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Fact Sheet for the Subcommittee on Aviation, Committee on Public Works and Transportation, House of Representatives

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AIRPORT CAPACITY

Synopses of Major Studies

GAO/RCED-92-117FS

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The Honorable James L. Oberstar
Chairman
The Honorable William F. Clinger, Jr.
Ranking Minority Member
Subcommittee on Aviation
Committee on Public Works and Transportation
House of Representatives

Airspace and airport congestion have created major problems for U.S. aviation, delaying domestic flights throughout the country. The Federal Aviation Administration (FAA) anticipates that unless improvements are made to the system, 41 airports will experience flight delays totaling more than 20,000 hours in 1998, as compared with 21 airports in 1988 (flight delay is defined as the difference between actual and optimal flight time). To improve the capacity and safety of airports and otherwise enhance their facilities, up to $1.9 billion in federal funding is available in fiscal year 1992 for current projects. Because the most recent extension of the airport and airway legislation authorizing this funding expires at the end of fiscal year 1992, the Congress will soon consider reauthorizing the legislation.

To provide the Subcommittee with information relevant to reauthorization, we have, as requested, briefly summarized the major airspace capacity-enhancement studies produced since 1987--the year in which the last amendments to the act were enacted. Prepared by FAA, congressional agencies, universities and others, these studies have analyzed the problem of congestion and offered many recommendations to mitigate the problem. We, too, have studied airport capacity issues, including certain aspects of the Airport Improvement Program (FAA's airport grant program), which we are reviewing for your Subcommittee.

As of December 1991, we had obtained and reviewed 14 significant studies that contain a total of 11 major options for enhancing or expanding domestic airspace capacity. (See sec. 1 for a listing of the 14 studies.) The options, which are summarized below, do not represent our conclusions but rather those of the studies' authors. In some cases, however, our past work allowed us to comment

on positive and negative aspects of some of the options. Although this report does not systematically evaluate the merits of these options, a subsequent report will compare the recommendations advanced by the majority of these studies with actions that FAA may be planning. The numbers in the parentheses show how many of the 14 studies included the options in their review.

-- Develop and implement new aviation technology (9). Technological improvements are recommended to increase capacity and promote more efficient air traffic movement at and around airports. Airspace technological developments currently being explored include airport guidance, surveillance, and control systems; more capable instrument landing systems to improve landing rates, particularly during inclement weather; and a system to determine more precisely the space required to accommodate each aircraft's wake, which would permit the reduction of separation standards. One of the studies estimated that new technology may help to meet only about 10 percent of the capacity shortfall.

-- Implement demand management techniques (8). In this context, demand management techniques would use economic market forces to redistribute demand for services at congested airports. Such techniques include peak pricing (raising the landing fees charged to airlines during the busiest times of day) and slot allocation (distributing a specific number of landing spaces per hour per airline). Drawbacks to these measures include creating the potential for airlines to pass on increased costs in the form of higher ticket prices during peak hours and reducing airport access to new entrants.

-- Use underused airports (8). Studies suggest that air traffic could be routed to underused airports that are located near major metropolitan areas or that could serve as reliever airports. Military airfields that could be partially or fully converted to civilian use might be included in this group. To have significant potential, however, such joint-use airfields must be located reasonably near congested major airports, be attractive to local air travelers and general aviation, and have minimal restrictions placed on them by their military sponsors.[1]

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[1]See our report entitled Airport Capacity: Civilian Use of Military Airfields Has Added Little to System Capacity (GAO/RCED-91-130, Apr. 1991).

-- Expand existing airports (8). New runways could be constructed at airports that have undeveloped runway potential. This option should be qualified because, as one study noted, many of the large hubs are located within dense metropolitan areas where runway expansion may be severely constrained. In some instances, the constraints involve the costs of mitigating aircraft noise rather than the physical difficulties associated with expanding the runways.

-- Modify existing air traffic procedures (7). Air traffic control procedures and other related modifications could be changed to allow a greater volume of traffic during adverse weather conditions. FAA has identified runway and technology improvements that could enable aircraft to take off and land at more closely spaced intervals despite inclement weather. These improvements would require changes in existing FAA procedures. Our past work shows that airport sponsors and FAA need to be mindful of the aircraft noise ramifications of these route and runway changes and follow the prescribed environmental assessment process.[2]

-- Develop new types of aircraft (6). Studies suggest that new aircraft that are substantially larger or are capable of operating on much shorter runways could be marketed. Aircraft with 700 to 1,000 seats are technically feasible but have not yet appeared on the market, perhaps, as one study noted, because of financial and technological risks. Manufacturers are currently developing both reduced-takeoff-and-landing (RTOL) aircraft, which can operate on short runways (2,000 to 3,000 feet) and follow steep approach and departure paths, and vertical-takeoff-and-landing (VTOL) aircraft, which could be used commercially.

-- Develop a national airport plan (4). Some studies recommend the development of a strategic plan that would identify and set priorities for airports essential to the national aviation system. A comprehensive plan could provide a structure for allocating funds to enhance the capacity of these airports. However, one study cautioned that this option would involve the federal government in what has long been the province of

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[2]Aircraft Noise: Implementation of FAA's Expanded East Coast Plan (GAO/RCED-88-143, Aug. 1988) and Aircraft Noise: Eight Airports' Efforts to Mitigate Noise (GAO/RCED-89-189, Sept. 1989).

local government and private industry.

-- Study the feasibility of remote transfer airports (wayports) (4). Studies suggest that, in theory, remote transfer airports could be developed in small communities away from major populated areas. One study concludes that the remote transfer airport concept is controversial because it is contrary to the widely held airline view that a substantial local traffic base is essential to a hub, or transfer, operation. Several of the studies conclude that because this concept departs from present airport concepts and has not been tested, it might have difficulty gaining acceptance and support from airlines, sponsoring authorities, and affected communities.

-- Promote defederalization/privatization (3). Studies exploring this option suggest that privately owned and operated airports could have a positive impact on overall system capacity because market forces would require these airports to be run efficiently. Under this option, private airports would not be eligible for federal grants and would need to generate their own project funds. One study concludes that privatization could lead to monopolies, which, in turn, might lead to unwarranted cost increases for travelers.

-- Build new airports (2). One study suggests that beyond the year 2000 new airports will be required to maintain the quality of service available today. As identified in several studies, the principal barriers to building new airports include aircraft noise, opposition from incumbent airlines at existing nearby airports, and the large investment needed to build in an already developed area. Our work on the new Denver airport confirmed that establishing new airports usually requires overcoming significant political and community opposition and having strong support from the anticipated user airlines.[3]

-- Develop high-speed surface transportation (2). Some studies see high-speed surface transportation as a way to relieve airport congestion for destinations between 200 and 500 miles. Such modes of transportation could include high-speed rail or magnetic levitation (maglev), systems and advanced superhighways. Some studies

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[3]New Denver Airport: Safety, Construction, Capacity, and Financing Considerations (GAO/RCED-91-240, Sept. 17, 1991).

conclude that the United States does not yet have the population density to make high-speed rail economically feasible in all the areas where it is currently being proposed.

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To obtain the information presented in this fact sheet, we conducted a comprehensive literature search in several files of the Dialog system. After reviewing the results of the search, we developed a preliminary bibliography of major studies of domestic airspace capacity enhancement issued between January 1988 and December 1991. We asked eight experts in the field of aviation capacity to comment on the completeness of the bibliography. On the basis of their comments and our reviews of the studies available to us for this analysis, we developed synopses for the 14 studies included in this report (see sec. 2).

As agreed with your offices, unless you publicly announce its contents earlier, we plan no further distribution of this fact sheet until 7 days from the date of this letter. At that time, we will provide copies to the Secretary of Transportation; the Administrator, FAA; and other interested parties.

Major contributors to this fact sheet are listed in appendix I. Should you need additional information on the contents of this fact sheet, please call me at (202) 275-1000.

John H. Anderson, Jr.

for Kenneth M. Mead
Director, Transportation Issues

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ABBREVIATIONS

ATC	air traffic control
FAA	Federal Aviation Administration
RTOL	reduced-takeoff-and-landing
TRB	Transportation Research Board
VTOL	vertical-takeoff-and-landing

SECTION 1

BIBLIOGRAPHY OF 14 AIRPORT CAPACITY STUDIES

This section lists the 14 studies summarized in this fact sheet:

American Association of State Highway and Transportation Officials. Beyond the Horizon: The Future of the Nation's Air Transportation System, 1988-2020. Washington, D.C.: October 1989.

Apogee Research. A Strategic Plan for the Nation's Airport System. Bethesda, Md.: January 1990.

Aviation Systems Research Corporation. America's Airport Capacity Needs in the 21st Century. Golden, Colo.: August 1990.

Congressional Budget Office. New Directions for the Nation's Public Works. Washington, D.C.: September 1988.

Federal Aviation Administration. 1990-91 Aviation System Capacity Plan. Washington, D.C: September 1990.

Hornbeck, J.F. Airport Improvement Program: Federal Capital Spending and Airport Capacity. Congressional Research Service, Washington, D.C.: February 1991.

McGrath, Dorn C., Jr., and Peter Schauffler. Airport Network Evaluation: A Memorandum Report to the Federal Aviation Administration. The George Washington University School of Business and Public Management Institute for Urban Development Research, Washington, D.C.: July 1991.

Metropolitan Council of the Twin Cities Area. Is the Airport Adequate? Report of the Minneapolis/St. Paul International Airport Adequacy Study Advisory Task Force to the Metropolitan Council. St. Paul, Minn.: October 1988.

Office of Technology Assessment. Safe Skies for Tomorrow: Aviation Safety in a Competitive Environment. Washington, D.C.: July 1988.

Reilly, J.D. "Airport Capacity Overview." Transportation Research Circular, Transportation Research Board, National Research Council, Number 352 (Feb. 1990), pp. 17-22.

---. Aviation System Capacity Task Force - Four Reports to James Busey IV, Administrator, Federal Aviation Administration. Washington, D.C.: September 1990.

Transportation Research Board. Airport System Capacity: Strategic Choices. Washington, D.C.: 1990.

---. Winds of Change: Domestic Air Transport Since Deregulation. Washington, D.C.: 1991.

Truitt, L.J.. "Alleviating the Airport Congestion Crisis in Western Cities Through the Wayport Concept." The Western Governmental Researcher - Journal of the Western Governmental Research Association, Vol. 6 (1990), pp. 318-334.

SECTION 2

SYNOPSES OF 14 AIRPORT CAPACITY STUDIES

This section describes the purpose and provides a synopsis of 14 studies on airport capacity published between January 1988 and December 1991. The studies are listed alphabetically by author.

Title American Association of State Highway and Transportation Officials. Beyond the Horizon: The Future of the Nation's Air Transportation System, 1988-2020. Washington, D.C.: October 1989.

Purpose This report was intended to provide background information for use by the association and others in developing national aviation programs and policies. One chapter focuses on airport capacity.

Summary The chapter on airport capacity was derived primarily from options for enhancing capacity explored in two reports, FAA's 1986 Airport Capacity Enhancement Plan and the Transportation Research Board's 1988 Future Development of the U.S. Airport Network. The report discussed the following options:

-- **Develop and implement new aviation technology.** Completing the implementation of FAA's National Air Space (NAS) plan would permit more efficient use of airspace. The NAS plan provides for improving technology to obtain more precise navigation and tracking information, more advance warning of adverse weather conditions, and better air-to-ground communications.

-- **Use underused airports.** New airport sites will be difficult to locate because of existing land constraints or environmental concerns. Opening other types of airports, such as general aviation or military airports, to commercial air traffic could enhance capacity.

-- **Expand existing airports.** Alternatives for expanding existing congested airports should be explored. However, many of the large hub airports with limited capacity for expansion are located within dense metropolitan areas where runway expansion may be severely constrained.

-- **Develop a national airport plan.** A national aviation policy would ensure that needed capacity improvements were initiated at airports of national significance.

-- **Study the feasibility of the remote transfer airport.** The remote transfer airport could enable airlines to shift the transfer portion of intercontinental or transcontinental travel away from congested major hubs to newly developed airports located in remote areas.

Title Apogee Research. A Strategic Plan for the Nation's Airport System. Bethesda, Md.: January 1990.

Purpose This report explores a broad range of alternatives for enhancing or expanding airport capacity. Apogee prepared the report at the request of the Federal Aviation Administration's Office of Airport Planning and Programming.

Summary Apogee examined various improvements for enhancing capacity, such as new runways, new airports, technological advances, demand management, and possible diversion to other modes of travel. Recommendations include the following:

-- **Develop and implement new aviation technology and modify existing air traffic procedures.** Continued air traffic control (ATC) improvements will be important; however, the report anticipates that new ATC technology may help to meet only about 10 percent of the capacity shortfall. The recommended technological advances include improving devices to reduce separation times between take-offs and landings; developing new aircraft guidance, surveillance, and control procedures; and using new methods to monitor weather and atmospheric conditions.

-- **Implement demand management techniques.** Demand management alone may meet almost one-third of the expected capacity requirements by early in the next century. Policies could simply be structured to divert part of peak-period demand to off-peak hours, or such policies could be supplemented by policies to expand airport hours and divert a portion of demand to other airports. Demand management techniques could include peak-period landing fees or the auction of landing slots by time.

-- **Expand existing airports.** New runways will be important simply because they can most directly meet any remaining gap in capacity.

-- **Develop new types of aircraft and develop high-speed surface transportation.** The capacity required for air travel could also be obtained by diverting some travel demand to alternative modes of transportation. Alternative modes potentially competitive with air travel for short to medium distances include tiltroter aircraft, magnetic-levitation ground transportation, high-speed rail, and intelligent-vehicle highway systems. New modes of transportation offer the potential to meet up to 10 percent of expected long-distance travel needs by 2030 but only 2 percent by 2000.

Title Aviation Systems Research Corporation. America's Airport Capacity Needs in the 21st Century. Golden, Colo.: August 1990.

Purpose The Aviation Systems Research Corporation stated that this report would establish a new foundation for projecting America's air traffic demand in the coming decade.

Summary This report discusses strategies for the U.S. aviation system to forecast demand, reduce and manage congestion, and enhance capacity. While supporting some capacity-enhancing options mentioned in other reports (see below), this report does not support the development of a new airport in Denver or the concept of remote transfer airports. The report recommends that funding for the new Denver airport be stopped immediately and that no funding be directed to the development of remote transfer airports. Capacity-enhancing options supported by the report include the following:

-- **Use underused airports.** For several reasons, nonhub airports will grow rapidly in the coming decade. These reasons include congestion at metropolitan airports, redirection of traffic flows by airlines away from hub connections, increases in the frequency of scheduled flights at smaller airports, and population shifts. The report suggests that local communities and airport authorities try to attract air service.

-- **Develop new types of aircraft.** Some new aircraft, like tiltrotor aircraft, are in the test stage of development. While the costs of operating the tiltrotor aircraft are much higher than the costs of operating fixed-wing aircraft, they are lower than the costs of operating helicopters. The tiltrotor aircraft could be useful in highly congested areas where both limited land and willingness to pay higher fares could make them operationally and economically viable.

Title Congressional Budget Office. New Directions for the Nation's Public Works. Washington, D.C.: September 1988.

Purpose This report was developed for the Congress as mandated by the Public Works Improvement Act of 1984. The act directed the National Council on Public Works Improvement to prepare and submit a report on the state of the nation's infrastructure. One chapter of the report focuses on aviation.

Summary This report concludes that spending money on new aviation facilities would probably not, in itself, alleviate widespread congestion. Additional capacity depends not only on increasing available physical capacity but also on improving air traffic control. Options for enhancing airport capacity reviewed in this report include the following:

-- **Develop and implement new aviation technology.** In 1982, the Congress approved FAA's plan to automate and consolidate air traffic control through the National Airspace System (NAS) Plan. Implementation of this plan is 5 years behind schedule. Without improvements in air traffic control, relatively few airports are likely to expand capacity significantly by developing runways and other ground facilities.

-- **Implement demand management techniques.** Introducing peak-period prices for air traffic control would help to make more efficient use of existing capacity by shifting some flights to off-peak hours. Furthermore, adoption of a national pricing system to allocate scarce peak-time airport and air traffic slots would ensure access to airports on the basis of willingness to pay. FAA has no experience with such a price system and may require an adjustment period for implementation.

-- **Use underused airports.** Some gains in capacity may be possible through limited federal funding targeted to airports that have enough air traffic control capacity to handle extra flights but may need ground or terminal improvements.

-- **Promote defederalization/privatization.** Eliminating federal aid would require airports to consider new ways to expand capacity using their own resources. The airlines, which ultimately underwrite airport expansion, would probably consider alternatives such as reorganizing their schedules or establishing secondary hubs at uncongested centers. Demand for airport expansion would tend to reflect what the users (the airlines) would be willing to finance.

Title Federal Aviation Administration. 1990-91 Aviation System Capacity Plan. Washington, D.C: September 1990.

Purpose FAA, the Transportation Center, and MITRE Corporation collaborated to review FAA's program to expand the capacity of the National Air Transportation System. The plan identifies the causes and extent of congestion and delays and outlines planned solutions and projects to address these problems.

Summary FAA documented planned or technologically feasible capacity developments for airports that currently or will soon experience significant delays. Although new runways would gain the most capacity for airports, several other options would also enhance capacity.

-- **Develop and implement new aviation technology.** Sixteen programs are currently under way at FAA to develop new technology to enhance airspace capacity. These include programs to improve aircraft movement in the air and on the ground.

-- **Use underused airports.** FAA assumes that as flight delays grow at traditional connecting hub airports, airlines will develop new connecting hubs by using underused airports. FAA identified 30 potential new connecting hubs.

-- **Expand existing airports.** More than 60 new runways or major runway extensions are planned or proposed at the 100 largest airports. FAA documented 17 runway projects scheduled for completion in 1990 and 1991 that would add significant capacity to the system.

-- **Modify existing air traffic procedures.** New terminal airspace procedures and runway improvements have been identified that would increase capacity for existing or new runway configurations. The procedures include changing runway separation standards to minimize the effects of adverse weather conditions.

-- **Build new airports.** New airports would be the last of the solutions for providing additional aviation system capacity. New commercial airports are in various stages of development at Denver, Colorado; Austin, Texas; Atlanta, Georgia; Chicago, Illinois; and other locations.

Title Hornbeck, J.F. Airport Improvement Program: Federal Capital Spending and Airport Capacity. Congressional Research Service, Washington, D.C.: February 1991.

Purpose The Congressional Research Service developed this study to provide the Congress with information on the Airport Improvement Program. One section contains information on airspace capacity.

Summary This report suggests that the nation's ability to enhance airport capacity depends, to a large extent, on the availability of public and private resources to make capital investments. The report briefly discusses the following options for enhancing capacity:

-- **Implement demand management techniques and use underused airports.** By managing existing facilities more efficiently, airports could expand capacity without requiring new construction or other capital improvements. This result could be achieved by introducing peak-hour pricing and using smaller hubs more efficiently to divert traffic from larger airports.

-- **Expand existing airports.** Building new runways at major hubs would be a more practical capital investment response to capacity concerns than new airport construction. FAA has emphasized building new runways as a means to alleviate capacity problems.

-- **Promote defederalization/privatization.** Airport defederalization was a major issue in the 1970s and 1980s. This term generally referred to reducing or eliminating federal funding to the largest airports because they either were or could have become financially self-sufficient. The Congress has declined to pursue this option to date; however, the option continues to resurface as a policy alternative.

Title McGrath, Dorn C., Jr., and Peter Schauffler. Airport Network Evaluation: A Memorandum Report to the Federal Aviation Administration. The George Washington University School of Business and Public Management Institute for Urban Development Research, Washington, D.C.: July 1991.

Purpose FAA asked the Institute for Urban Development Research at George Washington University to evaluate airport network options. In response, the Institute submitted this memorandum report, which provides information that could be used to determine which federal properties (military airfields) could be incorporated into a new airport network.

Summary This report develops an airport network concept that focuses on the use of remote transfer airports to relieve air traffic in congested metropolitan areas. To illustrate implementation of the concept, the report evaluates the potential use of federal properties (military airfields) as remote transfer stations. The report defines several types of remote transfer airports.

-- **Develop the concept of the remote transfer airport.** The report proposes to create an airport network consisting of the current airport system and a combination of the following types of remote transfer airports:

Centerport: A remote transfer airport devoted entirely to transfer traffic.

Feederport: An existing or new hub that would serve as a principal point of flight origination for centerports and of transfer for traffic entering the system at linkports and outerports (see below).

Linkport: An existing or new small airport serving as a point of flight origination for feederports and as an intermediate stop for traffic entering the system at outerports.

Outerport: An existing or new small airport serving as the most decentralized point of flight origination.

Local terminal: A basic point of system entry and exit, located at an existing or new airport or other activity center, such as a shopping mall or office park.

Interport: A remote transfer airport devoted entirely to transfer traffic and serving as an intermediate or traffic-aggregating point between a centerport and several of its feederports.

Title Metropolitan Council of the Twin Cities Area. Is the Airport Adequate? Report of the Minneapolis/St. Paul International Airport Adequacy Study Advisory Task Force to the Metropolitan Council. St. Paul, Minn.: October 1988.

Purpose The Metropolitan Council was charged with setting policy for the structure of the airport system in the seven-county metropolitan area. Part 1 of this report summarizes the principal findings of the task force, as well as its recommendations to the council. Members of the consulting team to the task force included representatives from four aviation research firms: Apogee Research, Inc.; Thompson-Hickling Aviation, Inc.; CH2M Hill; and Enviroscience.

Summary The metropolitan area risks forgoing substantial economic gains if airport capacity is not expanded over the next 30 years. Limits on runway and taxiway capacity form the major long-term constraints on growth at the current site. The region's short-term needs up to the year 2000 require either a new runway at the current site or a new airport. The region's long-term needs up to the year 2020 and beyond require either a new airport or additional runway expansions at the existing airport. The task force reviewed the following options:

-- **Implement demand management techniques.** The current airport should use demand management to alter flight scheduling to maximize airspace and terminal capacity. The task force included some form of demand management for every option for enhancing or expanding capacity that was reviewed in the study. Demand management techniques included changing airline schedules (spreading flights over a longer period of time during the day) to reduce operation at peak periods, and creating pricing adjustment policies, to be implemented by the council.

-- **Expand existing airports.** The task force recommended that at least one new runway be built at the present site within 5 to 10 years. If a new airport was not sited at the end of that period, the task force noted, an additional runway would be required within 15 to 30 years.

-- **Build new airports.** The task force recommended that the region secure a site for a new airport of adequate size to meet long-range aviation needs and to minimize environmental impacts. This acquisition would coincide with the development of a new runway at the present site.

Title Office of Technology Assessment. Safe Skies for Tomorrow: Aviation Safety in a Competitive Environment. Washington, D.C.: July 1988.

Purpose The House Committee on Public Works and Transportation and the Subcommittee on Government Activities and Transportation of the House Committee on Government Operations asked the Office of Technology Assessment to determine how well existing safety policies, regulations, and technologies meet the government's responsibility for ensuring safety in commercial aviation. One section of the report prepared in response to this request discusses airport capacity.

Summary This report states that additional airport capacity (new runways and new airports) is years away and that FAA needs to create systematic plans to handle projected increases in demand. These plans may include demand management where necessary. Without such planning, according to the report, delays will inevitably occur as a result of overburdening the existing system.

-- **Implement demand management techniques.** Tactics suggested for implementing demand management include limiting access to commercial airspace by restricting certain types of aircraft, establishing pricing policies, and introducing slot control (limiting the number of landing spaces available to an airline during a given time period). Certain prohibitions, such as those based on aircraft size, work best where reliever airports are available to handle diverted aircraft. Some economists maintain that if airport access must be limited, it should be treated as a scare resource and priced accordingly. Others note that competitive pricing would give already existing airlines an advantage over new competitors entering the market.

Title Reilly, J.D. "Airport Capacity Overview." Transportation Research Circular, Transportation Research Board, National Research Council, Number 352 (Feb. 1990), pp. 17-22.

Purpose This overview was presented at the Sixth International Workshop on Future Aviation Activities, which was conducted by the Transportation Research Board and was held at the National Academy of Sciences in Washington, D.C., from September 13 to September 15, 1989.

Summary The solutions to inadequate airport capacity are both short-term and long-term. The short-term solutions include improving airport technology and aircraft operating procedures, resolving aircraft noise problems, and establishing new financial mechanisms to fund airport facility improvements. Long-term solutions require a comprehensive study of the need for new airports and of the measures necessary to ensure their timely development. Options for enhancing capacity include the following:

-- **Develop and implement new aviation technology.** The report advocates the development of technology for improving airport surface surveillance, guidance control, and automation; reducing wake turbulence; and obtaining more immediate (real-time) information on weather conditions.

-- **Modify existing air traffic procedures.** The report notes that an industry capacity task force worked with FAA to complete simulations and flight demonstrations for enhanced air traffic control operating procedures to permit the implementation of these procedures as early as possible. These enhanced operating procedures include reducing runway separation standards.

Title Reilly, J.D. Aviation System Capacity Task Force - Four Reports to James Busey IV, Administrator, Federal Aviation Administration. Washington, D.C.: September 1990.

Purpose FAA convened this task force to develop options to address the U.S. aviation system's capacity. The four reports are prescriptive and provide recommendations for both government and industry to correct aviation delays and congestion. Two of the four reports contain recommendations to enhance airport capacity.

Summary Some of the recommendations in the report from the Technology Working Group were made previously by the Industry Task Force on Airport Capacity Improvement and Delay Reduction. The recommendations suggest that FAA try to enhance airport capacity by focusing on tasks that promise maximum gains, including the following:

-- **Develop and implement new aviation technology and modify existing air traffic procedures.** The task force developed 23 recommendations to improve air traffic control and aviation technology. Improvements include reducing runway separation standards, improving air and surface automation, improving weather and other information available to pilots and terminal personnel, reducing the operational impact of wake vortices (airspace between aircraft), and ensuring the optimum use of civil/military airspace if made available.

The report from the Airport Development Working Group offers a series of recommendations for the federal government to improve capacity, including the following:

-- **Use underused airports.** FAA, states, and local authorities should assist in identifying the capacity potential of surplus military airports.

-- **Expand existing airports.** FAA should provide appropriate support for expanding smaller existing airports (small and medium hubs that may be distant from current major population centers) into large transfer hubs where appropriate.

-- **Develop new types of aircraft.** FAA should determine whether a civilian aircraft could be developed and operated within the current system with a sufficiently low operating cost to be competitive with current modes of transport from one city center to another.

-- **Develop a national airport plan.** FAA should create a National Airport Master Plan that would develop a realistic, multiyear airport needs assessment and establish clear federal, state, and local airport objectives. Such a plan would have to be developed with the full participation of the local, regional and state governments involved in airport planning and funding. The master plan would generate a national funding needs scenario based on capacity needs, demographics, population trends, business forecasts, and state and local economic development.

-- **Study the feasibility of the remote transfer airport.** FAA should continue to study the potential value of remote transfer airports in the context of specific locations and specific problems to be solved.

Title Transportation Research Board. Airport System Capacity: Strategic Choices. Washington, D.C.: 1990.

Purpose This report grew out of the recommended study plan developed in 1988 by the Transportation Research Board (TRB) in Future Development of the U.S. Airport Network. FAA asked TRB to help FAA and the U.S. Department of Transportation develop a national strategy for meeting long-term airport capacity needs. Because the results of the 1988 plan are presented in this report, the study plan was not summarized in this fact sheet.

Summary The Transportation Research Board assembled a committee of experts on aviation and related fields to provide advice on alternative strategies that could be adopted to meet long-term airport capacity needs. The committee recommended that FAA develop an evolutionary long-range strategic planning process for the air transport system. At a minimum, the plan should include long-range and short-range goals both for major airports and for airports that serve business and private aviation. To support the strategic planning process, the committee recommended that the following short-term actions be taken immediately:

-- **Use underused airports.** FAA has identified 28 airports with underused capacity that could be used to relieve some of the congestion at airports now used as hubs by individual airlines. Currently, potential new hubs are either underused or capable of being expanded. The committee recommended that FAA support the development of new secondary hubs at these underused airports.

-- **Expand existing airports while modifying existing air traffic procedures.** Increases in capacity could be achieved by simultaneously constructing new runways or taxiways and changing air traffic control procedures, including reducing runway separation standards. Of the top 100 airports in the United States (in terms of annual aircraft operations), the committee estimated, about 66 percent are candidates for one or more kinds of runway additions or procedural improvements. If the improvements were implemented successfully at the top 100 airports, the committee suggested, the system might be able to handle up to about 50 percent more traffic than in 1990.

The committee also recommended studying the following strategies:

-- **Develop and implement new aviation technology.** This

would include improving airport design; developing dynamic, real-time management of airspace and airport resources; creating measures to reduce aircraft noise or mitigate its effects; and developing new, more powerful analytical tools and models capable of evaluating the effects of prospective changes in the airport and airways network as a whole.

-- **Implement demand management techniques.** The federal government would rely on market forces to redistribute demand and to allocate existing and new airport resources. Demand could be managed by using a cost-based approach. This approach would allow airports to assess differential access charges on the basis of the cost that each user imposes on the other users or on the airport operator to provide service. Demand could also be managed using a price-based approach, which would allow individual users to determine the charge either by auctioning operating rights or by negotiating access fees with the airport operator.

-- **Develop new types of aircraft and develop high-speed surface transportation.** Because it is assumed that airport capacity increases in future years will be limited almost exclusively to incremental improvements at existing sites and to the use of underused airport capacity, this option focuses on new air and surface transportation technology. The new types of aircraft to be explored include larger (800 to 1,000 seats) subsonic jets for densely traveled routes, versatile short-haul aircraft (tiltroter), and supersonic high-speed commercial transport for overseas routes. New surface technology would include some type of high-speed intercity transportation system.

-- **Develop a national airport plan.** For this plan, the federal government would create a centralized system for managing airports analogous to that now applied to the use of airspace. A federal entity would generally oversee the development and use of present and future primary airports and of general aviation airports deemed necessary as relievers for primary airports (primary airports are airports that enplane at least 0.01 percent of the total number of airline passengers each year). Individual airports would still be owned and operated locally, but as cooperating parts of a national system rather than as autonomous local enterprises.

Title Transportation Research Board. Winds of Change: Domestic Air Transport Since Deregulation. Washington, D.C.: 1991.

Purpose In 1988, the Governing Board of the National Research Council approved a 2-year study to review the nation's experience with airline deregulation. The Council appointed a committee to consider whether the current level of air passenger service is adequate in comparison with past and likely future levels; whether certain factors affect airline service; whether deregulation has affected safety; and whether policy changes are necessary to improve the quality of air passenger service. One chapter of the study deals with airport and airway capacity limits.

Summary The public sector's response to the increased demand for airway and airport capacity that was stimulated by deregulation has been inadequate. Given the difficulties in expanding airway and airport capacity, the existing system should be used more efficiently. FAA has held the view that further gains in capacity are possible from building or expanding runways at existing airports. However, major expansions in physical capacity (new airports or expansion of most existing congested ones) do not appear likely within the next decade. Therefore, more emphasis will need to be placed on finding ways to use airports more efficiently. These options include the following:

-- **Develop and implement new aviation technology and modify existing air traffic procedures.** Some modifications for controlling air traffic operating procedures during inclement weather would increase capacity at many major airports. Such modifications would include altering runway separation standards to accommodate more take-offs and landings per hour during adverse weather conditions. Some modifications await further research and further technological development to ensure safety. These include automated procedures for controlling air traffic, which would increase capacity by overcoming the limits of an individual controller. The microwave landing system also promises capacity gains because it would be more flexible than current instrument landing technology and would improve landing rates, particularly during inclement weather.

-- **Implement demand management techniques.** In general, the cost of using airport runways or air traffic control does not vary with demand. As a result, congestion occurs at some airports during peak hours.

A charge could be imposed on peak-hour users to cause some users to shift to off-peak operating hours or to other airports. Challenges associated with pricing to avoid congestion include defining optimal fees, ensuring that airports do not misuse fees, and accommodating airports that operate at near-peak demand throughout the day and therefore do not have any off-peak capacity available.

-- **Use underused airports.** Various incentives should be explored to encourage airlines to shift to underused airports, either as new hubs or reliever airports. If demand management were implemented and substantial fees were imposed for using congested airports during peak operating hours, then the underused airports could become more attractive options. The use of some underused airports is already increasing, notably in the Los Angeles and New York areas.

-- **Develop new types of aircraft.** The use of larger aircraft would encourage more direct flights in markets that could sustain such traffic. Larger cities could be served directly and bypass congested hubs. Small jets, which are fuel-efficient in longer-range use, might also be developed in the future.

-- **Develop a national airport plan.** A systemwide air traffic control plan should be developed to replace the current first-come-first-served air traffic control practiced at individual airports. Such a plan has already been implemented for air traffic headed toward the three New York area airports; FAA converges traffic at a single navigation point to be lined up for the airway into the New York area. This requires FAA to begin spacing aircraft as far away as Colorado. FAA should develop analytic systems performance models that could be applied to FAA management and planning.

Title Truitt, L.J.. "Alleviating the Airport Congestion Crisis in Western Cities Through the Wayport Concept." The Western Governmental Researcher - Journal of the Western Governmental Research Association, Vol. 6 (1990), pp. 318-334.

Purpose Mr. Truitt prepared this paper as a Ph.D. candidate at the School of Public Affairs at Arizona State University. The paper identifies and discusses several alternative approaches to alleviate airport congestion.

Summary Resolution of the airport capacity problem requires the involvement of government at all levels. Most analysts agree that a rational program to alleviate airport congestion must include both short- and long-term measures.

-- **Develop and implement new aviation technology and modify existing air traffic procedures.** The most cost-efficient short-term solution would be to utilize existing facilities fully through technology. This would include developing landing systems that would allow for decreased runway separation standards. Also, changes in air traffic control procedures could significantly increase capacity.

-- **Implement demand management techniques.** A market-based variable landing fee could increase capacity by basing landing fees on time of day and demand rather than on aircraft weight, as is currently done. Those aircraft operators unwilling to pay the higher landing fees during peak periods could shift their flights to other less expensive periods. The airports collecting the additional fees could use these fees to create additional programs for enhancing capacity.

-- **Expand existing airports.** New runways could significantly increase capacity.

-- **Develop new types of aircraft.** Another longer-term solution to the capacity problem would be for the airlines to use larger aircraft. Although aircraft manufacturers have plans for manufacturing such aircraft, most airports could not currently accommodate the larger aircraft at the terminal or the runway. Moreover, airlines would need to decide if they wanted to use them.

-- **Study the feasibility of the remote transfer airport.** A remote transfer airport, or wayport, may be defined as an airport located away from population centers that would be used as a switching or transfer point,

not as a place of origin or destination. The remote transfer airport would have to be located near a community capable of providing the municipal services and infrastructure and the labor force to support the operation of the airport. Because of its distance from population centers, the remote transfer airport would raise fewer objections on the grounds of noise and would be faster and cheaper to build than an airport in or near a metropolitan area. Challenges associated with the new airport concept include the need to connect the remote transfer airport with a metropolitan center by high-speed ground transportation, which could be enormously expensive. Also, the cost of operating aircraft requires airlines to fill a high percentage of seats in order to break even. If passengers avoid purchasing tickets for flights requiring transfers, then remote transfer airports may have difficulty covering costs. Arizona was one state examining the feasibility of remote transfer airports.

-- **Promote defederalization/privatization.** The ultimate market-based solution would be to privatize the system. This would extend deregulation from airlines to airports. Privatization could mean selling or leasing airports to private operators or developing public-private partnerships. Critics noted that privatization would lead to monopolies able to increase the cost of travel by charging consumers higher fees. Moreover, only 75 of the nation's 6,000 public-use airports would be profitable to operate.

APPENDIX I

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