



United States  
General Accounting Office  
Washington, D.C. 20548

**Resources, Community, and  
Economic Development Division**

B-281891

January 29, 1999

The Honorable James L. Oberstar  
Ranking Minority Member  
Committee on Transportation  
and Infrastructure  
House of Representatives

Subject: National Airspace System: Observations on American Airlines' 1997 Study of  
Future Air Traffic Congestion

Dear Mr. Oberstar:

In 1995, the Federal Aviation Administration (FAA) estimated that airline delays caused by air traffic congestion increased the industry's operating expenses by approximately \$2.5 billion per year. That cost is higher today and is expected to grow with increasing congestion in the air traffic system. In a 1997 study entitled Free Flight: Preserving Airline Opportunity, American Airlines concluded that by 2005 airline flight delays would negatively affect airlines' ability to operate their flight schedules and by 2014 these delays could become even more severe. Others, such as the National Civil Aviation Review Commission, have also concluded that delays are likely to grow at an ever-increasing rate,<sup>1</sup> producing additional negative effects on the National Airspace System<sup>2</sup> and on the nation's economy as a whole.

In preparation for an upcoming congressional debate on the reauthorization of FAA's programs, you asked us to review American Airlines' study and provide our observations on its findings. We also reviewed other studies of air traffic congestion, assessed the limitations of these types of studies, and identified next steps in addressing the problem of air traffic congestion.

<sup>1</sup> In 1996, the Congress established the National Civil Aviation Review Commission to review FAA's financing and evaluate FAA's safety programs. The Commission issued its report, Avoiding Aviation Gridlock and Reducing the Accident Rate: A Consensus for Change, in Dec. 1997.

<sup>2</sup> The National Airspace System consists of the air traffic control system--a vast network of radars and automated data processing, navigation, and communication equipment--and air traffic control facilities. Other components include airports or landing areas; rules, regulations and procedures; and personnel and material.

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In summary, American Airlines' study focused on two scenarios of future air traffic congestion. Under the first scenario--most frequently cited by others--the study found that by 2005 airline flight delays would interfere with airline flight schedules and by 2014 these delays would have a crippling effect on scheduled flight operations. This scenario assumed that air traffic would grow at a rate of 2.3 percent annually and that the current National Airspace System would not be modernized. We found, as did American Airlines, that the "do nothing" scenario is unrealistic because it ignores various actions under way or planned by FAA and others to alleviate future air traffic congestion. The second scenario also assumed that air traffic would grow by 2.3 percent annually, but in contrast to the first scenario, it factored in plans to modernize the National Airspace System. Under this scenario, American Airlines concluded that with the implementation of a new system of air traffic management known as free flight,<sup>3</sup> delays through 2025 would be substantially shorter than the average delay of 1.5 minutes experienced in 1996.

Officials from two consulting firms that also studied air traffic congestion--MITRE Corporation and the Logistics Management Institute (LMI)--told us the American Airlines study was important because it elevated a problem that had not received sufficient attention. However, these officials also stated that the value of the study was limited because it did not discuss in detail (1) air traffic congestion at lower altitudes, where MITRE and LMI consider the problem to be most severe, and (2) the methodologies and sources of data that were used to develop the study's results. In addition, we found that studies of future air traffic congestion are inherently limited by the difficulty of predicting factors such as air traffic growth and the impact of new technologies and procedures.

#### OVERVIEW OF AMERICAN AIRLINES' STUDY

In 1997, American Airlines conducted its Free Flight: Preserving Airline Opportunity study to answer key concerns about investments in free flight technologies. The airline wanted to determine at what point in the future its scheduled flight operations would be constrained by congestion in the National Airspace System. The study included two principal goals: (1) to determine the impact of future air traffic congestion on airline flight schedules and (2) to compare its results with those of other industry studies conducted to date. In performing this study, American Airlines used a model that simulated future air traffic congestion at higher altitudes<sup>4</sup> under two scenarios (see enc. I). The first scenario assumed that air traffic would grow at a rate of 2.3 percent

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<sup>3</sup> Free flight is to provide controllers and pilots with new technologies and procedures that will allow them to increase the safety, capacity, and efficiency of air traffic operations throughout the National Airspace System.

<sup>4</sup> In general, higher altitudes refer to airspace above 18,000 feet, while lower altitudes refer to airspace from the surface up to 10,000 feet.

annually and that the current National Airspace System would not be modernized. The second scenario assumed the same rate of growth in air traffic, but unlike the previous scenario, it incorporated a new system of air traffic management known as free flight into the current National Airspace System.<sup>5</sup>

Under the first scenario, American Airlines concluded that the current air traffic system would begin to experience serious delays by 2005 and that these delays could increase substantially by 2014. American Airlines also concluded under this scenario that each flight within U.S. airspace would incur an average air delay of about 4 minutes in 2014--up from an average delay of about 1.5 minutes in 1996.<sup>6</sup> Although the study did not elaborate on the significance of such air delays, it suggested that an air delay of 4 minutes could create a ripple effect throughout the system that would result in a ground delay of up to 2 hours at the nation's 50 busiest airports. However, because American Airlines maintained that the data for its study are proprietary, we were unable to independently assess the significance of a 4-minute air delay or determine how it could result in delays of up to 2 hours on the ground.

Under the second scenario, American Airlines concluded that with the implementation of free flight, delays through 2025 would be substantially shorter than the average delay of 1.5 minutes experienced in 1996. In arriving at this conclusion, American Airlines assumed that distances between aircraft could be reduced from the current 7 miles to 3 miles at higher altitudes and 4 miles to 2 miles at lower altitudes. Eventually, however, American Airlines concluded that more runways would be needed to allow the airline to continue to run its scheduled operations efficiently.

According to American Airlines, its study was complemented by other studies that used similar assumptions with different methods and models. Of particular interest, American Airlines noted, were studies by MITRE and LMI.

### COMPARISON OF AMERICAN AIRLINES' STUDY WITH OTHER STUDIES

Like American Airlines, MITRE and LMI found that air traffic congestion is likely to be a problem in the future if FAA, airports, and airlines do nothing to address this problem. However, the authors of all three studies agreed that this "do nothing" assumption is unrealistic. While American Airlines focused its analysis on air traffic congestion at higher altitudes, MITRE and LMI focused their analyses on congestion at lower

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<sup>5</sup> To approximate conditions in the future National Airspace System under free flight, the study used reduced separation distances between aircraft as a surrogate for modernization. Ultimately, new technologies and procedures planned under free flight are expected to allow for safe reductions in these distances.

<sup>6</sup> According to American Airlines, 4 minutes is commonly used as the limit of average delay for on-time scheduled airline operations in airport capacity studies.

altitudes, where they consider the problem to be most severe. According to MITRE and LMI, congestion at lower altitudes contributes to congestion at higher altitudes. Despite these limitations, MITRE and LMI officials stressed that the American Airlines study was important because it highlighted a problem that had not yet received sufficient attention.

In performing a limited analysis of domestic air traffic congestion, MITRE found that except in a small fraction of airspace, air traffic congestion is a limited problem at higher altitudes today. Assuming that FAA's current modernization initiatives--such as free flight--are implemented as planned, MITRE concluded that serious widespread congestion at higher altitudes is not likely to materialize for at least another decade.

At lower altitudes, MITRE found that congestion is already substantial at major airports and is expected to grow. Assuming the same annual 2.3-percent increase in air traffic as American Airlines assumed, MITRE predicted the need for a 60-percent increase in airport capacity by 2015 to maintain delays at today's levels. MITRE suggested that a combination of new runways and new operating procedures enabled by technology (such as new tools expected to improve controllers' ability to efficiently sequence air traffic) could allow reductions in the required distance between aircraft and substantially augment airport capacity. MITRE is now embarking on a more detailed analysis.

LMI also found in its analyses of air traffic delays that congestion is currently minimal at higher altitudes. According to LMI officials, congestion is found at lower altitudes, especially around 10 to 15 major airports, such as JFK International Airport. They also stated that congestion at lower altitudes would worsen over time. As a first step toward addressing this problem, LMI suggested that the aviation community maximize the use of existing concrete (such as runways and gates) with new technologies. Eventually, LMI believes that airlines may have to make better use of underutilized airports or readjust their flight schedules.

#### LIMITATIONS OF AIR TRAFFIC CONGESTION STUDIES

We found that any study of air traffic congestion is limited by many variables and these variables are subject to change. Specifically, we found that

- estimating traffic growth rates with any degree of confidence is extremely difficult, given fluctuations in economic conditions in the United States and abroad;
- airlines' plans to reconfigure operations remain unknown;
- the impact of new technology is uncertain;

- FAA's ability to deliver new technologies on time with the expected benefits (e.g., free flight) is questionable in view of the agency's poor modernization track record; and
- airports' plans for expansion are unknown because funding and other variables are uncertain.

#### NEXT STEPS IN ADDRESSING AIR TRAFFIC CONGESTION

To address future air traffic congestion, close coordination among FAA, airports, and airlines will be necessary to identify bottlenecks and their causes and to develop solutions to the congestion problem. Because air traffic congestion problems vary in degree with factors such as the (1) location and layout of an airport and (2) complexity of airspace, no single solution can mitigate congestion. As a result, more detailed studies—tailored to analyze problems at specific airports and/or in sections of airspace—will be important in determining the impact of any proposed course of action (such as the use of new technologies and procedures) on air traffic congestion.

#### SCOPE AND METHODOLOGY

To provide our observations on the findings of the American Airlines study, we (1) analyzed the study, (2) compared the study's findings with those of other air traffic congestion studies conducted by the MITRE Corporation and by the Logistics Management Institute, and (3) interviewed the authors of these studies. We did not independently verify the projections of any of these air traffic congestion studies and could not have done so for the American Airlines study, since the airline regarded its data as proprietary information. We also assessed the limitations on performing any air traffic congestion study and determined the next steps needed to help resolve air traffic congestion. To gain a better understanding of the limitations of air traffic congestion studies, we compared past air traffic growth projections with actual growth, reviewed the types of assumptions used to conduct these analyses, and consulted with economic experts. Through consultations with the studies' authors and our prior work in this area, we identified important next steps in addressing air traffic congestion. We conducted our review from November through December 1998 in accordance with generally accepted government auditing standards.

AGENCY COMMENTS

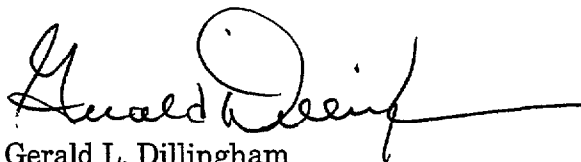
We provided copies of this report to the Department of Transportation for review and comment, and the Department had no comments.

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As you requested, unless you publicly announce its contents earlier, we plan no further distribution of this report for 7 days. We will then send copies to the Secretary of Transportation and the Administrator of the Federal Aviation Administration. We will also make copies available to others upon request.

If you or your staff have any questions or need additional information, please call me at (202) 512-2834. Major contributors to this report were Danielle Bartoni, Chuck Bausell, Beverly Dulaney, Pete Maristch, Belva Martin, and John Noto.

Sincerely yours,



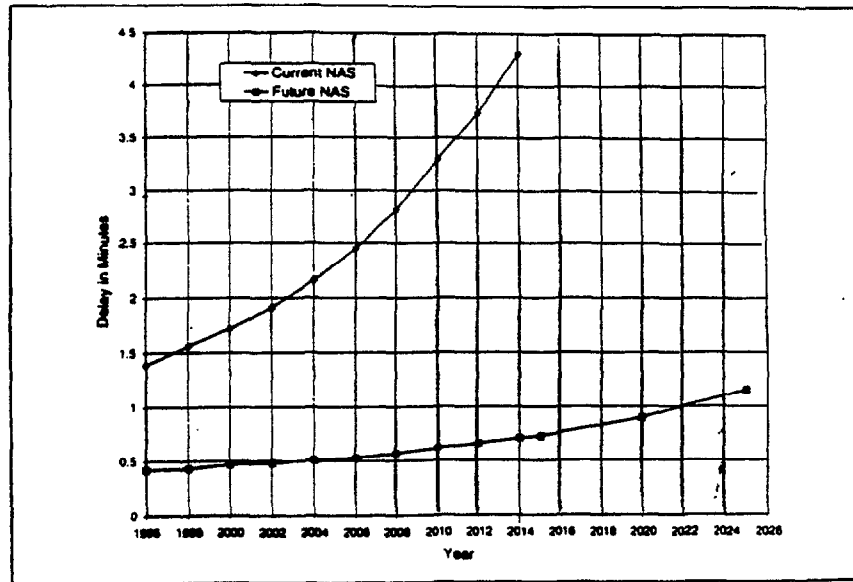
Gerald L. Dillingham  
Associate Director,  
Transportation Issues

Enclosure – 1

## American Airlines' 1997 Projections of Flight Delays--Current Versus Future National Airspace System (NAS)

◆ **Scenario 1:  
Current NAS--**  
No change except  
for an annual traffic  
growth rate of 2.3%

■ **Scenario 2:  
Future NAS--**  
Reduced separation  
standards<sup>a</sup> with an  
annual traffic growth  
rate of 2.3%



Average Air Delay Per Flight

<sup>a</sup> Separation standards are distances that aircraft are required to maintain from one another.

Source: Free Flight: Preserving Airline Opportunity, American Airlines, Sept. 22, 1997.

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