

GAO

Report to the Ranking Minority
Member, Committee on Commerce,
Science, and Transportation,
U.S. Senate

December 2001

NATIONAL AIRSPACE SYSTEM

Long-Term Capacity Planning Needed Despite Recent Reduction in Flight Delays



G A O

Accountability * Integrity * Reliability

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Abbreviations

AAAE	American Association of Airport Executives
ACI-NA	Airports Council International - North America
ADS-B	Automatic Dependent Surveillance - Broadcast
AIR-21	Wendell H. Ford Aviation Investment and Reform Act for the 21 st Century
ATC	air traffic control
AVOSS	Aircraft Vortex Spacing System
DDTC	Digital Display Taxi Clearance
DOD	Department of Defense
DOT	Department of Transportation
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
FFP1	Free Flight Phase 1
FLIR	Forward Looking Infrared Radar
GA	general aviation
GPS	Global Positioning System

HUGS	Heads-Up Guidance System
ILS	Instrument Landing System
ITWS	Integrated Terminal Weather System
LAAS	Local Area Augmentation System
LAHSO	Land-and-Hold Short Operations
MASSPORT	Massachusetts Port Authority
MII	majority-in-interest
NAS	National Airspace System
NATCA	National Air Traffic Controllers Association
NIMS	National Airspace System Information Management System
NOCC	National Operations Control Center
OCC	Operations Control Center
OEP	Operational Evolution Plan
OST	Office of the Secretary of Transportation
PFC	passenger facility charge
PRM	Precision Runway Monitor
RNAV	area navigation
SOIA	Simultaneous Offset Instrument Approach
TAAP	Tactical Altitude Assignment Program
TARGETS	terminal area route generation, evaluation and traffic simulation
TRACON	Terminal Approach Radar Control



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Accountability * Integrity * Reliability

United States General Accounting Office
Washington, DC 20548

December 14, 2001

The Honorable John McCain
Ranking Minority Member
Committee on Commerce,
Science, and Transportation
United States Senate

Dear Senator McCain:

In recent years, airline flight delays have been among the most vexing problems in the national transportation system. They reached unprecedented levels in 2000, when one flight in four was delayed. Although bad weather has historically been the main cause of delays, a growing reason has been the inability of the nation's air transport system to efficiently absorb all of the aircraft trying to use limited airspace or trying to take off or land at busy airports.

Recent events—most notably the terrorist attacks on buildings in New York City and Washington, D.C., using hijacked airliners, and the economic slowdown that preceded these attacks—have changed the extent of the delay problem, at least for the short term. With many airlines cutting their flights by 20 percent or more, the air transport system is having less difficulty absorbing the volume of flights. Whether the volume of flights will continue at these lowered levels is unknown. However, it is likely that a more robust economy and less public apprehension about flying will lead to renewed demands on the air transport system. If so, concerns about delays—and the actions being taken to address them—may once again command national attention.

Addressing delay problems requires action by several sectors of the aviation community because no single entity has the authority or ability to solve delay-related problems. The federal government, especially through the Federal Aviation Administration (FAA) and its parent agency, the Department of Transportation (DOT), plays a major role by operating the nation's air traffic control system, distributing federal funding for airports, and setting operating standards for commercial aircraft and airports. However, the nation's airports are primarily owned and operated by local units of government, so that decisions about such steps as expanding airport capacity are primarily local in nature. The nation's airlines also play a key role. Their business decisions have a strong effect on the volume and routing of flights, the type and size of aircraft used, and the

degree to which aircraft are upgraded to take advantage of new technology.

You asked us to examine the aviation community's efforts to reduce delays. As agreed with your office, we focused our work on the following questions:

- What initiatives are planned or under way by the federal government, airlines, and airports to address flight delays?
- What effect are these initiatives likely to have on reducing delays?
- What other options are available to address delay problems?

Our work involved extensive consultation with various stakeholder groups in the aviation community, including airlines, airports, local governments, industry associations, employee organizations, federal regulatory agencies, and aviation researchers. We contacted officials from DOT, FAA, 8 major airlines, and 18 large airports that experience major congestion and delays to identify the main initiatives planned or under way to address congestion and delay problems. As we were conducting our work, FAA released a plan, called the Operational Evolution Plan, incorporating many of these initiatives, and we focused much of our remaining efforts on analyzing this plan. Our gathering of information and FAA's issuance of the Operational Evolution Plan both occurred before the September 11, 2001, terrorist attacks, and the initiatives that actually move forward as well as the plan itself are subject to change. To assess the likely impact that current and planned initiatives will have on reducing delays, we relied on the extensive body of work we have conducted on aviation over the past decade, the views of FAA and other stakeholders, and evaluations and studies conducted by other researchers. We used these same types of sources in identifying other measures for addressing delay problems. Appendix I explains our scope and methodology in more detail. Our work, which we conducted from October 2000 through October 2001, was done in accordance with generally accepted government auditing standards.

Results in Brief

The federal government, airlines, and airports have a diverse set of initiatives under way to address flight delays. Examples of these initiatives include adding new runways, finding new ways to safely accommodate more aircraft in the skies, and doing more to coordinate efforts to adjust to spring and summer storms. Although most of these efforts were developed separately, FAA has since incorporated many of them into a plan, called the Operational Evolution Plan, which is designed to give more focus to these initiatives. FAA acknowledged that the plan is not intended as a final

solution to congestion and delay problems. The plan focuses on initiatives that can be implemented within 10 years and generally excludes any approaches that lack widespread support across stakeholder groups. FAA acts as the plan's coordinator, though the various stakeholders continue to retain responsibility for individual initiatives. FAA has made a good start in implementing the plan and believes that the steps taken to date have had some effect in the delay reductions that occurred in the first 6 months of 2001.

The current initiatives, if successfully carried out, will add a substantial amount of capacity to the nation's air transport system. Even so, these efforts are unlikely to prevent delays from becoming worse unless reduced traffic levels following the September 11 terrorist attacks persist over the long term. One key reason is that a number of the most delay-prone airports have limited ability to increase their capacity, especially in the form of adding new runways—the main capacity-building element of the Operational Evolution Plan. Many of the most delay-prone airports, such as La Guardia, Newark, Kennedy, Los Angeles, San Francisco, and Philadelphia, would find it difficult to build an additional runway either because they are out of room or they would face intense local opposition. Persistent delays at key airports such as these will continue to act as “choke points” that slow air traffic moving throughout the system. Thus, the system will have difficulty handling growth, even if this growth is considerably less robust than what was forecasted before the terrorist attacks. If growth should match the earlier, very robust forecasts, the delay problem will only be more pronounced.

The air transport system has long-term needs that require attention beyond the initiatives currently under way. Other measures exist—some perhaps made more viable by the recent terrorist attacks. These measures consist of three main types. The first involves adding new capacity—not by adding runways to existing capacity-constrained airports, but rather by building entirely new airports or using other nearby airports that have available capacity. The second involves ways to manage and distribute demand within the system's existing capacity. Examples include limiting the number of takeoffs and landings during peak periods or limiting the ability of aircraft, other than those operated by airlines, to use especially crowded or sensitive airports (under current law, all aircraft have equal access to even the largest airports). The third involves developing other modes of intercity travel, such as, but not limited to, high-speed rail where metropolitan areas are relatively close together. These measures would require extensive change; may conflict with the interests of one or more of the key stakeholder groups; and, in many cases, would be costly.

With the rising need to consider these three measures, either because of the increasing demand on the air transport system or because of the need to develop options that meet security and other concerns prompted by the terrorist attacks, the federal government will need to assume a central role. This role should include identifying the measures that are most appropriate for individual situations, framing the discussion, and moving forward with the best solutions. DOT has recognized the need for more and better long-range planning on the potential use of such measures, but its efforts are currently just in the beginning stages of development. The current hiatus in air traffic growth represents an opportunity for such planning to take place.

We are recommending that the Secretary of Transportation begin a more extensive evaluation of initiatives to address flight delays, including intermodal solutions, such as high-speed rail where appropriate, and a dialogue with the aviation community and other transportation stakeholders as a basis for developing a comprehensive blueprint for addressing the long-term needs of the nation's air transport system.

We provided a draft of this report to DOT for its review and comment. In responding, both DOT and FAA officials generally concurred with the facts as presented in the draft report. They also provided some technical clarifications, which have been incorporated. Neither agency commented on the report's conclusions or recommendations.

Background

In 2000, an unprecedented number of delays and cancellations in commercial airline flights occurred. At 31 of the nation's busiest airports, 28 percent of the domestic flights arrived late.¹ Certain flights were almost always late; for example, in December 2000, 146 regularly scheduled flights were late 80 percent or more of the time. The percentage of delayed flights declined to 24 percent in the first 6 months of 2001. According to FAA and others, the decline likely reflected various factors, such as better weather, fewer flying passengers because of the economic slowdown, a

¹In the past, there was no single, agreed-upon definition of delay, resulting in markedly different figures about the extent of the problem. To the degree possible, our figures are based on the definition used by the Bureau of Transportation Statistics, a DOT agency. Under this definition, a flight is late when it arrives at the gate 15 minutes or more after its scheduled arrival time. (Canceled flights are also included.) In March 2001, FAA's Administrator announced that FAA would also adopt this definition. Our figures are based on domestic flights of the nation's 10 largest airlines (United, American, Delta, Northwest, Southwest, US Airways, Continental, TWA, America West, and Alaska).

strike that idled one carrier's aircraft for several months,² a reduced demand on the system, and actions taken to better manage the nation's airways. The September 11 terrorist hijacking of four commercial airliners has further contributed to a drop in air passengers and scheduled flights, with major airlines cutting the number of flights by 20 percent or more and one carrier, Midway Airlines, ceasing operations entirely.

Although recent events may have moved airport congestion off center stage as a major national issue, delays remain a pervasive problem, in part because of the interdependence of the nation's airports. The effect of delays can quickly spread beyond those airports where delays tend to occur most often, such as New York's La Guardia, Chicago O'Hare, Newark, and Atlanta Hartsfield. Delays at such airports, particularly those with large numbers of flights, can quickly create a "ripple" effect of delays that affect many airports across the country. For example, flights scheduled to take off for such airports may find themselves being held at the departing airport because there is no airspace to accommodate the flight. Similarly, an aircraft late in leaving the airport where delays are occurring may be late in arriving at its destination, thus delaying the departure time for the aircraft's next flight. The September 11 attacks may also have added a new dimension to delays because the more thorough screening of airline passengers at ticket counters and security check points now takes additional time. So far, FAA and airlines have addressed this issue by telling passengers to arrive earlier for their flights and to be prepared for longer processing times. Whether additional security will affect the timeliness of aircraft flights has yet to be determined.

Delays have many causes, but weather is the most prevalent. Figures compiled by FAA indicate that weather causes about 70 percent of the delays each year. Apart from weather, the next main cause is lack of capacity³—that is, the inability of the air transport system to handle the amount of traffic seeking to use it.⁴ Capacity can be measured in a variety

²The strike affected Comair, a regional subsidiary of Delta Air Lines, grounding its airplanes for nearly 3 months. Comair, which is based at Cincinnati/Northern Kentucky International Airport, operated 119 aircraft when the strike began.

³In this report, our use of the term "capacity" refers to both types of measures—takeoffs and landings at airports, and the number of aircraft that can be safely managed when they are in the air.

⁴Besides weather and capacity, other causes for delay include air traffic control equipment problems (such as radar problems), runway closures (such as for construction), and a variety of other miscellaneous reasons.

of ways. At individual airports, one measure is the maximum number of safe takeoffs and landings that can be conducted in a given period, such as 15 minutes or 1 hour. FAA has established such a capacity benchmark at each of 31 of the nation's busiest airports.⁵ FAA's data on capacity and demand at these airports show that even in optimum weather conditions, 16 airports have at least three 15-minute periods each day when demand exceeds capacity. Weather and capacity problems are often linked, because bad weather can further erode capacity. For example, some airports have parallel runways that are too close together for simultaneous operations in bad weather. When weather worsens, only one of the two runways can be used at any given time, thereby reducing the number of aircraft that can take off and land. FAA's data show that in bad weather, 22 of the 31 airports have at least three 15-minute periods when demand exceeds capacity. Another measure of capacity, apart from the capacity of individual airports, is the number of aircraft that can be in a given portion of commercial airspace. For safe operations, aircraft must maintain certain distances from each other and remain within authorized airspace. If too many aircraft are trying to use the same airspace, some must wait, either on the ground or en route.

FAA's most recent long-term growth projections, which date from before the September 11 terrorist hijackings, anticipated considerable growth in demand for air travel. FAA projected that the number of passengers served by U.S. airlines would rise by more than 40 percent, to more than 1 billion annually by 2010. What effect, if any, the terrorist hijackings will have on long-term growth still remains to be seen. To accommodate the increased number of passengers it was projecting, FAA expected airlines to increase the size of the total fleet by about 2,600 jets—an increase of about 50 percent.⁶ The fastest-growing segment of the fleet is expected to be smaller aircraft called regional jets—that is, jets with 32 to 70 seats but generally with ranges of 1,000 miles or more. As we have pointed out in previous work, the growing use of regional jets in addition to turbojet aircraft currently flying has already added to congestion and delays, according to published studies and experts, but the precise amount has

⁵Together, these 31 airports accounted for almost 70 percent of all enplanements (paying passengers) in 1999.

⁶Estimates of future passenger and aircraft growth are based on FAA forecasts made in 2001. They are subject to change on the basis of economic and other factors.

not been determined and likely varies from airport to airport.⁷ Besides airlines, other parts of the aviation community are also likely to place increasing demands on the air traffic system. FAA expected increases of about 50 percent in the number of cargo aircraft and the number of smaller general aviation⁸ jets, such as corporate jets and jets operated by air taxi or charter services. Some industry analysts have suggested that in the wake of the terrorist hijackings, corporations may make increasing use of such jets, which often use the same airports as those used by airlines.

All three groups that are most heavily involved in addressing delay-related problems—federal agencies, airlines, and airports—have important roles. As the agency in charge of the air traffic control system, FAA has the lead role in developing technological and other solutions to airspace issues. FAA and DOT are also an important source of funding. Through the Airport Improvement Program, FAA provided \$1.95 billion in grants to airports in fiscal year 2000, and through its Facilities and Equipment appropriation, it pays for such things as improvements to the air traffic control system. FAA and the Office of the Secretary of Transportation (OST) monitor access rights to airports as well as the landing fees that airports can charge. FAA also grants authority for airports to levy passenger facility charges (PFC),⁹ which were a source of more than \$1.5 billion in revenue for airports in calendar year 2000. Airlines and airports are also important decisionmakers and funding sources. For example, changes in air traffic control technology may require airlines to make substantial investments in new technology for their aircraft. However, the recently enacted \$15 billion federal assistance package for the airline industry illustrates the airlines' dire financial conditions, particularly after the events of September 11. Accordingly, airlines may have a difficult time making investments in air traffic control technology for their aircraft. Similarly, while infrastructure improvements such as new runways often receive federal support, much of the funding is raised at the local level.

⁷*Aviation Competition: Regional Jet Service Yet to Reach Many Small Communities* (GAO-01-344, Feb. 14, 2001).

⁸FAA considers general aviation to be all aviation other than scheduled airlines or military aircraft.

⁹PFCs were first instituted in 1992. With FAA approval, airports can collect up to \$4.50 per enplaned passenger. These charges are collected as part of the price of an airline ticket.

Diverse Set of Initiatives Was Under Way to Address Delays

Government, airlines, and airports have undertaken a wide range of initiatives to address flight delays and increase the capacity of the air transport system. The stakeholders we contacted—DOT and FAA, 8 airlines, and 18 of the most delay-prone airports—identified 158 separate initiatives under way.¹⁰ Earlier this year, FAA issued the Operational Evolution Plan (OEP), which is designed to give more focus to some of the diverse initiatives under way. FAA's role, in addition to continuing to spearhead the initiatives for which it is directly responsible, is to act as overall coordinator for implementing the OEP. FAA believes that the OEP actions already implemented have contributed to the reduction in flight delays experienced in the first 6 months of 2001. Challenges still lie ahead in other areas, such as introducing new technology, adding new runways, funding billions of dollars of investment, and developing ways to help measure what the efforts are accomplishing.

Government, Airlines, and Airports Started a Variety of Initiatives on Their Own

The initiatives cited by DOT and FAA, airlines, and airports include steps for addressing both weather-related and capacity-related delays. Considerable efforts were under way to address weather-related problems, which is the major cause of delays. For example, to deal with the problems arising from thunderstorms and other severe weather in the spring and summer, FAA launched a program called Spring/Summer. Among other things, this program led to daily telephone conference calls between FAA and airline officials to discuss weather and other conditions that might affect the smooth flow of air traffic. The program also led to a new effort to predict severe weather affecting aircraft. Examples of initiatives directly related to capacity included an individual airport's plans to build new runways, taxiways, or gates; airlines' efforts to adjust schedules to relieve congestion at some hubs; and FAA's efforts to seek greater use of Canadian and military airspace. Some initiatives dealt with both weather and capacity. For example, FAA is testing a system that would allow the use of satellite navigation for landing approaches in all types of weather conditions. This system, if successful, will allow airports to operate at higher capacity in bad weather.

To an extent, the initiatives begun by each of the three stakeholder groups have different emphases. FAA and DOT initiatives emphasize improving

¹⁰The information regarding initiatives at DOT, FAA, airlines, and airports was gathered before September 11, 2001. We recognize the drop in air travel following the terrorist attacks may result in some of the initiatives being scaled back or even set aside.

the ability to handle more aircraft in the air, airline initiatives emphasize making adjustments to airline operations, and airport initiatives emphasize increasing the capacity for more takeoffs and landings through more runways and other infrastructure. The initiatives that stakeholders cited are summarized briefly below; appendix II contains a detailed list of the initiatives and their status.

DOT and FAA Initiatives

DOT and FAA officials identified 29 initiatives under way at their agencies. These initiatives can be grouped into three categories—adding capacity to the system, identifying specific problems contributing to delays, and identifying ways to better manage and coordinate responses to delays. Table 1 provides examples of each category. Some of these initiatives were completed, such as a benchmarking study to provide a better indication of the number of takeoffs and landings that can be supported at 31 of the busiest airports in the national airport system. However, most of the initiatives were ongoing or long-term projects. Some, such as reevaluating what is being done to deal with severe spring and summer weather, will be done annually or as needed. Longer term efforts include redesigning the airspace surrounding major metropolitan areas and developing technology that allows greater use of existing runways in low-visibility conditions.

Table 1: Examples of Government Initiatives to Reduce Flight Delays

Type of initiative	Examples
Enhancing capacity	Implementing new procedures, such as allowing selected flights to operate at lower, less-congested altitudes. Developing new technology, such as improved satellite navigation capabilities that enable aircraft to travel closer together.
Identifying problems and solutions	Developing benchmarks for better determining how many takeoffs and landings can be supported at various airports.
Managing delays	Improving communication between key airline and air traffic control officials through multiple conference calls each day to examine weather and other delay factors and work out solutions for congestion in the national airspace system.

Source: GAO analysis of agency information.

Airline Initiatives

Initiatives identified by the eight airlines generally fell into one of three categories—scheduling, weather and dispatch, and testing of new technology. (See table 2 for examples.) In some cases, these initiatives were tied to those of other stakeholders. For example, the main technology-testing initiatives involved airline participation in the

government initiatives previously discussed. Most of these initiatives were ongoing or long-term projects.

Table 2: Examples of Airline Initiatives to Reduce Flight Delays

Type of initiative	Examples
Scheduling	Moving flights to off-peak times at hub airports to reduce airspace and ramp congestion during peak hours.
	Adjusting flight times throughout the route network to reflect actual gate-to-gate departure and arrival times.
Weather and dispatch	Investing in meteorological technology to assist in poor weather planning and turbulence avoidance.
	Developing technology that allows dispatchers to produce new flight plans for flights that are already aloft.
Testing technology	Participating in FAA-sponsored efforts to identify arrival routes and improve aircraft flow at a hub airport.
	Testing new approaches for linking data between airplanes and air traffic control.

Source: GAO analysis of airline information.

Airport Initiatives

The 18 delay-prone airports we contacted identified a wide range of initiatives that varied from airport to airport, reflecting such differences as the relative amount of congestion and the airport’s ability to add infrastructure. Although each airport had a different set of concerns regarding delays, the initiatives generally fell into three areas: new runways and taxiways, terminals and gate space, and new technology to promote efficient use of the airport. (See table 3 for examples.) As with initiatives for the two other stakeholder groups, most of these projects were still in process when we completed our review.

Table 3: Examples of Airport Initiatives to Reduce Flight Delays

Type of initiative	Examples
Runways and taxiways	<p>Building new runways and extensions to existing runways.</p> <p>Building new taxiways.</p> <p>Adding high-speed exits from existing runways.</p>
Terminals and gate space	<p>Adding terminals and/or gates.</p> <p>Changing gate leasing arrangements to allow maximum flexibility during high-demand periods.</p>
New technology to promote efficient airport use	<p>Funding new FAA-developed weather information system.</p> <p>Installing additional navigational aids.</p> <p>Installing new runway monitoring systems for greater runway use in low-visibility conditions.</p>

Source: GAO analysis of airport information.

FAA’s Operational Evolution Plan Attempts to Bring Greater Focus to Stakeholders’ Efforts

FAA designed the OEP to provide a more focused and more coordinated approach to congestion and delay problems. The previously described initiatives were generally begun independently rather than as a collaborative response to a systemwide problem. Although FAA previously had made efforts to develop more coordination and cooperation among the stakeholder groups,¹¹ the OEP was FAA’s attempt to align its activities with those of other stakeholder groups using such approaches as collaborative decisionmaking, specific timelines for completing actions, and designation of accountability. The OEP does not replace or eliminate the previously described initiatives; rather, it incorporates many of them into “operational solutions” designed to address specific goals. Responsibility for the various actions is still shared among the various segments of the aviation community. As the overall coordinator for this effort, FAA faces challenges in ensuring a consistent funding stream for the federal government’s portion of the activities and developing performance measures that will help gauge the extent to which these operational solutions are reducing delays.

¹¹For example, FAA took steps to involve aviation community stakeholders in various planning efforts and individual programs, and it also published numerous plans, such as the annual *Aviation Capacity Enhancement Plan*, which combined various FAA projects into one document.

The OEP Incorporates Many Existing Initiatives

The OEP focuses on four goals, each with a set of operational solutions. The four goals and the types of operational solutions included for each goal are as follows:

- Increasing arrival and departure rates. Increasing the number of flight arrivals and departures during a given period is an effort to keep pace with demand at many key airports. Fifteen of the nation’s busiest airports suffer from insufficient capacity to meet peak demands, according to FAA. The plan proposes seven solutions to increase the arrival and departure rate, including building new runways and coordinating efficient surface movement.
- Increasing flexibility in the en route environment. This goal is aimed at easing congestion in the air and providing more operating flexibility for pilots. En route congestion occurs, according to FAA, because routes are tied to ground-based navigational aids, controller workloads are limited by manual monitoring of aircraft, and current aircraft separation standards do not account for advances in aircraft capability. The plan proposes eight solutions, including reducing aircraft separation; working collaboratively with users to manage congestion; and providing access to additional airspace, such as military operating areas.
- Increasing flexibility en route during severe weather. Thunderstorm activity—especially around busy airports—can cause problems for aircraft that are en route. The inability to predict the precise location, movement, and severity of hazardous weather can hamper air traffic managers and pilots alike. Improved equipment and procedures could better pinpoint weather characteristics and their impacts and lead to improved flight management and ultimately fewer delays. The plan proposes solutions to provide better hazardous weather data and to respond effectively to hazardous weather.
- Maintaining airport arrival and departure rates in all weather conditions. A significant portion of delays occur when local airport weather reduces arrival and departure rates. The plan calls for maintaining a constant rate of aircraft arrivals and departures, regardless of weather conditions. To meet this goal, the plan proposes such solutions as reconfiguring runways, developing ways to safely space aircraft closer together, and maintaining runway use in reduced visibility.

The OEP’s operational solutions incorporate most of the separate initiatives identified by the stakeholder groups. FAA officials emphasized that the OEP is subject to change, including revisions as a result of the

Although Off to a Strong Start,
the OEP Will Need to Meet
Several Key Challenges

September 11 terrorist activities. The OEP's operational solutions do not include all types of actions that have been advanced as possible solutions to the delay problem. FAA acknowledged that the OEP was not meant to be an end-all that would solve all delay problems, but was instead a more limited document dealing with near-term operational solutions. The solutions included in the OEP have widespread support across stakeholder groups and do not include any initiatives for which FAA could not obtain consensus from key aviation stakeholders. In addition, FAA specifically limited the types of measures included in the OEP to those that (1) will add new capacity and (2) can be implemented within 10 years. For example, the OEP's operational solutions include new runways that airports like Seattle-Tacoma and Lambert-St. Louis currently expect to complete by 2010. The OEP does not include all measures that have been advanced as possible solutions to the delay problem, such as new airports or high-speed ground transportation alternatives. The OEP also does not include administrative, regulatory, or market-based approaches that are largely for the purpose of managing existing capacity more efficiently, such as setting limits on the number of flights that could be flown to and from specific airports.

FAA has made a good start in developing the OEP and in taking the initial efforts to implement it. FAA followed a highly collaborative process in developing the plan. It encouraged input from stakeholders in a variety of ways, circulated drafts to various segments of the industry for comment, and revised those drafts to reflect the comments received. The final plan, issued in June 2001, establishes timelines for individual components of the plan and includes actions and decisions required by the different stakeholders. Lines of accountability have also been established within FAA. For example, a team of senior FAA personnel, chaired by the Acting Deputy Administrator, is to lead the implementation and be responsible for setting priorities, monitoring benefits and methods for measuring improvements, and engaging the aviation community leaders in key decisions.¹²

FAA officials believed that actions under way were already having an effect on reducing delays. During the first 6 months of 2001, 24 percent of major airlines' flights arrived 15 minutes or more after their scheduled

¹²The OEP also establishes lines of responsibility for the specific improvements anticipated. This responsibility is assigned to the heads of seven FAA units that are responsible for the various outcomes.

arrival at 31 of the nation's busiest airports, compared with 28 percent during the first 6 months of 2000. FAA officials believe that a combination of factors is responsible for this drop, including much more favorable weather conditions during the spring of 2001. They also cited the Spring/Summer initiative, which addresses weather issues resulting from spring and summer storms, as an example of a collaborative effort among airlines and various FAA organizations that helped reduce the amount of delays. Another effort they cited was the choke-points initiative, under which FAA made aircraft routing changes, added technology, changed procedures, and modified traffic management strategies to reduce the impact of congestion in seven highly congested areas in the national airspace system.

Many of the actions included in the OEP, including those that will add the most capacity, are still under way. Security and other concerns raised in light of the September terrorist attacks may have some effect on the initiatives. For example, initiatives allowing pilots greater flexibility in determining their route of flight or to use restricted military airspace will be affected by increased security concerns. Apart from concerns raised over the terrorist attacks, FAA and other stakeholders face the following challenges on several key fronts in implementing the actions in the OEP:

- **Introducing new technology.** A number of the OEP's efforts center on introducing new technology to allow aircraft to take off, travel, and land more closely together. For example, FAA is testing a satellite navigation system that would allow for instrument landings in all weather conditions. Our past reviews have shown that over the past two decades, FAA has encountered numerous problems in introducing new technologies, with many projects running years behind schedule. Because of the size, complexity, cost, and problem-plagued past of FAA's modernization programs, we have designated these programs as a high-risk information technology investment since 1995.¹³ The continued risks are sizable, in part because many technology-related projects under the OEP are still a number of years from being fully developed and will need to be integrated with existing technology. For example, we recently reported that FAA will

¹³See, for example, *Air Traffic Control: Role of FAA's Modernization Program in Reducing Delays and Congestion* (GAO-01-725T, May 10, 2001) and *High-Risk Series: An Update* (GAO-01-263, Jan. 2001).

face a technical challenge in ensuring that the components of its Free Flight initiative can work with other air traffic control systems.¹⁴

- **Overcoming barriers to building new runways.** FAA estimates that 50 to 55 percent of total capacity to be added under the OEP will come from runway projects at 15 of the nation's 31 busiest airports, such as Detroit, Minneapolis, St. Louis, and Atlanta. Six of these runways are currently under construction; the rest are in some stage of the planning, design, and review process. The process of planning and building a runway typically takes 10 years under the best of circumstances, and some of the projects still face legal challenges from local groups opposed to the projects because of environmental and other concerns.
- **Obtaining sufficient funding.** Successful implementation of actions included in the OEP hinges on the availability of funding from several sources, including FAA, airlines, and airports. The full cost of the OEP is unknown. FAA estimates that over the period of 2001 to 2010, its portion of the cost will be about \$88.5 billion—\$11.5 billion in federal funding for facilities and equipment, and \$77 billion in operations to deliver services. To help make this funding available, FAA officials told us they were adjusting priorities and developing future budget requests around the plan. Other significant funding will need to come from airlines and airports. For example, before benefits of new air traffic control technology can be fully realized, aircraft must receive new equipment. As the recent economic slowdown and the terrorist attacks have shown, the airline industry is subject to periods of profit and loss. If new equipment comes on-line at a time when airlines think they cannot afford to buy it, the planned benefit may not materialize. Similarly, infrastructure projects at airports usually require a substantial amount of local funding. Adding a runway at a major metropolitan airport, for example, could cost \$1 billion or more, only part of which is federally funded. In the wake of the terrorist attacks, some airports have already begun to reevaluate expansion plans and capital expenditures, reportedly in response to concerns about increased expenditures for security and declining airline and passenger fees to pay for improvements.

¹⁴Free Flight is a project for giving pilots greater freedom to select their own flight path and speed. See *National Airspace System: Free Flight Tools Show Promise, but Implementation Challenges Remain* (GAO-01-932, Aug. 31, 2001).

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- Establishing accountability through performance indicators. The OEP recognizes that, along with designating who is to be responsible for each action, performance indicators are needed to assess what the action is accomplishing. For example, under the Free Flight initiative, FAA has established direct routings¹⁵ as one performance indicator and set a goal of increasing these routings by 15 percent in the first year of implementation. At this early stage of the OEP, FAA is still in the process of developing most performance indicators. Having sound performance indicators is of particular importance if funding becomes limited, because these indicators can help determine which actions are likely to yield the best results for the dollars expended and where to redirect resources should doing so become necessary.

Capacity to Be Added in Next 10 Years Will Likely Have Limited Effect in Keeping Delays From Rising to Previous Levels

If fully implemented, the actions to be taken under the OEP will add substantially to the system's capacity but are unlikely to keep delays from rising again unless air traffic remains at substantially lower levels than anticipated over the long term. If the industry rebounds to the point that FAA's earlier projections about air traffic growth turn out to be correct, many of the busiest airports will be unable to keep pace with rising demand, even with their increased capacity. If the recovery is less robust, the system still will have difficulty because a number of delay-prone airports have limited ability to expand their capacity to meet even modest increases in demand. Many of the most delay-prone airports have already run out of room for adding other runways or will soon run out of room to do so. These delay-prone airports cause delays that ripple throughout the system. If problems at these airports are not alleviated, this ripple effect will continue, causing delays at airports that may have addressed their own capacity problems. Finally, competitive pressures within the airline industry may still lead airlines to continue using operations strategies that are vulnerable to delays. These pressures currently motivate airlines to schedule flights that fully use available air transport system capacity during those times of day in which they perceive consumers most want to fly. At delay-prone Newark International Airport, for example, after one airline recently decided to reduce schedule delays by trimming the number of peak-hour flights, rival airlines quickly responded by adding more peak-hour flights of their own.

¹⁵Direct routings allow pilots to take the most direct route to their destinations, rather than routes typically used in the airspace system.

Many Airports Cannot Significantly Expand Capacity

Even if all OEP actions are successfully completed, key airports in the system will likely lose ground in their ability to meet demand. Under the growth projections made before the terrorist hijackings, FAA forecasted that between 2001 and 2010, demand would increase faster than capacity at 20 of the nation's 31 busiest airports. For these airports, the ability to make significant headway in adding capacity is primarily related to one factor—adding a runway. FAA estimates that the 14 airports adding a runway by 2010 will see capacity increases averaging 34.9 percent. By contrast, the 16 airports not adding a runway will see a capacity increase averaging 6.3 percent.¹⁶

FAA expects that at least half of the capacity gain from OEP initiatives will come from the new runways included in the plan. Some industry sources have suggested that even more runways should be built by 2010, saying that 50 miles of new runways at the top 25 delay-prone airports—the equivalent of 1 runway at each airport—would solve the system's capacity problems. Airport stakeholder groups are calling for streamlining the procedures and reducing the time necessary for approving runways, which now takes at least 10 years to plan and complete. Proposed legislation has been introduced in the Congress to help shorten this process.¹⁷

Relying on adding runways to increase capacity at busy metropolitan airports, however, will likely have a limited effect over the long term. Some airports can accommodate additional runways, but many cannot. Denver International Airport is an example of a location with substantial expansion potential. Located in a sparsely populated area away from the metropolitan area, the airport has ample room to add capacity. The airport is currently building a new 16,000-foot runway to add to its five existing runways and can accommodate six more runways in its present configuration. By contrast, other airports, such as Los Angeles, Washington Reagan National, La Guardia, and San Francisco have little capacity to expand and would find it difficult to build even one more runway, either because they lack the space or because they would face

¹⁶A new 7,800-foot runway opened at Phoenix Sky Harbor International Airport in October 2000. FAA estimates that this airport will see a 60-percent capacity increase between 2001 and 2010.

¹⁷The Aviation Delay Prevention Act (S. 633) would, among other things, eliminate duplicative requirements in the environmental review process; it would also make certain projects, designated as National Capacity Projects, ineligible for federal funding if the airport does not initiate its planning and environmental review process for these projects in a timely manner.

intense opposition from adjacent communities. For this reason, many airports will likely face delay problems even if demand turns out to be much lower than FAA projected.

Of particular concern are key delay-prone airports—that is, those airports that experience the highest number of delays per 1,000 flight operations (takeoffs and landings). The seven airports that experienced the highest rate of delays in 2000 are shown in table 4. Among these, Chicago O’Hare indicates that it can add another runway, although it too faces intense opposition if it attempts to do so.¹⁸ FAA’s April 2001 Benchmarking Study concluded that of these seven airports, all but Boston Logan would still have significant passenger delays in 2010, largely because the gains in capacity during this decade will be relatively low. For example, according to FAA projections, the three New York airports—La Guardia, Newark, and Kennedy—will experience relatively small capacity gains during this decade—just 7 percent for Newark and 3 percent each for the other two airports.

Table 4: Projected Capacity Increases at the Most Delay-Prone Airports

Airport	Ranking by delays per 1,000 operations (2000)	Projected percentage increase in capacity through 2010
New York - La Guardia	1	3%
Newark International	2	7
Chicago O’Hare International	3	12
San Francisco International	4	3
Boston Logan International	5	4
Philadelphia International	6	11
New York - Kennedy International	7	3

Source: FAA’s Operational Evolution Plan.

Even for airports where a runway addition is possible, other factors make that alternative less desirable. Cost is one such factor. Some airports are surrounded by development that is extremely difficult and expensive to displace. For example, a new 9,000-foot runway currently under

¹⁸Boston Logan has a runway under construction; Philadelphia completed a runway in 1999. FAA’s projections included both of these runways. However, the runway at Boston Logan is to reduce delays in certain runway configurations and is not expected to increase the optimum capacity of the airport. The Philadelphia runway is only 5,000 feet in length and was designed for smaller and slower aircraft.

construction at St. Louis-Lambert Field will cost an estimated \$1.1 billion, in large part due to the required displacement of over 2,000 homes, businesses, churches, and schools around the airport. Similarly, a new 9,000-foot runway under way at Atlanta Hartsfield will cost an estimated \$1.3 billion, again largely due to the costs of relocating structures and highways. By contrast, the new 16,000-foot runway at Denver—where ample open land is available—will cost just \$171 million.

Another factor is the expansion potential over the longer term. Even if many airports like Atlanta Hartsfield, Chicago O’Hare, and St. Louis-Lambert Field are able to add another runway or reconfigure existing ones, continued growth in air traffic would mean that the airports would need to expand once again. At some point, these locations will have to consider other alternatives because the cost of adding another runway will be too expensive and environmentally unacceptable. For those locations where capacity is constrained and options to add runways are limited or nonexistent, that time has already come.

Continued Capacity Shortfalls at Key Airports Will Affect the Broader Air Transport System

Because the airports in the national system are so interdependent, continued shortfalls in capacity at key airports over the long term will likely perpetuate the delay problem throughout the entire system. The system’s interdependency comes from the hub-and-spoke routing pattern under which most airlines operate. Under this pattern, airlines schedule many flights to arrive at one airport (the hub) from other cities on their network (the spokes) during a short period of time. While the aircraft are on the ground, passengers transported to the hub connect to flights going to their final destination. These groups of arrivals and departures happen several times a day. This approach allows an airline to serve more cities than it could through a “point-to-point” approach that does not use a hub as a transfer point.

The interdependency inherent in this hub-and-spoke approach sets up a ripple effect in which delays at a hub can quickly affect not only flights to and from that airport, but also flights throughout the entire network. This ripple effect is illustrated by a scenario that is based on actual operations reported by FAA’s research and development center. In the scenario, a demand/capacity imbalance at Newark International Airport resulted in a backup of five aircraft trying to land at the airport. These aircraft had to be kept in holding patterns above the airport until they could land. Because of the backup, FAA’s New York en route center (which controls air traffic going in and out of Newark and other area airports) notified the adjoining Cleveland en route center that it could not accept more aircraft bound for

Newark until the aircraft in holding patterns around Newark were able to land. As flights began to back up, many aircraft were affected, whether or not they had Newark as their specific destination, because they were also seeking to use part of the backed-up airspace. Within 20 minutes, the delay in landing these 5 planes at Newark affected as many as 250 flights, some as far away as the West Coast.

Thus, continued difficulties at some hubs can have repercussions at airports that have successfully addressed their own local capacity problems. Phoenix Sky Harbor International Airport offers a good example. In 2000, Phoenix put an additional runway into service, and the airport now has sufficient capacity to allow flights to take off on time. However, the airport ranks among the top 15 in the United States for flight delays. According to airport officials, most of the delays at Phoenix are the result of delays and cancellations at other airports—circumstances unrelated to the capacity at Phoenix.

Effect of Added Capacity May Be Negated as Airlines Seek to Use Added Capacity to Their Competitive Advantage

Competition in the airline industry is another factor that may limit the effect that new capacity will have on reducing delays. Competition may have such an impact because it encourages airlines to take maximum advantage of capacity during the times that offer the greatest advantage. Capacity at an airport is relatively constant throughout the day because the airport theoretically can handle the same number of takeoffs and landings each hour. However, airlines are generally motivated not to stretch out their schedules throughout the day, but rather to concentrate their operations in certain peak periods. One reason airlines follow this practice is that they establish schedules that try to maximize what they perceive consumers want, such as flights that leave early and late in the business day. Another reason airlines follow this practice is that in order to conduct efficient hub-and-spoke operations, they try to schedule as many flights as possible to arrive at the hub airport at about the same time and then to depart at about the same time a short while later. By doing so, they minimize the amount of time that transferring passengers have to spend waiting for their connecting flights.

There are ample illustrations of the ways in which these competitive pressures lead airlines to make decisions that can potentially worsen delay problems, rather than reduce them. For example:

- When the opportunity came to submit applications for new flights operating in and out of La Guardia Airport, an airport that has had delay problems for years, airlines submitted proposals to add more than 600

flights.¹⁹ Airline officials said they did so because of consumer demand for service to and from New York.

- To help reduce delays at Newark International Airport, Continental Airlines began using larger aircraft on some routes, allowing the airline to reduce the number of scheduled flights. However, several other airlines soon filled the vacated slots with flights of their own.
- As Continental Airlines did in Newark, United Airlines began using larger aircraft and scheduling fewer flights to help address persistent delays in San Francisco. Here, too, other airlines soon filled the vacated slots.

Airlines make their decisions after considering many factors, so examples such as these cannot be taken as clear signals of what they will choose to do in the future, especially during the current slowdown in passenger demand. However, one scenario that must be considered is that these competitive pressures will quickly fill any openings that are considered to be economically advantageous. In this sense, the added capacity may mirror what transportation engineers and the traveling public have often noted about adding new highways in congested areas—that is, the additional capacity quickly induces more people to drive, thereby leaving traffic conditions little better than they were before.

¹⁹The Wendell H. Ford Aviation Investment and Reform Act for the 21st Century, Public Law 106-181, phased out slots at La Guardia Airport by 2007 and allowed for immediate exemptions from the slot rules for new entrant airlines and flights serving small communities. Within a short time, the airport was overwhelmed with applications from airlines asking for exemptions for over 600 flights to and from the airport. Because the requests far exceeded the capacity of La Guardia, FAA, in cooperation with the airport, developed a temporary lottery to allocate a limited number of slots while a study of market-based and administrative alternatives was undertaken. Until further notice, FAA has indefinitely suspended the latter study because of the reduction in aircraft operations at La Guardia following the terrorist attacks on September 11.

Other Measures Needed to Help Reduce Delays Are More Difficult to Implement but May Be More Viable in Light of Recent Events

Because OEP actions will likely not be sufficient on their own to resolve the delay problem over the long term, aviation stakeholders and policymakers will likely have to consider additional measures to enhance capacity and alleviate delays. A range of other measures is available, such as building new airports or developing alternative ground transportation systems. These measures are not new, but they have received rather limited attention relative to incremental steps that are being taken, largely because they require more extensive change that could conflict with the interests of one or more key stakeholder groups, such as airlines or local communities. Some of these measures, such as transportation alternatives like high-speed rail, may have become more viable in light of security and other considerations stemming from the recent terrorist hijackings. With the rising need for considering these measures, the Congress and DOT will need to assume a central role in identifying which measures are most appropriate for given situations, framing the discussion about them, and moving forward with the best solutions.

Variety of Other Measures Could Meet Capacity Needs

Other measures—not now part of the OEP—exist as potential solutions to alleviate delays. These measures, which have been cited by various researchers and policy organizations over the last decade, basically fall into three categories. The first category involves various other measures for adding airport infrastructure besides adding runways to existing airports, such as building new airports or using nearby underdeveloped regional airports. The second category involves approaches to better manage and distribute air traffic demand within the system's existing capacity. These include administrative and regulatory actions, such as limiting the number of takeoffs and landings during peak traffic periods or restricting the types of aircraft allowed to land, and market-based approaches, such as charging aircraft higher fees to land at peak times than at slack times. The third category includes developing alternative modes of intercity travel other than air transportation, such as high-speed rail. Table 5 provides a brief explanation of each of these measures, and appendix III contains more detailed information on each measure.

Table 5: List of Potential Measures—Not in the OEP—to Reduce the Airport Capacity Gap

Measures	Brief explanation
Category 1: Adding airport infrastructure	
Building new airports in metropolitan areas.	This measure involves new airports within metropolitan areas to provide additional capacity, especially where the existing airport has little expansion potential. This measure has recent limited use since only two major new airports—at Dallas-Fort Worth and Denver—have been built in large metropolitan areas since 1973.
Developing “wayports.”	A network of 4 to 10 wayports across the nation, each located on the fringe of or outside of a major congested metropolitan area, would serve mainly as transfer points for passengers connecting to other locations but also as cargo, mail, and maintenance facilities. This measure has not been used.
Developing regional airports.	Existing regional airports located within 50 miles of metropolitan hubs would be developed to take advantage of unused system capacity. This measure has seen limited use around major hub airports. A system of regional airports exists in the Los Angeles area and is being contemplated at several airports surrounding Boston Logan Airport.
Category 2: Managing demand	
Adopting market-based approaches.	This measure involves setting airport landing fees to bring flight demand into line with available capacity. This approach could involve setting higher landing fees during peak traffic periods in an attempt to get airport users to use alternative airports, alter their flight schedules, or fly larger aircraft. This approach is not in place at any major U.S. airport, although it is being considered at La Guardia Airport.
Using administrative and regulatory approaches.	Government regulators, airlines, or airports would manage demand through (1) restrictions on the number of takeoffs and landings (slots) during peak traffic periods, (2) voluntary flight schedule adjustments to even out peak periods of demand, (3) restrictions on the use of smaller aircraft at busy airports, and (4) more flexible policies governing airport gate access and airlines’ control over airport capital development projects. Two of these measures—slot control and voluntary schedule adjustments—are being used to a limited degree at a few U.S. airports, such as Newark (voluntary schedule adjustments) and New York’s La Guardia and Kennedy airports (slot control).
Category 3: Using ground transportation alternatives	
Building high-speed, intercity ground transportation.	Building high-speed ground transportation (e.g., rail) between populous cities within 200 miles of each other may free up capacity at congested airports by reducing the air traffic demand at those locations. Such trains could travel at speeds of 200 mph or more. Technologically, high-speed rail has proven successful in Europe and Asia; efforts are under way in the United States to develop high-speed rail in several designated corridors.
Connecting nearby airports with high-speed ground transportation.	Using high-speed ground transportation to connect congested airports with underused airports nearby could accommodate passenger transfers within the current hub-and-spoke system. This measure has not been done in the United States.

Source: GAO analysis of previous studies.

The applicability of any particular measure is likely to vary by location, considering the circumstances at each major airport. There is no “one-size-fits-all” solution; rather, substantially reducing delays will probably require a combination of measures spread out over time. For example, the airspace surrounding the greater New York metropolitan area is perhaps the most congested airspace in the nation. The three major airports in the area (La Guardia, Newark, and Kennedy), which currently are among the nation’s most delay-prone airports, are expected to experience substantial air traffic growth during this decade. But these airports have very limited expansion potential, largely because they cannot realistically build new runways. Building new airports or developing regional airports to serve the area may be long-term solutions, but they will likely take many years to materialize. In the meantime, other short-term measures would need to be considered as passenger demand increases, such as ways to use existing facilities more efficiently. This is the direction that FAA and the New York/New Jersey Port Authority, which owns and operates the three area airports, were moving before the drop in passenger demand following the events of September 11. FAA and the Port Authority had been considering market-based and administrative approaches for La Guardia but have temporarily suspended deliberations on this issue. Because major airports in other locations may face different circumstances than the New York airports face, they may need an entirely different set of solutions to address flight delays.

Adopting Other Measures Is Likely to Be More Difficult Than Implementing Initiatives in the OEP

While these other measures may hold promise for addressing capacity problems, adopting any of them is likely to be a more daunting challenge than implementing initiatives in the OEP. Accomplishing the OEP’s initiatives will not be easy, but the opportunity for success is enhanced because FAA has the support of major aviation stakeholders on nearly all of the initiatives.²⁰ By contrast, gaining consensus on any of these other measures will be much more difficult because they change the nature of the system to the degree that each one could adversely affect the interests of one or more key aviation stakeholder groups—including passengers; air carriers; and aircraft operators, airports, and local communities. For example:

²⁰The exception is adding runways at airports where, although airports are moving forward with these projects, they face substantial opposition in some nearby communities that consider themselves adversely affected.

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- Large infrastructure projects, such as new airports that are located in metropolitan areas, could create major controversy. Such projects are often opposed by adjacent communities that are fearful of noise, displacement, or other environmental concerns. Also, finding suitable sites for such projects in crowded metropolitan areas—with enough land that is compatible with other potential land uses—may be difficult. Airlines may oppose some types of infrastructure projects if they fear that the projects would adversely affect them. For example, an airline with a dominant market position at a major hub airport may oppose building an additional airport nearby because the dominant carrier may view it as an opportunity for their competitors to enter the market in that area.
 - Administrative, regulatory, and other measures for managing the demand for existing capacity could generate opposition from various sources as well. Airlines may oppose such measures if they perceive that these measures would restrict their choices in determining rates, schedules, and aircraft sizes—all of which could affect their profits and competitive status relative to other airlines. Smaller communities may also oppose such measures, fearing that commercial air service to and from their airports may be reduced or curtailed because airlines would react by choosing more profitable routes for the limited number of airport slots available.

Cost, a factor to be weighed in adding runways to existing airports, is also an important consideration when building a new airport. For example, the last major new airport—the Denver International Airport completed in 1995—cost almost \$5 billion to build. This cost would have been greater had the airport been located closer to the city, but since it was located on open land away from established communities, the costs of noise mitigation and other land-use issues were minimized. Also, the construction of fast-rail service in populated metropolitan corridors is likely to be costly. For example, Amtrak estimates the cost to construct fast-rail service in federally designated, high-speed corridors and the Northeast Corridor of the United States will be about \$50 billion to \$70 billion.

Although these measures for the most part have not received widespread consideration, some have come into play in limited situations. Where this has been the case, the wide disagreement among stakeholders regarding the best course of action illustrates the extent of controversy that can be present in weighing the various measures. Here are several examples:

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- In Chicago, where additional airport capacity has been under consideration for years, an intense debate has ensued regarding whether to build a new airport south of Chicago or add runways to O'Hare, which is located in an area of dense development. The city, which owns and operates O'Hare, recently unveiled a \$6.3 billion plan that includes adding and relocating runways. The two dominant airlines at O'Hare—United and American—and several congressional members favor this plan. Illinois, several communities adjacent to O'Hare, and other congressional members opposed the additional runways at O'Hare due to environmental and land-use concerns and instead favored building a new airport to be built at Peotone, Illinois, located about 35 miles southwest of downtown Chicago.
 - Atlanta is planning a \$5.5 billion upgrade to Hartsfield International Airport, including adding a fifth runway at a cost of about \$1.3 billion. The airport is constrained by adjacent highways and development, making modifications expensive. At a recent national meeting of airport executives, Atlanta's Aviation General Manager for Hartsfield Airport was asked why a new airport located north of the city—on a large tract of land outside of Atlanta that is already owned by the city—was not considered more seriously as an alternative to the expansion project. He cited the unlikely financial backing of the airport's dominant carrier—Delta Airlines—as the major barrier to considering an option other than adding capacity at Hartsfield.
 - In Los Angeles, the master plan for the Los Angeles International Airport calls for (1) reconfiguring and extending its runways and adding taxiways to increase capacity and (2) shifting a larger percentage of the area's air traffic to surrounding regional airports, such as Orange County's John Wayne Airport, Ontario, and Burbank-Glendale. The city also proposes high-speed rail service from Los Angeles International to facilitate the use of surrounding airports. Local officials and several Members of Congress favor no expansion at Los Angeles International and shifting even more flights to the outlying airports. At the same time, the outlying airports must overcome existing limitations. For example, the terminal at Burbank-Glendale does not meet FAA standards (too close to the runway) and needs to be replaced, but city officials in Burbank have indicated they will oppose a new terminal. The Ontario Airport is limited by the state to 125,000 operations annually. Also, significant interest has been shown in using the former Marine Corps Air Station at El Toro, but its use has been opposed by local factions because of noise and other concerns; FAA and others also have concerns about the runway configuration there because of mountainous terrain around the airport.

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- Lambert Field in St. Louis is undertaking a major runway project, which—at \$1.1 billion—is one of the most costly runway projects of any currently under way nationwide. Mid-America Airport—which the federal government has spent about \$216 million to develop²¹ over the last decade—is located about 24 miles from St. Louis, has modest but new terminal facilities, and has two runways (8,000 feet and 10,000 feet) capable of accommodating the largest aircraft in operation today. The only airline serving the airport in 2001 discontinued service at Mid-America in early December 2001. American Airlines, which has a major hub in St. Louis, supports the runway expansion project at Lambert, rather than using the facilities at Mid-America.

Although consideration of these other measures is likely to be controversial, developments stemming from the September terrorist attacks may make some of them more viable. For example, a shift in public opinion in favor of ground transportation for relatively short trips (150 to 300 miles) may make high-speed rail a more viable option for some high-density corridors, despite the cost and the dislocation it would bring for communities where new, better rail lines would need to be built. Similarly, the need for greater security controls on air traffic flying in sensitive locations, such as Washington, D.C., and New York City, may increase support for some administrative solutions, such as limiting the extent to which corporate jets and other general aviation aircraft can use airports that are already crowded because of commercial airline flights. In 2000, smaller general aviation aircraft and unscheduled air taxi service accounted for about 44 percent of the air traffic at Washington Reagan National Airport and about one-third of all traffic at La Guardia.

Addressing the Full Range of Measures Means Greater Involvement by DOT as a Strategic Planner

If satisfactory progress in addressing airline delays could be made through the initiatives in the OEP, the existing federal effort, spearheaded largely by FAA, might be sufficient. However, needed solutions, both short and long term, appear likely to include measures not included in the OEP. Because these measures are more controversial and include modes of transportation other than aviation, the federal government—particularly DOT—will need to take an expanded role.

²¹Since its development at Scott Air Force Base, Mid-America has received \$156 million in grants from FAA through the Airport Improvement Program and the Military Airport Program. The Department of Defense has also provided \$60 million to relocate a large housing complex from the airport grounds.

DOT has recognized the need for more long-range strategic planning on air transport system issues and has efforts under way to address this need. For the most part, these efforts are currently on hold in the aftermath of the September 11 terrorist attacks because FAA has focused its immediate efforts on other matters. One effort that continues, however, began in mid-2001 when DOT's Deputy Secretary convened a working group—comprised of senior officials within the Department—to address aviation congestion, delays, and competition issues. Specific goals, responsibilities, and the scope of the working group were still being developed. On August 21, 2001, FAA and OST began another effort when they published in the *Federal Register* a request for comments on market-based solutions for relieving flight congestion and delays. This request is part of a DOT effort to collect data and conduct an analysis of market-based pricing at airports. The request asked respondents to set aside consideration of the current legal framework in suggesting ways that demand management may be used as one component of a delay-reducing strategy. The comment period for this notice was to have closed on November 19, 2001. However, given the decline in air traffic after September 11, DOT has suspended the closing date for comments. Once DOT has a better understanding of the long-term impact of the events of September 11, they will publish a new closing date for comments.

Although actions like these are positive steps toward alleviating airport congestion and flight delays, what is still missing is a long-term plan or blueprint to guide the development of the entire national air transport system. Various researchers and policy organizations have suggested the need for such a plan and have recommended that it involve several critical steps, including the following:

- A thorough assessment of all potential measures and their applicability to the various circumstances and needs of each region. The advantages and disadvantages of each measure and the barriers to implementation would be clearly delineated.
- Close collaboration among airlines, airports, and other key stakeholder groups.
- Legislative, regulatory, and administrative actions needed to implement the plan.
- An innovative investment strategy, including federal incentives and leverage needed to encourage the use of recommended measures. Choosing many of the measures is the prerogative of local governments,

airports, and airlines, but the federal government can influence the stakeholders' decisionmaking using a variety of financial, administrative, and regulatory means. For example, although average aircraft size is determined by individual airlines, the government can help shape these decisions by allowing changes in landing fees and airport restrictions at selected locations to encourage the use of larger aircraft at crowded airports or encourage smaller aircraft to use nearby airports that have excess capacity.²² Similarly, the federal government can provide additional funding for targeted options, such as enhancing reliever airports, or make financing of airport infrastructure contingent on stakeholders' support of other options deemed beneficial.

To date, few of these elements have been included in DOT's planning efforts. Except for the effort to study market-based solutions for relieving delays, DOT at this time does not have plans to perform detailed analyses of other potential solutions, such as new airports and alternative ground transportation, in the context of a strategy for increasing national airspace capacity. Such analyses are a critical prerequisite to developing a blueprint for guiding the development of the air transport system, according to others who have studied this area. Also, the direction and planned outcome of DOT's strategic planning efforts are unclear. DOT has not decided, for example, whether—as part of its strategic planning—to develop a blueprint of potential measures that are needed to address the capacity needs in specific locations (e.g., a set of measures for addressing problems in the crowded Northeast or long-range alternatives in locations where incremental additions to existing airports are growing more limited).

Conclusions

FAA's Operational Evolution Plan is a positive step in addressing needed capacity-enhancing actions. But if the recent economic slump and the challenges posed by the September 11 terrorist attacks turn out to be only a temporary pause in the growth of air traffic, the plan will fall far short of meeting the system's growing needs. Unless passenger traffic remains at the current reduced levels over the long term, which seems unlikely, bolder more controversial measures—such as new airports and administrative and market-based approaches—will have to be considered. Exploring such measures is important because many of the nation's key

²²By law, all aircraft—general aviation, corporate, and air carriers—have equal landing access rights. This applies to small and large aircraft alike. When they land, regulations require that airports charge them in a nondiscriminatory, reasonable basis—typically, on the landed weight of each aircraft.

airports cannot significantly add to their capacity. Eventually, even airports that either currently have enough capacity or can perhaps add a runway to increase capacity will have to consider other measures such as these.

While the nation's attention is now justifiably focused on many other issues of aviation safety and security, now is also a good time to begin laying the groundwork for considering these additional delay-reducing measures. The current drop in air traffic represents an opportunity to develop plans for keeping the air transport system ahead of the curve of potential future growth. A carefully considered blueprint is needed to guide future actions for the next 20 years and beyond. Selecting a set of measures to solve the nation's flight delay problem involves difficult choices with considerable impact on the interests of the various stakeholder groups—the flying public, airlines, airports, and nearby communities. In addition, because of the interdependence of airports in the system, a national perspective is needed—one that considers the needs of the entire system while also considering the individual needs and circumstances of various locations. For some parts of the country, these unique needs and circumstances may require considering intermodal solutions, such as high-speed rail as an alternative to air travel.

DOT and the Congress both have key roles to play in bringing about needed changes to sustain a safe, sound, properly managed, and affordable air transport system. Because of the breadth of its management of all transportation modes, DOT is in a unique position to lead this effort. DOT's recent efforts are a start toward developing such a strategic planning effort, but additional steps will be needed to provide the kind of necessary blueprint for the future. DOT needs to work closely with the Congress in formulating its approach, because ultimately the Congress may have to make difficult choices that will please some stakeholders and displease others. Now is the time to begin these efforts in earnest.

Recommendations

We recommend that the Secretary of Transportation include the following as part of DOT's current strategic planning for airspace capacity:

- An evaluation of the capacity-enhancing measures (including the measures we discuss in this report) that are not in the OEP, such as building new airports, managing air traffic demand, and using other modes identified for increasing capacity. The evaluation should be done in the context of the situations or locations where such options would be most applicable considering key airport characteristics, circumstances, and expansion

potential. Barriers and potential legislative actions should be delineated for each measure.

- Collaboration and discussions—similar to the efforts made in formulating the OEP—on prospective measures with airlines, airports, and other key players in the aviation community.
- A blueprint for effectively addressing capacity issues and reducing delays in the nation’s air transport system. This blueprint, which would be a guide for future development of the system, should focus on both short-term (less than 10 years) and long-term (10 to 40 years) measures needed and address the specific measures applicable for each critical location as a means for achieving a viable national system. Where necessary, this blueprint should also consider addressing aviation delay problems by using other modes of transportation, such as high-speed rail.
- An innovative investment strategy, which includes an analysis of potential incentives that the federal government can bring to bear to encourage aviation stakeholders to adopt measures identified in the blueprint. Consideration should be given to financial incentives, such as targeting more funds to certain kinds of projects or types of airports, as well as incentives that would involve modification of existing regulatory and administrative requirements, such as allowing changes in the methods of determining landing fees.

Agency Comments and Our Evaluation

We provided a draft of this report to DOT and FAA for their review and comment. The two agencies generally concurred with the facts presented in the draft report. They provided some technical clarifications, which we have incorporated into this report where appropriate.

Neither agency specifically commented on the draft report’s conclusions and recommendations; for the most part, they did not discuss the additional measures that we recommended for consideration in developing a blueprint for future capacity enhancement. FAA did provide comments on one of the measures—the wayport concept. FAA said a panel of DOT and FAA experts had examined the near-term benefits of the wayport concept in the late 1980s. The panel concluded in 1990 that wayports would provide little or no benefit at the time because new hubs were not needed and airlines would be unwilling to use them. In its response, FAA also noted that airlines jealously guard their transfer functions and have ambitious expansion plans at their current hubs to meet future demand. Because wayports would mainly be transfer points

for passengers, FAA said, the absence of originating passengers would lead to relatively low concessions and would mean airports would have to charge higher landing fees and rents to remain fiscally sound.

As we indicated in this report, we remain impartial as to which measures are the best ones to adopt in any long-term plan for the air transport system. However, we are concerned that FAA's response misses a key point: in the long term, a successful strategy requires a careful look at measures other than expanding current hubs. Because so many key airports are severely restricted in their ability to add runways, other options must figure into long-term plans, even if they appear to have little merit in the short term. The panel may or may not have been correct in deciding that wayports were not desirable in 1990, but since then, dramatic changes have occurred in the system, such as rapidly escalating costs for and increasing local opposition to new runway construction at crowded hub airports. In addition, the rapid growth of regional airlines, regional jets, passenger enplanements, and cargo and express mail services have changed the aviation environment. In light of these changes and the conditions and circumstances that are likely to exist in the air transport system in the next 40 years and beyond, we believe all of these measures, including wayports, deserve a fresh look.

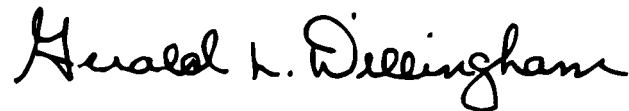
The judgments and decisions that are eventually rendered about these measures also need to be rooted in an in-depth, data-rich analysis. In this regard, FAA's current position about wayports appears lacking. For example, FAA has performed no quantitative analyses or conceptual modeling to support its conclusion about the impact of wayports on airport revenues and fees and airline competitiveness. In the years since the DOT/FAA panel examined the wayport concept, three major studies performed by reputable aviation experts outside FAA have concluded that wayports merit further study. Like us, these experts have not endorsed wayports but have called for developing more detailed information to make a sound decision. In the end, developing a meaningful blueprint to enhance capacity for the 21st century will require an expansive vision, a clear understanding of the realities facing the air transport system, and a sound evaluative approach that considers a broad range of possible solutions.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 7 days after the date of this report. At that time, we will send copies of the report to the Secretary of Transportation; the Administrator, Federal Aviation

Administration; and interested Members of Congress. Copies will be made available to others upon request.

If you or your staff have any questions about this report, please contact me at (202) 512-3650. Appendix IV lists key contacts and contributors to this report.

Sincerely yours,

A handwritten signature in black ink that reads "Gerald L. Dillingham". The signature is written in a cursive style with a large initial 'G' and a distinct 'L'.

Gerald L. Dillingham, Ph.D.
Director, Physical Infrastructure

Appendix I: Scope and Methodology

We examined efforts made by aviation stakeholders to reduce airline flight delays. Our efforts concentrated on three questions: (1) What initiatives are planned or under way by the federal government, airlines, and airports to address flight delays? (2) What effect are these initiatives likely to have on reducing delays? (3) What other options are available to address delay problems?

To determine what initiatives were planned or under way by the Department of Transportation (DOT) and the Federal Aviation Administration (FAA), we primarily spoke with program-level officials. To obtain a preliminary list of efforts, we reviewed congressional hearings, examined FAA and DOT publications, viewed FAA and DOT Web sites, reviewed academic and research studies, and read articles in the aviation press. From the list compiled from these sources, we held teleconferences and discussions with officials directly responsible for the programs leading the efforts. These included representatives from the offices of Free Flight Phase 1; System Capacity; and Communications, Navigation, and Surveillance. We also asked these officials and higher level officials to provide any other initiatives not on our preliminary list.

To learn about airline initiatives, we contacted the Air Transport Association and the Regional Airline Association to discuss approaches to reducing flight delays. In addition, we obtained contacts at the airlines from these organizations and held discussions with representatives from American, Atlantic Coast, Atlantic Southeast, Continental, Delta, Federal Express, Northwest, Southwest, United, and US Airways to discuss in-house efforts to address flight delays.

To learn about airport initiatives to reduce delays and add capacity, we met with representatives of the Airports Council International - North America and obtained the names and contact information of the council's members who were responsible for addressing delay issues. On the basis of this information, we held discussions with representatives of airports in Atlanta, Boston, Chicago, Dallas-Ft. Worth, Las Vegas, Los Angeles, Miami, Minneapolis-St. Paul, New York, Newark, Philadelphia, Phoenix, Pittsburgh, San Diego, San Francisco, and Seattle. We also visited Atlanta Hartsfield, Boston Logan, Chicago O'Hare, Dallas-Ft. Worth, Minneapolis-St. Paul, New York Kennedy and La Guardia, and Newark airports.

To examine the extent to which the initiatives will likely reduce flight delays, we reviewed congressional hearings, examined FAA statistics on demand and capacity growth, and held discussions with FAA and DOT officials. We also reviewed studies critiquing actions under way and

planned as well as forecasts on future airline activity and demand. We obtained FAA data on demand and capacity growth at different airports and followed up with FAA officials to obtain additional insight on their reports and data. We used reports from such organizations as the Transportation Research Board and San Francisco International Airport, and we also used articles in journals that described trends in air traffic demand and how current initiatives impacted those trends. We reviewed congressional hearings at which representatives of federal agencies, airlines, and airports reported how different efforts would affect delays. We also contacted aviation experts affiliated with the Airport Consultants Council, which is an airport industry consulting trade association, to discuss the impact of these initiatives.

To learn of other options available to address delays, we went to a large variety of sources. Using information from more than a decade of work that we had conducted on air transportation issues, as well as information we obtained in our work for this particular study, we identified a broad range of studies conducted by various researchers. We also reviewed assessments of these options by FAA, airports, and the DOT Office of the Inspector General. We also discussed these options with FAA officials as well as with various interest groups to discuss the advantages and disadvantages of each option.

Appendix II: Initiatives by DOT, FAA, and Selected Airlines and Airports to Address Flight Delays

Initiative sponsor and description	Objective	Status
Federal government procedures and technology - Department of Transportation		
Study of demand management techniques	A presidential directive issued on 12/7/00 directed the Department of Transportation (DOT) and the Federal Aviation Administration (FAA) to (1) study market-based congestion pricing and other demand management solutions to reduce delays and (2) undertake a policy analysis of how these solutions might be implemented, their potential impact, and any statutory impediments.	<u>Ongoing.</u> In a June 12, 2001, <i>Federal Register</i> notice, FAA requested comments on demand-management options that could be used to replace the temporary administrative limits on aircraft operations at La Guardia. Comments were due on October 12, 2001; however, FAA has indefinitely suspended this review. In an August 21, 2001, <i>Federal Register</i> notice, DOT requested comments on using market-based approaches to relieve flight delays and congestion at busy airports. Comments were due on November 19, 2001; however, DOT has indefinitely suspended this review.
Task force on short-term accommodation of the Wendell H. Ford Aviation Investment and Reform Act for the 21 st Century (AIR-21) slot exemptions at La Guardia Airport	FAA, DOT, and the New York/New Jersey Port Authority, working collaboratively, implemented an interim procedure to reallocate (on a lottery basis) schedule slots to airlines at La Guardia.	<u>Completed.</u> FAA has reallocated 159 AIR-21 slots to 13 carriers under an interim plan that became effective on 1/31/01.
Federal government procedures and technology - Federal Aviation Administration		
FAA air traffic organization	An executive order issued on 12/7/00 established a "performance-based organization" within FAA that is designed to increase the efficiency of the air traffic control (ATC) system.	<u>Ongoing.</u> FAA is developing an implementation plan and conducting a nationwide search for a chief operating officer.
National Airspace System (NAS) operational evolution plan	FAA and MITRE are developing a 10-year plan to address long-term, system capacity issues and solutions for airports, airlines, and the federal government.	<u>Ongoing.</u> FAA completed version 3.0 of the operational evolution plan, which was released in June 2001.
National airspace redesign	This is a long-term initiative to reconfigure NAS airspace routing and use, thereby improving system efficiency. Short-term efforts focus on relieving congestion at critical "choke points" in the Northeast.	<u>Ongoing.</u> Completion of the NAS redesign project is expected by the end of fiscal year 2006. To date, seven choke points in the Northeast have been identified by a group of airlines, FAA management, and the National Air Traffic Controllers Association (NATCA). Twenty-one action items were identified to address problems at the choke points, of which 11 have been implemented. All action items should be completed by 7/31/02.
National traffic management evaluation	A team of FAA and Air Transport Association representatives visited 34 air traffic facilities between July 19 and August 6, 1999. Participants evaluated air traffic management throughout these facilities.	<u>Completed.</u> The team identified 165 action items related to individual facilities, FAA's Command Center, and the NAS. The items were completed by 7/28/00.

Appendix II: Initiatives by DOT, FAA, and Selected Airlines and Airports to Address Flight Delays

Initiative sponsor and description	Objective	Status
Spring/Summer 2000 evaluation of air traffic	Beginning in late 1999, FAA began studying ways to reduce delays for spring/summer 2000 and beyond. Action items focused on improving communications between FAA and airlines, using available airspace more efficiently, using new technologies, establishing a strategic planning Web page for FAA's Command Center, and providing real-time weather information to users.	<u>Ongoing.</u> The procedures to address these action items were implemented in March 2000, and a formal evaluation was completed in December 2000. Actions were taken to improve procedures for spring/summer 2001, with an emphasis on additional training of FAA and aviation users. This evaluation will be conducted annually.
Spring/Summer Tactical Altitude Assignment Program (TAAP)	FAA is engaged in a pilot program involving 120 city-pairs to test the feasibility of allowing aircraft to operate at lower, less congested altitudes.	<u>Ongoing.</u> Test results have been positive, and FAA has reached an agreement with NATCA on proposed procedural changes. After completing training for controllers and pilots, TAAP was implemented at some facilities following a formal testing period.
Spring/Summer convective forecasting	This effort was undertaken to improve the ability to predict severe weather, ultimately resulting in better aircraft routing. It (1) collects weather information from the National Weather Service, airlines, and 20 central weather service units and (2) develops a collaborative convective forecast product, which is disseminated to FAA and user facilities.	<u>Ongoing.</u> The collection and dissemination process is in place. FAA has evaluated efforts from the year 2000 and has implemented changes and conducted training for the upcoming convective season. These efforts will be evaluated annually.
Spring/Summer use of Canadian airspace	This initiative is designed to enhance the use of Canadian airspace by U.S. air carriers through (1) new procedures for the automatic transfer of flight plan data between FAA and NavCanada ATC facilities and (2) an updated structure of overflight fees for airlines using Canadian airspace.	<u>Ongoing.</u> FAA has implemented procedures to ensure that NavCanada ATC facilities have adequate ATC staff before U.S. planes are routed over Canadian airspace. This effort has already helped relieve congestion at the Cleveland and Minneapolis centers. FAA and NavCanada are currently discussing expanded use of Canadian airspace and overflight fees.
Spring/Summer centralized operational authority	This is an effort to improve communications among FAA's Command Center, its ATC facilities, and airlines to smooth the flow of flights in the NAS.	<u>Completed.</u> FAA's Command Center holds several teleconferences daily with ATC managers and air carriers to discuss weather conditions and other factors causing delays at specific locations and to determine appropriate solutions for congestion in the NAS.
Spring/Summer use of military airspace	FAA and the Department of Defense (DOD) are studying the potential for the expanded use of DOD-designated airspace for commercial purposes. The initiative involves using new military airspace routes along the East Coast, improving procedures to reduce the effect on NAS operations from military	<u>Ongoing.</u> DOD is releasing some airspace for commercial use at certain times of the day, mainly in areas east of the Mississippi. Discussions are continuing on further use of military airspace by commercial carriers.

Appendix II: Initiatives by DOT, FAA, and Selected Airlines and Airports to Address Flight Delays

Initiative sponsor and description	Objective	Status
	operations in the Buckeye Military Operations Area (located in the Ohio Valley), and centralizing information on special-use airspace.	
Airport capacity studies	This is a long-term initiative with FAA, airport operators, and aviation industry groups forming airport capacity design teams at various airports to identify and evaluate alternative means, including procedural and technological innovations, and to enhance existing airport capacity to handle future demand.	<u>Ongoing.</u> Several reports have been issued. Since 1998, capacity reports or tactical initiative studies have been produced for six airports. Three more studies are in progress.
Airport capacity—benchmark arrival and departure throughput	FAA analyzed the capacity of 31 key airports in the NAS.	<u>Completed.</u> In April 2001, FAA released its final report on all of the airports that it studied.
Airport capacity—Aviation System Capacity Improvement	This program is designed to focus government and industry efforts on specific enhancements (e.g., traffic flow and hardware problems) needed to improve the free flow of traffic in the NAS.	<u>Ongoing.</u> FAA has identified Houston Bush Intercontinental Airport for a demonstration project which started in fiscal year 2001. The project will look at expanding the use of flight management systems and global positioning system (GPS) capabilities to accommodate additional traffic resulting from the construction of a new runway.
Military Airport Program	This program provides financial assistance to civilian sponsors of military airfields that are converted to civilian or joint military-civilian use to enhance airport system capacity and reduce flight delays. AIR-21 authorized adding 3 airports to the program (from 12 to 15 participants).	<u>Completed.</u> FAA selected three new airports on 1/8/01. <ul style="list-style-type: none"> • Mather Air Force Base as a backup airport for Sacramento International's cargo and general aviation (GA) traffic • March Air Force Base as a backup airport for Los Angeles International's cargo traffic • Gray Army Airfield as a joint-use commercial service (primary) airport for Killeen, Temple, and Fort Hood, TX
Free Flight Programs ^a	Free Flight (Phase 1) began in 1998 to make ATC less restrictive by using new technology and improved procedures. During Free Flight Phase 1, ^b FAA plans to deploy various decision support tools at its facilities and selected airports.	<u>Ongoing.</u> "Free flight" tools are being used at select locations throughout the system and results are being evaluated. Phase 1 is scheduled for completion in 2002.
Safe Flight 21	This federal government and industry effort was initiated to evaluate and validate the capabilities of advanced communications, navigation, and surveillance technologies to improve airport safety, capacity, and efficiency. Airport moving map displays in the cockpit will improve surface situational awareness for pilots; other technology will enable pilots and controllers to approach ideal	<u>Ongoing.</u> Two years of operational demonstrations and flights were successful in Alaska and the Ohio Valley region. Automatic Dependent Surveillance-Broadcast (ADS-B) ^c services are now being provided in the Bethel, AK, area and test infrastructure has been established in Memphis, TN, and Louisville, KY.

Appendix II: Initiatives by DOT, FAA, and Selected Airlines and Airports to Address Flight Delays

Initiative sponsor and description	Objective	Status
	aircraft-to-aircraft separations to land aircraft more efficiently.	Additional operational demonstrations and evaluations are planned. A preferred ADS-B link technology will be selected in 2001.
En-route Automation Modernization	This effort involves the replacement of legacy software and interfaces that make up the flight data processing and radar data processing automation systems.	<u>Ongoing.</u> This program began in early 2000 and completion is targeted for 2008. Funding in fiscal year 2001 is for initial analyses and a functional audit for the program.
Airway Facilities Enhancements	Three facilities-related initiatives to address flight delays: <ul style="list-style-type: none"> • National Operations Control Center (NOCC) to coordinate information between the Command Center and the field • NAS Infrastructure Management System (NIMS), an information system to collect and deliver NAS information • Three regional Operations Control Centers (OCC) to coordinate and prioritize NAS equipment (surveillance, communications, navigation, and telecommunications); operations; and management actions within their domains 	<u>Ongoing.</u> NOCC opened at the Command Center in March 1999. Deployment of NIMS is expected in 2003 and completion is expected in 2005. The three regional OCCs opened in June 2001, and full capabilities are expected to be in place in 2003.
Streamline and accelerate the development and implementation of navigation procedures	This initiative focuses on consolidating and streamlining the development and approval of navigation procedures and routes. On a test basis, FAA and carriers are using the terminal area route generation, evaluation, and traffic simulation (TARGETS) tool to create area navigation (RNAV) arrival and departure procedures.	<u>Ongoing.</u> TARGETS is being tested at eight major airports, and FAA expects to distribute the process and tools to other airports in the future.
Aviation System Performance Metrics	This initiative focuses on developing meaningful operational performance measures to help manage the NAS and improve operational efficiency. Through a designated reporting system, 10 participating carriers provide FAA with times for taxi-out, takeoff, on-ground, and taxi-in data at 21 airports. FAA then provides these data to its ATC facilities and to airports and airlines.	<u>Ongoing.</u> Data have been generated and disseminated since January 2000, but the system is still being validated. FAA is developing 18 new metrics related to the Command Center's operations—11 have been agreed upon by FAA and the airlines, and the remaining 7 are still being examined.
Local Area Augmentation System (LAAS) Satellite Navigation	When operational, LAAS is expected to yield the high accuracy, availability, and integrity needed for category I, II, and III precision approaches (instrument landings) in all weather conditions. If successful, FAA plans to purchase up to 160 LAAS installations (46 category I and 114 category III). Also, LAAS can increase the use of existing airports that currently are not available due to restricted areas or approaches.	<u>Ongoing.</u> Using a LAAS test prototype, FAA has flown over 240 approaches with a Boeing 727 and a Falcon 20 aircraft. FAA expects to have at least one category I LAAS installed and authorized for public use by 2002 and a category III LAAS available by late 2005. Full deployment of LAAS is scheduled to begin in 2002 and be completed by 2010.

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Initiative sponsor and description	Objective	Status
Improving environmental approval process - Federal Aviation Administration		
Streamline and expedite environmental reviews for airport capacity projects	This project will identify environmental delays, streamline environmental procedures, and expedite Environmental Impact Statements (EIS) for major runway projects at large hub primary airports.	<u>Ongoing.</u> In April, FAA submitted its Report to Congress on the environmental review of airport improvement projects. FAA will assign an EIS team of experts to each new major EIS and improve interagency environmental coordination at state and federal levels. It will also increase environmental resources through new hires in the Airports Office, reimbursable agreements with airports to fund expedited EISs, and amendments of existing third-party contracts for more consultant support. FAA also plans to reduce the amounts and types of environmental documentation required and to issue a "best practices" guide.
Improving environmental approval process - American Association of Airport Executives (AAAE) and Airports Council International-North America (ACI-NA)		
Expedited Airport System Enhancement	The goal of this proposal is to speed runway construction and other critical expansion projects at the nation's most congested airports by both streamlining and expediting current environmental reviews.	<u>Ongoing.</u> AAAE and ACI-NA introduced the legislative proposal to the Congress and the administration in March 2001.
Airline initiatives		
American Airlines and American Eagle	Major improvements recently completed or under way include: <ul style="list-style-type: none"> Assigning (isolating) specific aircraft to a limited number of hub routes to minimize the domino effect of delays at one hub on another hub Testing the prototype of AVOSS, a wake turbulence detection system, at Dallas-Fort Worth International Airport Adjusting flight times throughout its system to reflect the longer gate-to-gate departure and arrival times being experienced Reviewing and adjusting the schedule of American Eagle operations to minimize crowding in ramp areas Testing of data-link capabilities between aircraft and ATCs 	<u>Completed.</u> <ul style="list-style-type: none"> The isolation policy has been implemented at Chicago O'Hare. AVOSS was tested at Dallas-Fort Worth International Airport with positive results. <u>Ongoing.</u> <ul style="list-style-type: none"> American's flight times (as well as those of American Eagle) are reviewed continuously and revised with published schedules. Ramp operations are continuously reviewed to improve operational efficiency. Data-link capabilities are being tested on four of American's 767 aircraft serving European destinations; FAA tests are planned for the Miami Center in 2002 with over 24 of American's 737-800 aircraft.
Continental Airlines	Major improvements recently completed or under way include: <ul style="list-style-type: none"> Adjusting flight schedules at Newark to even out travel peaks Adjusting the level of service to some small and medium-sized cities to relieve congestion in some of their hubs 	<u>Completed.</u> <ul style="list-style-type: none"> Adjustments to Continental's flight schedules at Newark were made in 2000. Service adjustments were made in 2000. The airline was successful in

Appendix II: Initiatives by DOT, FAA, and Selected Airlines and Airports to Address Flight Delays

Initiative sponsor and description	Objective	Status
Delta Airlines and Atlantic Southeast Airlines	<ul style="list-style-type: none"> • Collaborating with FAA and the Port Authority on new equipment at Newark and other New York metropolitan area airports • Adjusting flight times throughout its system to reflect actual gate-to-gate departure and arrival times <p>Major improvements recently completed or under way include:</p> <ul style="list-style-type: none"> • Coordinating between Delta and Atlanta ATC to increase capacity at its Atlanta hub through schedule changes for Delta and its commuter affiliates • Assigning (isolating) specific aircraft to a limited number of hub routes to minimize the domino effect of delays at one hub on another hub • Adjusting the schedule structure at Atlanta Hartsfield Airport for spring 2001 to even out travel peaks • Adjusting flight times throughout its system to reflect actual gate-to-gate departure and arrival times • Installing Heads-Up Guidance System (HUGS) on its aircraft as a navigational aid during poor visibility weather conditions 	<p>obtaining the Integrated Terminal Weather System (ITWS) prototype at Newark, which benefits all New York area airports.</p> <p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • Continental's nationwide flight times are reviewed six times each year and adjusted as necessary. <p><u>Completed.</u></p> <ul style="list-style-type: none"> • Coordination has occurred with the ATC to improve capacity at the Atlanta hub, and Delta has rescheduled propeller aircraft traffic outside of jet arrival and departure banks to improve flow. • Delta has assigned (isolated) specific aircraft to specific city-pair routes each day to minimize the domino effect of delays at any single major airport. • Adjustments to Delta's schedule were made in early 2001. <p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • Delta's flight times (as well as those of owned subsidiaries ComAir and Atlantic Southeast) are reviewed continuously and revised four times each year. • Delta's new 737-800 aircraft and the regional jets for ComAir and Atlantic Southeast are being delivered with the HUGS installed. The MD-88 fleet will be retrofitted in the future.
Federal Express (FedEx)	<p>Major improvements recently completed or under way include:</p> <ul style="list-style-type: none"> • Canceling service to La Guardia • Installing LAAS at Memphis for GPS arrivals • Investing in HUGS and forward looking infrared radar (FLIR) for operations in poor visibility weather conditions • Participating in Safe Flight 21 to identify special arrival routes to improve aircraft flow at Memphis 	<p><u>Completed.</u></p> <ul style="list-style-type: none"> • FedEx cancelled its service to La Guardia in 1999 and is confining its New York operations to Newark, JFK, and Stewart. <p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • LAAS at Memphis is operational, and FedEx has equipped one aircraft with a GPS landing system for testing GPS approaches. • Research continues on the use of HUGS and FLIR. • Operational evaluation of Safe Flight 21 surface situational awareness applications conducted in 2001, and additional demonstrations at Memphis are planned for 2002.
Northwest Airlines	<p>Major improvements recently completed or under way include:</p> <ul style="list-style-type: none"> • Investing in technology for the meteorological department to assist in poor 	<p><u>Completed.</u></p> <ul style="list-style-type: none"> • Northwest's meteorological department began using turbulence avoidance systems to plan alternative

Appendix II: Initiatives by DOT, FAA, and Selected Airlines and Airports to Address Flight Delays

Initiative sponsor and description	Objective	Status
	weather planning and turbulence avoidance <ul style="list-style-type: none"> • Participating extensively in FAA's spring/summer initiative through its internal Strategic Planning Team • Adjusting flight times throughout its system to reflect actual gate-to-gate departure and arrival times • Providing additional service to satellite airports around the Boston area 	routing. <u>Ongoing.</u> <ul style="list-style-type: none"> • Northwest's Strategic Planning Team will continue to work with FAA to establish procedures. • Northwest's flight times are adjusted eight times each year. • Service levels have risen at Manchester, NH, and Portland, ME, in the last year.
Southwest Airlines	Major improvements recently completed or under way include: <ul style="list-style-type: none"> • Flying into and out of congested airports during periods of low demand • Adjusting flight times throughout its system to reflect actual gate-to-gate departure and arrival times • Developing an in-house flight planning system using Jeppesen data and on-line weather information to provide flight planning documentation to pilots • Developing the position of air traffic specialist for the dispatch office to interface with the FAA Command Center • Using less congested airports around metropolitan areas and withdrawing from San Francisco International Airport • Forming the in-house Punctuality Team to study on-time performance and find ways to reduce delays and cancellations • Exploring ways to use data-links to provide more accurate, timely information to pilots 	<u>Completed.</u> <ul style="list-style-type: none"> • Schedule revisions were incorporated into the January 2001 schedule for the most congested airports served by Southwest. The schedule published in June 2001 reflected additional revisions. • Termination of service at San Francisco International Airport occurred on 3/5/01. The business approach at Southwest is generally designed to serve outlying airports. • In-house flight planning system was implemented in 1997. • The air traffic specialist position was filled in December 2000. <u>Ongoing.</u> <ul style="list-style-type: none"> • Flight times are continuously reviewed, and revisions are incorporated into published schedules. • Recommendations from Southwest's Punctuality Team will be submitted on a periodic basis. • Studies of data-link use are still in progress.
United Airlines and Atlantic Coast Airlines (United Express)	Major improvements recently completed or under way include: <ul style="list-style-type: none"> • Assigning (isolating) aircraft between specific city-pairs to minimize the impact of delays at a single airport on other routes in the system • Revising ramp parking assignments for regional aircraft at Dulles International Airport to reduce taxi times • Adjusting flight times throughout its system to reflect actual gate-to-gate departure and arrival times • Using Digital Display Taxi Clearance (DDTC) at Dulles to digitally provide taxi times and routes to the cockpit • Attempting to reintroduce Land-and-Hold-Short Operations (LAHSO) at O'Hare to increase runway capacity 	<u>Completed.</u> <ul style="list-style-type: none"> • Aircraft have been isolated in a limited number of markets. • The strategic parking plan at Dulles has been implemented, reducing taxi times for regional aircraft by up to 50 percent. <u>Ongoing.</u> <ul style="list-style-type: none"> • Flight times are continuously reviewed, and revisions are incorporated into published schedules. • The experience with DDTC was successful; attempts are under way to get similar systems installed at other locations. • United is working with FAA, NATCA, and the Air Line Pilots Association to

Appendix II: Initiatives by DOT, FAA, and Selected Airlines and Airports to Address Flight Delays

Initiative sponsor and description	Objective	Status
US Airways	<p>Major improvements recently completed or under way include:</p> <ul style="list-style-type: none"> • Isolating aircraft routes that pass through Philadelphia and La Guardia to isolate systemwide delays • Developing a “slot-swapping” model to reduce specific flight and overall system delays • Deploying surface movement technology at congested airports to reduce ground congestion and taxi times. • Increasing the number of available backup aircraft from 11 to 16 • Redesigning the schedule structure and reducing service at its Philadelphia hub to match departure and arrival activity to the capacity of the airport • Adjusting flight times throughout its system to reflect actual gate-to-gate departures and arrivals • Developing aloft technology for dispatchers to revise the flight plans of flights that are already en route • Obtaining larger Airbus A-321 aircraft to reduce frequency in selected markets • Working with FAA, airport managers, and ATC personnel to implement new technology to enable dual landings on parallel runways during poor weather conditions • Pursuing initiatives with FAA regarding air traffic and airspace management • Implementing 21 additional initiatives to improve schedule reliability, including severe weather recovery plans, aircraft use improvements, crew scheduling, navigation capabilities, and other technological investments 	<p>agree on the use of LAHSO at O’Hare.</p> <p><u>Completed.</u></p> <ul style="list-style-type: none"> • Philadelphia and La Guardia aircraft are isolated to the extent possible. • An improved slot-swapping system was implemented to enable US Airways’ air traffic manager to make decisions more quickly. • The surface movement advisor technology has been installed at Philadelphia. • Additional backup aircraft were added in August 2000. • Changes to the Philadelphia schedule structure were implemented in June 2001. <p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • Flight times are reviewed continuously, and revisions are incorporated into published schedules. • Aloft technology capability is planned for implementation in 2002. • The first A-321 aircraft began service in February 2001, with more deliveries planned through the end of the year. • Philadelphia’s precision runway monitor is installed and certified, but is not in operation. Work for similar technology at the Pittsburgh and Charlotte hubs is ongoing. • US Airways is in the process of implementing 21 additional initiatives to improve schedule reliability; it continues to work with FAA on air traffic and airspace management.
Increasing airport physical capacity		
Atlanta Hartsfield International Airport	<p>Major improvements recently completed or under way include:</p> <ul style="list-style-type: none"> • Reconstructing runway 9R-27L • Constructing and expanding taxiways • Upgrading runway and taxiway intersections to facilitate movement of long wheelbase aircraft • Installing an Interference Monitoring and Direction Finding System to reduce radio frequency interference • Constructing a new fifth runway 	<p><u>Completed.</u></p> <ul style="list-style-type: none"> • Runway reconstruction was completed in 1999. <p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • Taxiway N5 and angled exit taxiway M14 are scheduled for completion in 2002; runway 8R taxiway will be completed and taxiway L will be extended in 2003. • Intersection upgrades scheduled for completion in 2002. • The interference monitoring system will be active in 2002.

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Initiative sponsor and description	Objective	Status
Boston Logan International Airport	Major improvements recently completed or under way include: <ul style="list-style-type: none"> • Adding a second ground control station to aid controllers • Implementing a new gate-leasing policy—airlines must “use or lose” • Constructing a new 5,000-foot runway for turboprops • Promoting the use of regional airports to reduce flight demand at Logan • Adding a centerfield taxiway 	<ul style="list-style-type: none"> • EIS for the new runway was issued in September 2001; it is scheduled for completion in 2005. <p><u>Completed.</u></p> <ul style="list-style-type: none"> • The ground control station is currently operational on an as-needed basis. • The “use or lose” policy is in effect for US Airways, American, Delta, and United. <p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • The new runway and centerfield taxiway are undergoing environmental review. • Efforts to promote regional airports began approximately 4 years ago; Massachusetts is spending \$500,000 in 2001 for a public marketing campaign.
Chicago O’Hare International Airport	Major improvements recently completed or under way include: <ul style="list-style-type: none"> • Initiating the World Gateway Program, which includes construction of 2 new terminals, the reconstruction of 2 concourses (adding 20 to 30 gates), and the extension and reconfiguration of taxiways • Undertaking the Chicago Airport System Strategic Capacity Initiative to share costs with FAA for installation of navigation aids and surface movement management systems. 	<p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • The World Gateway Program is currently under environmental review and is scheduled for completion in 2008. • The technology initiative is under FAA review; equipment installation is expected to be completed in 2006.
Dallas-Fort Worth International Airport	Major improvements recently completed or under way include: <ul style="list-style-type: none"> • Using an ongoing capacity enhancement design team to develop capacity-enhancing options • Employing new navigation and communication technologies to shorten flight times • Removing runway restrictions to allow greater use of regional jets • Constructing a new runway 	<p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • The capacity enhancement team meets monthly. • New navigation and communications technologies are being installed and tested. • Removal of runway restrictions is under environmental review. • The design layout for the new runway is being reviewed.
John F. Kennedy International Airport (New York)	Major improvements recently completed or under way include: <ul style="list-style-type: none"> • Studying jet blasts to more precisely determine the minimum intervals between aircraft departures and arrivals • Constructing an “air train” between JFK Airport and Manhattan/Long Island that will relieve congestion at La Guardia • Upgrading a runway to category II/III • Improving the southwest quadrant taxiway • Installing a new precision runway monitor (PRM) to increase landing efficiency 	<p><u>Completed.</u></p> <ul style="list-style-type: none"> • The jet blast study has been completed and separations have been reduced. <p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • The “air train” will connect with the N.Y. subway system and commuter rail by 2002 and make a second connection by 2003. • The runway upgrade is in design testing. • Taxiway improvements are under

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Initiative sponsor and description	Objective	Status
	<ul style="list-style-type: none"> • Obtaining Port Authority funding of the ITWS • Creating an ongoing capacity enhancement task force • Working with FAA to redesign airspace over New York to reduce operating restrictions and conflicts with other area airports 	<ul style="list-style-type: none"> design. • Construction of the PRM began in June 2001 and is scheduled for commissioning in mid-2002. • The Port Authority is currently funding a prototype ITWS while FAA develops a production system that is planned for installation in 2002. • The task force meets quarterly. • The airspace redesign is planned for completion by 2007.
La Guardia International Airport (New York)	<p>Major improvements recently completed or under way include:</p> <ul style="list-style-type: none"> • Collaborating with FAA to implement a “slot lottery” • Strengthening the runway deck to accommodate larger aircraft • Removing obstacles to the runway to increase aircraft weight restrictions and increase passenger capacity • Obtaining Port Authority funding for the ITWS • Using an ongoing capacity enhancement task force • Working with FAA to redesign airspace over New York to reduce operating restrictions and conflicts with other area airports 	<p><u>Completed.</u></p> <ul style="list-style-type: none"> • The slot lottery became effective on 1/31/01. • Deck strengthening has been recently completed. • A major obstacle was recently removed. <p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • The Port Authority is currently funding a prototype ITWS while FAA develops a production system that is planned for installation in 2002. • The task force meets quarterly. • The airspace redesign is planned for completion by 2007.
Lambert-St. Louis International Airport	<p>Major improvements recently completed or under way include:</p> <ul style="list-style-type: none"> • Adding two high-speed exits for the north parallel runway • Building a new terminal with 12 new gates • Installing a PRM to enable the use of two runways during bad weather conditions • Installing a converging runway display aid to assist controllers during the worst weather conditions • Building a new, third parallel runway • Maintaining control of gates at the new terminal to ensure maximum flexibility 	<p><u>Completed.</u></p> <ul style="list-style-type: none"> • The high-speed exits were added in 1999. • The new terminal opened in 1998. • The PRM was installed in 1999. • The converging runway display aid is operational. <p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • The new runway should be completed in 2005. • The airport is maintaining control of the gates as they are added.
Las Vegas McCarran International Airport	<p>Major improvements recently completed or under way include:</p> <ul style="list-style-type: none"> • Relocating the threshold on one runway to eliminate crossing of the airport’s two runways. • Adding 10 more gates. • Adding an infield taxiway to improve movements to the north and south 	<p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • FAA has approved the relocation of the threshold and is now working with the Air Transport Association to obtain concurrence from the airlines. • The additional 10 gates will be operational in 2004. • The taxiway addition is being designed and has an estimated completion date of late 2003.
Los Angeles International Airport	<p>Major improvements recently completed or under way include:</p> <ul style="list-style-type: none"> • Developing a new airport master plan with the preferred option to increase runway 	<p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • The preliminary EIS was released in January 2001 and was out for public comment from 1/18/01 through

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Initiative sponsor and description	Objective	Status
	separation <ul style="list-style-type: none"> • Adding 50 to 75 gates • Encouraging the use of the nearby Ontario Airport to reduce congestion at Los Angeles International Airport 	7/26/01. The project is to be completed by 2015. <ul style="list-style-type: none"> • The master plan for Los Angeles International Airport and the EIS plan are being revised to reflect the addition of gates. • To encourage the use of Ontario Airport, Los Angeles International Airport is supporting an application by United Parcel Service for freight service from Ontario to China.
Miami International Airport	Major improvements recently completed or under way include: <ul style="list-style-type: none"> • Adding a new 8,600-foot runway • Replacing the spoke-shaped concourse with a linear terminal to ease ground movements to gates and adding 32 to 33 commuter gates • Constructing a new international concourse with 14 gates • Reconfiguring the north/south taxiway to create a midfield hold pad to add more hold space and ease ground congestion 	<u>Ongoing.</u> <ul style="list-style-type: none"> • The runway has received its environmental approvals, and its design is complete. Scheduled completion date is mid-to-late 2002. • The new linear terminal is scheduled for completion in 2006. • The design for the international concourse is scheduled for completion by 2007. • The hold pad should be completed in 2003.
Minneapolis-St. Paul International Airport	Major improvements recently completed or under way include: <ul style="list-style-type: none"> • Building a new runway • Building a new terminal with up to 16 new gates and expanding an existing terminal to add 12 to 13 mainline gates and 29 regional jet gates • Maintaining control of the gates at the new terminal to ensure maximum flexibility • Reconfiguring taxiways to avoid runway crossings • Improving deicing pads to allow simultaneous deicing of up to six aircraft at the ends of the runways 	<u>Ongoing.</u> <ul style="list-style-type: none"> • The new runway should be completed in December 2003. • The new terminal was opened in May 2001, and the existing terminal expansion should be completed in 2002. • The airport is maintaining control of gates at the new terminal as they are built. • The taxiway reconfiguration should be completed in December 2003. • The deicing pads should be completed in December 2003.
Newark International Airport	Major improvements recently completed or under way include: <ul style="list-style-type: none"> • Extending a runway • Constructing a new ATC tower • Removing runway obstacles to allow the increased use of the crosswind runway • Introducing new approach procedures • Obtaining Port Authority funding for ITWS • Establishing an ongoing capacity enhancement task force • Working with FAA to redesign airspace over New York to reduce operating restrictions and conflicts with other area airports 	<u>Completed.</u> <ul style="list-style-type: none"> • The runway extension was completed in 1999. <u>Ongoing.</u> <ul style="list-style-type: none"> • A new tower is under construction by FAA. • Proceedings to remove the obstacles are under way. • New approach procedures are under development. • The Port Authority is funding a prototype ITWS while FAA develops a production system that is planned for installation in 2002. • The task force meets quarterly. • The airspace redesign is planned for completion by 2007.

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Initiative sponsor and description	Objective	Status
Philadelphia International Airport	<p>Major improvements recently completed or under way include:</p> <ul style="list-style-type: none"> • Constructing a new 5,000-foot runway for commuter and GA aircraft • Adding a new visual approach to runway 27L to increase the number of aircraft able to land • Installing a PRM system • Adding a new deicing pad capable of deicing seven aircraft simultaneously • Constructing 2 new terminal buildings—an international terminal that will add 12 widebody gates and a commuter terminal that will add 38 gates; an expansion to a third concourse will add 4 more gates • Construction of two new ramp control towers • Participating with an ongoing capacity enhancement task force • Collaborating with FAA on airspace redesign 	<p><u>Completed.</u></p> <ul style="list-style-type: none"> • The new runway became operational in December 1999. • The visual approach was first used in 1999. <p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • The PRM is installed and certification is expected by the end of 2001. • The deicing pad will be completed in late 2001. • The international terminal should be completed in early 2002, and the commuter terminal was completed in June 2001. Four additional gates on concourse D will be completed in late December 2001 or early 2002. • The first ramp control tower was completed in July 2001, and the second should be operational by the end of 2001. • The capacity task force meets every 3 months. • The airspace redesign group meets approximately every 2 months, and the redesign of airspace is scheduled to be completed in about 5 years.
Phoenix Sky Harbor International Airport	<p>Major improvements recently completed or under way include:</p> <ul style="list-style-type: none"> • Adding a new 7,800-foot runway • Reconstructing and extending two major runways • Widening and adding taxiways • Adding concourses and gates in existing and new terminals • Eliminating hangars for GA aircraft and offering GA hangars at nearby reliever airports on a priority basis • Constructing a new combined Terminal Radar Approach Control (TRACON) facility and tower to allow installation of a PRM system and the Standard Terminal Automation Replacement System • Relocating GA fixed based operators to the south side of the airport • Increasing the number of instrument landing systems (ILS) 	<p><u>Completed.</u></p> <ul style="list-style-type: none"> • The new runway became operational in October 2000. <p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • Runway reconstruction will be completed by 2002. • Taxiway improvements will be completed by 2002. • The new terminal will be completed in 2008. • Most GA hangars were removed in June 2000; the remaining hangars should be removed as replacement space becomes available. • The tower and TRACON projects are under discussion with FAA. • Relocation of fixed based operators' facilities is scheduled for completion in 2002. • The remaining ILS is to be added with runway reconstruction.
Greater Pittsburgh International Airport	<p>Major improvements recently completed or under way include:</p> <ul style="list-style-type: none"> • Adding a centerline, touchdown zone, and guard lights to a crosswind runway to reduce aircraft separation • Improving taxiway lighting • Rebuilding and rehabilitating taxiways to 	<p><u>Completed.</u></p> <ul style="list-style-type: none"> • The runway lighting was completed in 2001. • The taxiway lighting improvements were completed in 2001. <p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • Taxiway E is being planned and will

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Initiative sponsor and description	Objective	Status
	<p>reduce hold short and deicing delays</p> <ul style="list-style-type: none"> • Adding a fourth runway 	<p>be completed in 2002. Taxiways F and P were completed in 2001. Taxiway Y was completed in summer 2000.</p> <ul style="list-style-type: none"> • The new runway is in the early planning stage.
San Diego International Airport	<p>Major improvements recently completed or under way include:</p> <ul style="list-style-type: none"> • Lengthening the main taxiway • Constructing a new concourse with 10 additional gates 	<p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • The taxiway will be completed in 2002. • The new concourse is undergoing environmental review and is scheduled for completion by 2005.
San Francisco International Airport	<p>Major improvements recently completed or under way include:</p> <ul style="list-style-type: none"> • Concluding a voluntary agreement with United Airlines to refine its flight schedule • Introducing a PRM and a simultaneous offset instrument approach (SOIA) • Realigning a runway to provide full capacity operations in all weather conditions 	<p><u>Completed.</u></p> <ul style="list-style-type: none"> • The refined schedule with United Airlines was implemented in November 2000. <p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • Installation of the PRM and the SOIA is under way. • The runway reconfiguration is undergoing environmental analysis.
Seattle-Tacoma International Airport	<p>Major improvements recently completed or under way include:</p> <ul style="list-style-type: none"> • Constructing an additional runway • Replacing an old concourse and adding seven gates 	<p><u>Ongoing.</u></p> <ul style="list-style-type: none"> • The runway is undergoing environmental review and construction is scheduled for completion in 2006. • The new concourse is scheduled for completion by 2003.
Miscellaneous initiatives with indirect impact – Federal Aviation Administration		
Challenger Session 2000	<p>This November 2000 seminar brought together aviation community participants to exchange views on approaches to reduce flight delays.</p>	<p><u>Completed.</u></p> <p>A transcript of the seminar proceedings was prepared and made available on the Internet.</p>
Miscellaneous initiatives with indirect impact – Department of Transportation		
“Best practices” for improving the air travel experience	<p>The Office of the Secretary of Transportation (OST) initiated this project to identify (1) the “best practices” used by airlines and airports to improve consumer access to flight information and (2) the services that minimize the adverse effects of flight delays and cancellations on consumers.</p>	<p><u>Completed.</u></p> <p>A report on best practices was released in October 2000.</p>
Recommendations of the Air Carrier On-Time Reporting Advisory Committee	<p>DOT initiated this committee to address requirements in AIR-21 that the Department take steps to consider changes to current on-time reporting by airlines (14 CFR part 234) to provide clear information to the public about the nature and the sources of flight delays and cancellations.</p>	<p><u>Completed.</u></p> <p>The initial recommendation was sent to the Secretary on 11/29/00. In accordance with the recommendations of the task force, OST and FAA staff are now informally working with the industry to test the reporting of categories of sources of delays and cancellations. Ultimately, a rulemaking will be required to implement AIR-21’s requirement to modify part 234 to include the nature and</p>

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Initiative sponsor and description	Objective	Status
<i>Plane Talk</i> fact sheet	This document provides consumers with information to help them reduce their chances of encountering flight delays and assist them in coping with delays.	sources of flight delays and cancellations. <u>Completed.</u> This document was issued on 11/2/00 and is available on the Internet and in hard copy. It is the latest in a series of fact sheets for air travelers, which are issued by DOT's Aviation Consumer Protection Division.
Enhanced information regarding carrier rankings in terms of flight delays, cancellations, and consumer complaints in connection with DOT's monthly <i>Air Travel Consumer Report</i>	This monthly report provides consumers with information to make a more informed choice when making a flight reservation.	<u>Completed.</u> This information is now provided in DOT's monthly <i>Air Travel Consumer Report</i> available on the Internet.

^a“Free flight” is defined as a safe and efficient operating capability under instrument flight rules in which the pilots have the freedom to select their flight path and speed. Air traffic restrictions are only imposed to ensure separation between planes, keep an airplane from exceeding an airport's capacity, prevent unauthorized flight through special use airspace, and ensure flight safety. Restrictions to correct the identified problem are limited in extent and duration. Any activity that removes restrictions represents a move toward free flight.

^bFree Flight Phase 1 (FFP1) provides for the limited deployment of five initial core capabilities—User Request Evaluation Tool, traffic management advisor, passive Final Approach Spacing Tool, collaborative decisionmaking, and surface movement advisor—to manage risk while incrementally providing early benefits to users. FFP1 is chartered to implement capabilities that provide early, measurable benefits to the aviation community and provide a vital impetus to the agency's use of free flight.

^cADS-B uses satellite navigation to enable aircraft to broadcast such information as identification, position, altitude, velocity, and intent. This broadcast information may be received and processed by other aircraft or ground systems via data-links to improve situational awareness, the ability to avoid conflicts, surveillance, and management of air and ground traffic.

Source: GAO analysis of agency, airline, and airport data.

Appendix III: Description of Delay-Reducing Measures Not Included in FAA's Operational Evolution Plan

Presented below are additional details about each of the seven measures listed in table 5 of this report. Also shown is additional information from previous studies that have examined—and in some cases advocated—one or more of these measures.

Category 1: Adding Airport Infrastructure

Measure 1: Add New Airports in Metropolitan Areas With High Traffic Volume

This measure, which involves adding new airports in metropolitan areas to augment existing congested airports, has the potential to profoundly impact the capacity of the entire system, according to past studies. These studies say that building new airports in congested metropolitan areas holds perhaps the greatest promise for providing the capacity needed to meet rapid passenger growth. Also, multiple airports in certain areas, like those that exist in New York and the greater Los Angeles area, each have their own full-service patterns and can offer passengers convenience and improved accessibility. However, past studies were not optimistic about the probability that many new airports will materialize, given a number of formidable barriers, which include (1) finding a suitable site that does not conflict with other potential uses of the land, (2) overcoming concerns about noise and other environmental problems in sensitive areas, (3) providing adequate landside access (e.g., roads), (4) justifying the large investment required to build a new facility, and (5) gaining the support and financial backing from incumbent airlines.

Measure 2: Develop a New Type of Airport to Serve as Transfer Points

Several past studies have discussed the development of a new type of airport, called “wayports,” which differ from conventional airports in that they are further removed from large metropolitan areas and serve a special purpose. Under the wayport concept, such airports would be developed—either by using existing underused regional airports and former military bases or by building new airports—to supplement the current capacity needs of congested or capacity-constrained major hubs. Wayports are envisioned to be potentially large facilities—located on the fringe of or away from large metropolitan areas and near smaller cities (100,000 to 200,000 population)—that would serve mainly as transfer points for long-distance air travel routes. Except for nonstop service from one city to another (called “city pairs”), all flights would connect at these points to accomplish passenger transfer. As envisioned, service between these transfer points could be supplied either by large aircraft or by

conventional aircraft operating on a high-frequency schedule. Connection between wayports and major cities in the region could be provided by short-haul aircraft or high-speed ground transportation, such as rail or highway. Wayports would be regional multimodal transportation hubs offering connections to surrounding cities by whatever means of transport that would be cost-effective. They would also serve as cargo and mail handling centers.

Building wayports may not face the degree of opposition that building new airports would—especially from local communities—because wayports would be further away from large urban centers. Also, some studies have suggested that wayports would be less costly than comparable airports built in major metropolitan areas, could provide more open competition among airlines, and would likely result in less airspace congestion because of their location further away from congested metropolitan areas. However, the wayport concept has never been tried and gaining acceptance from airlines, sponsoring authorities, and affected communities might prove difficult.

Measure 3: Develop Regional Airports That Are Underused

This measure involves the creation of more regional airports at underused airports located about 50 miles from congested metropolitan airports. Many such underused facilities already exist throughout the nation. These regional airports could be used in two scenarios. Under one scenario, the regional airports would be similar to wayports, except on a smaller scale. They would be used mainly for transfer passengers, particularly at large, congested hubs that have a large percentage of transfer passengers. Under the second scenario, a network of regional airports located around a major congested hub would take origin and destination passengers diverted from the large hub. The regional airports around Boston Logan Airport are an example. The Massachusetts Port Authority (MASSPORT), which operates Logan, is working with state aviation directors and transportation agencies to make more efficient use of regional airports around Logan, including Manchester (New Hampshire), Worcester (Massachusetts), and T.F. Green (Providence, Rhode Island), to steer millions of new origin and destination passengers to these airports by 2010. All of these regional airports are within an hour's drive of Logan. Mid-America Airport near St. Louis is another example of a potential candidate for a regional airport for St. Louis-Lambert Field—a major hub for American Airlines. Located just 24 miles from downtown St. Louis, Mid-America is a joint-use civilian and military facility colocated with Scott Air Force Base. It has two, well-spaced runways over 8,000 feet long; it has substantial excess capacity.

Regardless of which scenario is used, the implementation of this measure could provide needed system capacity and accommodate some of the growth in air travel over the short term without adding significantly to the congestion and delay now experienced at the busiest metropolitan airports, according to past studies. Also, the cost to upgrade and expand the existing facilities would likely be less than new airports and possibly somewhat less than wayports. To the extent that regional airports were located in less densely populated areas, concerns with noise and conflicting land use may be less than at large metropolitan airports. Like the previous two measures, however, this measure would require at least one airline to commit to incorporating a regional airport into its long-range hubbing service system. Similarly, the airport must secure the financial resources necessary to develop the airport to its full capacity.

Category 2: Managing Demand

Measure 1: Adopt Market-Based Mechanisms

This measure relies on market forces to redistribute flight demand and allocate existing airport resources efficiently. Past studies and current literature suggest that the current airport access policies and the approach for determining landing fees have created some incentives that lead to the inefficient use of existing capacity at many congested airports. Two policies in particular have been cited as influencing airline behavior in this regard. The first policy deals with an aircraft's access to airports, the second with the fees that airports can charge for landing. By law, all aircraft—corporate and other general aviation aircraft, cargo carriers, and airlines—have equal landing access rights. This applies to small and large aircraft alike. When they land, laws and regulations require that airports charge the aircraft operators in a nondiscriminatory, reasonable basis—generally on the landed weight of each aircraft.²³ Although this fee structure is fine for noncongested airports, it can have profound consequences at congested ones. Some economists and industry representatives contend that these policies allow airlines—which are driven by competitive pressures and profit-maximizing motives—to

²³Weights of different types of aircraft are based on manufacturers' specifications; airplanes are not weighed upon arrival or departure from an airport. Fees are charged only for landings; there are no takeoff fees.

overschedule flights at busy airports during peak hours and use smaller aircraft and more frequent flights to meet passenger demand. They also contend that the current system provides little incentive for airlines or general aviation aircraft to use other nearby airports that have underused capacity.

Two market-based methods are most commonly mentioned to alter the behavior of airlines and passengers at congested airports to better ensure that existing capacity is used efficiently—differential pricing and auctions. Adopting a differential pricing approach would mean that landing fees would be higher at times when demand exceeded the availability of landing slots and lower at other times. An auction approach would allow airports to periodically auction a fixed number of takeoff and landing slots—equal to the airport's capacity—to the highest bidders. For example, an airport, in conjunction with FAA, could determine its per-quarter-hour takeoff and landing capacity, and a competitive bidding process among carriers could determine fees during each period. The two methods differ to a degree in the simplicity of implementation and the certainty they would provide about congestion levels. Of the two, differential pricing is the simpler to implement, but this method provides less certainty about congestion levels. Auctioning takeoff and landing slots provides greater certainty about congestion levels, but entails a more complex design and may be more costly to operate.

Because of increased congestion and delays at some airports, airport managers and FAA were seriously studying this option before September 11, 2001. For example, FAA and the New York/New Jersey Port Authority were studying market-based and administrative solutions for use at La Guardia to bring demand and airport capacity into alignment and reduce delays. It was anticipated that some form of demand management approach would be adopted there sometime next year. However, citing the significant decrease in operations at La Guardia following the terrorist attacks, FAA has suspended this study.

Proponents of a market-based approach cite several advantages, namely that (1) this approach will bring about needed changes without artificial or forced administrative or regulatory changes, (2) the costs of implementing it are relatively modest, and (3) increased revenues derived from various forms of congestion pricing can be used by airports to fund needed capital development projects. Critics say this approach could increase passenger ticket prices; reduce access for financially weaker small carriers; and adversely affect service to small communities, which would be less likely than large cities to retain their service to the capacity-constrained airports.

Measure 2: Using Administrative or Regulatory Methods

Past studies have mentioned a number of administrative and regulatory methods to manage flight demand. These methods include maintaining or expanding slot restrictions, adjusting airline flight schedules, diverting smaller aircraft to reliever airports, using larger aircraft at congested airports, and developing more flexible gate access policies. Each method is described below.

Using Slot Restrictions

Since 1969, four airports—La Guardia, JFK International, Washington Reagan National, and Chicago O'Hare—have operated under a slot system, whereby the number of flight operations is capped and takeoff and landing rights (slots) are allocated administratively.²⁴ Such systems are often done through grandfathering, a lottery, or some other nonmarket mechanism. These slots have been somewhat effective in controlling delays at these airports. However, provisions in the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (AIR-21) would eliminate the slot system at three of these airports by 2007. At La Guardia, AIR-21 provided immediate exemptions from the slot system for flights by new entrants and flights serving small communities. Almost immediately, the airport was overwhelmed with applications for over 600 new flights to and from the airport. Because the requests far exceeded the capacity of La Guardia, FAA in cooperation with the airport implemented a temporary lottery to allocate a limited number of slots and requested that a study of market-based alternatives be completed. However, due to the reduction in aircraft operations at La Guardia following the terrorist attacks this year, FAA has delayed this study until the long-term impact of September 11 on traffic at La Guardia is better understood.

Researchers have concluded that slot systems can be effective in controlling congestion at busy airports, but they also note that potentially slot systems can pose barriers to competition and adversely affect service to smaller communities, which are two important congressional concerns.

Adjusting Airline Flight Schedules

An alternative to using slot systems is to have airlines make voluntary flight schedule adjustments to even out periods of peak demand. In an attempt to reduce congestion, some airlines have recently done this on their own in limited situations. However, they are prohibited by antitrust provisions of current law from discussing flight schedules with other airlines. Two bills before the Congress (H.R. 1407 and S. 633) would allow

²⁴Newark International Airport was among those airports chosen for slot restrictions in 1969. Newark abandoned the slot system in 1970.

air carriers to discuss voluntary flight schedule changes at congested airports to reduce delays.²⁵

The ability of airlines to agree on schedule adjustments to even out peaks in air traffic at crowded airports is uncertain. Historically, critics point to the failure of airline scheduling committees that existed for the same purpose in the 1970s and 1980s. The committees—made up of airlines serving the four slot-controlled airports—worked reasonably well before deregulation in 1978, but afterwards the committees found it increasingly difficult to agree on voluntary adjustments. Deregulation brought fierce competition and a sizable drop in passenger fares, a corresponding growth in passenger demand, and increased profit opportunities. This caused airline overscheduling during congested times to satisfy passenger demand and maximize profits. As experience has shown, voluntary flight schedule adjustments by one airline can create slots for other airlines to add to their schedules.

Diverting Smaller General Aviation and Other Aircraft to Reliever Airports

This measure would require much of the general aviation aircraft (including corporate aircraft) and aircraft involved in air taxi service to shift from congested airports to nearby reliever airports, which are underused. Currently, smaller aircraft account for at least 25 percent of all air traffic at most of the congested airports in the nation—many of which have expensive runway projects under way. For example, general aviation aircraft and air taxi flights at four severely capacity-constrained airports, La Guardia, Kennedy, Philadelphia, and Boston Logan, account for about 31, 34, 41, and 46 percent of the total operations at each airport, respectively.

Diverting smaller aircraft away from congested metropolitan airports to reliever airports could free up capacity for use by larger commercial air traffic. For example, congestion pricing mechanisms implemented at Boston Logan in 1988 and the three New York airports (Kennedy, Newark, and La Guardia) in 1968 produced sizable results. Much of the general aviation aircraft abandoned Logan for secondary airports, and delays at Boston Logan dropped. After a \$25 premium fee was imposed for peak-hour use of runways at the three New York airports, general aviation

²⁵S. 633 would allow only DOT to convene a meeting of the airlines to discuss schedules. The FAA Administrator would chair the meeting and serve as an intermediary between the airlines for any delay-reduction offers.

aircraft use dropped 30 percent.²⁶ Adopting this kind of measure on a nationwide basis would likely require a change in the law that requires airports to provide equal access to all aircraft.

Using Larger Aircraft

Through regulatory means, this measure would require airlines to fly larger aircraft into congested airports that are currently being served with smaller aircraft. Currently, airlines decide the size of aircraft to fly on their routes. The average size of aircraft serving airports today is getting progressively smaller, because airlines are using smaller aircraft and more frequent flights to meet passenger preferences. For example, in 1999, there were actually 10 fewer seats per aircraft, on average, than in 1993. In 2000, at La Guardia, one of the most congested airports in America, 5 percent of the passengers traveled on 25 percent of the planes—a reality of the incentives to which the airlines are reacting.

Flying larger aircraft (that were full or nearly full) into congested airports could allow airlines to accommodate more passenger growth and potentially decrease flight frequencies, which ultimately could decrease delays and improve the use of existing facilities at crowded airports. However, the unilateral imposition of administrative restrictions by airports on the size of aircraft allowed into congested airports could violate provisions of current laws that require airports to allow equal access to all aircraft. Implementation would likely require a change in such statutory provisions.

Developing More Flexible Gate Access Policies

This measure would require altering contractual arrangements or use agreements between airlines and airports, which specify the air carriers' use of the airports' facilities. The nature and longevity of two agreements in particular—gate leasing arrangements and majority-in-interest (MII) clauses—can potentially result in the inefficient use of airport facilities and may prevent the airport from undertaking capacity-enhancing capital projects. The terms of gate leasing arrangements can be particularly critical in ensuring the efficient use of airport capacity. By law, airports are forbidden from denying an air carrier reasonable access to airport facilities. However, some large commercial airports have long-term “exclusive use” agreements with airlines for most of their gates, which means that even if a gate is not in use, no other airline can use it without

²⁶These congestion pricing mechanisms at Boston Logan Airport were found to be illegal by a federal district court because, among other things, they had a discriminatory effect on smaller aircraft. In addition, the Department had ruled, as an outcome of an administrative proceeding, that the landing fees at Boston Logan were illegal.

permission from the signatory airline. According to DOT, this practice is contrary to the legal requirement for reasonable access. By locking up all of the gates, even if they are underused, airlines can limit capacity at affected congested airports, and, if prevalent at a number of airports, can effectively limit the capacity of the entire system. Restrictive practices at exclusive use gates are becoming less prevalent also due to the passenger facility charge (PFC) program requirement that competitive access must be ensured at a carrier's exclusively leased gates if that carrier uses PFC-financed gates. Modification of MII clauses is equally important in ensuring that future capacity can be realized. Current MII clauses give dominant airlines at an airport "veto" power, in effect, over large capital projects that can increase capacity.

Encouraging or even requiring airports to develop more flexible, shorter term gate and MII agreements is a way to better ensure that existing airport capacity is enhanced.²⁷ However, this practice would not be doable immediately in many cases, since use agreements between airlines and airports are usually long-term contracts. Airports cannot unilaterally renegotiate shorter or more flexible agreements until these long-term agreements expire.

Category 3: Using Ground Alternatives

Unlike other measures that concentrate on enhancing capacity through airport improvements, this category of measures would enhance airport capacity by providing alternative transportation modes to move passengers from one location to another.

Measure 1: Build High-Speed Intercity Ground Transportation

This measure would involve developing high-speed ground transportation, such as rail, between large metropolitan cities. A portion of a congested airport's capacity may be freed up by diverting some shorter distance travel demand to high-speed ground transportation. As an alternative to air travel, this measure would be focused mainly on high-density routes of 200 to 500 miles. DOT has designated 11 high-speed rail corridors in U.S. locations, such as the Northeast, California, Chicago, and the Pacific Northwest. Work is under way at several locations, most notably in the Northeast Corridor, and, when completed, could provide viable

²⁷In accordance with AIR-21 and its newly required competition plans for airports, DOT has required airports to describe how they would make exclusive use gates available to requesting carriers and how they might modify their MII clauses so that signatory carriers could not impede or delay competition-enhancing capital construction projects.

alternatives to air travel, thereby alleviating the pressure on the air transport system.

High-speed trains have been used successfully in Europe and Asia and have proven to be viable alternatives for air travel in some cases. For example, the French Railway company recently initiated service between Paris and Marseilles via a high-speed train; this service reduces the travel time for the 500-mile trip from 5 to 3 hours by rail. The train is expected to siphon off as much as one-fourth of the 2.5 million passengers who travel by air between these cities each year. Already, one airline serving this route has discontinued its service between the two cities due to the added competition of the new rail service.

Although this measure has been tried successfully in Europe and Asia, its cost-effectiveness and technical feasibility in this country have not been demonstrated. For example, trains on Amtrak's Metroliner service between New York and Washington, D.C., travel up to 125 miles per hour for portions of the trip. However, Amtrak's estimate of the cost to fully develop the federally designated high-speed rail corridors and the Northeast Corridor is \$50 billion to \$70 billion over 20 years. Whether ridership will be sufficient to cover this cost is unknown. In the end, competitive rates and comparable portal-to-portal travel time would be keys to the success of this alternative.

Measure 2: Provide High-Speed Ground Transportation Connections for Airports

Another possible application of high-speed ground transportation is to facilitate passenger movement between airports or from city centers to new airports located on the fringe or outside of the metropolitan area. For example, in the long term, MASSPORT plans to connect Boston Logan International Airport to five nearby regional airports by ground transportation, using Logan for long-haul flights and the regional airports for short- and medium-haul flights. One study also suggested that high-speed surface transportation could help the development of wayports, since it would provide links to major cities in the region served without imposing a burden on the airspace and runways at the wayport. Like the previous measure, the cost-effectiveness of such systems would have to be demonstrated in the context of an overall regional airport system to increase capacity.

Appendix IV: GAO Contacts and Staff Acknowledgments

GAO Contacts

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