate the courtesies and cooperation extended by your staff. If you have any questions or need further information, please contact me at (202) 366-1992 or Darren Murphy, Project Manager, at (206) 220-7754.

Attachment

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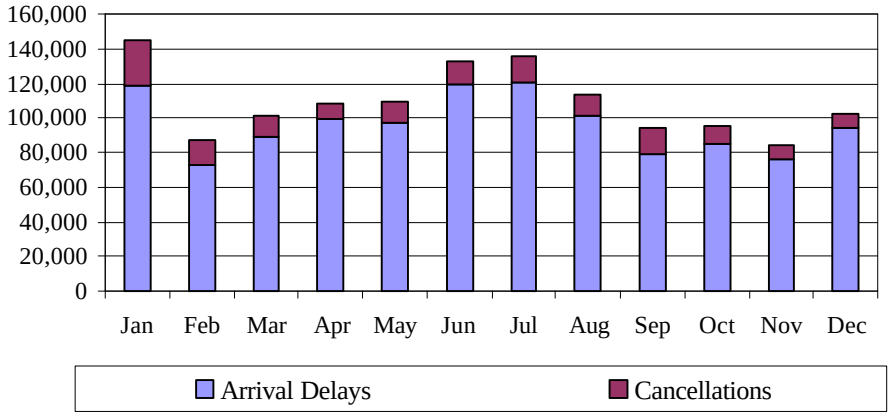
Mr. Chairman and Members of the Committee:

We appreciate the opportunity to discuss flight delays and cancellations and the implications of airline scheduling, Air Traffic Control (ATC) modernization, airport infrastructure, and safety.

By all accounts, the first 7 months of 2000 experienced the highest number of delays and cancellations of any similar period since 1995. Over the next few months, we have a small window of opportunity to identify needed solutions and to begin acting on them. Historically, air travelers have experienced the most problems during the winter and summer months, as illustrated in Figure 1.

Figure 1: Arrival Delays and Cancellations by Month, 1999 (BTS Data)



Over the past year, the Secretary and the Federal Aviation Administrator have announced a number of actions to address the growth in flight delays and cancellations, including the Spring/Summer 2000 initiative for managing air traffic. Most recently, the Secretary formed three task forces with mandates to determine the causes of delays and cancellations, to identify "best practices" in providing better service and information to air travelers, and to expedite investment in technology and infrastructure. These initiatives have the potential to make inroads in addressing the growing problem of flight delays and cancellations.

Mr. Chairman, the potential contribution that can be made by these initiatives will be greatly constrained until a key question is answered and that question lies at the heart of the debate about delays and cancellations and what can be done about them. That question is what traffic load can the ATC and airport systems reasonably be expected

to accommodate—in the immediate term (over the next l or 2 years), the intermediate term (4 or 5 years), and the long term (8 to 10 years)?

More specifically, what is the traffic departure and arrival rate by time of day at the top 30 airports that can be accommodated without experiencing major delays or compromising safety? A set of capacity benchmarks is essential in helping understand the true impact of airline scheduling practices and what relief can realistically be provided by new technology, revised ATC procedures, and runway and airport infrastructure enhancements—using the funding provided by AIR-21.[1] We are not suggesting in any way that there should be scheduling controls, but the Federal Aviation Administration (FAA), the airlines, and the public need benchmarks to determine what can reasonably be expected of the system, in the near and long term, including what level of inconvenience.

Yet, in what may be a surprise to many, we currently do not have clarity on what traffic load the ATC and airport systems can reasonably be expected to safely and efficiently process or whether the ATC modernization effort should be expected to provide major relief. The Secretary, the task forces recently commissioned by him, FAA, the Congress, and the airlines must have this information to get at the core issues. Without it, our ability to understand the impact of flight volume on flight delays and cancellations, and, in turn, to make informed decisions is severely constrained.

The relevance of these points, in the time frames I mentioned—immediate, intermediate, and long term, is this—new runways or airports or ATC technology that may be in place 5 or 10 years from now hold promise for the future, but they offer limited or no bottom line relief over the next few years. Also, as our detailed testimony indicates, we think FAA needs to explain in clear terms the extent to which the ATC modernization effort can be expected to provide material relief to the current problem of delays and cancellations. This is because much of the modernization effort is not geared to making quantum leaps in increasing capacity. The answer lies in a cumulative mix of solutions—scheduling and technology are among them. However, the role played by ground infrastructure—runways and airports (and the airlines that use them) is of enormous importance; mainly because of the large impact that ground infrastructure has to play and the decisionmaking associated with building and locating either a new runway or airport requires clearance by local communities.

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[1] The Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (Public Law 106-181, April 5, 2000).

Flight Delays and Cancellations

Flight delays and cancellations are key indicators for measuring the health of the National Airspace System. These indicators highlight growing problems that require immediate attention. The following provides some key findings from our recent report[2] on flight delays and cancellations.

- FAA reported a 58 percent increase (from 236,802 to 374,116) in flight delays between 1995 and 1999. The Bureau of Transportation Statistics (BTS) reported an 11 percent increase (from 1,863,265 to 2,076,443) in delays during this same period.

- Cancellations grew at an even faster pace, increasing 68 percent (from 91,905 to 154,311) between 1995 and 1999.

- Overall, 1 in 5 flights (1,152,725 of 5,527,884) arrived late in 1999, with each delay averaging about 50 minutes. When cancellations are added, nearly 1 in 4 flights (1,307,036 of 5,527,884) either arrived late or were canceled in 1999.

- Most delays take place on the ground during gate departure, taxi-out, and taxi-in.

- The number of taxi-out times of 1 hour or greater increased 130 percent (from 17,164 to 39,523) between 1995 and 1999. Flights with taxi-out times of 2, 3, and 4 hours increased at an even faster pace (that is 186; 216; and 251 percent, respectively).

- Airlines have expanded flight schedules on 82 percent of their domestic routes (1,660 of 2,036) between 1988 and 1999, ranging from 1 to 27 minutes, to compensate for growing ground and air delays.

For the first 7 months of 2000, these trends have only gotten worse. For example:

- FAA reported an additional 11 percent increase (from 227,719 to 251,874) in delays over the same period in 1999.

- Cancellations were also up an additional 10 percent (from 101,814 to 112,253) when comparing the first 7 months of 1999 with 2000.

- The average arrival delay is almost 54 minutes.

- Overall, 877,661 domestic flights either arrived late or were canceled between January and July 2000, affecting over 90 million passengers.

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[2] Audit Report No. CR-2000-112, Air Carrier Flight Delays and Cancellations, July 25, 2000.

- Consumer complaints to the Department have risen dramatically, more than doubling (from 7,980 to 17,381) between 1998 and 1999, with an additional 47 percent increase (from 8,697 to 12,772) during the first 7 months of 2000.

It is important to note that FAA and BTS use very different methodologies for determining flight delays.[3] These differences can lead to somewhat confusing results. For example, FAA collects data on flight delays via the Operations Network (OPSNET). OPSNET data come from FAA personnel who manually record aircraft that were delayed by 15 minutes or more after coming under FAA's control, i.e., the pilot's request to taxi-out. As such, an aircraft could wait an hour or more at the gate or ramp area before requesting clearance to taxi. So long as the flight, once under FAA's control, took off within 15 minutes of the airport's standard taxi-out time, the flight would be considered an on-time departure.

Conversely, the major airlines submit monthly flight data to BTS. According to BTS, a flight is counted as "on time" if it departed or arrived within 15 minutes of scheduled gate departure or arrival times shown in the airline's reservation system. Using this definition, an aircraft could wait an hour or more on the airport taxiway for

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[3] A key reason for differing data maintained by FAA and BTS is in how each uses the information it collects. For FAA, delay information serves to measure system-wide ATC performance as well as to identify areas for improvement. For BTS, measuring delays (and subsequent ranking of the major airlines by on-time arrival performance) serves as a source of air travel information to consumers and helps to ensure more accurate reporting of flight schedules by the airlines.

takeoff and be reported by BTS as having departed on time if it left the gate within 15 minutes of its scheduled departure.

Flight Volume and Aviation Safety

One of the driving forces behind flight delays and cancellations has been the growth in flight volume. Such growth must be considered in arriving at workable solutions—a point discussed at the Secretary's August Summit with the Nation's airline executives. Between 1995 and 1999, the total number of operations at the Nation's airports increased over 8 percent, from approximately 115.6 million to 125.3 million.[4] Similarly, since 1995, the number of passenger enplanements rose nearly 16 percent, from approximately 582 million to 674 million.[5] These trends have continued into the first 6 months of 2000, with the 10 major airlines reporting a 3.7 percent increase in scheduled flights and a 5.8 percent increase in the number of passengers over the same period in 1999.

Against the backdrop of increases in flight delays, cancellations, and flight volume is the growth in runway incursions and operational errors. Runway incursions are incidents on the runway that create a collision hazard. Operational errors occur when

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[4] Flight operations, as reported by FAA, include takeoffs and landings by all types of aircraft (e.g., commercial, general aviation, and military) at approximately 3,400 domestic airports.

[5] Operations and enplanement data for 1999 were based on FAA projections.

an air traffic controller does not ensure that FAA separation standards are maintained between aircraft. As data show:

- Runway incursions increased 34 percent (from 240 to 321) between 1995 and 1999. In the first 8 months of 2000, there were 288 runway incursions, a 39 percent increase from the same period in 1999. If this trend continues, runway incursions may surpass 400 by the end of 2000, a new high.

- Operational errors increased 23 percent (from 764 to 939) between Fiscal Years 1996 and 1999. In the first 11 months of Fiscal Year 2000, there were 1,053 operational errors, surpassing the 939 operational errors that occurred in all of Fiscal Year 1999.

To counter trends in runway incursions, FAA held a Runway Safety National Summit in June and has developed new initiatives that focus on reducing runway incursions in the near-term. FAA must now follow through on initiatives at the national and local levels to reverse the upward trend of runway incursions. FAA must also identify and evaluate emerging technologies that can be advanced quickly for use by pilots and air traffic controllers at airports that are a high-risk for incursions. Likewise, FAA should determine actions needed to reduce operational errors at its air traffic facilities that continue to show increases in the number and rates of operational errors.

Airline Scheduling

There has been much debate in recent months as to the role played by airline scheduling in causing delays. Fundamental to understanding the relationship between delays and scheduling is gaining an appreciation of how the "Hub and Spoke" system works. Following deregulation in 1978, most of the major airlines began using the Hub and Spoke system. A hub airport is analogous to a switching center. In its simplest form, passengers arrive on inbound routes, or spokes, join other passengers arriving on different flights, and transfer to aircraft departing on outbound spokes.

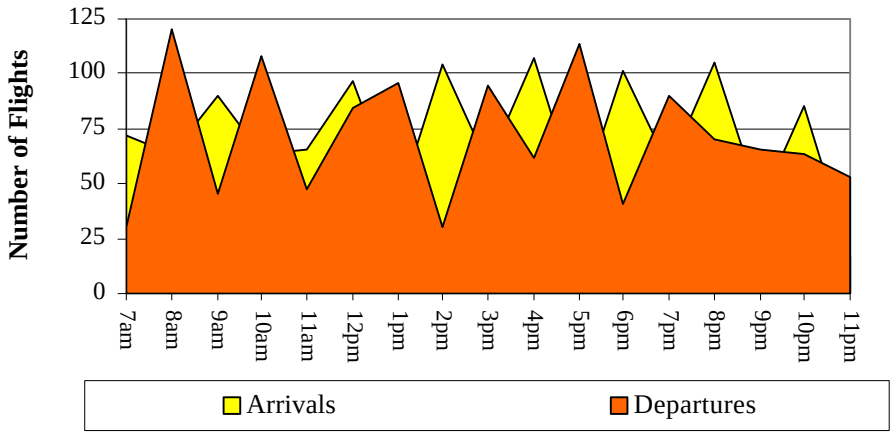
A key aspect of this system is the concentration of flights and passengers into the various hub airports. For example, just five airports (Atlanta, O'Hare, Dallas/Ft. Worth, Los Angeles, and Phoenix) comprised nearly a third of the passengers handled by the 10 major airlines in 1999. While the concentration of passengers and flights at these airports is seen by the airlines as providing significant operational efficiencies, the Hub and Spoke system also presents some operational inefficiencies, especially when one or more of the hubs break down.

For example, on April 3, 2000, poor weather caused a significant reduction in flights to and from Atlanta. Because of the interconnectivity of Atlanta (the hub) to various other airports (the spokes), the number of delays “rippled” throughout the system,

affecting over 50 airports. Overall, FAA reported 1,317 delays system-wide, of which 405 (31 percent) were due to weather conditions at Atlanta.

Beyond the concentration of flights at the largest airports, we found that one outcome from the Hub and Spoke system is the banking of flights into sizeable departure and arrival "pushes" at most of the major airports. Such pushes, as illustrated by Figure 2, place enormous demands on the ATC system's ability to efficiently manage the flow of traffic, both on the ground and in the air.

Figure 2: Atlanta Scheduled Departures and Arrivals (July 17, 2000)



The extent to which these departure or arrival pushes exceed capacity, however, is difficult to quantify due to the lack of a firm benchmark for measuring capacity. FAA uses fluid departure and arrival acceptance rates. These rates exist for most of the major airports, but are used primarily to manage the flow of air traffic, not as a benchmark or gauge for measuring the relationship between capacity and scheduling.

Specifically, on July 17, 2000, Newark's departure and arrival acceptance rates were adjusted to accommodate an increase in scheduled departures from 2 p.m. to 5 p.m. (see Figures 3 and 4). By adjusting the rates, however, Newark's ATC effectively shifted the airport's capacity from the arrival to the departure side, resulting in an excess number of scheduled arrivals. Overall, Newark experienced 75 arrival delays on July 17, 2000, of which 20 occurred between 2 p.m. and 5 p.m. It is also important to note that FAA reported good visibility at the airport during these 3 hours.

Figure 3: Newark's Capacity Rates vs. Scheduled Departures (7/17/2000)

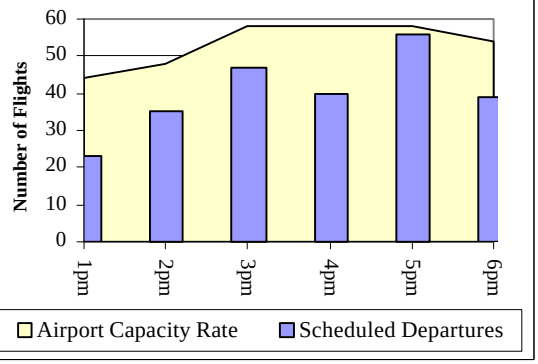
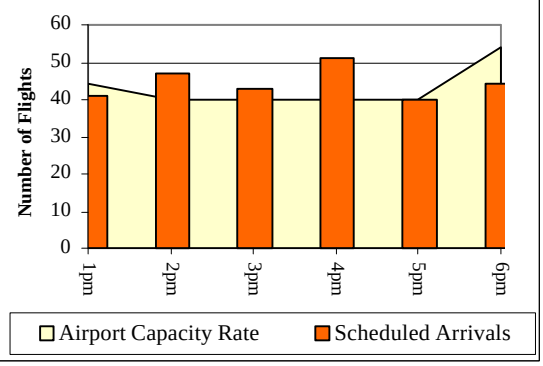


Figure 4: Newark's Capacity Rates vs. Scheduled Arrivals (7/17/2000)



In comparison, Seattle's departure and arrival rates were held constant between 11 a.m. and 3 p.m. on July 10, 2000, even though there was an increase in scheduled departures during the early afternoon (see Figures 5 and 6). Overall, Seattle experienced 96 departure delays on July 10, 2000, of which 23 occurred between 12 p.m. and 3 p.m. Weather may have played a role in some of these delays, since visibility was a problem at Seattle from 12 p.m. to 1 p.m.

Figure 5: Seattle's Capacity Rates vs. Scheduled Departures (7/10/2000)

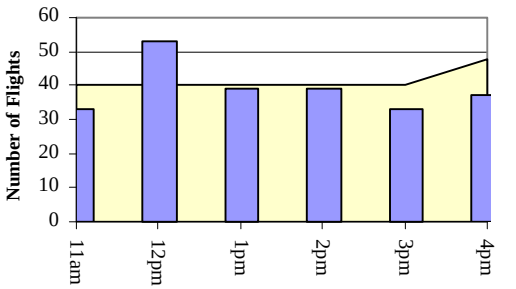
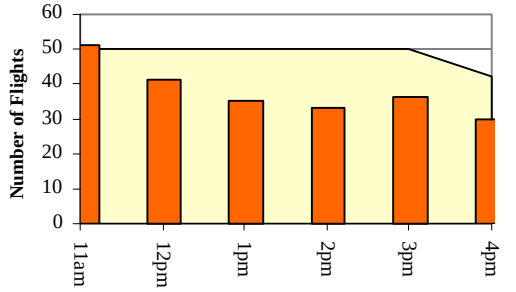


Figure 6: Seattle's Capacity Rates vs. Scheduled Arrivals (7/10/2000)



Flexible rates are important as a traffic management tool, since both FAA and the airlines need to work within existing and changing operating conditions; but they do little in helping measure the extent of excess demand. FAA (in consultation with the aviation industry) needs to establish a set of capacity benchmarks or gauges for the top airports that measure what the system can reasonably be expected to handle given normal operating conditions by time of day. Such benchmarks would go far in helping all stakeholders understand the impact of volume on flight delays, as well as devising the necessary solutions.

Over the last 6 months, FAA has been working closely with the major airlines in developing the Aviation System Performance Metrics (ASPM). This system, which became operational in April 2000, measures the extent to which departure and arrival demand exceeds airport capacity based on fluctuating rates. With some minor modifications, ASPM could serve as the platform for measuring excess volume—

once reasonable benchmarks are developed for the major airports. The information obtained from this effort will be critical in ensuring the success of the Secretary's recently announced task forces.

Air Traffic Control Equipment

The Congress, industry, and the traveling public need to know what can be realistically expected from FAA's investments in new technology in the immediate, intermediate, and long term, exclusive of airport improvements. There is a good deal of confusion on this point. FAA spends about $2 billion annually on various ATC modernization efforts. Given the framework established by AIR-21, FAA will invest about $8.6 billion on modernization initiatives between Fiscal Years 2001 and 2003. With this in mind, there are several factors to consider.

- First, much of FAA's modernization efforts are not geared toward enhancing capacity and reducing delays. The main objective of some projects was to replace aging equipment with modern technology that is easier to operate and maintain. For example, the Standard Terminal Automation Replacement System ($1.4 billion) and the Display System Replacement ($1.1 billion) efforts provide controllers with new computers and workstations. While these systems provide the platforms for future initiatives, they do not, in and of themselves, provide capacity enhancements.

- Second, FAA's Free Flight Phase 1 (FFP1) initiative with an estimated cost of over $700 million (Fiscal Years 1998 to 2004) is now the agency's key effort for enhancing capacity in the immediate and intermediate term. FFP1 is an *initial step toward* Free Flight and is a limited deployment of new information sharing technologies and automated controller tools at selected locations. Expectations for FFP1 are high.

  FFP1 will help in the sense that it will provide incremental improvements but it should not be viewed as a panacea. For example, the passive Final Approach Spacing Tool[6] is helping controllers land about 1.4 to 2 additional aircraft at Dallas/Fort Worth Airport during peak periods. Also, new collaborative information sharing systems are helping FAA and airlines manage the impacts of adverse weather.

  Considerable work remains with FFP1's automated controller tools, and FAA is not scheduled to have a firm handle on bottom line impacts on reducing delays and enhancing capacity from these technologies until 2002 when FFP1 systems are fully deployed. FAA is preparing a plan for the geographic expansion of FFP1 technologies. It is not a question of whether or not to expand FFP1 initiatives to

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[6] The passive Final Approach Spacing Tool, or "pFAST" for short, was pioneered by the National Aeronautics and Space Administration and helps controllers sequence aircraft for landing. It provides a sequencing number and runway assignment for each arriving aircraft.

other locations but rather one of deciding at what pace and where to provide the most benefits in terms of enhancing capacity and reducing delays.

- Finally, new communication, navigation, and surveillance technologies for enhancing capacity and moving toward Free Flight are longer-term efforts. These efforts include, among others, satellite navigation ($3.7 billion) and Controller Pilot Data Link Communications ($166 million for initial steps). FAA analyses show that a sizable portion of benefits from satellite navigation is the time passengers are expected to save once the system is in place. However, these savings include small increments of time—a minute or less per trip—which passengers may not value and the benefits accrue over many years. FAA recognizes that the true benefits of some of these new systems have not been conclusively quantified.

Obtaining benefits from these cutting-edge technologies in terms of reduced flight times, closer spacing of aircraft, and more flexible routes depends on several complex issues, including synchronized investments by FAA (new ground systems) and industry (new avionics).[7] For example, realizing the benefits of satellite-based navigation is contingent upon large numbers of airspace users equipping with new avionics and resolving complex performance and safety issues

[7] For additional details about the benefits of new communication, navigation, and surveillance technologies, see OIG Report no. AV-1999-057, FAA's Progress and Plans for Implementing Data Link for Controllers and Pilots, February 24, 1999.

that recently emerged.[8] Moreover, the full benefits from new communication, navigation, and surveillance technologies will not be realized until new ATC procedures and airspace redesign efforts are implemented.

Airport Enhancements

Aside from FAA's modernization efforts, capacity can also be increased through new runways and airport facilities. Although FAA will provide, through AIR-21, about $9.9 billion in airport improvement funds between Fiscal Years 2001 and 2003, many of the runway projects being funded will not be completed for many years.

As noted in the following table, between 1991 and 1999, a total of 5 new runways were added at the 29 largest airports, [9] with another 15 either under construction or proposed.[10] With the exception of two of these new runways, most will not be opened for another 3 to 7 years.

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[8] For additional information on progress and problems with FAA's satellite navigation efforts and anticipated benefits, see OIG Report no. AV-2000-113, Observations on FAA's Satellite Navigation Efforts, July 26, 2000.

[9] In addition to these runways, the Denver International airport was opened in 1995.

[10] The 15 runways will cost approximately $4.5 billion, according to FAA estimates.

New Runways at Large Hub Airports, 1991 through 2007

City, State	Year Work Begun	Opening Date	Status
Las Vegas, NV		1991	Completed
Detroit, MI		1993	Completed
Salt Lake City, UT		1995	Completed
Dallas/Ft. Worth, TX		1996	Completed
Philadelphia, PA		1999	Completed
Phoenix, AZ	1997	2000	Under Construction
Detroit, MI	1999	2001	Under Construction
Minneapolis, MN	1999	2003	Under Construction
Orlando, FL	2000	2003	Under Construction
Denver, CO		2003	
Houston, TX		2003	
Miami, FL		2003	
Charlotte, NC		2004	
Atlanta, GA		2005	
Boston, MA		2005	
Cincinnati, OH		2005	
Washington Dulles, VA		2006	
Seattle, WA	1999	2006	Under Construction
St. Louis, MO		2006	
Dallas-Ft. Worth, TX		2007	

FAA estimates that any increase in capacity as a result of adding a new runway will vary widely from airport to airport. For example, Phoenix airport officials estimate that its new runway, which will become operational on October 5, 2000, will increase capacity by 20 to 25 percent. In comparison, airport officials in Seattle noted that their new runway, which is scheduled to open in 2006, will provide added capacity during low visibility, which occurs a significant percentage of time.

Whereas AIR-21 provides substantial resources for funding these as well as future airport improvements, the extent to which such improvements will come in the form of new airports (that the airlines will use) and new runways remains to be seen. Moreover, unlike technology enhancements and revised ATC procedures, construction of new runways, longer runways, and new airports clearly requires approval by local communities. They simply cannot be accomplished independent of the needs and desires of the surrounding communities and airlines. As illustrated by the Mid-America Airport, establishing a new commercial airport does not necessarily guarantee its use by the airlines.

Mr. Chairman, this concludes my statement. I would be happy to answer any questions you might have.