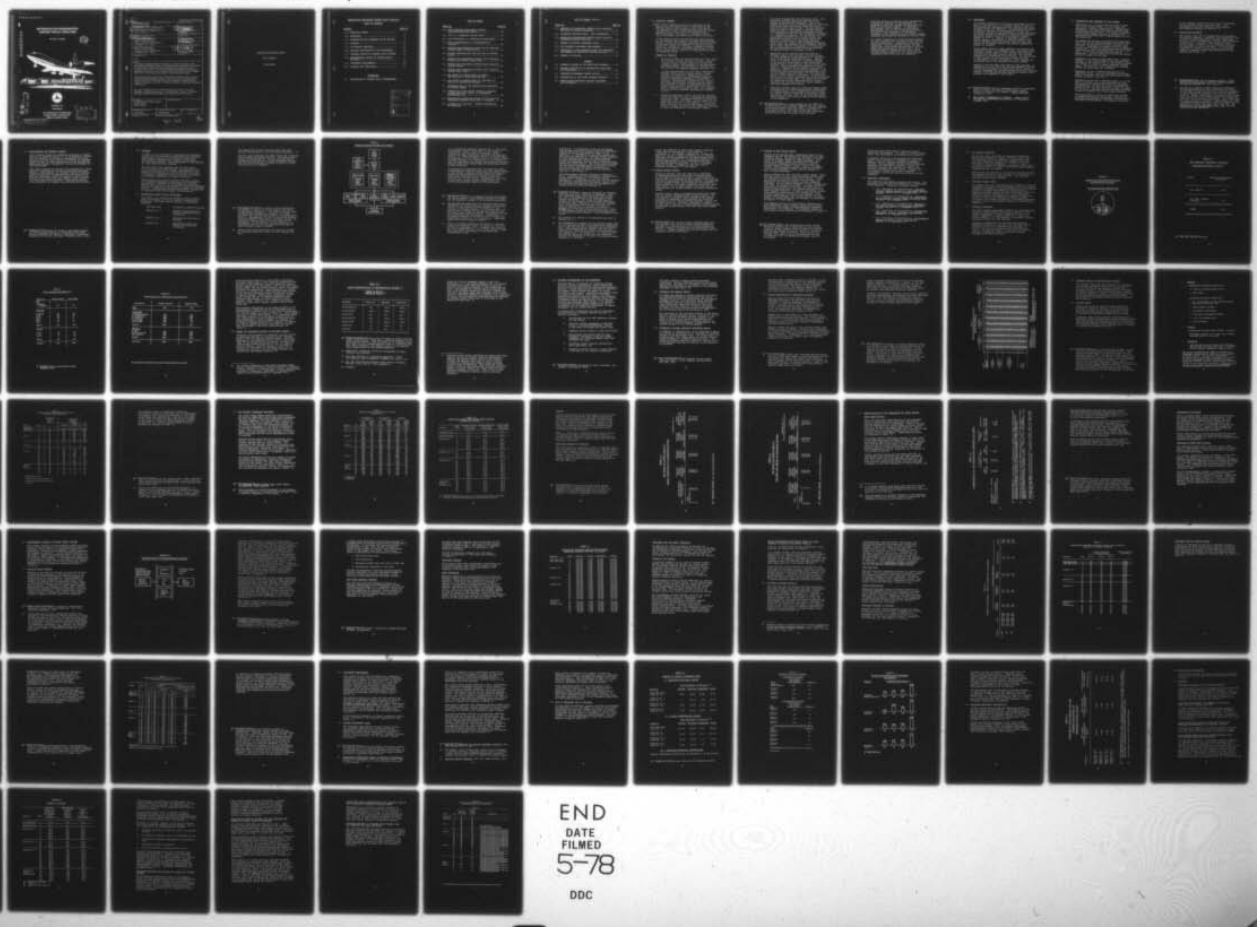
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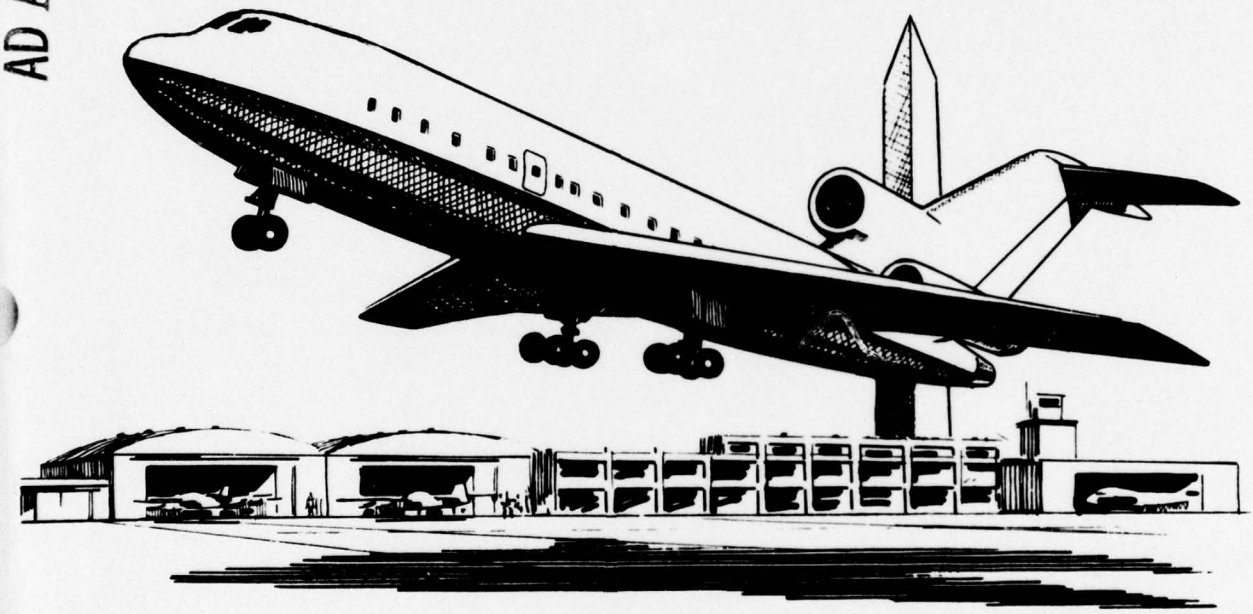
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METROPOLITAN WASHINGTON AIRPORT POLICY ANALYSIS

WILLIAM R. FROMME

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Office of Aviation Policy

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16. Abstract

The Federal Aviation Administration (FAA), as owner and operator of the Metropolitan Washington Airports, Washington National and Dulles International, is issuing a policy statement to guide development and operation of these facilities into the 1990's. The FAA's Metropolitan Washington Airport policy establishes a balance between a complex set of criteria which reflect transportation service, investment requirements, and environmental impacts.

This report evaluates a wide range of policy options defining various roles for the Metropolitan Washington Airports. Quotas, curfews, and possible wide-body aircraft service at National Airport are examined for potential policy impacts on regional air travelers, community residents, and airport investment requirements.

The report highlights the role of National Airport as the key to the entire regional air transportation system. At the same time, however, it indicates that Dulles will play an increasingly more important role in the future.

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METROPOLITAN WASHINGTON AIRPORT

POLICY ANALYSIS

FINAL REPORT

METROPOLITAN WASHINGTON AIRPORT POLICY ANALYSIS

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1.0 EXECUTIVE SUMMARY

This report presents results of an analysis of the Metropolitan Washington Airports undertaken by the Federal Aviation Administration (FAA) to establish the appropriate role of Washington National and Dulles International Airports within the Metropolitan Washington area. The report is intended to guide future development and operation of these facilities.

A wide range of policy options defining various roles for the Metropolitan Airports are tested and evaluated. Quotas, curfews, and possible wide-body aircraft service at National Airport are examined for potential policy impacts on regional air travelers, community residents, and airport investment requirements. Findings of the report, drawn from an analysis of these policy options, are summarized below.

SUMMARY OF FINDINGS

- By the year 1990, the planning period of this report, the Aviation Forecast Branch of the FAA expects 17.8 million air carrier, general aviation, and commuter passenger enplanements for the Washington-Baltimore region. This estimate is derived from the official FAA Aviation Forecast, September 1975.

- In each case evaluated in this report, Washington National remains the preferred airport of most regional air travelers. Demand for service at National continues to exceed passenger demand at Dulles and Baltimore-Washington International Airports. Results show a balance of air traveler and local environmental interest would be reasonably achieved if growth at Washington National Airport were managed to approximately 9.5 million annual passengers enplaned by 1990. This compares with 5.7 million passenger enplanements recorded in 1975.

- Dulles International Airport will play an increasingly more important role in Metropolitan Washington by the year 1990. Passengers handled at Dulles are expected to more than triple, and the number of aircraft operations to at least double. It is anticipated that over the next fifteen years, Dulles will grow at a faster rate than either Washington National or Baltimore-Washington International Airport.

- Jet aircraft operations are inherently noisy. Consequently, aircraft noise will continue to be a problem in Metropolitan Washington. While the adverse effect of noise on people cannot be completely eliminated, there are certain steps that can be taken to relieve airport noise. The most effective measures found in this report to relieve airport noise exposure in Metropolitan Washington include (1) extending FAR Part 36 noise standards to domestic U.S. commercial airplanes, (2) introducing two- and three-engine wide-body jet aircraft service into Washington National, and (3) discontinuing commercial jet operations at Washington National after 10:00 P.M. These steps, implemented together would remove approximately 33,000 residents from the NEF 30 level contour, 1/ compared to 171,000 Metropolitan Washington residents who would otherwise be exposed to NEF 30 or greater by 1990.

- Reductions in air carrier flight activity at National Airport would provide some noise relief to local residents at the expense of air travelers using Metropolitan Washington Airports. Specifically, a 50 percent reduction in quotas allotted to the airlines at National in 1990 would remove approximately 13,000 residents from the NEF 30 level contour. These residents are exposed to aircraft noise on a repetitive basis whenever the airport is operating. However, the 50 percent reduction in air carrier activity would displace approximately 4 million passenger trips each year to a less accessible airport, either Dulles or Baltimore. It would also add to the air traffic congestion and delay anticipated at Dulles by the year 1990. The annual cost of both the additional ground transportation for airport travelers and the additional air traffic delays by 1990 would approach $40 million.

- Wide-body aircraft service at National Airport would minimize both the ground transportation requirements of airport users in the metropolitan area and also air traffic delays anticipated at the three regional airports by the year 1990. At the same time, wide-body aircraft could alleviate airport noise exposure in the community.

1/ An important aspect of this analysis is the impact of aircraft noise. The technique employed for this purpose is the Noise Exposure Forecast (NEF), a computed value of noise exposure that takes into account the noise of individual aircraft, the number of aircraft operations, and the ratio of day and night flight activity.

Wide-body service at National would periodically increase the "peaking" or concentration of passengers within the terminal building and elsewhere on the airport complex. To maintain a satisfactory level of service at the airport, approximately $16 million of improvements would be required over and above the investments necessary to meet passenger and air traffic demand otherwise anticipated at National by the year 1990.

- Air traffic operations at night are more annoying to local residents than the same flight activity during daytime hours. Regardless of the hour of operations, turbojet aircraft present the most significant noise problem experienced at National today and anticipated by the year 1990. Thus, discontinuance of commercial jet operations at National Airport after 10:00 P.M. would provide measurable noise relief for the community.

2.0 BACKGROUND

The analysis presented in this report culminates an effort begun at the FAA in 1971 to properly define the role of the Metropolitan Washington Airports (National and Dulles Airports) within the community. By congressional mandate, the FAA has control over and responsibility for the management, operation, and maintenance of these facilities. An earlier proposal attempting to establish Metropolitan Washington Airport policy was circulated for public comment in 1973. 1/ Because it suggested cutbacks in certain types of air service at National Airport, this policy statement generated adverse reactions from some sectors of the general public, the airline industry and Members of Congress.

During agency review of these comments, the Metropolitan Washington Council of Governments (COG) initiated a study (partially funded under the FAA Planning Grant Program) covering much the same ground as the FAA, but from the perspective of Washington area residents. The FAA decided to await results of the COG study in order to bring to the agency's policy deliberations a more complete and structured view of the interests of local citizens.

Results of the COG study were recently made available. 2/ Augmented by the COG work, and the many comments from the earlier policy proposal, the FAA has moved to formulate a policy statement for the Metropolitan Washington Airports. Results of the FAA Metropolitan Washington Airport Policy Analysis are presented in this report.

1/ Notice of Policy Decision Regarding the Role of Washington National Airport and Dulles International Airport; Notice of Invitation for Comments, Federal Register, January 29, 1973.

2/ The Future of Washington's Airports. Summary report, Metropolitan Washington Area Council of Governments, December 1975.

3.0 INTRODUCTION AND STATEMENT OF THE PROBLEM

Washington, D.C. is the capital and ninth largest city in the United States. It is a center for government, tourism, transportation, communication, publication, and other activities of national and international significance. The Federal Government is the largest single activity in metropolitan Washington, providing jobs to approximately 375,000 area residents.

Government and cultural attractions made Washington one of the world's leading centers of tourism, and every year an estimated 20 million tourists visit the city. Washington has become a site for annual conventions of national organizations and professional associations, many of which maintain offices in the city. In 1970, 670 conventions were held in Washington. Tourism accounts for the second largest source of income for the area.

Washington is a major transportation hub. National Airport, in the Virginia side of the Potomac River, adjacent to the central city, is the eleventh largest U.S. airport in terms of annual passenger enplanements. It serves as a major terminus and transfer station for east coast air travelers.

Washington is also a leading communication and publishing center. Many of the world's major newspapers, magazines, and radio and television networks maintain offices in the city.

Washington is not only a national center, it is also home to residents of a growing metropolitan area. The Metropolitan Washington Council of Governments estimates that, by 1990, the city's population will exceed 770,000, and the metropolitan area, including two counties in Maryland and four counties and three cities in Virginia, will total almost 4,000,000.

This multiplicity of roles can complicate efforts to develop metropolitan area plans. Policies and programs which provide for efficient functioning of the Federal establishment, for example, may not be

in the interest of all who live or work in Washington and surrounding suburbs, and vice versa. Any comprehensive plan for Washington must recognize the different functions of the city. 1/

3.1 Conflicting Interests

The regional plan for air transportation must balance conflicting interests. Presently, the metropolitan area is served by three commercial airports: Washington National, Dulles International, and Baltimore-Washington International. National is the preferred airport, serving almost 70 percent of all passengers arriving and departing the area (1974 data). It is the most convenient in access time and cost to the greatest number of passenger origins and destinations in the metropolitan region. 2/

1/ Comprehensive Plan for the National Capital: Goals for the National Capital, National Capital Planning Commission, November 15, 1968, page 1-1.

2/ The degree of Federal activity within the Washington Central Employment Area (CEA) contributes not only to the passenger volume at National but also the preference of air travelers for National over the other regional airports. Federal employment in the area is significant; nearly 25 percent of all people working the Metropolitan area work for the National Government. Many others work for State and local Governments, trade groups, and other Government-related activities. Almost 50 percent of all metropolitan Federal employees work in the CEA. See Washington's Central Employment Area: 1973, National Capital Planning Commission.

While National is the most desirable airport for the traveling public, it is often viewed as a source of noise, air pollution, and congestion by many local residents. 3/ The conflict of interests at National, as at almost all of the major air carrier airports, is between local residents who would prefer to see traffic levels at the airport substantially reduced, and consumers (passengers, commercial enterprises, public agencies, and other airport users), who benefit greatly from and wish to continue having convenient flight frequencies at the airport.

3.2 DOT Policies

The recent Department of Transportation (DOT) "Statement of National Transportation Policy" articulates DOT policy that air transportation should contribute substantially to an improved quality of life by (among other things):

- Protecting the environment from air noise pollution;
- Bringing people close to the variety of benefits our culture and environment offer;
- Minimizing congestion, inadequate transportation service, and inefficient transportation operations; and
- Promoting the most efficient use of our resources.

Furthermore, it is DOT policy that the air transportation system must be accessible to all citizens and responsive to the varying demand of tourists, families and businesses. 4/

In other words, one thrust of DOT policy is aimed at reducing adverse environmental impacts of transportation. At the same time, it is necessary to attempt to meet the needs of the individual consumer.

3/ Air Facilities Planning in Metropolitan Washington, Washington Council of Governments (COG), 1972.

4/ Department of Transportation, A Statement of National Transportation Policy by the Secretary of Transportation, (September 17, 1975, page 4.)

There is plainly a need at the Metropolitan Washington Airports to strike a judicious balance between these frequently conflicting interests.

3.3 The Key Role of National Airport

The Metropolitan Washington Council of Governments (COG) in its December 1975, Summary Report, "The Future of Washington's Airports," acknowledges the existence of a regional airport system comprised of Washington National, Dulles, and Baltimore; and concludes that the facilities of Washington National are required to handle the projected long-run growth of regional air traffic activity. 5/

COG also recognizes that National Airport is the key to the future regional air transportation system.

3.4 Growth at National is the Primary Issue

As the preferred airport in the Washington Metropolitan area, National will continue to attract the largest number of air travelers, consistent with its capacity limitations. Restrictive policies towards growth at National could divert passengers and air traffic to either Dulles or Baltimore. This would relieve congestion and noise pollution at the expense of air travelers. 6/

The rate of growth of passengers and air traffic at National therefore, is a primary issue in future plans and policies for Metropolitan Washington Airports. The fundamental question addressed in this policy analysis is,

> "HOW MUCH AIR TRAFFIC SHOULD NATIONAL AIRPORT SUPPORT BY THE YEAR 1990?"

5/ "The Future of Washington's Airports," Metropolitan Washington Council of Governments, 1975.

6/ Refer to Growth and Use of Washington Area Airports, Comptroller General of the United States; August 1971. Also, "Task Force Studies on Expansion of Traffic at Dulles," FAA, 1969.

3.5 Environmental and Economic Impacts

Local interest groups are proposing reductions in traffic activity at National Airport. 7/ It is essential, however, that environmental and economic consequences of service cutbacks and other policy options be defined and assessed before the FAA, as owner and operator of the Metropolitan Washington Airports, implements a new policy strategy for these facilities.

This report presents the results of an analysis of a broad range of policy options for the Metropolitan Washington Airports. Environmental and consumer impacts of airport-policy alternatives are described and the trade-offs of each are identified. Where the impacts of policy alternatives can be translated into monetary terms, relative costs and benefits are assigned. Where quantification is not possible, the impacts are described qualitatively.

7/ Comments of Virginians for Dulles on the Summary Report of the Metropolitan Council of Governments and other Agencies entitled "The Future of Washington's Airports," Virginians for Dulles, Arlington, Virginia, July 9, 1976.

4.0 APPROACH

In order to test the impacts of Metropolitan Washington Airport policy alternatives, experiments with selected operational scenarios or situations are developed; each scenario representing an airport policy option the FAA might exercise. The consequences of each scenario are then systematically examined.

The year 1990 is the planning year for this report. It is reasoned that 1990 provides a sufficiently long period to allow for major capital improvements at the metropolitan airports, yet not too far into the future to preclude a reasonably accurate forecast of regional air passenger demand and air traffic activity.

Three regional air carrier airports, National, Dulles, and Baltimore-Washington International are included in the analysis. Although the FAA manages and operates National and Dulles, it is recognized that policy decisions relating to these airports may have an impact on Baltimore Airport. Consequently, Baltimore-Washington International is included as the third airport in the analysis.

4.1 Alternative Airport Policy Strategies

This report is an analysis of potential policy alternatives for managing air traffic growth in Metropolitan Washington. Four basic policy options are developed, including:

1990 Base Case	-	No Change in Present Policies
Scenario No. 1	-	Reduced Airline Quotas to Restrict Passenger Growth at National
Scenario No. 2	-	Wide-Body Aircraft use at National
Scenario No. 3	-	Wide-Body Aircraft and Reduced Airline Quotas at National

The assumptions and the rationale underlying each scenario are presented in the following paragraphs. 1/

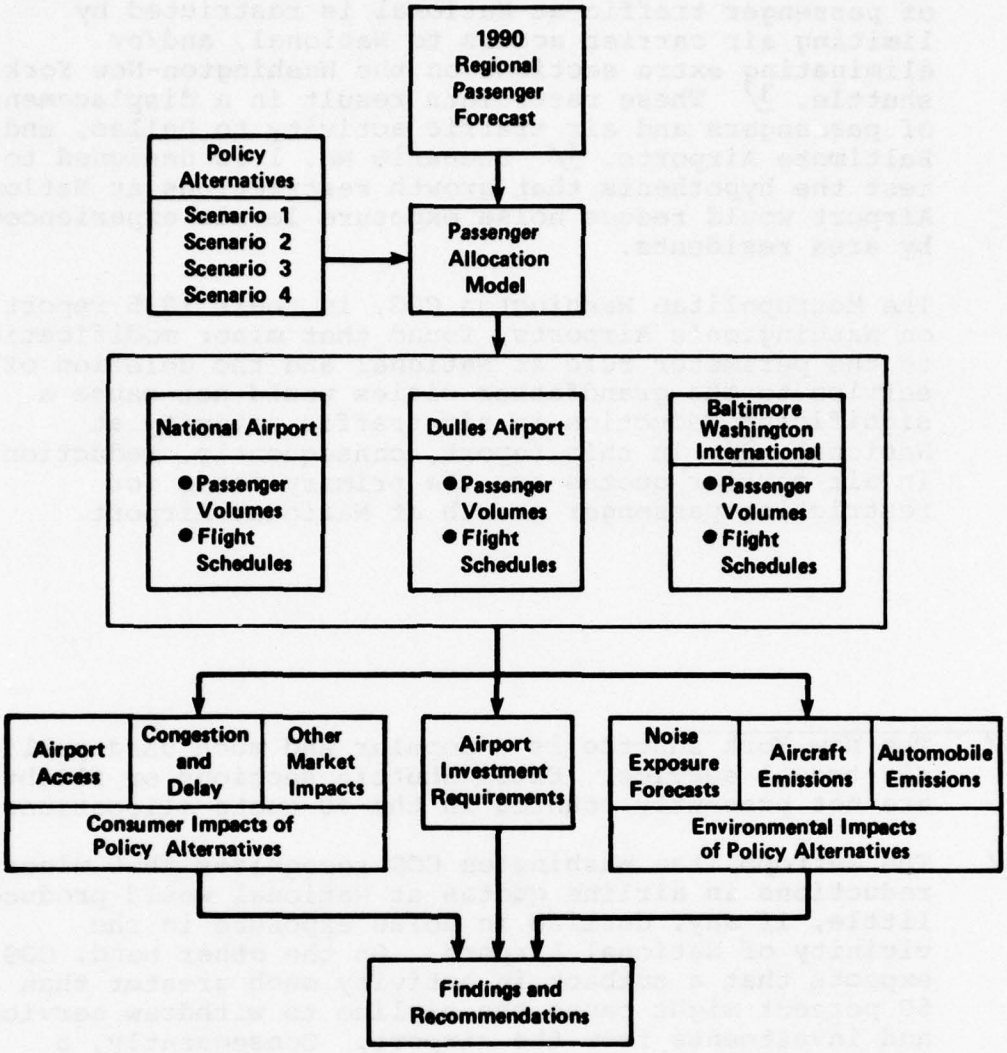
The base case represents the 1990 "status quo" condition, with no change in present policies. Air carrier quota limits are maintained, 2/ and two and three engine narrow-body jets continue to serve Washington National. The base case serves as a standard to which all other policy options are compared.

1/ Development of the basic airport policy alternatives was guided by results of the COG report "The Future of Washington's Airports." COG found that three major airfields were adequate and necessary to "handle projected long-run passenger growth in the [Washington] region." Consequently, in each of the policy alternatives developed for this report, National, Dulles, and Baltimore airports continue to serve regional air passengers. No new airports are considered for the planning period, nor are any scenarios developed in which National Airport is closed.

2/ Under present quota provisions, airlines are allowed 40 scheduled operations (take-offs and landings) per hour.

FIGURE 4.1

SCHEMATIC DIAGRAM OF THE ANALYTICAL APPROACH



In an alternative scenario, Scenario No. 1, the growth of passenger traffic at National is restricted by limiting air carrier access to National, and/or eliminating extra sections on the Washington-New York shuttle. 3/ These restraints result in a displacement of passengers and air traffic activity to Dulles, and/or Baltimore Airports. 4/ Scenario No. 1 is designed to test the hypothesis that growth restrictions at National Airport would reduce noise exposure levels experienced by area residents.

The Metropolitan Washington COG, in their 1975 report on Washington's Airports, found that minor modifications to the perimeter rule at National and the deletion of service to the grandfather cities would not cause a significant reduction in air traffic activity at National. 5/ In this report, consequently, reductions in air carrier quotas are the primary means for restricting passenger growth at National Airport.

3/ The New York shuttle is a popular and much used public air travel service. Extra shuttle sections or flights are not presently counted in the 40 quota allocations.

4/ The Metropolitan Washington COG recognizes that minor reductions in airline quotas at National would produce little, if any, decline in noise exposure in the vicinity of National Airport. On the other hand, COG expects that a cutback in activity much greater than 50 percent might cause the airline to withdraw services and investments from the airport. Consequently, a 50 percent reduction in quotas from 40 to 20 per hour represents Scenario No. 1 in this report. Additional quota limits are evaluated, however.

5/ There is a current operating restriction on non-stop service from National Airport in excess of a 650 mile radius from Washington, D.C., excepting the cities of St. Louis, Minneapolis-St. Paul, Miami, Orlando, Tampa, West Palm Beach, and Memphis, often termed the "grandfather cities."

Scenario No. 2 is designed to test the philosophy that growth at National Airport could be accommodated without additional environmental impact on the community. It introduces two and three engine wide-body jets into National at a maximum average frequency of four departures per hour. 6/ These wide-body aircraft operate more quietly than conventional narrow-body equipment, and can serve a given passenger demand with fewer flights. The second scenario allows for additional passenger growth at National, limited only by safety, and reasonable convenience and efficiency standards as dictated by the physical capacity of the airport. 7/

The third scenario combines features of Scenarios 1 and 2. Wide-body jets are introduced at National with a simultaneous reduction in air carrier quotas. Scenario No. 3 is designed to test the 1975 COG proposal that adverse consumer and environmental impacts could be minimized with wide-body jets and a reduction in overall airline traffic at National. 8/

6/ Airlines, of course, cannot be compelled to introduce wide-body aircraft at National or elsewhere. They will introduce jumbo jets at National when allowed but only in accordance with the economics of their network operations. This study has undertaken an analysis of the domestic airline network anticipated in the year 1990. Results of this analysis indicate that, if authorized, the airlines are likely to operate wide-body jets at National Airport at an average of no more than four per hour by 1990. Refer to the document "Wide-Body Aircraft Demand Potential at Washington National Airport," which accompanies this report.

7/ Air carriers are limited to 40 operations per hour in Scenario No. 2.

8/ COG recommends the reduction of air carrier quotas from 40 to 20 per hour by 1990, and assumes that essentially all air carrier aircraft at National will be wide-body jets. This analysis shows, however, that COG over-estimates the frequency of service with wide-body jets (see Section 5.5). In Scenario No. 3, airline quotas are reduced from 40 to 30 per hour, and wide-body aircraft are scheduled at National at a maximum average frequency of 4 per hour.

Within the framework of these three primary scenarios, a wide range of variations or test cases are introduced. 9/ For example, Scenario No. 1 tests the impact of a range of quota limitations on air carriers. Wide-body jets are scheduled at varying average hourly frequencies in Scenario No. 2--and within Scenario No. 3, various combinations of quota limitations and wide-body service patterns are used. In all, 32 discrete cases are tested. A summary of each test case is presented in Appendix A to this report.

4.2 Airport Traffic Levels

Choice of airports, when more than one is available, is determined largely by the relative attractiveness of each facility to air travellers. Attractiveness of each airport is influenced by the location of the facility relative to population and business centers; the speed and cost of airport access; the availability of convenient flight schedules; and airport capacity limitations, among other things. All of these factors vary over time as population growth, access systems, and airport capacities change.

Airport traffic levels in Metropolitan Washington result from the choices passengers make between airports. For this analysis, a computer model represents the choices available to passengers, and determines the resulting distribution of air traffic between National, Dulles, and Baltimore Airports. The model, described in Chapter 6 of this report, reflects a balance bwtween airline passenger preferences, airport policy, and other real world market factors.

9/ Several additional scenarios where developed which are not related to any of the scenarios already described. Included is a restructuring of the airline schedule at National, wherein jet operations are discontinued after 10:00 P.M. Another scenario has National Airport serving commercial traffic exclusively.

4.3 Impacts of Each Policy Option

Airport policy options have a measurable impact on the consumers who use the Metropolitan Washington air transportation system. Additional time and cost of airport access are primary impacts on these consumers. As a result of possible growth restrictions at National, for example, passengers may be forced to travel to another airport to catch a flight. Travel to a more distant, less accessible airport (Dulles or Baltimore), will involve additional access time and expense for most of these passengers.

Policy alternatives also influence airport delays. While National Airport is often quite congested, delays there are limited by the quota system now in effect. Dulles and Baltimore handle less traffic than National, and experience minor delays compared to other commercial terminals. As air traffic continues to grow, however, airport delay can increase noticeably. A policy curtailing operations at National by the year 1990 could relieve aircraft congestion there, but worsen conditions at the other regional airports. In terms of air traffic delays, there would be little merit to an alternative, which relieved congestion at National, but resulted in even greater delay elsewhere. 10/ Airport delays, and other impacts of airport policy on the consumer, are evaluated in Chapter 7 of this report.

Environmental impacts of airport policy decisions are also identified. These include airport noise exposure, and aircraft and airport related automobile emissions discharged in the community. Environmental impacts of each airport policy alternative are discussed in Chapter 8.

10/ Air traffic delay costs include both airline (direct operating expenses) and inconvenience to the consumer. It may be argued, however, that any additional airline expenses are ultimately borne by the user. Certainly, they represent costs to society. While airline and consumer delay costs could be disaggregated for ease of reporting, they are combined as consumer costs in this report.

Policy decisions would have an impact on airport investment requirements. The costs of airport capital improvement requirements are identified in Chapter 9.

A schematic overview of the Metropolitan Washington Airport Policy Analysis is presented in Figure 4.1. Based on the 1990 regional passenger enplanement forecast, hourly passenger volumes and airline flight schedules are developed at National, Dulles, and Baltimore Airports; one schedule for each of the 32 policy alternatives under review. Consumer and environmental impacts and airport investment requirements are derived from these traffic activity schedules.

4.4 Technical Supplements

Five technical supplements accompany this report. Each supplement provides detailed information on subsections of the analysis. Supporting documents include:

- U.S., Department of Transportation, Wide-Body Aircraft Demand Potential at Washington National Airport, FAA-AVP-77-37, September 1977.
- U.S., Department of Transportation, Description of the Multiple Airport Demand Allocation Model, FAA-AVP-77-39, September 1977.
- U.S., Department of Transportation, Analysis of Air Traffic Delays at Metropolitan Washington Airport, FAA-AVP-77-41, September 1977.
- U.S., Department of Transportation, Metropolitan Washington Airport Investment Requirements, FAA-AVP-77-38, September 1977.
- U.S., Department of Transportation, Environmental Impacts of Airport Policy Alternatives, FAA-AVP-77-40, September 1977.

5.0 AIR TRAFFIC FORECASTS

By the year 1990, the number of passengers handled by Metropolitan Washington airports will more than double. This forecast covers all domestic, international, and chartered commercial flights, plus commuter, military, and general aviation passengers. In 1975, a total of 8.3 million passengers enplaned at National, Dulles, and Baltimore Airports. By 1990, 17.8 million annual passenger enplanements are anticipated.

Changes also are forecast in the types of aircraft serving the regional airports. New, quieter jet aircraft will be introduced into the air carrier fleet. The following sections discuss these forecasts.

5.1 National Airport--1975

In calendar year 1975, National Airport enplaned 5.7 million passengers, 68 percent of all Washington area air travelers. Passenger preference for National compared to other regional airports is largely attributable to its proximity to Federal Government centers and other activities within the Washington central employment area, to its convenient location relative to metropolitan residential areas, and to the relatively high frequency of flight schedules available. The present distribution of passengers between National, Dulles, and Baltimore Airports is illustrated in Figure 5.1.

5.2 Passenger Forecasts

The 1990 passenger enplanement forecast for the Washington/ Baltimore region shows a 114 percent increase over the number of passengers actually enplaning in 1975. Air carrier passengers, as shown in Table 5.1, remain the largest segment. Air taxi/commuter, and general aviation passengers account for the remainder.

Passengers enplanements anticipated at Metropolitan Washington Airports for the year 1990 are based upon a forecast of total U.S. passengers for that year. A ratio is used to derive local activity from national totals. As shown in Figure 5.2, the ratio of local to national enplanements remains relatively constant throughout the forecast period.

FIGURE 5.1

PRESENT DISTRIBUTION OF METROPOLITAN WASHINGTON AIR TRAVELERS

1975 PASSENGER EMPLANEMENTS (000)

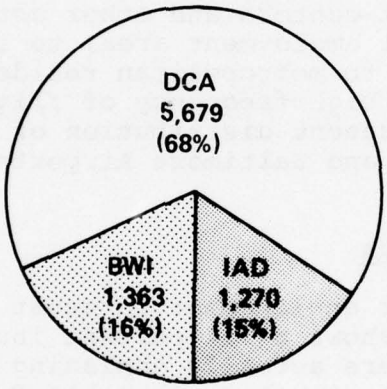


Table 5.1

1990 Passenger Enplanement Forecasts

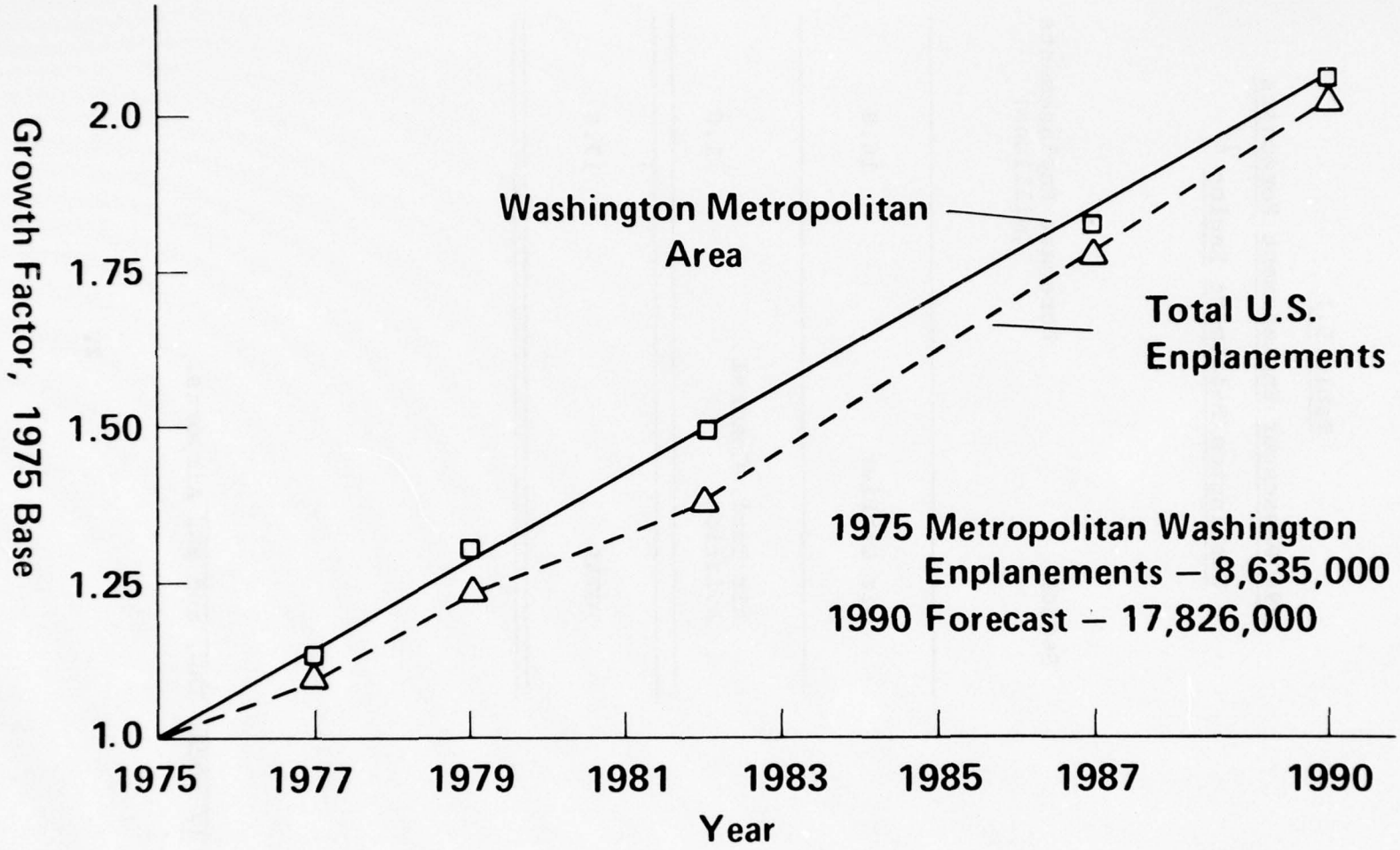
Washington/Baltimore Region [1/]

Sector	Forecast Enplanements (millions)
Air Carrier	16.8
Air Taxi, General Aviation	1.0
TOTAL	17.8

1/ DCA, IAD, and BWI Airports.

FIGURE 5.2

PASSENGER ENPLANEMENT GROWTH FACTORS



U.S. air passenger enplanement forecasts are generated from a projection of national economic activity, and from a regression model which explains the relationship between economic performance and air traffic activity levels. For further discussion of the passenger enplanement forecasts, refer to the FAA publication, "Aviation Forecasts." 1/

5.3 New Aircraft

Narrow-body two and three engine jets are predominant in today's U.S. scheduled airline fleet (see Table 5.2). These aircraft present the most significant noise problem in the Metropolitan Washington area. By 1990, however, a shift towards more wide-body aircraft is anticipated, as shown in Table 5.3.

Changes in the air carrier fleet could influence noise exposure levels in Metropolitan Washington. Aircraft noise is generated primarily by the aircraft's engines (as a result of the external turbulent jet exhaust, and the internal compressors and combustion process). High-bypass ratio engines, such as the Pratt and Whitney JT9D, General Electric CF-6, and Rolls Royce RB-211 models now used on the 747, L-1011, and DC-10 aircraft, reduce the primary jet exhaust velocity and thus reduce its noise. At the same time, improved

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1/ Aviation Forecasts: Fiscal Years 1976-1987, Department of Transportation, Federal Aviation Administration, Washington, D.C., September 1975, page 53.

TABLE 5.2

1975 U.S. SCHEDULED AIRLINES FLEET 1/

Type Aircraft	Number of Aircraft	Percent of Fleet
Small		
2/3 Propeller, Miscellaneous	224	10%
Narrow Body		
B–707/720	287	12%
B–727	765	34
B–737	133	6
DC–8	177	8
DC–9	377	15
Other	51	2
Subtotal	1,750	77%
Wide Body		
B–747	97	4%
L–1011	75	3%
DC–10	121	6%
Subtotal	293	13%
Total Fleet	2,267	100%

1/ Air Transport, 1976, Air Transport Association of America, Washington, D.C., 1976

TABLE 5.3

1990 PROJECTED U.S. SCHEDULED AIRLINES FLEET

Type Aircraft	Number of Aircraft	Percent of Fleet
Small	185	5%
Narrow Body		
B–707/DC–8–50/62	65	2%
B–727/200/100	735	21%
B–737/DC–9	495	14%
DC–8–61/63	55	2%
DC–9–50/60	250	7%
Subtotal	1600	46%
Wide Body		
B–747	310	9%
B–7X7/DCX–200	840	24%
DC–10/L1011	540	16%
Subtotal	1690	49%
Total Fleet	3475	100%

Source: Office of Aviation Policy, Aviation Forecast Branch, Feb. 14, 1977.

sound absorptive materials in the nacelle surrounding the engine reduce much of the internally generated noise produced by the compressors and the combustion process. Current technology in new engines, such as the Pratt and Whitney JT10D, and the General Electric CFM56 (the planned B-7X7/DCX-200 powerplants), shows potential for further reductions in engine noise levels through better designs of the internal compressors and more efficient mixing of exhaust streams. Additionally, decreased aircraft weight through the use of composite materials, more efficient wing designs, and more effective control surfaces (flaps, spoilers, etc.) require less engine thrust for safe flight, making possible further noise reductions.

Environmental improvements in the newer aircraft can be demonstrated by comparing the noise characteristics of representative aircraft from the 1975 and 1990 scheduled U.S. airline fleets, as shown in Table 5.4. While people's reactions to noise differ widely, it is generally agreed that human response to single event aircraft noise is best represented in terms of Effective Perceived Noise Levels expressed in units of EPNdB. An increase of 10 EPNdB is usually perceived as a doubling in loudness. The quieter operating levels of the 1990 air carrier jets are evident in the noise characteristics of Table 5.4.

5.4 Demand for Wide-Body Aircraft at National Airport

Potential airline demand for wide-body aircraft service at Washington National is estimated using a computer model of the U.S. domestic airport system. The model, developed at the Massachusetts Institute of Technology (MIT) Flight Transportation Laboratory, simulates the planning and routing activities of the U.S. domestic airline industry. Aircraft service is allocated to airports in the network in accordance with a set of optimization criteria, city pair market demands, and airline cost and revenue functions. 2/

2/ For further explanation of the fleet assignment model, consult "Wide-Body Aircraft Demand Potential at Washington National Airport," R. Austotas and M. Taylor, Massachusetts Institute of Technology, Department of Transportation, Federal Aviation Administration, September 1976.

TABLE 5.4

NOISE CHARACTERISTICS OF REPRESENTATIVE AIRCRAFT [1]

EPNdB at FAR 36 Measuring Points [2]

Aircraft	Take-off	Approach	Sidelines
B-707-320B [3]	113	116.8	102.1
B-727-200 [3]	101.2	108.2	100.4
DC-8-61 [3]	114	115	103
B-747-100 [3]	115	113.6	101.9
DC-10-10 [4]	99	100.3	95.1
L-1011 [4]	97	103.4	95
B-7X7 [5]	97	102	97

1/ Federal Aviation Regulation Part 36 requires certain aircraft noise certifications. Three noise levels are measured in the certification process: take-off noise at 3.5 nautical miles from start of roll, landing approach noise at 1 nautical mile from runway threshold, and sideline noise at 0.25 nautical miles perpendicular to the runway centerline.

2/ EPNdB units incorporate subjective perceptions of noise frequency and duration.

3/ DOT, FAA, FAR Part 36, Compliance Regulation: Final Environmental Impact Statement, November 10, 1976, p. 10.

4/ DOT, FAA "Certificated Airplane Noise Levels," Advisory Circular 36-1A, July 21, 1975, Appendix 1.

5/ Estimate.

Given the 1990 air passenger demand to and from Washington, D.C., the model indicates that, if allowed, airlines would offer wide-body service to National Airport at an average frequency of four departures per hour. This assumes air carrier quotas at National of from 30 to 40 hourly operations (arrival or departure). The fleet assignment model also indicates that if quota limits in 1990 were reduced by 50 percent to 20 operations per hour, airline demand for wide-body service frequency at National Airport would drop to an average of two departures every hour. 3/

3/ Findings of this report contradict the theory that wide-body jet service at National could be encouraged by reducing air carrier traffic levels at the airport. Instead, the analysis shows that if airline "slots" or quotas at National were reduced, fewer wide-body aircraft would be scheduled. What would most likely happen is that airlines would begin shifting short-haul traffic to Dulles, keeping the longer range but less frequent schedules at National. Most of the traffic remaining at National would not justify wide-body equipment.

6.0 REGIONAL DISTRIBUTION OF AIR PASSENGERS

The distribution of regional air travelers between National, Dulles, and Baltimore varies between the policy options selected for the Metropolitan Washington Airports. Growth restrictions instituted at National, for example, would depress the amount of traffic activity at that airport, accelerating passenger growth at Dulles and Baltimore. Conversely, with fewer constraints placed on National Airport, more moderate passenger growth at Dulles and Baltimore would result. To properly assess the implications of the various airport policy options under review, it is necessary to establish the relationship between each policy alternative and the resulting distribution of airport passengers and air traffic activity.

A computer model facilitates the task of forecasting the allocation of passengers between airports. 1/ Briefly, the model:

1. Incorporates the FAA 1990 passenger forecast for the region;

2. Initially assigns passengers to National, Dulles, or Baltimore-Washington Airports on the basis of minimum trip travel time;

3. Schedules hourly flights to each city served;

4. Recalculates trip travel time for each passenger, including a value for flight frequency, and reassigns demand based upon adjusted trip times;

5. Introduces airport capacity constraints, where applicable; and

6. Reassigns overflow traffic to other airports in the case of any capacity limitations.

1/ The model used was developed by Simat, Helliesen, and Eichner, Incorporated (SH&E).

The model reflects a balance between passenger preferences, airline scheduling practices and airport capacities. The model is introduced in the following sections and discussed in more detail in the technical supplement to this report. 2/

6.1 Proximity and Airport Choice

To format the problem of airport passenger allocation, the Washington/Baltimore Metropolitan area can be divided into 72 zones for originating and terminating passenger traffic. Six additional zones represent the remaining portion of Maryland, Virginia, and other states with reasonable access to the three regional airports. There are 67 cities identified as current or likely nonstop markets from Washington for the planning period of the analysis, 1990.

The first step of the allocation process is the assignment of forecast passenger traffic from each of the 72 zones to one of the three regional airports on the basis of minimum total ground access/egress time. Based on this distribution of passenger demand, an initial set of flight schedules is developed at each regional airport to the nonstop markets.

6.2 Frequency of Flight Schedules Influences Choice

In addition to accessibility, an air passenger's choice of airports is influenced by the frequency of scheduled service to his destination city. All things equal, air travelers will most likely select an airport offering flight schedules at preferred departure times. The difference between preferred departure times and actual flight schedule represents a measure of inconvenience to travelers.

2/ See, "Description of the Multiple Airport Demand Allocation Model," Brian Campbell and Associates, DOT, FAA, 1976.

The next step in demand allocation, therefore, is the redistribution of passengers to the regional airports on the basis of minimum access time plus schedule frequency provided. The result of the allocation routine is a listing of passenger demands and associated airline flight schedules hourly by airport for each policy alternative under review. 3/

6.3 Growth Restrictions at Washington National

With no change in current operating policies at Washington National, the 1990 base line forecast indicates 8.7 million passenger enplanements at National, a growth of 34 percent over 1975 traffic levels. National traffic will represent 49 percent of the total regional passenger enplanements by 1990. By comparison, 68 percent of regional air travelers now use National Airport (1975).

Scenario No. 1 (see Chapter 4) tests the impact of growth restrictions at National. The airport traffic distribution associated with Scenario 1 is presented in Table 6.1. It is noted that when airline quotas at National Airport are reduced, passenger enplanements decrease proportionally.

Table 6.1 shows that most of the overflow traffic from National diverts to Dulles. Dulles is more accessible to the 1990 population centers in Metropolitan Washington; and likely will offer more convenient (frequent) airline flight scehdules. Consequently, it is anticipated that Dulles will attract the largest share of passengers displaced from National.

3/ In a final step, number four, the model applies airport capacity limitations (number of operations per hour that the airport can comfortably handle), and removes or cancels flights during those hours when the airport has been scheduled over its maximum capacity. Refer to the technical supplement, "Description of the Multiple Airport Demand Allocation Model."

Airport passenger distributions for the two wide-body airport scenarios (Scenario No. 2 and No. 3) are also shown in Table 6.1. In these scenarios, the use of wide-body aircraft provide more available capacity and produce a larger distribution of passenger traffic at National than otherwise would have resulted.

Passenger enplanements, passenger originations, peak-hour passenger enplanements, and scheduled aircraft operations for each policy alternative evaluated are shown in Table 6.1. 4/ The information presented in Table 6.1 is used to derive consumer and environmental impacts discussed in the following chapters of the report.

4/ The "peaking" or bunching of airport passenger traffic is reflected in the number of aircraft departures, the size of the aircraft, and the load factor. Aircraft type and departure frequency are determined by the scheduling logic built into the passenger allocation model. Load factor at each airport varies from hour to hour, and market to market, in accordance with passenger demand. For this analysis, the average load factor at National Airport for the 1990 period is estimated at 69 percent; Dulles is 64 percent; and Baltimore is 60 percent.

TABLE 6.1

METROPOLITAN WASHINGTON AIRPORT POLICY ANALYSIS

AIRPORT TRAFFIC DISTRIBUTION

Scenario[1]	Case	Forecast 1990 Passenger Enplanements[2] (000)			Forecast 1990 Passenger Originations[3] (000)			Forecast 1990 Typical Peal Hour Passenger			Forecast 1990 Scheduled Domestic Aircraft Operations (000)		
		DCA	IAD	BWI	DCA	IAD	BWI	DCA	IAD	BWI	DCA	IAD	BWI
1975 Base Case	1	5679	1270	1363	4141[4]	1087[4]	1080[4]	1396[5]	1390[6]	1136[7]	239[8]	67[9]	107[9]
1990 Base Case	2	8651	5418	3605	6309	4639	2859	2127	2411	1195	261	139	116
Scenario #1 (Growth Restrictions at DCA)	3	7767	6143	3815	5297	5295	3015	1844	2375	1560	235	158	114
	4	6765	7048	3861	4715	6083	3010	1679	2645	1560	209	178	116
	5	5795	8074	3805	4034	6811	2963	1532	3407	1651	183	201	114
	6	4806	8938	3930	3424	7306	3188	1307	3571	1661	161	215	117
	7	8276	5691	3708	5993	4862	2954	2008	2419	1490	251	145	117
	8	6765	7045	3861	4715	6088	3010	1679	2645	1560	209	178	116
	9	4806	8938	3930	3422	7303	3083	1307	3571	1661	158	215	117
Scenario #2 (Wide Body Aircraft at DCA)	10	8943	5238	3498	6579	4457	2774	2101	2387	1501	259	135	112
	11	9262	4951	3461	6881	4694	4736	2231	2389	1534	256	128	111
	12	9492	4753	3430	7088	3999	2724	2316	2389	1522	252	121	110
	13	9624	4648	3403	7250	3865	2694	2355	2400	1559	248	116	108
Scenario #3 (Wide Body Aircraft and Growth Restrictions at DCA)	14	7294	6546	3837	5145	5665	2997	1770	2371	1581	212	168	114
	15	7704	6284	3688	5488	5450	2874	1934	2344	1530	212	112	113
	16	8037	5907	3730	5783	5089	2934	2009	2343	1546	210	158	115
	17	8238	5721	3715	5931	4949	2928	2069	2354	1568	206	153	115
	18	5385	8435	3854	3805	6993	3010	1402	3409	1613	162	208	117
	19	5735	8156	3784	4658	6683	2967	1463	3254	1640	162	209	115
	20	6177	7785	3712	4446	6475	2886	1530	3267	1558	161	203	112
	21	6544	7416	3714	4659	6264	2884	1680	3094	1599	161	197	113
	22	9403	4806	3466	7015	4041	2752	2307	2400	1554	240	122	112
	23	7942	5987	3745	5718	5142	2949	2001	2354	1575	198	160	116
	24	6372	7558	3744	4530	6372	2906	1677	3259	1608	157	197	113
	25	8238	5721	3715	5931	4949	2928	2069	2354	1568	206	153	115
Additional Policy Alternatives	26	8390	5615	3669	6121	4795	2892	2100	2419	1485	254	143	116
	27	9624	4648	3403	7250	3865	2694	2365	2400	1559	248	116	108
	28	8157	5812	3705	5875	5020	2913	2064	2354	1571	204	156	114
	29	8651	5418	3605	6309	4639	2859	2127	2411	1195	261	139	116
	30	9624	4648	3403	4658	6683	2967	1463	3254	1640	162	209	115
	31	8238	5721	3715	5718	5142	2949	2001	2354	1575	198	160	116
	32	6544	7416	3714	7250	3865	2694	2365	2400	1559	248	116	108

1) See Appendix A
2) Passenger enplanements = deplanements
3) Passenger originations = destinations
4) Using 1990 origination to enplanement ratio
5) Using 1990 Peak Hour Passenger Ratio
6) May, 1975
7) 1975 Data
8) Terminal Area Forecast, 1977–1987, DOT, FAA, pEA-4, FY 1975
9) Terminal Area Forecast, 1977–1987, DOT, FAA, pEA-4, FY 1975 includes International and Supplemental

7.0 CONSUMER IMPACTS OF AIRPORT POLICY OPTION

This chapter identifies and evaluates the impacts of Metropolitan Washington Airport Policy alternatives on air travelers who use National, Dulles, and Baltimore Airports. The consequences of each option on airport access and egress are discussed. Airport delays are examined. Finally, special characteristics of the Metropolitan Washington air travel market which bear on the airport policy issue are introduced and evaluated.

7.1 Airport Access

Access time is one of the key factors affecting a passenger's choice of airports. Policy decisions can have an impact on the costs of airport access. These access costs must be considered in a review of Metropolitan Washington Airport policy options.

A computer model of the projected 1990 Metropolitan Washington ground transportation system evaluates access costs associated with each airport policy alternative. The model incorporates characteristics of the projected 1990 highway and mass transit network, which is assumed to include the following features: 1/

1/ Numerous improvements in metropolitan highway, transit and airport limo services are assumed by 1990. Rapid transit from Washington to National Airport will be operating before 1990. Limited rapid rail service for downtown Baltimore also is assumed. These improvements are embodied in the access time inputs of the passenger allocation model described in Chapter 6. Refer also to the technical supplement, "Description of the Multiple Airport Demand Allocation Model." The new inter-city air/rail passenger station to be constructed adjacent to Amtrak's Washington-Boston rail cooridor near Baltimore Airport is not incorporated in the model.

- o Highway

  - Washington--existing system plus:

    -- I-495 in Virginia south of D.C.

    -- Sully Road

  - Baltimore--existing system plus:

    -- Md. 46 extended to link airport access road and I-95 at Md. 166

    -- Outer Harbor Crossing

    -- 3A System in Baltimore

    -- I-95 east from Hanover Street

    -- I-70 in Baltimore City

    -- I-83 extension

- o Transit

  - Washington--Partial Metro System - 50 miles

  - Baltimore--Section A of Metro only (Phase I from CBD north to City Line)

- o Limousine

  - Limo service from all zones with existing service and all zones with over 2.5 percent of an airport's passenger volume in 1973.

The ground transportation model is sensitive to passenger preferences for different types (modes) of ground travel. The relative preferences actually used in the model are based upon a survey of airline passengers aboard scheduled flights departing National, Dulles, and Baltimore Airports. (Refer to the technical supplement, Description of the Multiple Airport Demand Allocation Model)

In order to facilitate the forecast of regional air passengers' demand, Metropolitan Washington is subdivided into 72 zones. Time and cost of these zones to each of the three regional airports are estimated, based on the factors presented in Table 7.1. 2/ Using these estimates and the airport passenger distributions developed in Table 6.1, regional average airport access times can be computed for each airport policy alternative. These regional averages are presented in Table 7.2

For the 1990 baseline scenario, Table 7.2 shows an average one-way airport access time of 49 minutes. 3/ The average access time increases up to 54 minutes when growth restrictions are placed on National Airport (Scenario No. 1). Generally, as passengers are displaced to less accessible airports, access times increase. Conversely, when wide-body aircraft provide additional capacity at National, average access times decline to 47 minutes (Scenario No. 2 and No. 3).

2/ The passenger survey and the basic access time and cost measurements were conducted by Alan M. Voorhees and Associates, Incorporated, for the Maryland Department of Transportation's statewide airport system study (1975). The Voorhees work was adopted by the COG in their 1975 study. For a more complete description of the process, see Maryland Aviation System Plan, Technical Report, Maryland Department of Transportation, 1975, pp 3.59-3.72.

3/ There are 27.6 million origin and destination passengers forecast for the Washington airports by 1990. Small changes in average airport access times can have large impacts in total travel time for airport access. A 7 minute difference in average access time, for example, represents an extra (7 minutes x 27.6 million passengers) 3.2 million passenger hours of ground travel each year.

TABLE 7.1

FACTORS AFFECTING ACCESS TIMES AND COSTS

BY MODE

Mode	Time	Cost
Auto-Park	o Line haul time o Auto terminal time (auto park)	o Line haul distance o Marginal operating cost per mile o Length of trip o Parking rates o Vehicle occupancy
Auto-Drop Off	o Line haul time o Airport terminal time (auto-drop)	o Line haul distance o Marginal operating cost per mile o Vehicle occupancy
Taxi	o Line haul time o Airport terminal time (taxi)	o Line haul distance o Fare structure o Vehicle occupancy
Rental Auto	o Line haul time o Airport terminal time (rental auto)	o Line haul distance o Rental car rates (fixed and per mile) o Vehicle occupancy
Limousine	o Scheduled time o Origin terminal access time o Airport terminal time (limousine)	o Fare structure by origin terminal
Rapid Transit	o Anticipated running times o Anticipated headways o Station access time o Airport terminal time	o Anticipated fare structure

TABLE 7.2
METROPOLITAN WASHINGTON AIRPORT POLICY ANALYSIS
ANALYSIS OF AIRPORT ACCESS TIMES [1]

Scenario	Case	Regional Average *One-Way* Access Time (Mins.)	*Relative Cost of* Airport Access [2] ($ Millions)		
			Vehicle Cost	Passenger Disutility [3]	Total [4]
1975 Base Case	1	–			
1990 Base Case	2	49	$ 4.9M	$11.6M	$16.5M
	3	50	7.4	17.4	24.8
	4	52	12.4	29.0	41.4
	5	53	14.8	34.8	49.6
Scenario #1	6	54	17.3	40.6	57.9
	7	49	4.9	11.6	16.5
	8	52	12.4	29.0	41.4
	9	54	17.3	40.6	57.9
	10	48	2.5	5.8	8.3
	11	47	–	–	–
Scenario #2	12	47	–	–	–
	13	47	–	–	–
	14	50	7.4	17.4	24.8
	15	49	4.9	11.6	16.5
Scenario #3	16	49	4.9	11.6	16.5
	17	48	2.5	5.8	8.3
	18	53	14.8	34.8	49.6
	19	52	12.4	29.0	41.4
	20	51	9.9	23.2	33.1
	21	51	9.9	23.2	33.1
	22	47	–	–	–
	23	49	4.9	11.6	16.5
	24	51	9.9	23.2	33.1
	25	48	2.5	5.8	8.3
Additional Policy Alternatives	26	49	4.9	11.6	16.5
	27	47	–	–	–
	28	48	2.5	5.8	8.3
	29	49	4.9	11.6	16.5
	30	47	–	–	–
	31	48	2.5	5.8	8.3
	32	51	9.9	23.2	33.1

[1] 1990 Forecasts, see Table 6.1.

[2] Relative to 47 minute minimum average access time.

[3] Assuming passenger time is valued at $12.50 per hour.

[4] Annual Costs.

The economic impact on consumers of potential variations in airport access times can be considerable. For example, the 7 minute differential 4/ in average access times for Scenarios No. 1 and No. 2 may result in up to $57.9 million in additional ground transportation costs for travelers using Washington airports by year 1990. 5/ Relative annual access costs are presented by scenario in Table 7.2.

4/ This is an average for all airport users. Many passengers would travel more than the additional 7 minutes, particularly during morning and evening peak travel periods; many would travel less.

5/ This is an annual cost in 1976 constant dollars. It assumes all air passengers arrive in standard size automobiles, one airline passenger per car, 30 m.p.h. average speed, and 17.9 cents per mile automobile travel costs, as shown in "Cost of Owning and Operating an Automobile; 1976," DOT, FHWA, 1976.

7.2 Air Traffic Congestion And Delay

Air travel delays impose additional inconvenience and cost on commercial airlines and their passengers. For the airlines, delay means addiditonal aircraft operating expenses. For the passenger, time is a valuable, often scarce resource. Air travelers try to conserve time, and avoid unnecessary delays. 7/ One of the consequences of the policy alternatives or scenarios presented in this study is aircraft delay. Thus, in evaluating the merits of policies implicit in each scenario, the magnitude of aircraft delay resulting from the policy implementation must be assessed.

Aircraft delays associated with alternative policy options are the result of the interplay between airport capacity and air traffic demand. The capacity of each regional airport is altered by the distribution of aircraft types associated with each policy alternative. Demand at each airport is likewise determined by the policy options. Therefore, for each policy alternative, or scenario, there is a unique airport delay value.

The actual computation process for capacity and delay is relatively complicated. Computer programs that facilitate the process have been used to compute delays at each airport. 8/ Delay levels computed for each policy option are presented in Table 7.3. The cost of delays at National, Dulles, and Baltimore to air carriers and passengers are shown in Table 7.4.

7/ See Maryland Aviation System Plan, Final Report, Maryland DOT, 1970, page 22.

8/ These programs are further described in "An Analysis of Airport Delays in the Metropolitan Washington Area," a technical supplement to this report.

TABLE 7.3
METROPOLITAN WASHINGTON AIRPORT POLICY ANALYSIS
AIRPORT DELAYS

Scenario	Case	Washington National Airport		Baltimore Washington Airport		Dulles Airport	
		Total Annual Delay (Mins. 000)	Average Delay Per Operation (Mins)	Total Annual Delay (Mins. 000)	Average Delay Per Operation (Mins)	Total Annual Delay (Mins. 000)	Average Delay Per Operation (Mins)
A	1	720.0	2.13	262.0	1.20	102.0	0.52
B	2	673.1	1.96	219.7	0.96	755.1	1.74
	3	421.3	1.58	215.0	0.98	787.4	1.74
	4	373.6	1.30	223.0	1.01	959.0	2.0
	5	266.1	1.03	213.2	0.98	1,216.0	2.4
Scenario #1	6	210.2	0.91	240.7	1.08	1,382.0	2.7
	7	594.0	1.79	240.7	1.05	762.1	1.7
	8	392.4	1.38	191.2	0.90	1,318.0	2.42
	9	176.9	0.77	196.0	0.92	1,694.0	3.34
	10	645.7	1.90	207.7	0.96	643.0	1.5
	11	626.0	1.86	202.6	0.94	532.7	1.31
Scenario #2	12	599.8	1.80	199.8	0.93	565.5	1.37
	13	579.8	1.76	192.8	0.91	541.0	1.32
	14	381.4	1.32	215.8	0.96	870.0	1.87
	15	519.0	1.63	210.9	0.97	856.2	1.85
	16	374.1	1.30	219.2	1.0	788.6	1.74
	17	370.7	1.31	219.2	1.0	824.1	1.84
	18	191.8	0.82	227.9	1.03	1,270.0	2.5
	19	169.7	0.82	219.2	1.0	1,284.1	2.52
Scenario #3	20	189.9	0.81	207.7	0.96	1,208.4	2.4
	21	193.0	0.82	210.3	1.01	1,122.7	2.26
	22	536.0	1.67	218.4	0.97	715.0	1.69
	23	331.0	1.21	256.8	1.12	924.5	1.99
	24	180.7	0.79	181.5	0.87	1,378.0	2.82
	25	361.8	1.28	188.6	0.89	866.9	1.97
Additional	26	613.9	1.83	237.9	1.04	756.2	1.69
Policy	27	582.6	1.77	222.8	1.01	674.4	1.62
Alternatives	28	354.9	1.26	250.3	1.10	941.0	2.05
	29	428.3	1.52	340.9	1.36	814.0	1.75
	30	362.7	1.35	312.2	1.28	728.2	1.66
	31	194.6	0.87	354.9	1.42	1,022.2	2.13
	32	97.2	0.56	341.0	1.37	1,476.7	2.81

A 1975 Base Case
B 1990 Base Case

TABLE 7.4
METROPOLITAN WASHINGTON AIRPORT POLICY ANALYSIS
AIRPORT DELAY COSTS 1/

Scenario	Case Number	Annual Aircraft Delay Cost ($ Millions)	Annual Passenger Delay Cost ($ Millions)	Total Annual Delay Cost ($ Millions)
1975 Base Case	1	9.8	7.6	17.4
1990 Base Case	2	14.2	10.8	24.9
Scenario No. 1	3	12.2	9.4	21.7
	4	13.2	10.2	23.5
	5	14.8	11.6	26.3
	6	15.9	12.4	28.4
	7	14.8	11.5	26.3
	8	15.9	12.3	28.1
	9	17.8	13.9	31.7
Scenario No. 2	10	13.6	10.4	24.0
	11	12.6	9.7	22.3
	12	12.7	9.9	22.7
	13	12.4	9.7	22.1
Scenario No. 3	14	12.7	9.8	22.4
	15	14.2	11.0	25.3
	16	12.0	9.4	21.4
	17	12.3	9.6	21.9
	18	14.4	11.2	25.7
	19	14.3	11.1	25.4
	20	13.6	10.6	24.2
	21	12.9	10.0	22.9
	22	14.0	11.1	25.1
	23	13.6	10.6	24.2
	24	14.4	11.2	25.6
	25	12.0	9.3	21.2
Additional Policy Alternatives	26	15.0	11.6	26.6
	27	14.3	11.3	25.6
	28	14.1	11.1	25.1
	29	13.7	10.5	24.1
	30	12.5	9.8	22.3
	31	12.9	10.0	22.9
	32	15.9	12.5	28.3

1/ Includes cost of delay for all aircraft operations at National, Dulles, and Baltimore-Washington International Airports.

Traffic

Traffic restrictions at National Airport will not solve the aircraft delay problem. The analysis shows that reduced airline activity at National, represented by the policy strategies in Scenario No. 2, would lower air traffic delay anticipated at that airport in the year 1990. However, any reduction in congestion and delay at National would be offset by increased delay costs at Dulles and Baltimore, as projected traffic is diverted to those airports.

Table 7.5 shows that a reduction of air carrier quotas at National from 40 to 20 per hour would actually increase annual 1990 delay costs at the three airports by $3.5 million, almost 13 percent higher than the 1990 base case conditions.

Wide-Body Aircraft at National

The introduction of wide-body aircraft at National would lead to reduced air traffic delay at all regional airports. With larger capacity aircraft at National, the airlines would tend to schedule fewer flights for a given level of demand. Table 7.6 shows that an average service frequency of four wide-body jets per hour at National 9/ would provide almost $3 million savings in delay compared to the 1990 base case.

9/ If authorized, airlines would most likely operate wide-body jets at National Airport at an average frequency of four departures per hour by 1990. See "Analysis of Potential Wide-Body Use at National Airport," a technical supplement to this report.

TABLE 7.5

THE IMPACT ON AIRPORT DELAY OF

TRAFFIC RESTRICTION AT WASHINGTON NATIONAL

Scenario No. 1

Case	Airline Quotas (Operations/Hr.) At National	National Annual Aircraft Operations (000)	National Annual Aircraft Delay (Mins/000)	National Average Aircraft Delay (Mins/Operation)	Total Regional 1/ Airport Delay Costs ($ Millions)
2	(1990 Baseline) 40	343	673	1.96	$24.9
3	35	266	421	1.58	21.7
4	30	288	374	1.30	23.5
5	25	251	266	1.03	26.3
6	20	231	210	0.91	28.4

1/ National, Dulles, and Baltimore-Washington

TABLE 7.6

THE IMPACT ON AIRPORT DELAY OF

WIDE-BODY JET SERVICE TO WASHINGTON NATIONAL

Scenario No. 2
40 Airline Operations/Hr.

Case	Wide-Body Departures Per Hour at National (Average)	National Annual Aircraft Operations (000)	National Annual Aircraft Delay (Mins,000)	National Average Aircraft Delay (Mins/Operation)	Total Regional 1/ Airport Delay Costs ($ Millions)
2 (1990 Baseline)	0	343	673	1.96	$24.9
10	1	340	646	1.90	24.0
11	2	337	626	1.86	22.3
12	3	333	600	1.80	22.6
13	4	330	580	1.76	22.1

1/ National, Dulles, and Baltimore-Washington

7.3 Characteristics of the Washington Air Travel Market

Short Range Traffic

There are additional characteristics of the metropolitan air travel market which should be considered as regional airport policy is developed. First is the fact that the Washington air traffic market is highly concentrated in the short and medium range markets. Nearly two-thirds of the flight departures are on flights of less than 400 miles; long-range flights account for only 7 percent of the total market. These characteristics are reflected in Table 7.7.

The primary airport, Washington National, is very close to the Washington central business district (CBD) and is particularly convenient for many air travelers. Driving time from the CBD is less than 15 minutes, and accessibility should be further enhanced by the Metro subway. National currently services 60 percent of the area's total scheduled air carrier departures and 68 percent of the enplaned passengers.

Dulles, located 26 miles from the Washington CBD, is considerably less convenient for most area travelers. The normal access time from downtown Washington is one hour, with taxi fares approaching $25.00 per trip. 10/ This partially explains why Dulles attracts less than 15 percent of the total scheduled air carrier traffic. 11/

10/ It is noted, however, that motor coach service to Dulles is available from downtown Washington every hour from 6-10 A.M., and every 1/2 hour from 10:30 A.M. to 11:00 P.M. The fare is $4.25 one way.

11/ This percentage will increase, however, as the passenger handling capacity of National Airport is approached, and travelers are forced to use another facility.

TABLE 7.7

CHARACTERISTICS OF THE METROPOLITAN WASHINGTON AIR TRAVEL

	% of Flts 1/ by Segment Length			Transfer 2/ Psngrs.	Airport 3/
	Under 400 Mi.	400 1,000	Over 1,000 Mi.	as a % of Ttl. Psngrs.	Location from CBD
Washington, D.C. (Total)	67	26	7		
National	70	30	0	32	3 S
Dulles International	51	10	39	31	26 W
Friendship International	69	25	6	36	32 NE

1/ Calculated from U.S. Department of Transportation, Federal Aviation Administration, Profiles of Scheduled Air Carrier Operations by Stage Length, Federal Aviation Administration Regions' Top 100 U.S. Airports November 1, 1974, May 1975.

2/ Provided by FAA Office of Policy Development based on U.S. Civil Aeronautics Board, Airport Activity Statistics, December 21, 1972, Tables 3 and 4, and Origin - Destination Survey of Airline Passenger Traffic. Volume V-4-1, Fourth Quarter 1972, Table 1.

3/ Official Airline Guide, North American Edition, June 15, 1975, and U.S. Department of Commerce, Sectional Aeronautical Charts - effective between June 19, 1975, and July 17, 1975.

Baltimore-Washington International Airport, serving both Baltimore and Washington, competes with both National and Dulles for metropolitan travelers. While it is within 10 miles of the Baltimore CBD, it is 32 miles from downtown Washington.

An analysis of the metropolitan air travel market shows that differences in access time are magnified in a predominantly short-haul market. For most Washington markets, airport access time looms as a significant part of the total travel time and, consequently, the cost of the trip. The difference in access times may make a one-stop flight from a nearby airport (National) more attractive than a nonstop flight from a more distant airport (either Dulles or Baltimore).

Since travelers flying short distances prefer airports that are relatively convenient, restrictive growth policies at National which force traffic to more distant airports would not serve area passengers well. 12/

12/ There are indications that, faced with reduced quotas at National Airport, airlines would shift short-haul traffic to Dulles, and continue to serve the longer haul markets from National. See "Wide-Body Aircraft Demand Potential at Washington National Airport," DOT, FAA, 1976. This supports the contention that growth restriction at National would inconvenience short-haul travelers in the Metropolitan Washington market.

Transferring Passengers

There is another aspect of the Metropolitan Washington air travel market which should be considered. Over 30 percent of the passengers at Washington airports are transferring to other aircraft rather than terminating their flights. For these passengers, and the airlines serving them, it is better to concentrate flights at one facility. Higher flight frequencies provide more schedule alternatives, flexibility and convenience for connecting air travelers.

Growth restrictions at National would force the airlines to split traffic between the three regional airports, lowering flight frequency at National, and inconveniencing transferring passengers.

Communities Served From National

The "Official Airline Guide" (OAG) for July 1, 1976, shows 67 communities receiving direct nonstop air service from National Airport. Growth restrictions at National would reduce that number.

This can be illustrated by way of example. In the 1975 report, "The Future of Washington's Airports," the Metropolitan Washington Council of Governments recommends that the number of commercial slots at National be reduced by 50 percent, and wide-body aircraft be permitted at the airport. COG recommends that the diversion of flights from National to Dulles and Baltimore should be well underway by 1990.

The COG recommendation, however, is based upon an operational scenario discontinuing nonstop service from National to 43 of the 67 cities now served. Communities which would lose nonstop service to National under the COG proposal are shown in Table 7.8. Service on larger markets--Chicago, Atlanta, Boston, and New York--would continue, but at approximately half the original flight frequency.

TABLE 7.8
COMMUNITIES LOSING DIRECT SERVICE TO NATIONAL AIRPORT UNDER THE COUNCIL OF GOVERNMENTS RECOMMENDED PLAN[1]

West Palm Beach, Fla.
Tampa, Fla.
Memphis, Tenn.
St. Louis, Mo.
Jacksonville, Fla.
Milwaukee, Wisc.
Huntsville, Ala.
Louisville, Ky.
Charleston, S. C.
Knoxville, Tenn.
Lexington, Ky.
Columbia, S. C.
Dayton, Ohio
Myrtle Beach, S. C.
Providence, R. I.
Bristol, Va.
Wilmington, N. C.
Albany, N. Y.
Syracuse, N. Y.
Buffalo, N. Y.
Fayetteville, N. C.
Jacksonville, N. C.
New Bern, N. C.
Winston Salem, N. C.
Ithaca, N. Y.
Charleston, W. Va.
Kinston, N. C.
White Plains, N. Y.
Elmira, N. Y.
Rocky Mount, N. C.
Danville, Va.
Newark, N. J.
Scranton, Pa.
Clarksburg, W. Va.
Morgantown, W. Va.
Lynchburg, Va.
Allentown, Pa.
Staunton, Va.
Newport News, Va.
Richmond, Va.
Charlottsville, Va.

[1] Based upon the DCA revised flight schedules for COG Alternative 1, the recommended plan. See "The Future of Washington's Airports," Metropolitan Washington Council of Governments, 1975.

The convenience of National Airport to the Capitol and other Federal buildings has been noted. Loss of non-stop air service to National must be counted as a disbenefit, particularly for the businessmen, legislators, professionals, and others who work in close liaison with the Federal Government. Growth restrictions at National cannot be imposed without curtailing or eliminating some of the air service provided.

8.0 ENVIRONMENTAL IMPACTS OF AIRPORT POLICY OPTIONS

This chapter examines the environmental impacts of alternative policy strategies for the Metropolitan Washington Airports. Three types of environmental impacts are considered: aircraft noise exposure, aircraft emissions, and automobile emissions. In the following sections of the chapter, analytical techniques used to calculate the magnitude of these impacts are explained, and results of the analysis are presented. A more detailed presentation of environmental impact data is provided in the technical supplements to this report and the Environmental Impact Statement for the Metropolitan Washington Airports Policy. 1/

8.1 Aircraft Noise Analysis

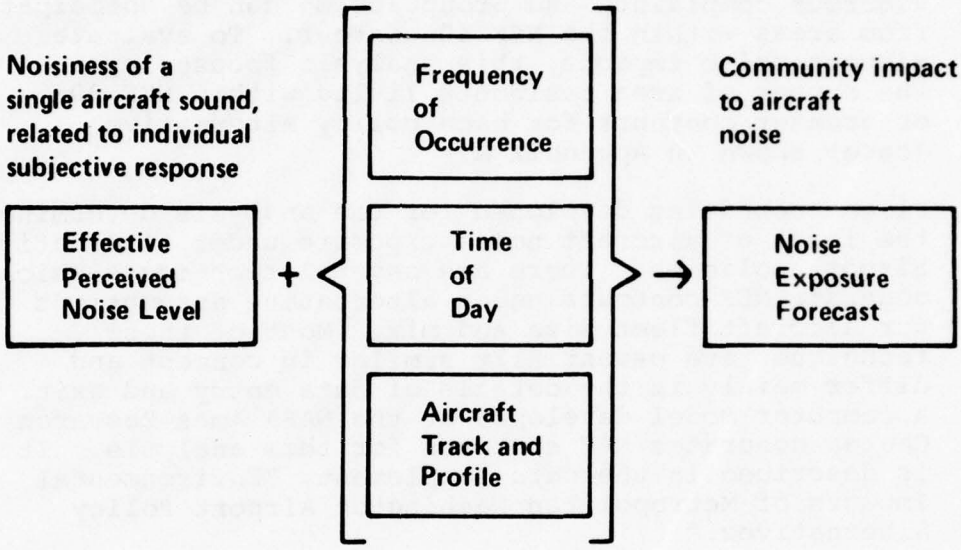
Research on the costs of aircraft noise in the vicinity of airports has advanced to the point where it is now possible to predict patterns of community response to various levels of noise exposure. Noise exposure is determined by the frequencies and durations of overflights, 2/ times of day of occurrence, output levels of the aircraft engines, and the aircraft flight paths over the ground. Integration of these factors permits delineation of Noise Exposure Forecast (NEF) contours within which degrees of community responses to aircraft noise can be anticipated. NEF contours have become a standard method of representing airport noise impacts. Figure 8.1 depicts how NEF contours are developed.

1/ Refer to the "Environmental Impacts of Metropolitan Washington Airport Policy Alternatives," DOT, FAA, technical supplement, 1976.

2/ Unlike some earlier work, unscheduled aircraft are included in this ebvaluation, and the effects of policy changes are seen in relation to the entire noise picture at each regional airport. This is significant because it is the way policy alternatives would be perceived by the community. Airports with a relatively large number of unscheduled operations (e.g., Dulles) are affected less by a change in flight schedules than are airports with a small number of unscheduled operations (e.g., National).

FIGURE 8.1

CONSTRUCTION OF THE NOISE-EXPOSURE FORECAST



Contours of NEF values of 30 and 40 define three NEF areas of particular importance in land-use planning: NEF less than 30; between 30 and 40; and NEF greater than 40. Noise is not generally considered objectionable for NEF 30 or less. Noise may interfere with some community activities but few complaints should be expected. 3/ Above NEF 30 levels, conversation would be interrupted periodically, and some residents would experience interruption of sleep. Furthermore, there could be organized attempts to seek noise abatement in communities subjected to this level. Finally, areas subjected to NEF levels greater than 40 are generally expected to be severely impacted. Repeated vigorous complaints and group action can be anticipated from areas within the NEF 40 contour. To evaluate airport noise impacts, this analysis focuses upon the number of area residents living within NEF 30 or greater contours for each policy alternative (case) shown in Appendix A.

Flight schedules developed for the analysis determine the level of aircraft noise exposure under alternative airport policies. There are several techniques which generate NEF contours under alternative assumptions for aircraft fleet size and mix. Most of these techniques are essentially similar in concept and differ mainly in the details of data entry and exit. A computer model developed at the NASA Ames Research Center generates NEF contours for this analysis. It is described in the data supplement, "Environmental Impacts of Metropolitan Washington Airport Policy Alternatives."

When used in conjunction with United States census data, noise exposure models can be used to determine the number of people living in areas exposed to designated NEF values.

3/ 23-Airport Cost-Effectiveness Analysis of Noise Abatement Alternatives, a statement for the Subcommittee on Aeronautics and Space Technology, Committee on Science and Astronautics, House of Representatives, Office of Noise Abatement, DOT, July 25, 1974, page 4.

A computerized demographic data retrieval program [4] provides access to the most recent United States sensus information. It retrieves such census statistics as population by age, race, and sex; occupation; family income; number of dwelling units and housing values at the census tract level. Each census tract is identified by the following data elements:

- State and county code;
- 1970 population;
- Population growth rate from 1970 to 1990; and
- Latitude and longitude of the tract.

The NEF and demographic retrieval programs generate a report describing the total population exposed to NEF 30 or greater, by country and state, in the vicinity of each Metropolitan Washington Airport.

1990 Noise Exposure Forecast

The 1990 Base Case Noise Exposure Forecast for National Airport shows that approximately 145,000 residents of Washington, D.C., Maryland, and Virginia will be exposed to NEF 30 or greater as a result of aircraft operations at National. Noise impacts for the 1990 base case are identified by city, county, and state in the environmental impact technical supplement to this report.

4/ Site II is a proprietary, interactive package developed by CACI, Incorporated.

The 1990 base case compares with an estimated 146,000 residents exposed to NEF 30 conditions in the vicinity of National Airport today. The location of residents presently exposed to NEF 30 is summarized in the technical supplement.

The NEF 30 population estimates for each policy alternative evaluated in this report are presented in Table 8.1.

Wide-Body Aircraft

This analysis shows that introduction of wide-body jets at National Airport would reduce the number of area residents exposed to NEF 30 by approximately 4,000 compared to the 1990 base case.

Quota Reductions

Moderate reductions in quotas available to airlines at National Airport offer no discernable relief from noise exposure. Reducing airline quotas from 40 to 35, or from 40 to 30 per hour would provide no noticeable reduction in the number of people exposed to NEF 30 or greater. Similarly, the elimination of extra shuttle sections from National would offer no discernable noise relief. Only if air carrier quotas were further reduced to 25 or 20 an hour would the number of residents within the NEF 30 contour in 1990 decline. With air carrier quotas cut by 50 percent, there are 158,000 local residents within the NEF 30 or greater area for forecast year 1990. This is 13,000 fewer than the 1990 base case.

TABLE 8.1

Metropolitan Washington Airport Policy Analysis
Population Residing Within NEF 30 Contours

Scenario	Case	National	Dulles	Baltimore	Total
1975 Base Case	1	146,000	1,000	15,000	162,000
1990 Base Case	2	145,000	1,000	25,000	171,000
	3	145,000	1,000	25,000	171,000
	4	145,000	3,000	25,000	173,000
	5	131,000	3,000	25,000	159,000
Scenario #1	6	130,000	3,000	25,000	158,000
	7	145,000	1,000	25,000	171,000
	8	145,000	3,000	25,000	173,000
	9	130,000	3,000	25,000	158,000
	10	145,000	1,000	25,000	171,000
	11	145,000	1,000	25,000	173,000
Scenario #2	12	145,000	1,000	25,000	171,000
	13	141,000	1,000	25,000	167,000
	14	145,000	1,000	25,000	171,000
	15	145,000	3,000	25,000	173,000
Scenario #3	16	145,000	1,000	25,000	171,000
	17	130,000	1,000	25,000	156,000
	18	131,000	3,000	25,000	159,000
	19	131,000	3,000	25,000	159,000
	20	130,000	3,000	25,000	158,000
	21	112,000	3,000	25,000	140,000
	22	141,000	1,000	25,000	167,000
	23	123,000	1,000	25,000	149,000
	24	112,000	3,000	25,000	140,000
	25	130,000	1,000	25,000	156,000
Additional Policy Alternatives	26	131,000	1,000	25,000	157,000
	27	112,000	1,000	25,000	138,000
	28	112,000	1,000	25,000	138,000
	29	145,000	1,000	25,000	171,000
	30	141,000	1,000	25,000	167,000
	31	130,000	1,000	25,000	156,000
	32	112,000	3,000	25,000	140,000

Wide-Body Jets and Quota Reduxction

By reducing air carrier quotas to 30 per hour and simultaneously introducing wide-body aircraft at National, the metropolitan population inside NEF 30 contours by 1990 can be reduced to 130,000 residents. This has the same effect on noise exposure as a 50 percent cut back in anticipated 1990 air carrier traffic activity at National.

Nighttime Jet Flights

A voluntary agreement is in force at National Airport between the airlines and the FAA, as airport sponsor, not to schedule turbojet flights after 10:00 PM nor to operate jets after 11:00 PM. In practice, several departures are scheduled at the 10:00 PM hour, and there are numerous arrivals after 10:00 PM. As of October 1, 1976, 17 commercial flights routinely operate between 10:00 and 11:00 PM; 11 of these are normally turbojet operations.

Discontinuation of post 10:00 PM commercial jet traffic offers potential for noise relief. Of all possibilities evaluated in this report, Table 8.1 shows that a policy of no jet operations after 10:00 PM (Case 27) results in the fewest number of people exposed to NEF 30 in the year 1990. In this case, all post 10:00 PM jet flights operate from either Dulles or Baltimore Airport.

The improvements derived through a 10:00 PM jet cutoff are understandable, given the methodology used for noise exposure forecasts. Nighttime (post 10:00 PM) operations are currently weighted or penalized in the NEF models to reflect the additional annoyance of aircraft noise during normal sleeping hours. One night operation is equivalent in terms of noise exposure to 16.76 daytime flights of similar aircraft and flight track. Eliminating night operations would have a significant impact on airport noise exposure levels.

Policy Alternatives Have Little Impact on Noise Exposure at Dulles or Baltimore Airports

Table 8.1 indicates that the most significant noise problems are experienced at National.

It is noted, further, that the population residing within NEF 30 or greater contour at Baltimore remains constant for all 1990 airport policy alternatives examined in this report. Baltimore provides sufficient capacity in the 1990 base case schedule to handle its passenger demand fluctuations with approximately the same number and mix of air carrier aircraft.

Projected 1990 traffic activity at Dulles does vary under alternative airport policy strategies. However, the number of residents observed within the NEF 30 or greater contour at Dulles by 1990 never exceeds 3,000 in any scenario. The large (10,000 acres) tract of land dedicated to airport use at Dulles serves as a buffer for aircraft noise and minimizes the number of people adversely affected by aircraft operations.

8.2 Aircraft Emissions Analysis

The level and type of aircraft emissions associated with each airport policy option are also investigated. Each policy option evaluated establishes a unique schedule of aircraft flight activity at National, Dulles, and Baltimore (see Chapter 6). Aircraft at these airports can be characterized by number and types of engines used. The engines, in turn, are characterized by the amount of pollutants emitted for each landing and take-off (LTO) cycle. Emissions are calculated by multiplying the number of LTO engine cycles at each airport by the pounds of pollutant per engine cycle. Four types of aircraft emissions are evaluated; carbon monoxide, nitrogen oxides, hydrocarbons, and particulates. 5/

5/ Emission factors are based upon the reference Compilation of Air Pollution Emissions Factors U.S., Environmental Protection Agency, Research Triangle Park, North Carolina, Report AP-42, April 1973.

Carbon monoxide, nitrogen oxides, hydrocarbon, and particulate emissions each constitute a relatively constant proportion of total aircraft emissions at National, Dulles, and Baltimore for each 1990 airport policy option. (The percentages for each airport are shown in Table 8.2.) Consequently, the analysis of aircraft air pollution focuses only on the total amount of emissions (pounds per day) and the percentage of the total generated at each airport. Results of the aircraft emission analysis are presented in Table 8.3. A more detailed analysis of emission is contained in the Environmental Impact Statement for the Metropolitan Washington Airports Policy.

1990 Base Case

The 1990 base case represents no change in current airport policies. Total aircraft emissions at National, Dulles, and Baltimore airports for the 1990 base case show a 14 percent increase over 1975 conditions. Imissions at National, however, remain relatively constant. Most of the traffic increase and, consequently, the biggest change in aircraft emissions, occurs at Dulles.

Traffic Restrictions

Restricted passenger growth at National results in a 40 percent reduction in aircraft emissions at National but no significant change in total emissions for the three regional airports compared to the 1990 base case. (See Table 8.3, Case 6.) Additional aircraft emissions at Dulles and Baltimore by 1990 reflect the additional traffic diverted to these airports as a result of growth restrictions at National.

Wide-Body Aircraft at National

Wide-body aircraft handle passenger demand with fewer flights, and less air pollution. Wide-body jet service at National results in a 27 percent reduction in emissions there, and a 16 percent reduction in total emissions for the three regional airports, compared to the 1990 base case (See Table 8.3, Case 13).

TABLE 8.2

AIRCRAFT AIR POLLUTION: PERCENT DISTRIBUTION OF EMISSIONS

Airport	Case	Emissions (Relative%)				
		Carbon Monoxide	Oxides of Nitrogen	Hydro-Carbons	Particulates	Total
DCA	1975 Base Case	43%	43%	12%	2%	100%
	1990 Base Case	44%	45%	10%	2%	100%
IAD	1975 Base Case	41%	32%	25%	2%	100%
	1990 Base Case	32%	57%	10%	1%	100%
BWI	1975 Base Case	42%	30%	27%	2%	100%
	1990 Base Case	36%	53%	10%	1%	100%

TABLE 8.3

METROPOLITAN WASHINGTON NATIONAL AIRPORT POLICY ANALYSIS
ANALYSIS OF AIRCRAFT EMISSIONS

Scenario	Case	Airport Emissions (% Distribution) DCA(%)	IAD(%)	BWI(%)	Total Emissions (Pounds/Day)
1975 Base Case	1	45	32	23	37059
1990 Base Case	2	45	32	23	47989
	3	41	36	23	47296
	4	36	41	23	47618
	5	32	44	24	46333
Scenario #1	6	27	50	23	48213
	7	43	34	23	47828
	8	36	41	23	47574
	9	26	50	24	48125
	10	47	31	22	48201
	11	49	30	21	48235
Scenario #2	12	50	29	21	48563
	13	51	28	21	48731
	14	39	38	23	47773
	15	41	37	22	47899
Scenario #3	16	35	40	25	41681
	17	44	33	23	48174
	18	30	47	23	47687
	19	32	45	23	47770
	20	34	43	23	47690
	21	36	41	23	47969
	22	50	29	21	48795
	23	43	35	22	48221
	24	37	39	24	45469
	25	46	34	20	46749
Additional Policy Alternatives	26	44	33	23	48017
	27	51	28	21	48731
	28	44	34	22	48197
	29	45	32	23	47989
	30	51	28	21	48731
	31	44	33	23	48174
	32	36	41	23	47969

Wide-Body Jets and Reduced Quotas

A policy of wide-body jet service at National averaging 4 departures per hour coupled with a reduction in airline quotas there to 30 per hour reduces emissions at National less than 2 percent compared to 1990 base case conditions. Total emissions at National, Dulles, and Baltimore remain relatively unchanged compared to the base case (see Table 8.3, Case 17).

8.3 Automobile Emission Analysis

Automobiles driven by airline passengers and airport employees contribute to the Metropolitan Washington air pollution problem. Each of the airport policy options shown in Appendix A results in a different distribution of air travelers among the three regional airports. Given airport passenger origins and destinations, average automobile occupancy rate, and the average distance driven at each airport, the number of miles driven by all airport travelers can be found. 6/ Emission rates assumed for automobiles in 1990 are shown in Table 8.4. 7/ For each scenario, average daily automobile emissions for airport travelers are computed by multiplying the number of miles driven at each airport by the factors from Table 8.4.

6/ The technique and much of the data used in the automobile emission analysis are discussed more thoroughly in Appendix V of the "Final Environmental Impact Statement for Policy Regarding the Role of Washington National Airport." Briefly, given the number of origin and destination passengers, a factor was applied to account for airport employees: 1.3 for National, 1.5 for Dulles, and 1.3 for Baltimore. Total arriving and departing people are converted to total vehicles using an average automobile occupancy ratio of 1.24 people per car. Also, an average airport driving distance of 1 mile, 3.1 miles, and 3.1 miles per vehicle were assumed for National, Dulles, and Baltimore, respectively.

7/ Source: Compilation of Air Pollution Emissions Factors, U.S., EPA, April 1973.

TABLE 8.4

AUTOMOBILE EMISSION RATES

1990 Projections

Type of Emission	Pounds/Mile	Percent of Total Emissions
Carbon Monoxide	$4.25 * 10^{-2}$	79%
Nitrogen Oxide	$4.96 * 10^{-3}$	9%
Sulphur Dioxide	$3.90 * 10^{-4}$	1%
Aldehydes	$7.80 * 10^{-4}$	1%
Total Hydrocarbons	$4.96 * 10^{-3}$	9%
Lead	$3.55 * 10^{-5}$	---
Particulates	$7.09 * 10^{-5}$	---
Total	$5.37 * 10^{-2}$	100%

Automobile emissions at each airport are presented in Table 8.5. Because of the nature of the auto emissions model, air pollution attributable to the automobile can be expressed in pounds per day. The percentage distribution of each category of automobile emission (e.g., carbon monoxide, particulates) remains constant at the values indicated in Table 8.4.

Table 8.5 shows that growth restrictions at National tend to reduce the level of automobile emissions at that airport at the expense of increased emissions at Dulles. The net result is that the absolute level of combined air pollution at National and Dulles remains relatively constant. 8/ At Baltimore, traffic activity and, consequently, automobile pollution is relatively unaffected by alternative Metropolitan Washington Airport Policy options.

8/ Given the pollution characteristics of 1990 automobiles and the 1.24 passenger occupancy ratio, automobile pollution levels at National and Dulles are likely to remain unchanged until a larger proportion of passengers utilizes public transportation to the airports (i.e., subway, bus).

TABLE 8.5
METROPOLITAN WASHINGTON AIRPORT POLICY ANALYSIS
AUTOMOBILE EMISSIONS ANALYSIS

Scenario	Case	Automobile Air Pollution (Pounds Per Day) [1]				
		On Airport				Additional Metropolitan Area Auto Pollution from Air Travelers Not Accommodated at National Airport
		DCA	IAD	Combined DCA & IAD	BWI	
1975 Base Case	1	455	140	585	471	–[2]
1990 Base Case	2	707	611	1,318	1,001	–[2]
	3	615	696	1,311	1,051	1,136
	4	530	800	1,330	1,051	2,226
	5	452	897	1,349	1,041	3,199
Scenario #1	6	382	958	1,340	1,081	4,034
	7	671	641	1,312	1,031	441
	8	530	800	1,330	1,051	2,226
	9	382	959	1,340	1,081	4,057
	10	735	586	1,321	971	–[2]
	11	770	549	1,319	961	–[2]
Scenario #2	12	792	525	1,317	951	–[2]
	13	813	506	1,319	941	–[2]
	14	580	745	1,324	1,051	1,623
	15	615	714	1,329	1,011	1,159
Scenario #3	16	650	672	1,322	1,031	742
	17	664	653	1,317	1,021	533
	18	424	922	1,346	1,051	3,524
	19	466	879	1,346	1,041	3,014
	20	495	855	1,349	1,011	2,619
	21	523	824	1,347	1,011	2,318
	22	784	531	1,315	961	–[2]
	23	643	678	1,321	1,031	835
	24	509	836	1,345	1,021	2,504
	25	664	647	1,311	1,021	533
Additional	26	686	629	1,314	1,011	–[2]
Policy	27	813	507	1,320	741	–[2]
Alternatives	28	657	659	1,317	1,021	603
	29	707	611	1,318	1,001	–[2]
	30	813	506	1,319	941	–[2]
	31	644	653	1,317	1,021	533
	32	523	824	1,347	1,011	2,318

[1] To find the extent of specific air pollutants, apply the distribution shown in Table 8.1.

[2] By definition, there are no displaced passengers in this case.

In addition to automobile emission from cars driven on the airports, the nature of policy options being examined makes it necessary to consider passengers who, because of air carrier scheduling restrictions at National, are forced to drive longer distances to another airport. 9/ These additional driving requirements result in additional automobile emissions in the metropolitan area as shown in Table 8.5. Additional emissions can exceed by a factor of three the total pollution from automobiles at National and Dulles combined.

9/ Displaced passengers are defined as those not accommodated at National Airport because of growth restrictions. Passenger origins in the 1990 base case indicate the level of demand for service at DCA. The "on-airport" travel for displaced passengers already is accounted for. The only additional consideration is for the extra miles of driving to an airport of second choice. It is assumed the distance involved is an additional 25 miles per passenger, and the average automobile occupancy rate is 1.24 passengers per car. The 25 mile estimate represents the approximate difference in distance from the Metropolitan Washington CBD to National and to Dulles/Baltimore Airports. The CBD is viewed as the center of passenger origins and destinations in the metropolitan area.

9.0 INVESTMENT REQUIREMENTS

This chapter of the report considers the investments required at National, Dulles, and Baltimore Washington International Airports to support regional air travel demands anticipated by the year 1990. It provides a general indication of the relative cost impact of different Metropolitan Washington Airport policy options. Runway, apron, terminal, curbside automobile parking, and access system cost estimates presented here provide a comparison among facility requirements associated with each airport policy option. 1/

The sources of basic unit costs for this analysis are derived from comparable airport construction projects nationwide (since 1972), previous studies, Mean's Building Construction Cost Data, and current construction projects at National and Baltimore Airports. All costs are in constant 1976 dollars. They include 6 percent for architectural and engineering fees, 15 percent for contingencies, and 20 percent for contractor overhead and profit.

A more detailed discussion of airport investment requirements is provided in the technical supplement to this report. 2/

9.1 AIRPORT DEVELOPMENT COSTS

The investment requirements of each regional airport are evaluated under the four alternative policy assumptions introduced as policy options in Chapter 4. These requirements reflect development necessary to provide what is typically regarded as "industry standard" quality of service levels for the passenger demands anticipated.

1/ The analysis presented in the chapter is neither a master planning exercise no a detailed airport design study. It is intended only to provide an indication of the relative differences in airport development requirements between the policy alternatives under review.

2/ Metropolitan Washington Airport Investment Requirements, Trans Plan Incorporated, New York, New York, 1976. This document is the source of all cost estimates presented in this section.

Failure to undertake airport development called for in this section does not necessarily imply the airport(s) will be unable to accommodate, passenger demand. It is likely, however, that airport passengers would experience some deterioration in service levels if the improvements were not provided.

Even under present demand conditions (1975), improvements are required at Washington National to bring current facilities up to industry standards. As a rule of thumb, airport terminals require gross floor areas equivalent to about 200 square feet per typical peak-hour passenger (TPHP). The current terminal of approximately 504,000 square feet, with a demand of approximately 2,757 TPHP, 3/ provides 183 square feet per passenger; below the industry norm. Special characteristics of Washington travelers, moreover, compound the congestion problem. 4/

Facilities at National with inadequate capacity under today's 1975 demand conditions include the number of gate positions, baggage claim devices, certain passenger flow areas, curb areas near the terminal, and automobile parking spaces.

The Dulles passenger terminal is considerably different from National in concept and utilization patterns. At Dulles, more than 60 percent of the 300,000 square feet of terminal are dedicated passenger access areas. Moreover, mobile transporters and ground level passenger gates provide a more uniform distribution of people throughout the terminal facility. The initial design of Dulles contemplated about 224 square feet per TPHP. Experience with the terminal indicates a capability of greater efficiency, to the point that 170 square feet of terminal space per TPHP appears more reasonable. 5/

3/ Profiles of Scheduled Air Carrier Passenger Activity, FAA, DOT, January 1976, p. 194.

4/ For example, with a higher than normal ratio of business to pleasure travelers, passenger arrival times at National cluster closely around scheduled departures, creating a greater than average "surge" in demand for terminal space.

5/ National Capital Airports, DOT, FAA, James Wilding, 1972.

While Dulles is effecient with respect to space per passenger requirements, its expansion costs are inherently more expensive on a per passenger enplanement basis than National Airport. This is indicated in Table 9.2, which shows per passenger investment costs at Dulles in any scenario considered are higher than at National.

Total development costs for all three airports are illustrated in Figure 9.1. While investment requirements at Dulles and National vary from scenario to scenario, Figure 9.1 shows that total regional airport development requirements are relatively constant. In fact, the difference between the highest and lowest cost investment alternative (11%) is not considered significant for this planning analysis.

9.2 Cost of Wide-Body Jets at National

In each policy alternative, airport investment requirements are sensitive to; (1) the demand for space at the airport associated with different numbers and types of aircraft during peak periods, and (2) the demand for facilities to accommodate varying numbers of passengers from the access roadways to the holdrooms and loading bridges. The sensitivity of airport development to peak-hour passenger demand is shown in Table 9.3.

TABLE 9.1

SUMMARY OF AIRPORT INVESTMENT COSTS

I. WASHINGTON NATIONAL AIRPORT

Scenario	Cost Estimates ($ Million) [1/]			
	Airside	Terminal	Groundside	Total
1990 Base Case (Case No. 2)	0.81	34.34	12.28	47.43
Scenario No. 1 (Case No. 6)	---	15.04	1.33	16.37
Scenario No. 2 (Case No. 13)	2.59	42.86	17.72	63.18
Scenario No. 3 (Case No. 17)	2.20	34.62	18.72	55.54

II. DULLES INTERNATIONAL AIRPORT

Scenario	Cost Estimates ($ Million) [1/]			
	Airside	Terminal	Groundside	Total
1990 Base Case (Case No. 2)	$10.30	$38.90	$6.8	$56.00
Scenario No. 1 (Case No. 6)	22.50	69.50	12.7	105.70
Scenario No. 2 (Case No. 13)	12.40	38.60	5.1	56.10
Scenario No. 3 (Case No. 17)	12.40	37.40	7.5	57.30

III. BALTIMORE-WASHINGTON INTERNATIONAL

Current development program cost at Baltimore is $64.50 million.

1/ These are total project costs in 1976 constant dollars.

TABLE 9.2

PER PASSENGER INVESTMENT REQUIREMENTS

I. WASHINGTON NATIONAL AIRPORT

Scenario	Cumulative Enplanements 1976–1990 (Million Passenger Enplanements) 1/	$/Enplanement 2/
1990 Base Case (Case No. 2, Appendix A)	109.13	0.43
Scenario No. 2 (Case No. 6)	79.88	0.20
Scenario No. 3 (Case No. 13)	116.63	0.54
Scenario No. 4 (Case No. 17)	106.13	0.52

II. DULLES INTERNATIONAL AIRPORT

Scenario	Cumulative Enplanements 1976–1990 (Million Passenger Enplanements) 1/	$/Enplanement 2/
1990 Base Case (Case No. 2)	50.10	1.12
Secenario No. 2 (Case No. 6)	76.35	1.38
Scenario No. 3 (Case No. 13)	44.10	1.27
Scenario No. 4 (Case No. 17)	52.35	1.09

III. WASHINGTON NATIONAL AND DULLES INTERNATIONAL AIRPORTS

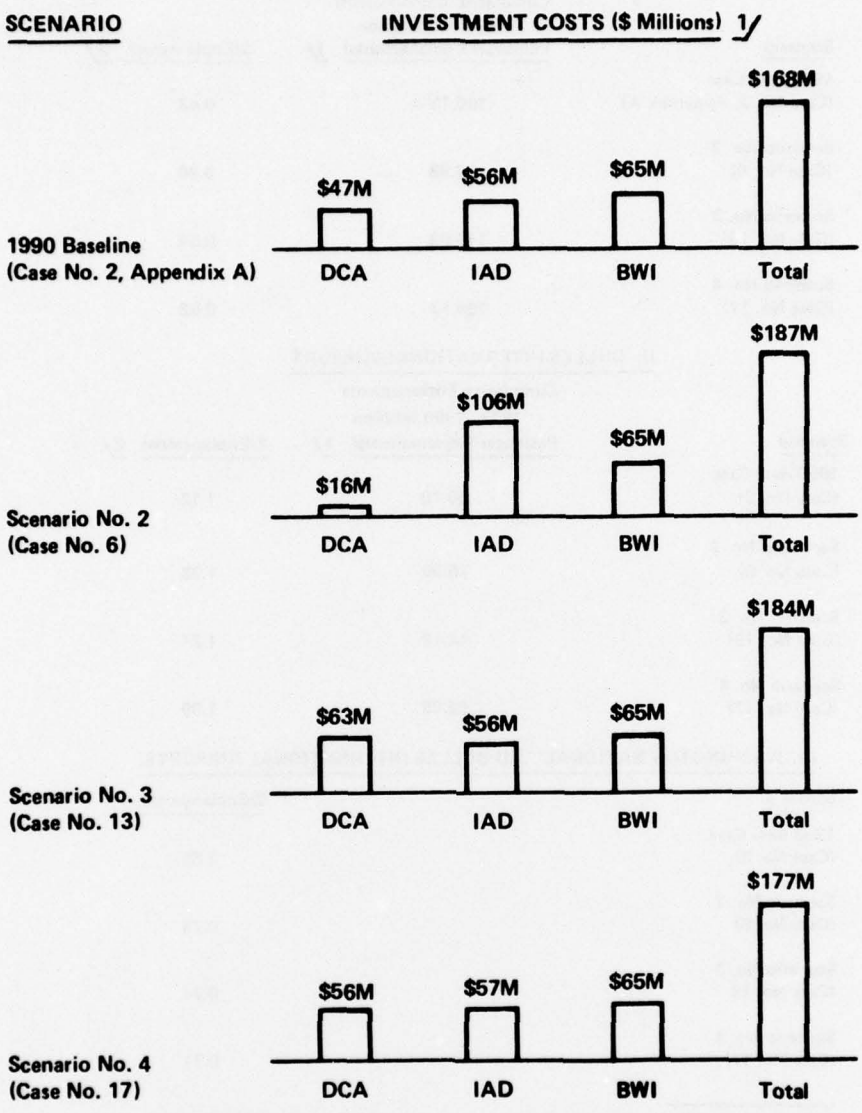
Scenario	$/Enplanement
1990 Base Case (Case No. 2)	0.65
Scenario No. 2 (Case No. 6)	0.78
Scenario No. 3 (Case No. 13	0.74
Scenario No. 4 (Case No. 17)	0.71

1/ Assuming straight line growth of enplanements from 1975 level to 1990 Forecast.

2/Constant dollars.

FIGURE 9.1

METROPOLITAN WASHINGTON AIRPORT INVESTMENT COST ESTIMATES



1/ 1976 Constant Dollars.

As noted, the rule of thumb terminal floor area per TPHP is about 200 square feet. Passenger surges created by wide-body operations could increase the space requirement by about 10 percent, or 220 square feet per TPHP. Curbside activity, baggage processing, and public parking areas would be most noticeably affected by wide-body jet service at National. Additional gates and improvements to the general airfield operating surface would also be required.

The development cost of introducing wide-body aircraft at National appears to be in the range of $8 million, if a comparison is made between the 1990 base case and Scenario No. 3. This is indicated in Table 9.3. Scenario No. 2, which also introduces wide-body jets at National, costs $16 million more than the 1990 base case in terms of airport development requirements.

9.3 Baltimore-Washington International

A $64.5 million airport terminal remodeling program has been initiated at Baltimore. When complete in 1978, the new terminal facilities will provide approximately 700,000 square feet of terminal area and 26 gates. The design capacity of the expanded terminal is 11.2 million annual passengers, equivalent to approximately 3,500 passengers during a typical peak hour.

Traffic projections developed in this report never exceed the peak-hour passenger design levels of this construction program. Thus, the present development program appears adequate to accommodate future demand, and investment at the Baltimore Airport remains constant ($64.5 million) throughout this analysis.

TABLE 9.3

COMPARISON OF PEAK-PASSENGER LOADS AND

INVESTMENT REQUIREMENTS AT

WASHINGTON NATIONAL AIRPORT

Scenario	1990 Annual Passenger Enplanements at National (000)	1990 Peak-Hour Passenger Enplanements at 1/ National	National Investment Cost Estimate ($ Millions) 2/
1990 Base Case (Case No. 2)	8,651	2,127	$47.43
Scenario No. 1 (Case No. 6)	4,806	1,307	16.37
Scenario No. 2 (Case No. 13)	9,624	2,355	63.18
Scenario No. 3 (Case No. 17)	8,238	2,069	55.54

1/ The passenger allocation model, described in Chapter 6.0 provided hourly demand profiles for both aircraft and passenger demands which were used to derive airport development requirements and related investment costs.

2/ Total project costs in 1976 Constant Dollars.

10.0 FINDINGS AND CONCLUSIONS

This chapter presents the major findings and conclusions derived from the Metropolitan Washington Airport Policy Analysis.

10.1 FINDINGS

Washington National is the Preferred Airport

Present demand for service at Washington National exceeds demand at either Dulles or Baltimore Airport. The number of passenger enplanements at National is limited primarily by restrictions placed on air carrier aircraft operations at the airport. National, because of its close-in location and convenient flight schedules, is preferred by most regional air travelers.

With No Policy Changes, Enplanements at National Will Grow to 8.7 Million by 1990

In 1975, passenger enplanements at National Airport totaled 5.7 million for 11.4 million total passengers handled (enplanements plus deplanements). By 1990, with no change in air carrier quota limits or aircraft mix, enplanements at National Airport will increase over 50 percent to 8.7 million, and total passengers will grow to 17.4 million.

Sharp Growth Restrictions at National Could Limit Passenger Enplanements to 4.8 Million in 1990

By reducing the number of air carrier quotas 50 percent to 20 per hour, passenger traffic at National Airport could be limited to 4.8 million enplanements in 1990.

Sharp Growth Restrictions at National Relieve Noise But Increase Access and Delay Costs

A 50 percent reduction in air carrier quotas at National in 1990 would result in 13,000 fewer residents within the NEF 30 contour, compared to the 1990 base case. The 50 percent cut back, however, would impose $40 million or more of additional annual airport ground access and air traffic delay costs on travelers using Metropolitan Washington Airports by 1990, compared to other policy alternatives. Furthermore, the flight reduction would result in the loss of all non-stop airline schedules to Washington National from approximately 40 cities now served.

Passenger Traffic at Dulles Will Grow Substantially by 1990

Passenger enplanements at Dulles Airport totaled 1.3 million in 1975. By 1990, the number of passengers at Dulles will more than triple. Assuming no change in present Metropolitan Washington Airport policies, passenger enplanements at Dulles could grow 400 percent over the next 15 years. Restrictive growth policies at National Airport would divert even more travelers to Dulles. Regardless of the policy action taken, however, Dulles will experience at least a 300 percent growth in passenger traffic by 1990.

Dulles Air Traffic Activity Will More Than Double by 1990

In 1975, there were approximately 180,000 aircraft operations at Dulles Airport. By 1990, absent change in Metropolitan Washington Airport policy, that number could grow to almost 400,000. General aviation would account for almost 250,000 of these operations. Restrictive growth policies at National could increase 1990 aircraft operations at Dulles to almost 500,000.

Wide-Body Usage Could Mean 8 to 9.5 Million Passengers at National by 1990

Air carriers using wide-body aircraft at National Airport, with no change to the current 40 per hour quota limitation, would enplane approximately 9.6 million passengers (19.2 million total passengers) in 1990. This assumes a wide-body frequency of four aircraft departures per hour. If quotas were reduced to 30 operations per hour, National would enplane 8.2 million passengers in 1990.

Wide-Body Aircraft at National Could Minimize Access and Delay Costs and Alleviate Noise

Wide-body service at National Airport, at an average frequency of four departures per hour by 1990, could

remove approximately 4,000 residents from the NEF 30 contour. Reduction in air carrier quotas to 30 per hour would result in an additional 11,000 residents being removed from the NEF 30 contour, at the expense of up to $7 million of additional airport ground access costs each year.

Discontinuing Commercial Jet Flights at National After 10:00 P.M. Would Provide Substantial Noise Relief

Jet operations at night are more annoying to local residents than the same flight activity during daytime hours. Post 10:00 P.M. flights are weighted heavily in computing aircraft noise exposure. The discontinuation of jet operations anticipated after 10:00 P.M. at National in 1990 would remove approximately 33,000 local residents from the NEF 30 contour.

No Significant Differences in Investment Requirements Among Policy Alternatives

The 1990 base case or status quo option - no change in airport policies - appears to offer the least overall cost ($168 million) for airport improvements necessary to support air traffic demand anticipated by 1990. However, the variance between investments associated with each policy alternative (11 percent) is not considered significant. Policy recommendations, *therefore, should not be based upon expected differences* in airport investment requirements.

10.2 CONCLUSIONS

The attributes of a wide range of Metropolitan Washington Airport policy alternatives are described in this report. For each alternative, these attributes include the number of local residents living inside NEF 30 countour (Table 8.1); airport emissions (Table 8.3); automobile emissions (Table 8.5); aircraft delay costs at National, Dulles, and Baltimore (Table 7.4); and the relative costs of airport access for regional travelers (Table 7.2). A summary of impacts of each policy option is presented in Table 10.1. A description of each option is found in Appendix A.

TABLE 10.1

Summary of Findings

Scenario	Case	Relative Annual Cost of Airport Access and Air Traffic Delay ($ Million) 1/	Metropolitan Residents Living Within NEF 30 Contours (000) 2/	Aircraft and Automobile Air Pollution (000 lbs/day) 3/
1975 Base Case	1	18.8	162	38.1
1990 Base Case	2	41.4	171	50.3
Scenario No. 1	3	46.5	171	50.8
	4	64.9	173	52.2
	5	75.9	159	51.9
	6	86.3	158	54.7
	7	42.8	171	50.6
	8	69.5	173	52.2
	9	87.6	158	54.6
Scenario No. 2	10	32.3	171	50.5
	11	22.3	173	50.5
	12	22.6	171	50.9
	13	22.1	167	51.0
Scenario No. 2	14	47.2	171	51.8
	15	41.8	173	51.4
	16	37.9	171	43.5
	17	30.1	156	51.0
	18	75.3	159	53.6
	19	66.8	159	53.2
	20	57.3	158	52.7
	21	56.0	140	52.7
	22	25.1	167	51.1
	23	40.7	149	51.4
	24	58.7	140	50.3
	25	29.6	156	49.6
Additional Policy Alternatives	26	43.0	157	50.3
	27	25.5	138	50.8
	28	33.5	138	51.1
	29	40.6	171	50.3
	30	22.3	167	51.0
	31	31.2	156	51.0
	32	61.4	140	52.7

1/ Table 7.2 and Table 7.4
2/ Table 8.1
3/ Table 8.3 and Table 8.5

Noise exposure, air pollution, aircraft delay, and airport access costs are negative attributes, for each represents a cost to society. The "best" policy alternative is the one which minimizes these costs or negative attributes.

No one policy option shown in Table 10.1 clearly dominates all others; i.e., no policy alternative minimizes negative impacts of every attribute described. Trade-offs must be made between costs of airport access and delay, noise exposure, and air pollution.

Attention is focused, however, on the policy alternative which minimizes community noise exposure, Case 27. This alternative can be described as follows:

1. National continues its role as a major air carrier airport.

2. No change in perimeter rule or grandfather cities.

3. 9.5 million passenger enplanements at National by 1990.

4. Wide-body aircraft at National.

5. No jet operations at National after 10 p.m.

No other policy option offers more favorable noise exposure characteristics. Moreover, the remaining attributes of Case 27, as shown in Table 10.1, are sufficiently close to optimum to maintain its relative ranking or desirability. Considering the regional impacts, a policy that incorporates the features of Case 27 appears to provide the best balance between transportation service, investment requirements, and environmental concerns. Additional observations are presented below.

Washington National Best Serves as a Major Air Carrier Airport

The Metropolitan Washington Council of Governments (COB), in their proposal plan for an air transportation system for the national capital area "The Future of Washington's Airports," recognizes the role of National Airport as the key to the entire regional air transportation system. The COG recommends that Washington National should be maintained as a commercial airport serving the region.

This analysis supports the COG findings. National Airport is preferred by the majority of regional travelers in every case examined in this report, primarily because National is the most convenient airport in terms of access time and cost to the greatest number of passengers. It is concluded, therefore, that Metropolitan Washington is best served if National Airport continues its role as a major air carrier facility.

Steps Can Be Taken To Relieve, But Not Eliminate The Problem Of Airport Noise in Washington

Jet aircraft operations are inherently noisy. Consequently, aircraft noise will continue to be a problem in Metropolitan Washington, particularly in the vicinity of National Airport. While the adverse effect on noise on people cannot be completely eliminated, there are certain steps that can be taken to relieve airport noise.

Three approaches to the aircraft noise problem effectively relieve noise exposure in Metropolitan Washington. Two of these approaches reduce noise levels at their source by (1) extending FAR Part 36 noise standards to all commercial jets, and (2) introducing two- and/or three-engine wide-body jet aircraft service into Washington National. The third alternative discontinues commercial jet aircraft operations at Washington National during the more noise sensitive nighttime hours (post 10:00 P.M.). Within the range of alternatives evaluated in this analysis, these steps minimize exposure in Metropolitan Washington.

Reductions in air traffic activity have been proposed as a solution to the airport noise problem. Given the characteristics of aircraft noise in Washington, however, even sharp reductions (up to 50 percent) in the number of air carrier flights at National have only minor effect on noise exposure. While a 50 percent cut back in air carrier flight schedules at National would appreciably "shrink" the total area exposed to NEF 30+, it would result in only 13,000 fewer residents within the NEF 30+ contour. This is explained by the larger number of people who live very close to the airport relative to the number living further out, and by the large amount of water area encompassed within the NEF 30+ contour.

Dulles Will Play A Significantly More Important Role In The Metropolitan Washington Airport System

Regardless of the growth of aircraft activity at Washington National, traffic levels at Dulles will increase significantly by 1990. In 1975, Dulles handled approximately 15 percent of all regional air travelers. Dulles' share of all regional passengers will increase to approximately 30 percent by 1990. Over the next 15 years, Dulles will grow at a faster rate than either National or Baltimore airports.

Wide-Body Aircraft at National Would Benefit Both Air Travelers and Local Residents

Two- and three-engine wide-body operations at National have the potential for improving the quality of service provided to air travelers using the airport. A larger number of passengers could be handled with the same or fewer numbers of flight. Wide-body aircraft are quieter and cleaner operating than conventional air carrier aircraft. It is concluded, therefore, that wide-body aircraft service at National would better serve consumers and the community's environmental interests.

APPENDIX A
METROPOLITAN WASHINGTON AIRPORT POLICY ANALYSIS
DESCRIPTION OF AIRPORT POLICY ALTERNATIVES

Scenario	Case	Description: Number Airline Quotas at DCA Per Hour 1/	Description: Wide Body Aircraft Authorized AT DCA	Description: Special Provisions
1975 Base Case	1	40	No	
1990 Base Case	2	40	No	
Scenario #1	3	35	No	
	4	30	No	
	5	25	No	
	6	20	No	
	7	40	No	– No extra shuttle sections
	8	30	No	– No transfer of extra quotas to commuters
	9	20	No	– No transfer of extra quotas to commuters
Scenario #2	10	40	Yes	– 1 wide-body aircraft operation per hour average at DCA
	11	40	Yes	– 2 wide-body aircraft operations per hour average at DCA
	12	40	Yes	– 3 wide-body aircraft operations per hour average at DCA
	13	40	Yes	– 4 wide-body aircraft operations per hour average at DCA
Scenario #3	14	30	Yes	– 1 wide-body aircraft operation per hour average at DCA
	15	30	Yes	– 2 wide-body aircraft operations per hour average at DCA
	16	30	Yes	– 3 wide-body aircraft operations per hour average at DCA
	17	30	Yes	– 4 wide-body aircraft operations per hour average at DCA
	18	20	Yes	– 1 wide-body aircraft operation per hour average at DCA
	19	20	Yes	– 2 wide-body aircraft operations per hour average at DCA
	20	20	Yes	– 3 wide-body aircraft operations per hour average at DCA
	21	20	Yes	– 4 wide-body aircraft operations per hour average at DCA
	22	40	Yes	– 4 wide-body aircraft operations per hour average at DCA Also, no extra shuttle sections at DCA.
	23	30	Yes	– 4 wide-body aircraft operations per hour average at DCA. Also, no extra shuttle sections at DCA.
	24	20	Yes	– 4 wide-body aircraft operations per hour average at DCA. Also, no transfer of extra quotas to commuters
	25	30	Yes	– 4 wide-body aircraft operations per hour average at DCA. Also, no transfer of extra quotas to commuters
Additional Policy Alternatives	26	40	No	– 10:00 curfew on commercial jet traffic at DCA
	27	40	Yes	– 4 wide-body aircraft operations per hour average at DCA. Also, 10:00 curfew on commercial jet traffic at DCA
	28	30	Yes	– 4 wide-body aircraft operations per hour average at DCA. Also, 10:00 curfew on commercial jet traffic at DCA.
	29	40	No	– Commercial traffic only at DCA
	30	40	Yes	– 4 wide-body aircraft operations per hour average at DCA. Also, commercial traffic only at DCA
	31	30	Yes	– 4 wide-body aircraft operations per hour average at DCA. Also, commercial traffic only at DCA.
	32	20	Yes	– 4 wide-body aircraft operations per hour average at DCA. Also, commerical traffic only at DCA.

1/ Except where otherwise noted, quotas at DCA surrendered by air carriers were reassigned to commuter operations.