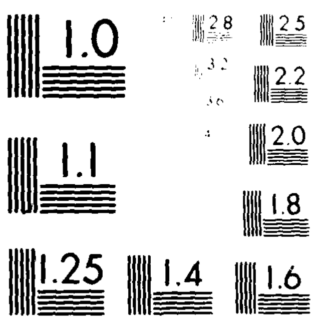
AD-A109 835 MIAMI AIRPORT IMPROVEMENT WORKING GROUP EAST POINT GA F/G 1/5
TASK FORCE DELAY STUDY, MIAMI INTERNATIONAL AIRPORT.(U)
JUL 81

UNCLASSIFIED NL

1 of 1
AD A
109835

END
DATE
FILMED
02-82
DTIC



MICROCOPY RESOLUTION TEST CHART

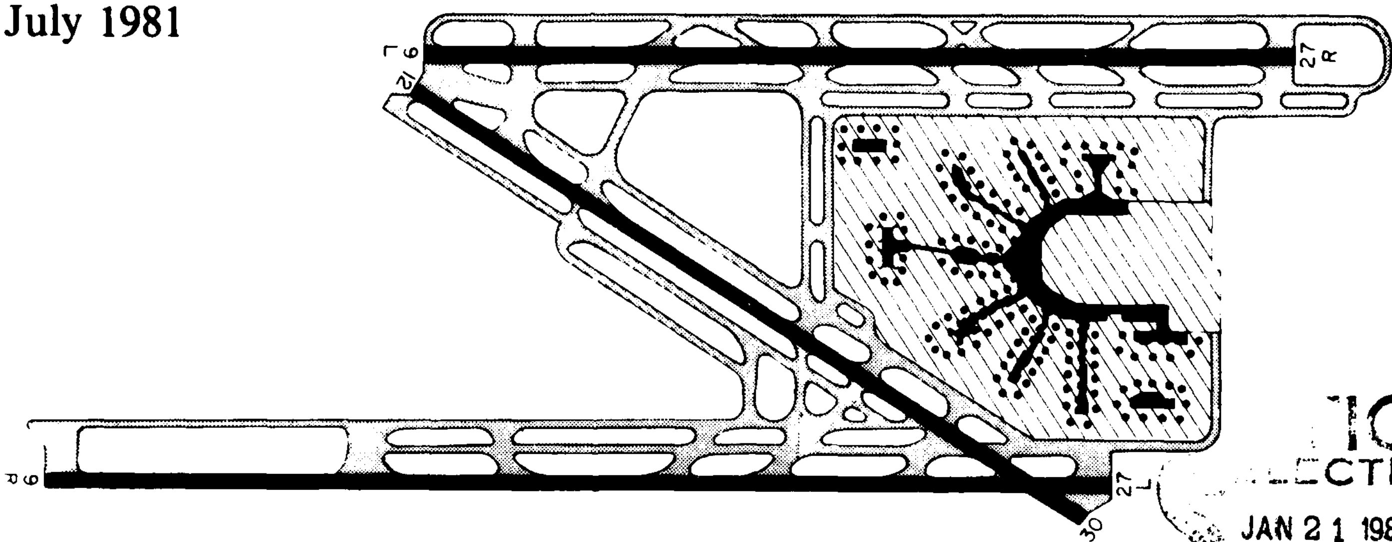
LEVEL

(12)

Task Force Delay Study

Miami
International
Airport

July 1981



Prepared Through Joint Effort of:

Department of Transportation
Federal Aviation Administration
Dade County Aviation Department
Air Transport Association
Airlines Serving Miami

Technical Report Documentation Page

1. Report No.	2. Government Accession No. AD-A109835	3. Recipient's Catalog No.
4. Title and Subtitle: Task Force Delay Study Miami International Airport		5. Report Date: July 1981
		6. Performing Organization Code
7. Author(s)		8. Performing Organization Report No.
9. Performing Organization Name and Address: Miami Airport Improvement Working Group, FAA Planning & Appraisal Staff, ASO-4, 3400 Whipple St., East Point, GA. 30320		10. Work Unit No. (TRAIS)
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address: U.S. Department of Transportation, Federal Aviation Administration, Program Management Staff, ATF-4, Washington, D.C. 20591		13. Type of Report and Period Covered
		14. Sponsoring Agency Code

15. Supplementary Notes

Supporting documentation can be found in the Task Force Delay Study, Miami International Airport, VOL II.

16. Abstract

This report presents the results of a detailed analysis of the Miami International Airport. The analysis was conducted by the Miami Airport Improvement Working Group which had representatives from the airport sponsor, the Air Transport Association, the airlines serving Miami, and the Federal Aviation Administration. The purpose of the analysis was to determine the causes of delay and the potential delay reduction benefits of recommended improvements. The effort was part of the Airport Improvement Program.

17. Key Words	18. Distribution Statement
Airfield Capacity Aircraft Delay	Document is available to the public through the National Technical Information Service Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Table of Contents

412 142

Preface

This study of air traffic at Miami International Airport (MIA) has focused on improving airfield capacity and reducing aircraft delays by refining air traffic control procedures, and by making improvements to the airport and its navigational aids. A comprehensive program of delay reduction measures has been identified which, if implemented, has the potential to *dramatically* reduce the future level and costs of delay and to permit the significant growth of traffic in the future. The potential cost savings outlined are not intended to represent absolutes, but rather to point out the most productive directions in which to focus industry action.

The study was conducted by a Task Force composed of representatives of the Federal Aviation Administration (FAA), the airlines serving Miami, the Air Transport Association (ATA), and the Dade County Aviation Department (DCAD). Support to the Task Force was provided by the FAA Washington Headquarters organizations, the FAA Technical Center and consultants from the Mitre Corporation and Peat, Marwick, Mitchell and Company. The Dade County Aviation Department provided the continuous technical and editorial support of Howard, Needles, Tammen and Bergendoff, airport consultants.

During the three years of the study (which commenced in 1978 and concluded in 1981), several of the delay reduction improvements identified by the Task Force have been implemented by the FAA and the Dade County Aviation Department, with results which closely agree with those predicted in the Task Force *evaluations*. This lends additional credence to the remaining recommended improvements.

Introduction

Background

In recent years, aircraft delays have increased at the nation's major airports. Noise restrictions and wake vortex separation standards, when coupled with increases in aviation demand, have *caused significant increases in delay and delay-related fuel consumption.*

The development of new metropolitan airports to augment system capacity and reduce delay is difficult and costly, as is large-scale expansion of existing facilities. To continue satisfactory air transportation service, it has become clear that the aviation industry must concentrate its efforts on achieving the highest efficiency of the existing airport system. To accomplish this and to identify future requirements in practical terms, quantitative performance data for major airports are needed. Such data would permit management decisions on:

1. optimum airport-use strategies;
2. expenditures for new or improved runways, taxiways, or other facilities and equipment; and
3. research and development priorities.

A 1974 FAA report on airport capacity furnished considerable insights to capacity-related operational problems at eight of the nation's major airports; however, it was decided that the findings should be evaluated by the persons directly involved in the operation and use of the airports. Therefore, in late 1974, the FAA established ad hoc working groups (local Task Forces) with the primary purpose of developing action plans to reduce airport delays, and to identify development options for implementation or further study at those eight airports. It was anticipated that recommendations developed jointly by the Task Forces for each of the major airports would form a basis of support for individual management decisions by each participating agency within the Task Force. The net result of these recommendations was envisioned as a coordinated series of further actions, whose combined effect would reduce delays substantially at each of the major airports.

The objectives, scope and methodology of the Miami Task Force study, plus an operational overview of Miami International Airport, are summarized in this report. The key recommendations of the supporting technical studies are presented on the pages that follow.

Objectives

Considering Miami International Airport's escalating delays and their cost implications, the Task Force agreed on four objectives to guide the analysis of current and future operations. These objectives were:

1. To estimate current levels of airport capacity and aircraft delay, and to identify causes of delay associated with operations in the terminal airspace, airfield, and apron/gate systems.

2. To estimate the potential benefits of reducing aircraft delay through modified air traffic control operational procedures, airfield improvements and airport policies.

3. To estimate the benefits of increased airport capacity and reduced aircraft delay resulting

from potential improvements in air traffic control systems and FAA Engineering and Development Programs.

4. To estimate current and future relationships between air traffic demand and aircraft delay as an aid for future planning at Miami International Airport.

Scope

The analysis in this study focused on means of increasing the operating efficiency of the airport and reducing aircraft delay through changes in air traffic control procedures and airport use policies, and potential airfield improvement actions. It was recognized that significant problems are associated with the landside of the airport operation. Although environmental concerns must also be considered in future airport master planning, they are beyond the scope of the Task Force study.

Methodology

This study was conducted using a fast-time simulation model, the Airfield Delay Model, which describes the significant movements performed by aircraft on the airfield and the effects of delay in the adjacent airspace. The model was validated against real world flow-rate and delay data at Chicago O'Hare International Airport. It was then calibrated against field data collected at Miami International Airport to ensure the model was site-specific.

The application of alternate delay reduction options, as specified by the Task Force participants, was examined through a set of model experiments. These experiments reflected both current and future system operations, with various levels of improvement and traffic demand assumed for future time frames.

Sets of input parameters were structured which characterized each option to be modeled. Air traffic demands, airfield layouts, and ATC procedures and system improvements were specified for both current and future time frames according to the assumed improvement options.

Air traffic demands were developed using Official Airline Guide data and Task Force forecasts to reflect aircraft volume, mix and peaking characteristics for the various time frames. Specific air traffic demands were developed in order to study the future effects of General Aviation Reliever Airport upgrading. It was assumed that improved facilities at the General Aviation Airports would attract small low-performance general aviation aircraft away from Miami International, and thus provide an improved aircraft mix at MIA.

Alternate airfield geometries for MIA were prepared from current and projected airport layout plans; this permitted assessment of the delay reduction potential of projected airfield improvements.

The time frame for air traffic control procedures and system improvements determined the aircraft separations to be used for the experiments under VFR (visual flight rules) and IFR (instrument flight rules) weather conditions. Separation values specified for future time frames were those deemed most likely to result from FAA Engineering and Development (E&D) programs.

Other simulation model inputs were empirically derived from the collected field data. Each experiment was replicated ten times by the model, with Monte Carlo sampling techniques introducing system variability into each replication. The results of the replications were then averaged to produce output statistics of total and hourly aircraft delays, travel times, and flow rates for the total airport and its individual runways. It was through this process that the model reflected the real world variations in actual system operations.

Annual delay estimates based on various improvement options were extrapolated from the experimental results. These estimates took into account the yearly variations in runway configuration, weather, and demand, as observed through historical data. The annual delay estimates where then compared, and the potential yearly delay reductions assessed.

Comparison between individual experiments permitted the relative benefits of the delay reduction options to be assessed under similar weather conditions and runway configurations.

Operational Overview

This study analyzed a system composed of Miami International Airport's terminal area airspace, its airfield, and its apron/gate facilities.

Airspace

The Miami Approach Control airspace, through which aircraft arriving and departing Miami International are transitioned to and from the enroute portion of their flight, is shown in Exhibit 1.

Arrivals are handled by four approach controllers. Two receive arrivals as they are handed-off by the Miami ARTCC transition sector controllers. These arrivals, from one or more directions depending on the configuration, are merged into a single flow for each major arrival runway. (At least two runways are used for simultaneous arrivals at MIA; under westerly operations Runways 27R and 30, under easterly operations Runways 9L and 9R.) The arrivals are then transferred to two final controllers who regulate the approach intervals for their landing runway for maximum runway acceptance.

Departures are initially handled by one of two departure controllers, either north or south. The departing aircraft is given an initial heading to fly; additional radar vectors are employed to position the aircraft into the appropriate departure transition area for hand-off to the Miami ARTCC transition sector controllers.

Because of the high traffic levels in the Miami Terminal Area, a Group I Terminal Control Area (TCA) overlies Miami International. While the Miami Terminal Area is dominated by the Miami International Airport (MIA), its traffic flows must also consider the activities at the other ten airports in the terminal area handled by Miami Approach Control.

Airfield

The airfield system of runways and taxiways is shown in Exhibit 2.

Runway 9R/27L

Runway 9R/27L, the primary long-haul departure runway, has been extended to 13,000'. Runway 9R/27L also is provided with high intensity runway lights (HIRL) and centerline lights (CLL). Category I ILS (instrument landing system) and MALSR (medium intensity approach lighting system with runway alignment indicator lights) approach lighting systems are installed on both the Runway 9R and Runway 27L approaches. Runway 9R has no runway visual range (RVR) system. Takeoff minima on the RVR-equipped Runway 27L is 1,600' RVR. A new 250' baseline RVR should be installed on Runway 9R, and mid-point RVR should be installed on Runway 9R/27L. Takeoff minima on runways 9R and 27L would then be lowered to 700'/700'/600' RVR.

Runway 12/30

Runway 12/30 is 9,600' long and HIRL's are installed. Runway 30 is equipped with ILS Localizer/Distance Measuring Equipment (LOC/DME) and a full ILS is planned for Runway 12. Medium intensity approach lights (MALS) will be installed on the Runway 30 approach and MALSR will be installed on the Runway 12 approach. Runway 12/30 plays a vital role in the operation of MIA, since the highest peak hour capacity of the airport (approximately 120 operations per hour) is obtained by completely integrating the use of Runway 12 with the use of Runways 9L and 9R, when on east operations; and completely integrating the use of Runway 30 with the use of Runways 27L and 27R, when on west operations. (On east operations: land Runway 9R, takeoff Runway 12, land and takeoff Runway 9L. On west operations: land Runway 30, takeoff Runway 27L, land and takeoff Runway 27R).

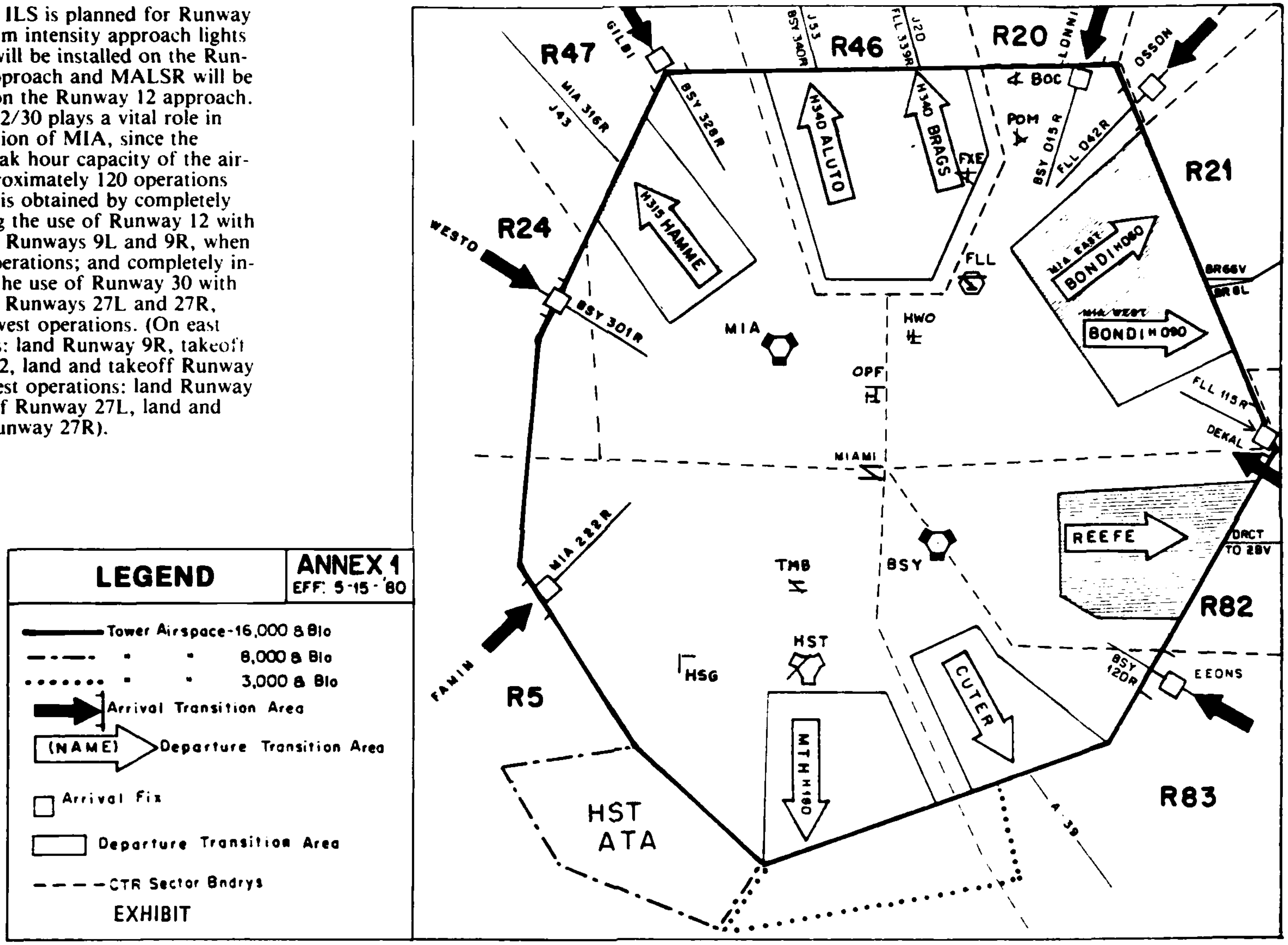


Exhibit 1—Miami Tower Delegated Airspace

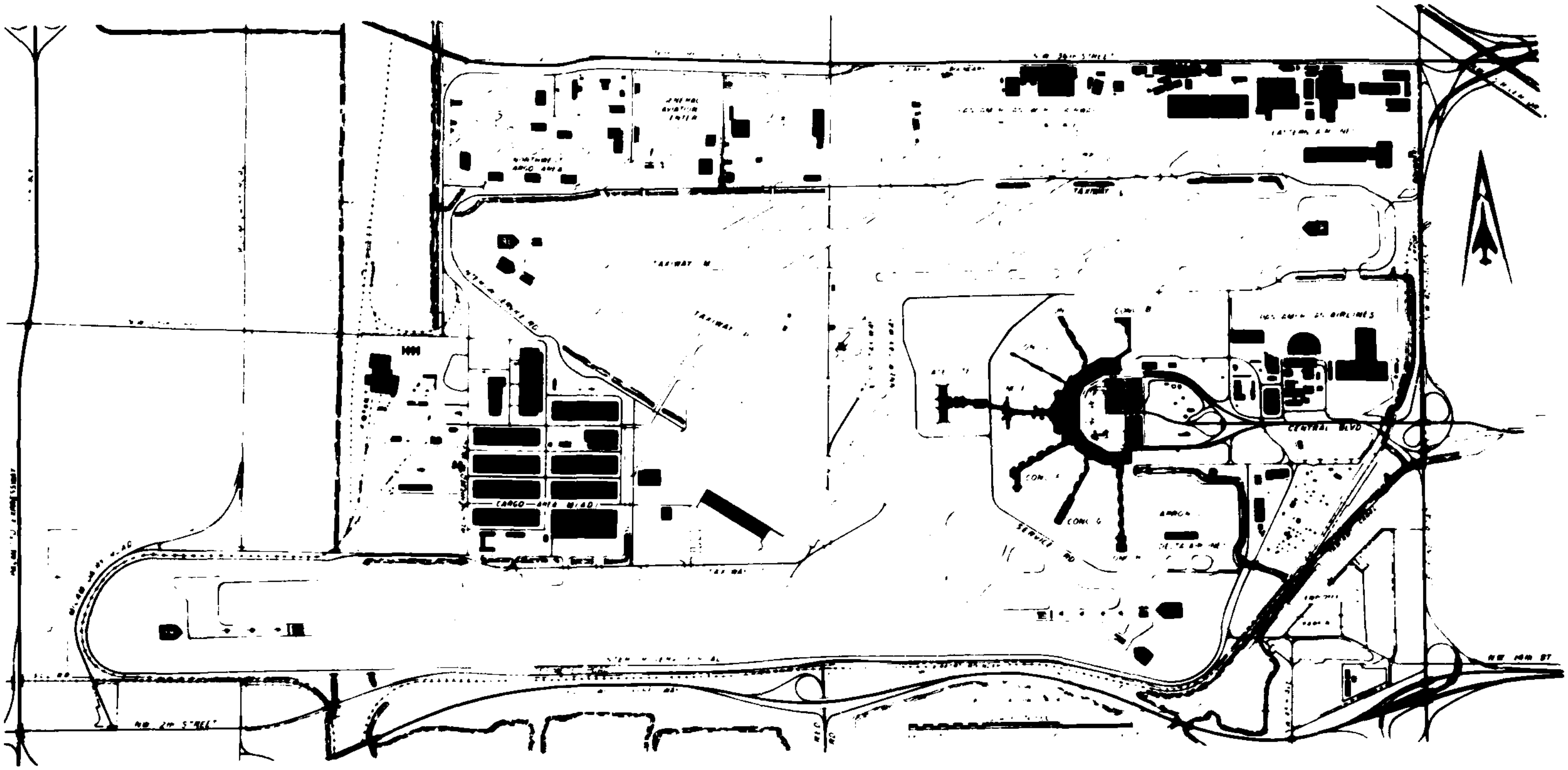


Exhibit 2—Miami International Airport

Runway 9L/27R

Runway 9L/27R is 10,500' long and HIRL's are installed. Runway 9L is provided Category I ILS, ALSF (high intensity lights with sequenced flashing lights) and RVR. Runway 27R is provided with MALSR and Category I ILS. Runway 9L/27R is the most heavily used runway; however, the runway's capacity is somewhat limited by its existing taxiway system which is being improved. The takeoff minima on Runway 9L/27R urgently needs lowering to reduce delays during winter morning fog conditions. Category II weather minima facilities should be provided on Runway 9L.

There are no restrictions on usage of Runways 9L/27R, 12/30, or 9R/27L by either weight or class of aircraft. The full Category I ILS systems on the two parallel runways may be used for either staggered or simultaneous ILS approaches for either easterly or westerly operations. The arrival and departure minima for each runway are presented in Exhibit 3.

Apron/Gate Complex

The apron/gate complex at Miami *International* Airport is shown in Exhibit 4. Several modifications to the Main Terminal Building are in the final design stages. These modifications will add new wide-body gates to existing concourses. In addition, a new Concourse J will be constructed east of Concourse H. The completion of these improvements will provide the passenger terminal are with 129 gates by 1985, efficiently accommodating the approximately 28 million passengers per year projected for that time frame.

Exhibit 3—Arrival and Departure Minima

RUNWAY	MINIMA: ARRIVAL	MINIMA: AIR CARRIER DEPARTURE	GENERAL DEPARTURE MINIMA 1&2 Engine RVR 5000 or 1 3&4 Engine RVR 2400 or 1/2
9L	DH 209(200) RVR 2400 or 1/2	RVR 1600 or 1/4	FAR 135 Takeoff RVR 2400 or 1/2
9R	DH 208(200) 1/2	1/4	FAR 135 Takeoff - 1/2
27L	DH 260(250) RVR 5000 or 1	RVR 1600 or 1/4	FAR 135 Takeoff RVR 5000 or 1
27R	DH 210(200) 1/2	1/4	FAR 135 Takeoff 1/2
12	MDA 420(411) A-B RVR 5000 or 1 C-D RVR 6000 or 1-1/4	RVR 1600 or 1/4	FAR 135 Takeoff RVR 5000 or 1
30	MDA 360(350) A-B-C RVR 5000 or 1 D RVR 6000 or 1-1/4	RVR 1600 or 1/4	FAR Takeoff RVR 5000 or 1

Field Elevation 10'

Recommended Improvements

Based on the data developed in this study, the Task Force recommends the following improvements as essential to meet future demand without excessive delays. The status of each improvement, as of April 1981, is shown.

Four general categories of recommended improvements offer the potential for increasing airport capacity and reducing aircraft delays.

- Airfield Improvements
- Additional Facilities and Equipment Improvements
- Air Traffic Control Operations Improvements
- Airport Use Policy

Brief descriptions of the improvement packages and estimates of their potential annual savings are summarized in Exhibit 5 and are discussed briefly in the following text.

A. Airfield Improvements at Miami International Airport.

Many of the recommended airfield improvements have already been implemented. **The remaining airfield improvements, however, are essential if the 1988 demand is to be accommodated without excessive delay.**

Runway 9L/27R

A1—Improve the Taxiway System for Runway 9L/27R.
Runway 9L/27R is a heavily used runway, but its capacity is somewhat limited by its existing taxiway system. The taxiway improvement project is underway, with expected completion date in late 1982.

A2 and A3—Install Centerline Lights Runway 9L/27R and Install Touch Down Zone Lights (TDZ) Runway 9L.
These two items have been combined since both are required to reduce landing minima and they will be installed during the same time frame. The lowest landing minima presently authorized *for Runway 9L is Decision Height (DH)* 209′ (200′) and visibility ½ mile or 2400′ RVR. The addition of both CLL and TDZ lighting systems will reduce the visibility minima to 1800′ RVR for Category A, B, and C aircraft, and to 2,000′ RVR for Category D aircraft. The expected completion date is late 1982.

Runway 9R/27L

A4—Extend Runway 9R/27L and Install Centerline Lights
This project has been completed.

A5—Improve the Taxiway System for Runway 9R/27L.
An improved taxiway system will reduce runway occupancy time and increase capacity by 2 to 4 operations per hour. The dual parallel taxiway system is also essential to maximize mixed-mode (arrival departure) operations on this runway. The expected completion date is late 1983.

Runway 12/30

A6—Install HIRL Runway 12/30.
HIRL on Runway 12/30 permit the use of RVR operating minima rather than meteorological visibility minima. This project has been completed.

A7—Provide Blast Protection Shoulders Runway 12/30.
As previously stated, Runway 12/30 plays a vital role in the most efficient operation of Miami International Airport. The blast protection shoulders permit B747 aircraft to takeoff on Runway 12/30, thus increasing its useability. This project has been completed.

Other Airfield Improvements at MIA

A8—Provide Overflow Aircraft Parking Positions within the Terminal Area. (Concourse J apron, Concourse E remote positions).
The additional gates reduce taxiing congestion and generally reduce aircraft taxiing time on the airport. These projects have been completed.

A9—Complete Interior Service Road Around Perimeter of Airfield.
The service road reduces the requirements for vehicles to cross the operating runways and/or taxiways. This increases airfield safety, reduces controller workload, allows more time for aircraft-related functions, and results in reduced delays. This project has been completed.

Airfield Improvements at General Aviation Reliver Airports

A10—Upgrade the Runway and Taxiway System at Opa Locka Airport.
These improvements are part of the DCAD's efforts to make Opa Locka Airport more suitable for general aviation operations, and thus relieve general aviation aircraft congestion at Miami International. This project has been completed.

A11 and A12—Extend Runway 9R/27L at Tamiami Airport to 7,000' and Provide Dual Parallel Taxiways to Runways 9R/27L and 9L/27R.
These two projects are part of the DCAD's improvement of Tamiami Airport; they will also relieve general aviation aircraft congestion at Miami International Airport. Both of these projects are in the planning stage.

B. Facility and Equipment Improvements at Miami International Airport

Runway 9L/27R

B1—Install RVR Runway 27R and Midpoint RVR Runway 9L/27R. Convert Runway 9L RVR to 250' Baseline.
The new RVRs, the conversion of the Runway 9L RVR baseline, and the addition of CLL on Runway 9L/27R (Improvement A2 and A3) will permit takeoff minima of RVR 700'/700'/600' vs. RVR 1600' or 1/4 mile. Lower takeoff minima will reduce aircraft delays and improve airline service to the public. Completion of these projects will be combined with projects A2 and A3 (installation of CLL and TDZ lighting Runway 9L). The expected completion date is late 1982.

Runway 9R/27L

B2—Install RVR Runway 9R and Midpoint RVR Runway 9R/27L.
The new RVRs, together with the existing CLL, will permit takeoff minima of RVR 700'/700'/600' vs. RVR 1600' or 1/4 mile. Lower takeoff minima will reduce aircraft delays and improve airline service to the public.

Items B1 and B2 will provide RVR data for all runway approaches and for all departure directions at Miami International Airport. The expected completion date is 1983.

Runway 12/30

B3—Install Localizer/DME Runway 30.
These facilities have been installed.

B4—Examine Feasibility of Installing Glideslopes, Outer Marker, Middle Marker and MALSR Runway 30.
The purpose of Items B3 and B4 is to permit independent arrival operations to Runway 27R and Runway 30 when weather conditions are below a 1500' ceiling and 5 miles visibility. Total airfield runway capacity can be increased 20 percent when Runway 27R and Runway 30 are used for simultaneous independent arrivals. This project is in the planning stage.

B5—Install ILS and MALSR Runway 12.
These facilities will permit the use of Runway 12 as a back-up arrival runway during both VFR and IFR weather conditions. ILS and MALSR on Runway 12 also will permit independent ILS approaches to Runway 12 and Runway 9R when weather conditions are below 1,500' ceiling and 5 miles visibility (the present restrictions), thus increasing the capacity of the airport during easterly operations. These facilities will be installed late 1981.

Other F&E Improvements

B6—Install VOR/DME on Airport.
An on-airport VOR/DME will enhance the ability of air carrier pilots to perform profile descent procedures, reduce pilot/controller workload, reduce departure delays and contribute to fuel conservation. This project is in the planning stage.

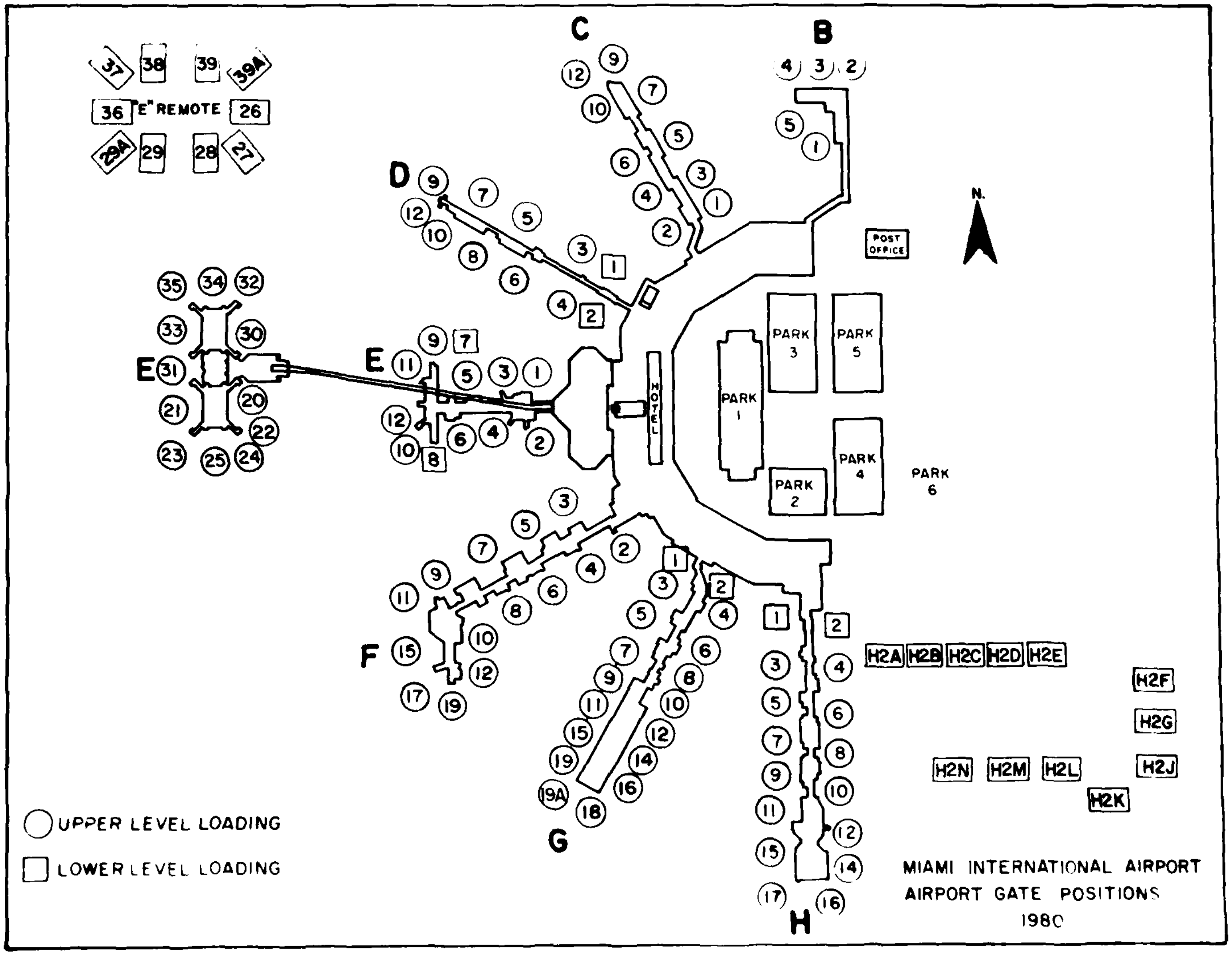

MIAMI INTERNATIONAL AIRPORT
AIRPORT GATE POSITIONS
1980
UPPER LEVEL LOADING
LOWER LEVEL LOADING
"E" REMOTE
B
C
D
E
F
G
H
N.
POST OFFICE
HOTEL
PARK 1
PARK 2
PARK 3
PARK 4
PARK 5
PARK 6
H2A
H2B
H2C
H2D
H2E
H2F
H2G
H2J
H2K
H2L
H2M
H2N

Exhibit 4

B7—Expedite Development of Wake Vortex Advisory and Avoidance System (WVAS).
The WVAS is envisioned as a ground-based predictive system which will allow decreased longitudinal spacing between aircraft when wind conditions are such that wake vortices will not present a hazard to following aircraft. The WVAS and other ATC programs, such as metering and spacing, are required to achieve reduced separation standards. These projects are in the FAA Research and Development stage.

Facility and Equipment Improvements at the General Aviation Reliever Airports

B8—Install ILS, MALSR and Visual Approach Slope Indicator (VASI)-4 Runway 9R at Tamiami Airport.
These projects have been completed.

B9—Install VASI-4 Runway 9L at Tamiami Airport.
This project is in the planning stage.

B10—Install VASI-4 Runway 27L and Runway 27R at Tamiami Airport.

B11—Install a TVOR on Tamiami Airport.
This will enhance the ability of general aviation pilots to locate Tamiami Airport when approaching the airport from the south (e.g., Central America, South America and the Caribean.)

B12—Install ILS, VASI-4 and MALSR Runway 9L at Opa Lock Airport.
These projects have been completed.

B8, B9, B10 and B11 with the airfield improvements at Tamiami shown in A11 and A12 are designed to improve the efficiency of Tamiami as a reliever airport. This will attract general aviation aircraft away from and thus reduce air carrier delays at Miami International.

B13—Install VASI-4 Runway 27R at Opa Locka Airport.
This project has been completed.

Items B12 and B13, with the airfield improvements at Opa Locka shown in Item A10, are designed to improve the efficiency of Opa Locka as a reliever airport, and thus to attract general aviation aircraft away from MIA. This will reduce air carrier aircraft delays at Miami International Airport.

C. Operational Improvements at Miami International Airport

C1—Implement Operational Procedures to Make Greater Use of Intersection Takeoff Position on Runway 30.
These operational procedures will reduce congestion on the taxiways in the southeast part of the airport, and facilitate taxiing to and from Concourses G and H. These procedures have been implemented.

C2—Implement Operational Procedures to Expand Simultaneous Use of Runway 12 and Runway 9R.
During east operations, the highest peak hour capacity of the airport is obtained by completely integrating the use of Runway 12 with Runway 9L and Runway 9R. These procedures have been implemented.

C3—Utilize 2-Mile In-Trail Staggered Parallel Approaches When Applicable.
When it is not possible to conduct simultanious parallel approaches, the 2-mile *in-trail staggered* parallel approaches will improve the arrival capacity of the airport. These procedures have been implemented.

C4—Implement Operational Procedures Which Will Permit Independent Arrival Operations to Runway 27R and Runway 30 When the Weather Is Below 1500′ Ceiling and 5 Miles Visibility.
Ceiling 1500′ and 5 miles visibility is the lowest weather minima which permits independent arrivals to Runway 27R and Runway 30. With the use of Runway 30 for arrivals, Runway 27R for arrivals and departures, and Runway 27L for departures, airport capacity increases 20 percent above baseline capacity. These procedures are at the planning stage.

D. User Improvements at Miami International Airport

D1—Improve Aircraft Mix at Miami International Airport.
The large number of low-performance general aviation aircraft using Miami International Airport during peak hours causes extensive delays to large air carrier aircraft. This is due to the greater separation standards required between small low-performance aircraft and large high-performance air carrier aircraft, and the critical runway slots taken up by these small aircraft.[1] DCAD has a program underway to upgrade the conveniently located general aviation reliever airports at Opa Locka and Tamiami. In the future the introduction of a demand management system at Miami International Airport during peak hours may also be required to reduce the growth rate of low-performance general aviation aircraft.

Exhibit 5—Summary of Improvements Required and Annual Benefits

Package No. 1—Improvements At Miami International Airport

Completed	Improvement Project
A4	Extend Runway 9R/27L and install centerline lights
A6	Install HIRL Runway 12/30
A7	Provide blast protection shoulders Runway 12/30
A8	Provide overflow aircraft parking within terminal area
A9	Complete interior service road around perimeter of airport
B3	Install Localizer/DME Runway 30
C1	Implement operational procedures to make greater use of intersection takeoff position on Runway 30
C3	Utilize 2-mile in-trail staggered parallel approaches when applicable

Recommended	Improvement Project
A1	Improve taxiway system for runway 9L/27R
A2 & A3	Install centerline lights Runway 9L/27R and touchdown zone lights Runway 9L
A5	Improve taxiway system for Runway 9R/27L
B1	Install RVR Runway 27R and midpoint RVR Runway 9L/27R. Convert Runway 9L RVR to 250′ baseline
B2	Install RVR Runway 9R and midpoint RVR Runway 9R/27L
B4	Examine feasibility of installing Glidescope Outer Marker, Middle Marker, and MALSR Runway 30
B5	Install ILS and MALSR Runway 12
B6	Install VOR/DME on Miami International Airport
B7	Expedite development of Wake Vortex Advisory and Avoidance System, and install at MIA
C2	Implement operational procedures to expand independent use of Runway 12 and Runway 9R when the weather is below 1500′ ceiling and 5 miles visibility
C4	Implement operational procedures which will permit independent arrival operations to Runway 27R and Runway 30 and when the weather is below 1500′ ceiling and 5 miles visibility

	1983	1988
Annual Benefit, in 1980 Dollars,* Improvement Package No. 1 (Improvements at MIA)	$22,100,000	$42,400,000

*Note: The 1980 operating costs of the various types of aircraft used in this study are shown below:

Aircraft Type	1980 Operating Costs Per Minute	
	Ground Delay	Airborne Delay
General Aviation (single engine)	$0.12	$0.32
General Aviation (twin turboprop)	$5.06	$7.78
Large Aircraft (DC9, B727, B757, B767)	$24.74	$34.55
Heavy Aircraft (A300, B747, DC10, L1011)	$56.39	$74.43

[1] Calendar Year 1980, General Aviation Aircraft Operations as a percentage of Total Aircraft Operations: Chicago O'Hare 4.7%, Atlanta 6.7%, New York Kennedy 12.2%, Miami International 19.3%.

Package No. 2—Improvements At General Aviation (G.A.) Reliever Airports To Provide Improved Aircraft Mix At Miami International Airport

Completed	Improvement Project
A10	Upgrade the runway and taxiway system as shown on the Opa Locka Airport Layout Plan
B8	Install ILS, MALSR, and VASI-4 Runway 9R at Tamiami
B12	Install ILS, VASI-4, and MALSR Runway 9L at Opa Locka
B13	Install VASI-4 Runway 27R at Opa Locka

Recommended	Improvement Project
A11 & A12	Extend Runway 9R at Tamiami to 7000′
B9	Install VASI-4 Runway 9L at Tamiami
B10	Install VASI-4 Runway 27L and 27R at Tamiami
B11	Install TVOR on Tamiami
D1	Improve aircraft mix at Miami International Airport

	1983	1988
Annual Benefit, in 1980 Dollars,* of Improvement Package No. 2 (Improvements at G.A. airports to provide improved aircraft mix at MIA)	$44,600,000	$102,900,000

Total Annual Benefits, In 1980 Dollars	**1983**	**1988**
Package No. 1 (improvements at MIA)	$22,100,00	$ 42,400,000
Package No. 2 (improvements at G.A reliever airports to provide improved aircraft mix at MIA)	$44,600,000	$102,900,000
Total Annual Benefits	$66,700,000	$145,300,000

*1980 Aircraft operating costs shown previously.

Summary of Technical Studies

The operation of the existing airfield and the potential benefits of the improvements were assessed in terms of airfield capacity, airfield demand, and average aircraft delays. Estimates of average aircraft delays are based on the values and the interrelationships of airfield capacity and demand. The estimated average aircraft delays permit assessment of both the operational efficiency of the airfield and the potential economic benefits of improvements.

Various airfield system improvements, ranging from changes in air traffic control procedures to changes in physical facilities, operations and aircraft mix can increase airfield capacity and thus reduce aircraft delays. If a dollar value is attached to each minute of aircraft delay, the cost of a particular package of airfield improvements can be weighed against the annual aircraft delay savings. Thus, a comparison of the costs and the delay reductions associated with each of the improvement packages will indicate the cost effectiveness of each of the improvement packages. For a given forecast increase in demand, a suitable combination of airfield improvements can be implemented in stages so that airfield capacity is increased as needed, and average aircraft delays are maintained within acceptable limits.

The following Exhibits summarize the technical studies. First, present-day runway configurations and associated weather parameters are identified. Then, estimates of 1978 and projected 1983 and 1988 airfield demand, capacity and average aircraft delay are presented.[2] Next, the airfield capacity increases and the aircraft delay reductions associated with the recommended improvements are illustrated.

Finally, the interrelationship of airfield demand, airfield capacity, and aircraft delays are examined in terms of constant 1980 dollars.

---

[2] The study commenced in 1978 and therefore used that level of demand and resultant delay as its base reference level. The future scenarios of demand, capacity and delay then were examined in five year increments from that 1978 base; thus the analyses of 1983 and 1988, which should be regarded as indicators of future traffic levels rather than specific years.

Runway Configurations

Exhibit 6a defines the terms "VFR", "IFR 1", and "IFR 2" used in this study. Exhibit 6b illustrates the runway configurations used at the airport and presents the average percentage utilization of these configurations in the different weather conditions of VFR, IFR 1 and IFR 2.

Although the weather conditions at Miami are shown as VFR for the majority of the time, modern air traffic control radar procedures and airline operating procedures generally require adherence to IFR-type procedures at all times, particularly within a Group I Terminal Control Areas such as that surrounding Miami International Airport.

Exhibit 6a—Airfield Operations

Weather	Ceiling	Visibility	Percentage Occurrence
VFR	At least 1,500 feet	At least 5 miles	98.6
IFR 1	Between 200 feet & 1,500 feet	Between 2,400 feet RVR and 5 miles	1.3
IFR 2	Less than 200 feet	Between 1,600 feet RVR and 2,300 feet RVR	0.1

Exhibit 6b—Percentage Use (1978 Baseline)

Condition	Configuration	VFR	IFR 1	IFR 2	Total (all weather)
VFR East		71.1%			71.1%
VFR West		27.5%			27.5%
IFR-1 East			0.4%		0.4%
IFR-1 West			0.9%		0.9%
IFR-2 East	9L			0.1%	0.1%
IFR-2 West	27L				
Total		98.6%	1.3%	0.1%	100.0%

Airfield Demand

Exhibits 7a to 7f illustrate the projected increases in annual demand from 346,384 annual operations (arrivals and departures) in 1978, to 422,100 annual operations in 1988; their traffic mixes; and the corresponding increases in daily peak-hour traffic from 88 operations per hour in 1978, to 140 operations per hour in the unconstrained General Aviation case in 1988. Also shown is the potential de-peaking which would result by achieving a 50% reduction in low-performance general aviation aircraft operations during peak hours at MIA by 1983.

Exhibit 7a

	Aircraft Operations			
Year	Annual Operations	24-Hour Day (Average Day of Peak Month)	Peak 8—Hour Total (11:00 to 19:00 Hours)	Peak Hour
1978	346,384	1,060	596	88
1983	380,200 (340,200)*	1,163 (1,041)	765 (683)	126 (104)
1988	422,100 (382,100)	1,292 (1,169)	849 (767)	140 (118)

Exhibit 7b

	Traffic Mix (24-Hour Day)							
	Air Carrier						General Aviation	
	Large		Heavy		Total			
Year	Volume	Percent of Total Ops.	Volume	Percent of Total Ops.	Volume	Percent of Total Ops.	Volume	Percent of Total Ops.
1978	625	59%	191	18%	816	77%	244	23%
1983	581 581 *	50% (56%)	373 373	32% (36%)	954 954	82% (92%)	209 87	18% (8%)
1988	530 530	41% (45%)	555 555	43% (47%)	1,085 1,085	84% (93%)	207 84	16% (7%)

*Values in parentheses assume a 50% reduction during peak hours in low-performance general aviation aircraft operations at MIA by 1983.

Exhibit 7c—Average Day, Peak Month Demands

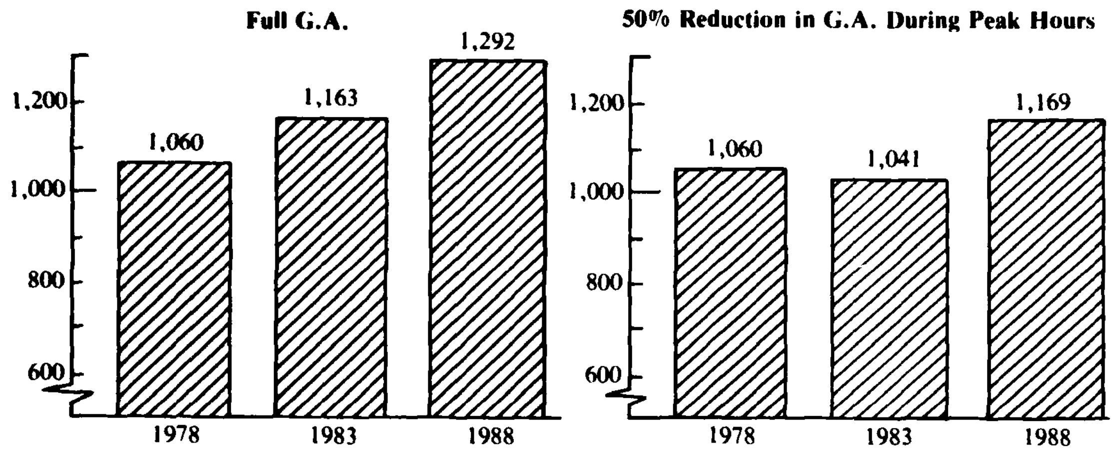


Exhibit 7d—Hourly Variation Of 1978 Peak 8-Hour Demands (Average Day, Peak Month)

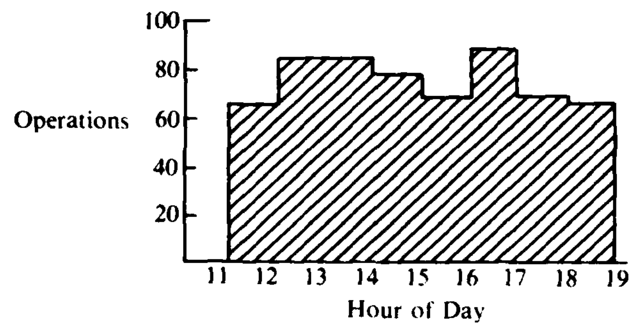
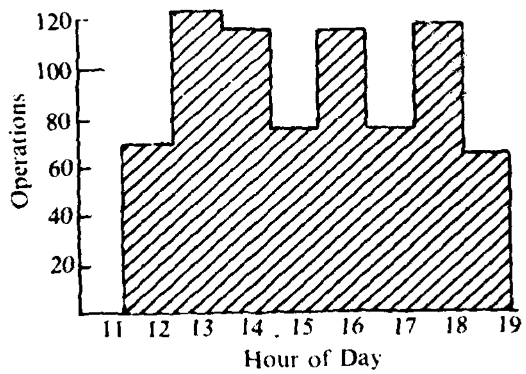


Exhibit 7e—Hourly Variation Of 1983 Peak 8-Hour Demands (Average Day, Peak Month)

Full G.A.



50% Reduction In G.A. *During* Peak Hours

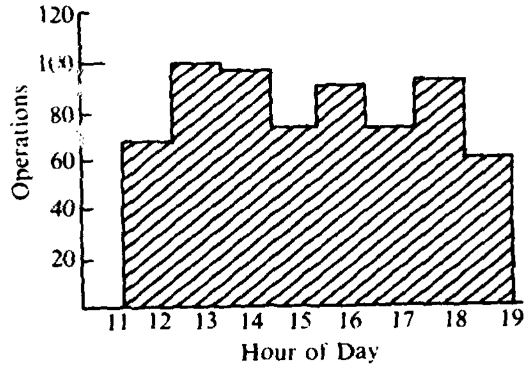
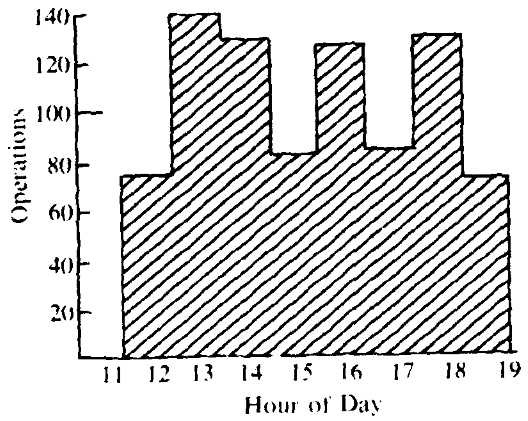
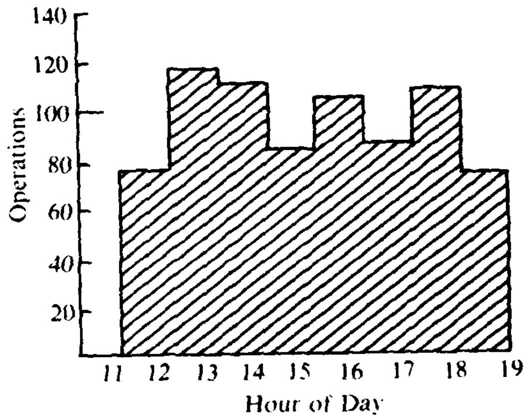


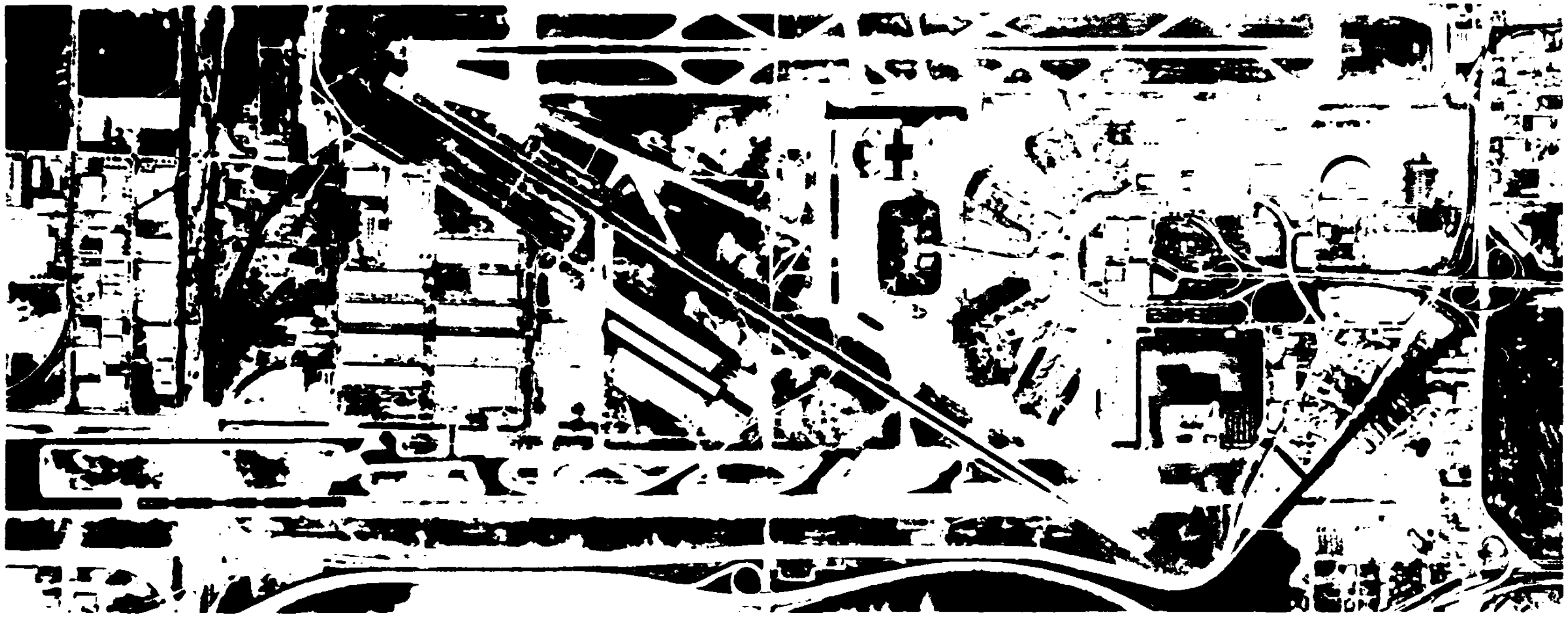
Exhibit 7f—Hourly Variation Of 1988 Peak 8-Hour Demands (Average Day, Peak Month)

Full G.A.



50% Reduction In G.A. During Peak Hours





Airfield Capacity

Airfield capacity is the maximum number of aircraft operations (arrivals and departures) that can be processed in a given time under specific conditions of:

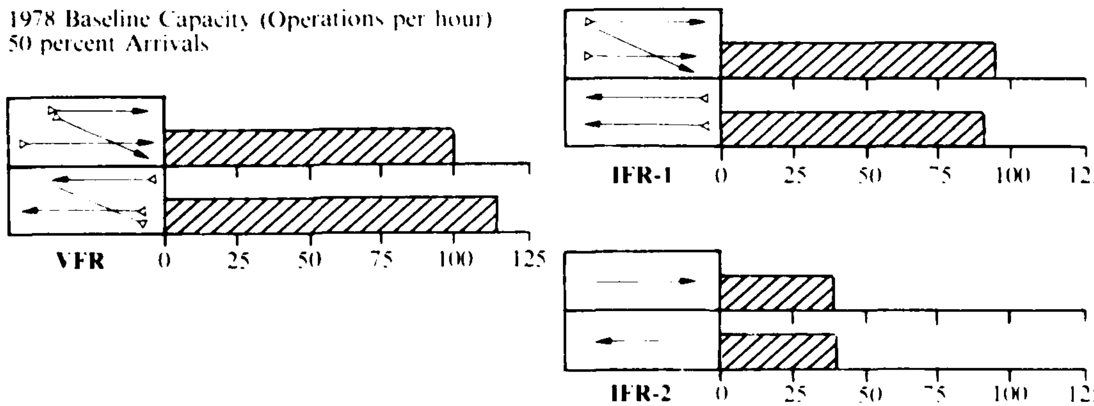
- Airspace constraints
- Ceiling and visibility conditions
- Runway layout and use
- Aircraft mix (types of aircraft)
- Percent arrivals

Aircraft capacity is normally expressed on an hourly basis.

Exhibit 8 shows estimates of airfield capacity for the runway configuration and weather conditions defined in Exhibit 6.

Exhibit 8—Airfield Capacity

1978 Baseline Capacity (Operations per hour)
50 percent Arrivals



Aircraft Delays

Aircraft delay is the additional travel time, either taxiing or airborne, caused by airport congestion. Computing average annual aircraft delays involves:

- Airport physical characteristics
- Air traffic control procedures
- Aircraft operational characteristics
- Airport demand
- Weather

Average annual delays are expressed in minutes per aircraft operation.

Congestion results whenever the volume of aircraft operations at an airport approaches airport capacity. During peak periods aircraft delays, both on the ground and in the air, are already high. Extremely high levels of congestion will prevail at Miami International Airport for extended periods of each day by 1988 unless airfield improvements, and/or changes in air traffic control procedures, and/or changes in aircraft mix are implemented.

Exhibit 9 tabulates the increases in average annual delay costs that are estimated to occur in the future under the various computer-simulated scenarios.

Exhibit 9

Annual Delay Costs—1983 Demand

Traffic Demand	Airfield Layout	ATC System	Annual Delay Costs (Millions of 1980 Dollars)
1978 (Baseline)	1980	1980	15.5
1983 full GA	1980	1980	110.2
1983 full GA	1983	1980	88.1
1983 limited GA	1983	1980	43.5
1983 full GA	1980	1983	71.9
1983 full GA	1983	1983	57.6
1983 limited GA	1983	1983	27.7

Annual Delay Costs—1988 Demand

Traffic Demand	Airfield Layout	ATC System	Annual Delay Costs (Millions of 1980 Dollars)
1988 full GA	1980	1980	287.3*
1988 full GA	1983	1980	244.9
1988 limited GA	1983	1980	142.0
1988 limited GA	1983	1983	67.8
1988 limited GA	1983	1988	47.2

*In the 1988 "Do-Nothing" scenario the average annual delay for all aircraft became 17 minutes.

Exhibit 9 is presented graphically in Exhibit 10.

Exhibit 10

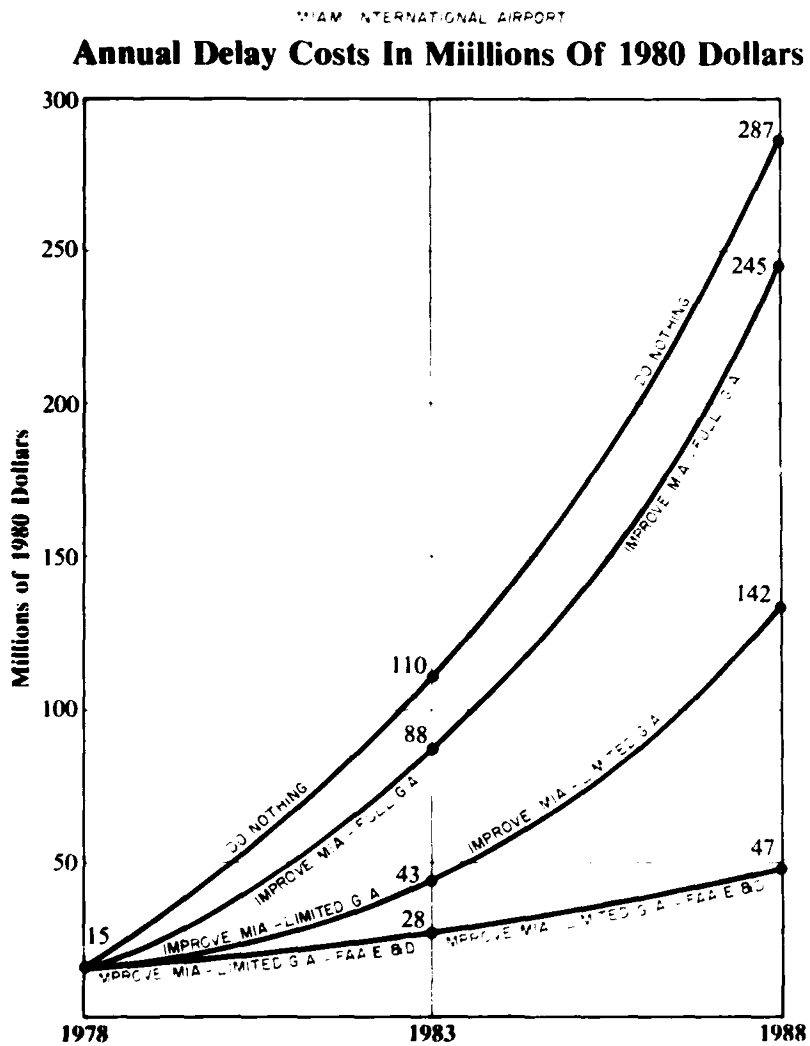

MIAMI INTERNATIONAL AIRPORT
Annual Delay Costs In Miillions Of 1980 Dollars
Millions of 1980 Dollars
300
250
200
150
100
50
1978
1983
1988
DO NOTHING
IMPROVE MIA - FULL G A
IMPROVE MIA - LIMITED G A
IMPROVE MIA - LIMITED G A - FAA E & D
15
110
88
43
28
287
245
142
47

Exhibit 11

Exhibit 11 shows the annual delay **savings** potential available if improvement packages 1 and 2 are implemented.

Annual Delay Savings—1983 Demand

	Annual Savings*
Package 1 -Improve MIA Airfield Layout, Navaid Facilities and Operational Procedures	$22.1 million
Package 2 -Improve GA Reliever Airports to provide improved traffic mix at MIA	$44.6 million
Total Annual Savings - 1983 Demand	$66.7 million

Annual Delay Savings—1988 Demand

	Annual Savings*
Package 1 -Improve MIA Airfield Layout, Navaid Facilities and Operational Procedures	$42.4 million
Package 2 -Improve GA Reliever Airports to provide improved traffic mix at MIA	$102.9 million
Total Annual Savings - 1988 Demand	$145.3 million

Summary

	Millions of 1980 Dollars		
	1978 Baseline	1983	1988
Annual Delay Costs - "Do Nothing"	15.5	110.2	287.3
Annual Delay Costs - Implement Packages 1 & 2		43.5	142.0
Annual Delay Savings		66.7	145.3

*Savings are in 1980 dollars.

Impacts of FAA Engineering and Development Programs

The Task Force also attempted to estimate the potential delay savings associated with FAA Engineering and Development (E&D) programs.

The impacts of the programs were studied through identification of the delay reduction benefits achieved by decreasing longitudinal separation standards and increasing delivery accuracy on final approach. The separation standards were based upon potential ATC equipment developments.

For purposes of analysis, the impacts of the programs were identified by the FAA as "near-term" and "far-term" according to the estimated availability. The "near-term" programs were assumed to be operational in 1983; the "far-term" in 1988.

For study purposes, the Task Force used the air traffic control operating parameters as given in the FAA report, "Parameters of Future ATC Systems Relating to Airport Capacity/Delay" (FAA-EM-78-8A), dated June 1978. The separations listed in the report are those estimated to be achievable as a result of the E&D improvements. The standard minimum IFR arrival/arrival separation for a small aircraft operating behind a heavy aircraft was reduced from 6 NM today, to 4 NM in the near-term, and to 3.5 NM in the far-term. The minimum departure/departure separation, which ranges from 1 to 2 minutes today, was not changed in the near-term, but was reduced to range from 1 to 1.5 minutes in the far-term.

The evaluation was based on an analysis of simulation model results which estimated average annual delay in minutes per aircraft movement in 1983 and 1988. Two cases were studied: (1) a base case with no improvements, and (2) a case in which the E&D systems were operating and wake vortices were assumed absent all year.

The estimated delay savings of the E&D systems represent additional savings beyond the other airport improvements identified for 1983 and 1988.

Estimated Delay Savings

FAA Engineering and Development Improvements	Minutes per aircraft Airborne	Minutes per aircraft Ground	Minutes per year Airborne	Minutes per year Ground	Savings per year* (in Millions)
Near-term systems (1983)	0.3	1.0	95,580	331,320	$15.8
Far-term systems (1988)	2.5	3.2	955,680	1,205,880	$94.7

*Using 1980 Aircraft operating costs shown previously.

In view of these results, the Task Force strongly supports the expeditious development of all *E&D system elements* that significantly contribute to reduced separation standards and increased delivery accuracy on final approach.

The Task Force also supports the immediate implementations of procedures to achieve reduced in-trail separations under meteorological conditions which eliminate wake vortices impact. This would contribute significant benefits during the transition period from 1983 to 1988.

If Package 1 (Improvements at MIA), Package 2 (Improvements at the G.A Reliever Airports to provide improved traffic mix at MIA), and the FAA Engineering and Development Programs, are all implemented in the relevant time frames, then the annual delay costs and annual delay savings will reflect a synergistically improved situation at MIA, as shown in Exhibit 12.

Exhibit 12

	Millions of 1980 Dollars 1978 Baseline	1983	1988
Annual Delay Costs - "Do Nothing"	15.5	110.2	287.3
Annual Delay Costs - "Do Everything"		27.7	47.2
Annual Delay Savings		82.5	240.0

Action Plan

No.	Improvement	C	Time Frame N	I	F	Lead Agency DCAD	FAA	AL
	Airfield Improvements		By 1983	By 1985	By 1988			
A1	Improve Taxiway System - Runway 9L/27R		●			●		
A2	Install CLL Runway 9L/27R		●			●		
A3	Install TDZ Runway 9L		●			●		
A4	Extend Runway 9R/27L & Install CLL	●						
A5	Improve Taxiway System Runway 9R/27L		●			●		
A6	Install HIRL Runway 12/30	●						
A7	Provide Blast Protection Shoulders Runway 12/30	●						
A8	Provide Overflow Aircraft Parking Positions Within Terminal Area	●						
A9	Complete Interior Service Road Around Perimeter of Airfield	●						
A10	Upgrade Runway and Taxiway System Opa Locka Airport	●						
A11	Extend Runway 9R at Tamiami Airport to 7000′		●			●		

C - Complete
N - Near Term - 1983
I - Intermediate Term - 1985
F - Far Term - 1988

DCAD - Dade County Aviation Department
FAA - Federal Aviation Administration
AL - Airlines

Action Plan (continued)

No.	Improvement	C	N	I	F	DCAD	FAA	AL
		Time Frame				Lead Agency		
Facilities & Equipment Improvements			By 1983	By 1985	By 1988			
A12	Upgrade Taxiway System at Tamiami to Provide Dual Parallel Taxiways to Runway 9R/27L and Runway 9L/27R		●			●		
B1	Install Midpoint RVR Runway 9L/27R and RVR Runway 27R. Convert Runway 9L RVR to 250′ baseline		●				●	
B2	Install RVR Runway 9R and Midpoint RVR Runway 9R/27L		●				●	
B3	Install Localizer/DME Runway 30	●						
B4	Examine feasibility of installing Glideslope, Outer Marker, Middle Marker and MALSR to serve Runway 30		●			●	●	
B5	Install ILS and MALSR Runway 12		●			●	●	
B6	Install VORTAC on airport			●		●	●	
B7	Expedite development of Wake Vortex Advisory and Avoidance System				●		●	

C - Complete
N - Near Term - 1983
I - Intermediate Term - 1985
F - Far Term - 1988

DCAD - Dade County Aviation Department
FAA - Federal Aviation Administration
AL - Airlines

Action Plan (continued)

No.	Improvement	C	N	I	F	DCAD	FAA	AL
			Time Frame			Lead Agency		
Operational Improvements			By 1983	By 1985	By 1988			
B8	Install ILS, MALSR and VASI-4 Runway 9R Tamiami	●						
B9	Install VASI-4 Runway 9L at Tamiami		●				●	
B10	Install VASI-4 Runway 27L and Runway 27R at Tamiami		●				●	
B11	Install TVOR on Tamiami Airport			●		●	●	
B12	Install ILS and MALSR Runway 9L at Opa Locka Airport	●						
B13	Install VASI-4 Runway 27R at Opa Locka Airport	●						
C1	Implement operational procedures to make greater use of the intersection takeoff position Runway 30 at MIA.	●						
C2	Implement operational procedures which will permit independent arrival operations to Runway 12 and Runway 9R when the weather is below 1,500′ ceiling and 5 miles visibility		●				●	

C - Complete
N - Near Term - 1983
I - Intermediate Term - 1985
F - Far Term - 1988

DCAD - Dade County Aviation Department
FAA - Federal Aviation Administration
AL - Airlines

Action Plan (continued)

No.	Improvement	Time Frame: C	N (By 1983)	I (By 1985)	F (By 1988)	Lead Agency: DCAD	FAA	AL
User Improvements								
C3	Utilize 2-mile in-trail staggered parallel approaches when applicable	●						
C4	Implement operational procedures which will permit independent arrival operations to Runway 27R and Runway 30 when the weather is below 1500' ceiling and 5 miles visibility		●				●	
D1	Improve aircraft mix at MIA		●	●	●	●	●	

C - Complete
N - Near Term - 1983
I - Intermediate Term - 1985
F - Far Term - 1988

DCAD - Dade County Aviation Department
FAA - Federal Aviation Administration
AL - Airlines

Glossary

DEFINITION OF TERMS

AL: Airline

ALP: Airport Layout Plan

ALSF: High Intensity Approach Lights with Sequenced Flashing Lights

ARTCC: Air Route Traffic Control Center

ATA: Air Transport Association

ATC: Air Traffic Control

CLL: Centerline Lights

DCAD: Dade County Aviation Department

DH: Decision Height

DME: Distance Measuring Equipment

E&D: Engineering and Development

FAA: Federal Aviation Administration

F&E: Facilities and Equipment

GA: General Aviation

HIRL: High Intensity Runway Lights

IFR: Instrument Flight Rules

ILS: Instrument Landing System

LOC: ILS Localizer

MALS: Medium Intensity Approach Lights

MALSR: Medium Intensity Approact Lights with Runway Alignment Indicator Lights

MIA: Miami International Airport

MM: Middle Marker

OM: Outer Marker

RVR: Runway Visual Range

TCA: Terminal Control Area

TDZ: Touchdown Zone Lights

TVOR: *Terminal Very High Frequency* Omni-directional Range

VASI: Visual Approach Slope Indicator

VFR: Visual Flight Rules

VOR: Very High Frequency Omindirectional Range

WVAS: Wake Vortex Advisory and Avoidance System

☆ U.S. GOVERNMENT PRINTING OFFICE: 1981 — 361-428 1460

DATE
FILMED

2-8