DOT/FAA/CT-TN99/1



# NEWARK

# INTERNATIONAL AIRPORT

## Data Package Number 10

**Airport Capacity Enhancement Design Team Study**



**March 1999**

**Prepared by**
**Federal Aviation Administration**
**FAA William J. Hughes Technical Center**
**Atlantic City International Airport, New Jersey**

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16 Abstract

This interim report contains technical data pertaining to the Newark International Airport Capacity Enhancement Design Team Study.

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# Newark International Airport (EWR)

## Data Package Number 10

**Airport Capacity Enhancement**
**Design Team Study**



**March 1999**

**Prepared by**

**Federal Aviation Administration**
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## LIST OF EXHIBITS

# 1. GENERAL DISCUSSION AND MODEL INPUTS

## Accepted Model Inputs

The accepted model inputs are described in detail in Appendix A.

## Status of EWR Inputs and Tasks

Exhibit 1 describes the status of the EWR inputs and tasks.

## EXHIBIT 1 - STATUS OF EWR INPUTS AND TASKS

| INPUTS AND TASKS | STATUS |
|---|---|
| ALPs, Improvements, Simulation Scenarios | DP10 |
| Aircraft Classifications | X |
| ATC Separations | X |
| Dependencies between Parallel Runways | X |
| Other Runway Dependencies | X |
| Operational Procedures and Minima (By Configuration) | DP10 |
| Other Model Inputs | X |
| Annual Demand Levels (1996 and Future Demands) | X |
| Demand Characteristics (1996 and Future Demands) | X |
| Hour Counts (1996 and Future Demands) | X |
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| Queuing Model Results -- Calibration & Improvements -- Future 2 | DP10 |
| Fleet Mix Costs | DP10 |
| Annual Delay Costs and Savings | DP10 |
| Gate Analysis | Handout |

NOTE: X: The item was previously accepted and appears in Appendix A of this data package.

DPn: Data Package n.

## 2. POTENTIAL IMPROVEMENTS AND AIRPORT DIAGRAM

Exhibit 2 summarizes proposed improvements for the Airport Capacity Enhancement Design Team Study. The potential improvements are grouped as follows:

- Airfield
- Facilities and Equipment
- Operations
- User and Policy

The proposals for this Design Team study require detailed analysis of runways, taxiways, and gates. The Airfield Delay Simulation Model (ADSIM) will be used for simulating the Newark International Airport.

Exhibit 3 lists simulation scenarios for Newark.

Exhibit 4 presents a diagram of the existing airport.

Exhibit 5 shows the EWR Calibration runway configurations.

Exhibit 6 describes the *simulated* weather categories and runway configurations.

Simulation Scenarios

**At the last meeting, the Design Team added the following simulation scenarios:**

**PKG (B5)** ***1996 Fleet Mix at Future Demands*** **– simulate only at Future 1.**

Gate Analysis & Gate Capacity

**At the last meeting, the Design Team agreed to analyze gate use and gate capacity at Future 1. The Technical Center performed the analysis for all 3 demand levels. The results are presented in the Data Package 10 Handout.**

## EXHIBIT 2 - POTENTIAL IMPROVEMENTS

(Revised on 1/26/99)

### AIRFIELD IMPROVEMENTS

- **Taxiway System Improvements (Exits, Queuing, Hold Blocks, etc.).**
  - Alternative departure queue schemes for extended Runway 4L/22R.
  - Additional access to Runway 11/29 (between Y and RM) across drainage ditch.
  - Off-gate holding areas in addition to BALL PARK.
- **New East Runway -- 2 independent arrival streams in all weather conditions.**

### FACILITIES AND EQUIPMENT IMPROVEMENTS

- **LDA 24° Offset Approach**
  **-- to inboard runway (4L or 22R) by non-heavy aircraft & commuters.**
  - Allows parallel arrival streams during arrival peaks in less than VFR1 weather.
  - Do sensitivity analysis because weather minima and frequency of use in VFR-2 are unknown.
  - LDA offset to 4s does not affect Teterboro operations.
  - LDA offset to 22s affects Teterboro operations (arrivals to Runway 6) and reduces its capacity.
  - Perform capacity analysis to determine adverse impact on Teterboro arrival capacity.

### OPERATIONAL IMPROVEMENTS

- **Parallel Dual Visual Approaches.**
  - LDA may aid this operation. Props & jets can use inboard runways.
  - Heavy & 757 cannot overtake a prop on the parallel runway.
- **DCIA -- Dependent Converging Instrument Approaches (affects SW flow).**
  - Possible improvement in 1998.
  - Look at ground movement alternatives for arrivals to 11 and 22R, and departures to 22L.
  - DCIA requires CRDA (Converging Runway Display Aid) and ASR-9.
  - In VFR2 -- permits simultaneous approaches to 11 and either 22R or 22L.
  - In IFR1 -- permits dependent approaches to 11 and either 22R or 22L.
  - Enables departures on 22s to be released more efficiently between successive arrivals on 11?
  - In SW flow, reduces the A/A separations on 11 (to 6 NM from 10NM) when landing on 22s.
- **SCIA -- Simultaneous Converging Instrument Approaches (affects NE flow).**
  - In VFR2 & IFR1 -- permits simultaneous approaches to 11 and either 4R or 4L.
  - Down to IFR1 minimums using FMS (which reduces TERPS criteria).
  - Down to IFR1 minimums using GPS.
- **Reduce Minimum In-Trail IFR Separation to 2.0 NM -- between similar class non-heavy aircraft.**
- **Props Can Do Immediate Divergent Turns -- Prop/Jet departure penalty is eliminated.**

### USER OR POLICY ALTERNATIVES

- **More Uniform Distribution of Traffic within the Hour.**
- **Tilt Rotor Aircraft -- with a Vertiport and independent operations at EWR.**
  - Based on discussion with NASA/Ames: simulate at Future 2. Assume all Air Carrier LC (Large Commuters) use Vertiport. Arrival & departure streams are independent of all other EWR ops.
- **1996 Fleet Mix at Future Demands -- simulate only at Future 1.**

## EXHIBIT 3 - SIMULATION SCENARIOS (EWR)

(Revised on 3/25/99)

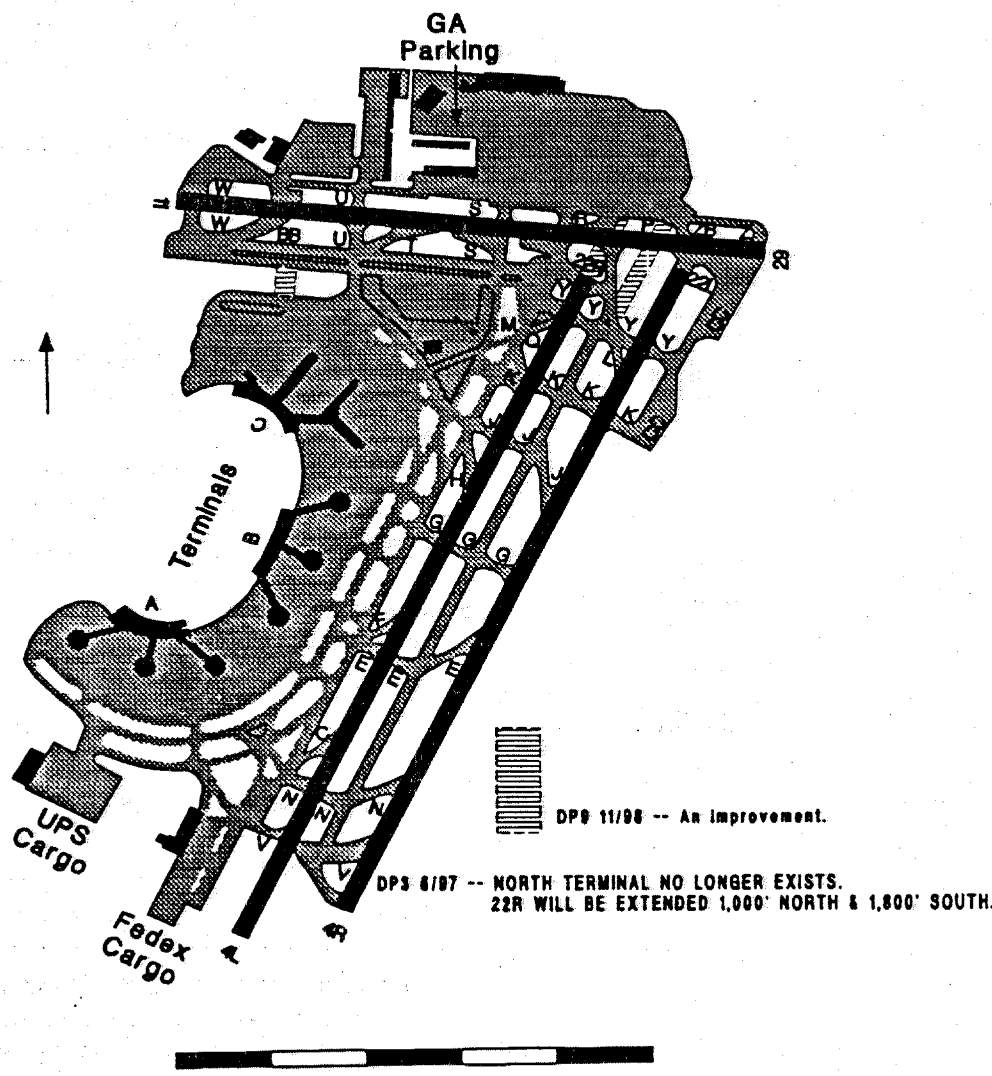
| PKG | DESCRIPTION OF PACKAGE | SIMULATE AT THESE DEMAND LEVELS 1996 ADSIM | F1 ADSIM | F2 Queuing |
|---|---|---|---|---|
| (0) | **CALIBRATION (with 2.5 NM minimum IFR spacing)**<br>This will be the Do-Nothing or BASE-CASE. | Y | Y | Y |
| (A) | **DCIA – in SW flow**<br>With Dependent Converging Instrument Approaches expected in 1998. | Y | Y | * |
| (B) | **Taxiway System Improvements**<br>Exits, Queuing, Hold Blocks, etc. | | | |
| | **(B1) Alternate Departure Queuing Scheme for Extended 4L/22R** | Narrate | | |
| | **(B2) Additional Access to 11/29 across Drainage Ditch** | Y | Y | * |
| | **(B3) Off-Gate Holding Areas in Addition to BALL PARK** | Narrate | | |
| (B4) | **More Uniform Distribution of Traffic within the Hour**<br>Simulate VFR-1 only. | N | Y | * |
| (B5) | ***1996 Fleet Mix at Future Demands* – simulate only at Future 1** | N | Y | * |
| (C) | **LDA 24° Offset Approach to Inboard Runway by Non-Heavy Aircraft** | | | |
| | **(C1) LDA Offset to 4s** (does not affect Teterboro ops) | Y | Y | * |
| | **(C2) LDA Offset to 22s** (affects Teterboro ops) | Y | Y | * |
| (D) | **Parallel Dual Visual Approaches** | Y | Y | * |
| (E) | **SCIA (in NE flow) – Simultaneous Converging Instrument Approaches** | Y | Y | * |
| (F) | **Reduce Minimum In-Trail IFR Separation to 2.0 NM**<br>(Between similar class non-heavy aircraft) | Y | Y | * |
| (G) | **Props Can Do Immediate Divergent Turns**<br>(Prop/Jet Departure Penalty is eliminated. Standard separations used.) | Y | Y | Y |
| (H) | **New East Runway – Independent Arrivals All Weather Conditions** | Y | Y | Y |
| (I1) | **Vertiport & Tilt Rotor Aircraft – independent of other EWR operations**<br>Simulated without the use of 11/29. | N | N | Y |

Notes:

**Y (N): Simulated (Not Simulated) at this demand level.**
**__ : Has not yet been simulated at this demand level.**
*** : Will not be simulated at Future 2. It would be unrealistic to reach future demand levels without some dramatic change in future operations.**

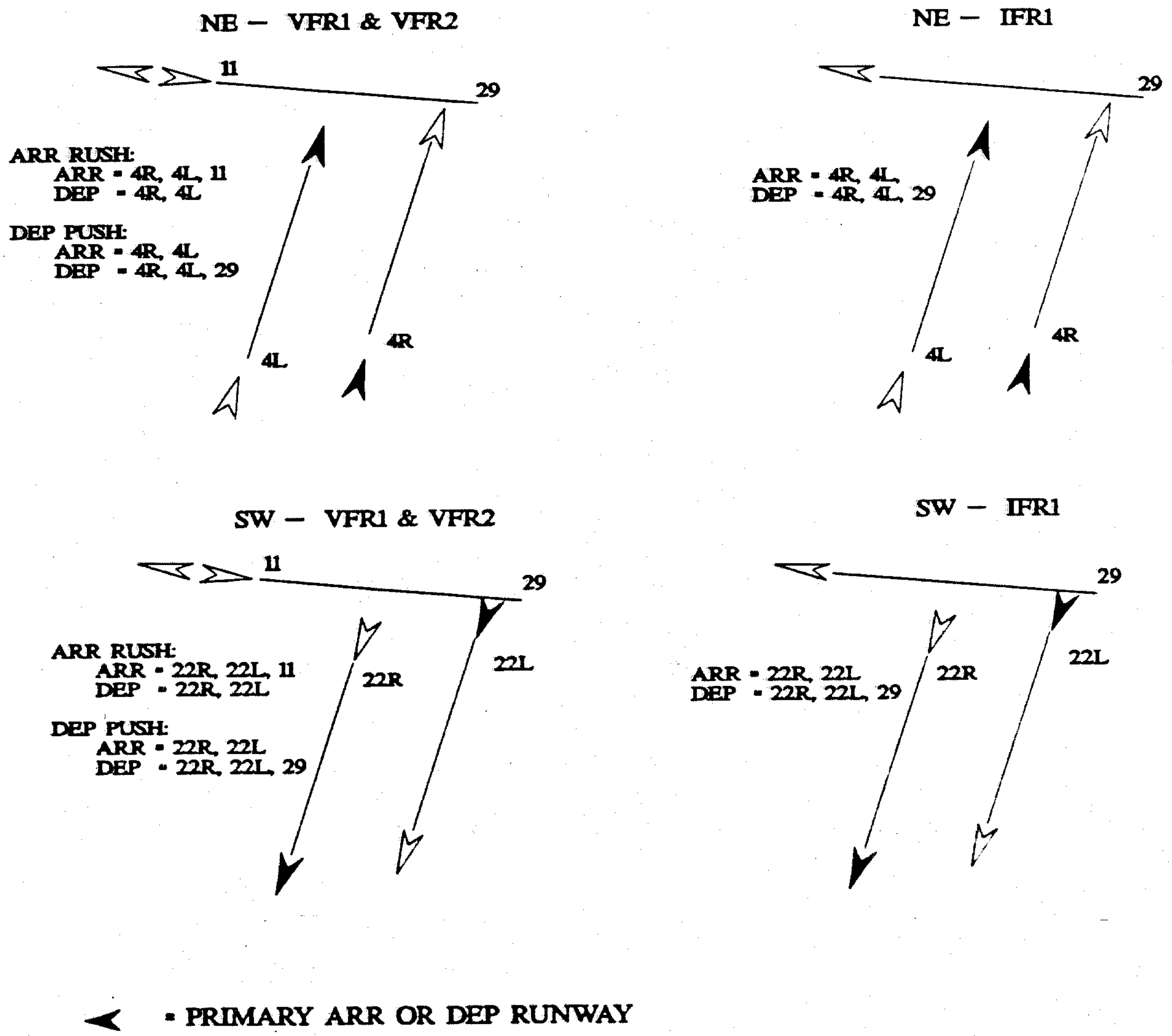
**On 4/28/98, the EWR Design Team agreed that DCIA would be simulated as an improvement and Calibration would be the Do-Nothing or Base-Case for computing annual delay savings.**

# EXHIBIT 4 - AIRPORT DIAGRAM (EWR)




Filename: T:\AIRPORTS\EWR\DP9\ALP-EWR9.SED

## EXHIBIT 5 - RUNWAY CONFIGURATIONS (EWR CALIBRATION)




Filename: T:\AIRPORTS\EWR\DP4\CON-EWR4.GED
Modified IFR1 on 7/10/97 -- Departures on 29. No Arrivals on 11.
CONFIG 1 - NE FLOW
CONFIG 2 - SW FLOW

**NOTES FROM TOWER ON 11/19/97:**

**VFR-2 & IFR-1: NO ARRIVALS ON 4L OR 22R.**

**USE 4L FOR ARRIVALS <u>ONLY WHEN</u> WINDS <u>PREVENT</u> USE OF 11.**

## EXHIBIT 6 - WEATHER CATEGORIES & CONFIGURATIONS (Simulated)

***ACCEPTED BY THE EWR DESIGN TEAM ON 1/28/98.***

**The following table represents the way the weather categories and configurations can be simulated. It forms the basis for the EWR ADSIM experimental design, reflects the way Calibration or an improvement is simulated, and shows how delays are annualized.**

**TECHNICAL CENTER RECOMMENDATIONS FOR SIMULATIONS – AFTER NORMALIZATION**
***REVISED ON 12/8/97 (based on comments at meeting on 11/19/97)***

| | | VFR-1 | VFR-2 | IFR-1a | ≤IFR-1b | TOTAL |
|---|---|---|---|---|---|---|
| 4, 11, 29 | with *normal* use of 11 | 31.3% | 6.8% | 2.4% | 2.4% | 42.9% |
| 4, 29 | with *restricted* use of 11 | — | — | — | — | 0.0% |
| | **NE Flow Subtotal** | **31.3%** | **6.8%** | **2.4%** | **2.4%** | **42.9%** |
| 22, 11, 29 | with *normal* use of 11 | 22.1% | 4.5% | 1.8% | 1.7% | 30.1% |
| 22, 11, 29 | with *restricted* use of 11<br>*15 NM In-trail for ALL ARR on 11*<br>*Half the number of ARR to 11* | 24.1% | — | — | — | 24.1% |
| 22, 29 | *without* use of 11<br>*ARRIVE ONLY ON 22L* | — | 2.9% | — | — | 2.9% |
| | **SW Flow Subtotal** | **46.2%** | **7.4%** | **1.8%** | **1.7%** | **57.1%** |
| | **TOTAL** | **77.5%** | **14.2%** | **4.2%** | **4.1%** | **100.0%** |

**Notes:**

**The percentages were normalized so they sum to 100%.**
**Updated comments on 1/15/98.**
NE Flow: VFR-1, VFR-2, IFR-1a, IFR-1b assume winds always permit normal use of 11.
(Rwy 29 used for arrivals when winds do not permit use of 11.)
SW Flow: VFR-1, VFR-2 combines "without 11" & without LAHSO.
SW Flow: IFR-1a, IFR-1b assume winds always permit use of 11.
DCIA affects only IFR-1a (down to RWY 11 minima) and only in SW Flow.
SCIA affects only IFR-1a (down to RWY 11 minima) and only in NE Flow.
Assumes LAHSO permitted when 11 is used.
Captures critical delays and delay savings, while reducing unnecessary simulations.

## 3. EWR ADSIM RESULTS

Exhibit 7 (bargraph) and Exhibit 8 (chart) present the average delays per operation in minutes for each demand level.

Exhibit 9 graphically shows the EWR annual delay costs for all demand levels. Exhibit 10 shows the annual delay costs and savings for all demand levels.

Exhibit 11 presents the EWR experimental designs for all demand levels.

Exhibit 12 compares EWR daily delays and savings (in minutes) for each simulation scenario, by configuration and demand level. Arrival delays include both air and ground delays. Arrival ground delays consist of taxi-in delays and runway crossing delays. Departure delays, are ground delays; they consist of runway (queue) delays, taxi-out delays, runway crossing delays, and gate hold delays.

Exhibit 13 provides more detailed information and shows daily delays and travel times (in minutes) for each simulation. Both ADSIM and FAA Queuing Model delays are presented.

### *(A) DCIA – Dependent Converging Instrument Approaches*

**This improvement will permit arrivals to Runway 11 in the SW Flow in IFR-1a conditions. The DCIA requires a CRDA (Converging Runway Display Aid) and ASR-9. The CRDA tool will assist controllers in maintaining the stagger distances established between aircraft using DCIA.**

The DCIA order requires that aircraft be separated by 2NM from a Non-Heavy ghost target and 5NM from a Heavy ghost target. Consequently, a slot is lost when there is a Heavy arrival. In simulating the DCIA in their ETG (Enhanced Target Generator) Lab, the Tracon staggers the arrivals and places aircraft 5NM in-trail on 22L.

With the DCIA, the average daily delay per operation is 28.0 minutes at the 1996 demand level and 74.9 minutes at Future 1. The *average daily delay savings* per operation for the DCIA are 24.7 minutes at the 1996 demand and 25.6 minutes at Future 1.

***Annual Delay Savings for PKG (A):* With a fleet mix cost of $2,200 per hour, the DCIA in the SW Flow can save $ 7.4 million at the 1996 demand and $ 8.5 million at Future 1.**

> **Note: The savings are less than that of SCIA because there are dependent approaches in DCIA and weather conditions will permit DCIA less often than SCIA.**

### *(B2) Additional Access to 11/29 Across Drainage Ditch -- 1996 and Future 1*

**The Access was simulated with the existing gates -- at the 1996 and Future 1 demands. The simulations assumed Continental Commuters used the existing commuter gate area/ramp at C-3. The Design Team wanted to measure the benefit of the Access with existing gates.**

**The additional access to 11/29 will provide the greatest benefit in VFR-1 and VFR-2 conditions, when the use of Runway 11 is permitted. Therefore, we did not simulate this improvement when Runway 11 is not used.**

At the 1996 demand level, the average daily delay savings per operation for the Access are 0.1 minutes in NE VFR-1; 0.4 minutes in NE VFR-2; and 0.3 minutes in SW VFR1-R. At Future 1, the average daily delay savings per operation for the Access are 0.5 minutes in NE VFR-1; 0.3 minutes in NE VFR-2; and none in SW VFR1-R.

**The Access provided more delay savings in the NE Flow than the SW Flow. We expected more savings in the SW Flow than the model indicated. Without the ability to dynamically reroute aircraft on the taxiways, the model may not be sensitive enough to capture all the benefits of the Access which the controllers might achieve.**

*Annual Delay Savings for PKG (B2): **With a fleet mix cost of $2,200 per hour, the Additional Access to 11/29 can save $ 2.3 million at the 1996 demand and $ 3.4 million at Future 1.***

> **Note: The simulations DID NOT MEASURE delays associated with moving the commuter area and constructing a jet terminal at C-3. The Design Team believed construction would include the Access to move jets to and from C-3, away from jets using C-2.**

### *(B4) More Uniform Distribution of Traffic within the Hour*

**We simulated Future 1, VFR-1, with a more uniform distribution of traffic within the hour in the NE Flow.** It effectively smoothed out the arrival and departure peaks within each hour. The numbers of arrivals and departures per hour remained the same as Calibration.

The average daily delays were 42.6 minutes for arrivals, 17.7 minutes for departures, and 30.1 minutes for both. These delays were similar to those of Calibration (42.2 for arrivals, 19.5 for departures, and 30.8 for both). **More uniformly distributing traffic within the hour increased arrival delays and reduced departure delays, yielding a net savings of 0.7 minutes per operation.**

***The Future 1, VFR-1, results showed nominal benefit. The average daily delay per operation still exceeded 30 minutes. Therefore, this improvement will not make Future 1 levels of operations achievable and was not simulated in other weather conditions. Annual delay costs and savings were not computed for Package (B4), More Uniform Distribution of Traffic within the Hour.***

### *(B5) 1996 Fleet Mix at Future Demands -- simulate only at Future 1.*

***We used the FAA Queuing Model to simulate Future 1, VFR-1, with the 1996 fleet mix. The average daily delay for all operations was approximately 30 minutes -- a savings of almost 4 minutes per operation. However, the results indicate this improvement will not make Future 1 levels of operations achievable. Annual delay costs and savings were not computed for Package (B5), 1996 Fleet Mix at Future Demands.***

### *(C) LDA 24° Offset Approach to Inboard Runway by Non-Heavy Aircraft*

An LDA would allow 2 arrival streams to the parallel runways in VFR-1 and some portion of VFR-2. Heavies and 757s cannot overtake a prop on the other runway. Therefore, we simulated dependent approaches and applied wake vortex separations which are required for closely spaced runways.

As a NAVAID in VFR-2, an LDA would permit dual parallel arrival streams to lower minima. The expected minima for an LDA are approximately 3,000' and 5 miles, which is 500' less than the VFR-1 minima. **Because the frequency of occurrence of the minima is unknown, we performed a sensitivity analysis by varying the use of an LDA in VFR-2: 0% of the time in VFR-2 and 50% of the time in VFR-2.**

**Arrivals were permitted to land on the inboard runway during peak arrival times in order to minimize their impact on departures. In VFR-1, there were 13 arrivals on the inboard runway at the 1996 demand and 26 arrivals at Future 1. In VFR-2 *without Runway 11*, there were approximately 65 arrivals to the inboard runway at both demand levels.**

#### *(C-1) LDA Offset to the 4s -- NE Flow*

These simulations were not rerun for this data package.

*Annual Delay Savings for PKG (C1-0%):* ***With a fleet mix cost of $2,200 per hour, the LDA-NE with 0% Use in VFR-2 can save $ 5.0 million at the 1996 demand and $ 13.1 at Future 1.***

*Annual Delay Savings for PKG (C1-50%):* ***With a fleet mix cost of $2,200 per hour, LDA-NE with 50% Use in VFR-2 can save $ 5.4 million at the 1996 demand and $ 17.2 at Future 1.***

#### *(C-2) LDA Offset to the 22s -- SW Flow*

VFR-1 delays were the same as those in PKG (D), *Dual Parallel Visual Approaches.* We modified the simulations and reran VFR-1, Future 1.

In VFR-2 *with Runway 11*, we reran the simulations. The average delay savings per operation were approximately 1 minute at the 1996 demand and 4 minutes at Future 1.

In VFR-2 *without Runway 11*, we reran the simulations with more arrivals on the inboard runway. The average delay savings per operation exceeded 20 minutes at both demand levels.

*Annual Delay Savings for PKG (C2-0%):* ***With a fleet mix cost of $2,200 per hour, the LDA-SW with 0% Use in VFR-2 can save $ 3.5 million at the 1996 demand and $ 9.8 at Future 1.***

*Annual Delay Savings for PKG (C2-50%):* ***With a fleet mix cost of $2,200 per hour, LDA-SW with 50% Use in VFR-2 can save $ 8.8 million at the 1996 demand and $ 17.0 at Future 1.***

### *(D) Parallel Dual Visual Approaches*

This improvement would allow 2 arrival streams to the parallel runways in VFR-1. Heavies and 757s cannot overtake a prop on the other runway. Therefore, we simulated dependent approaches and applied wake vortex separations which are required for closely spaced runways.

**Arrivals were permitted to land on the inboard runway during peak arrival times in order to minimize their impact on departures. There were 13 arrivals on the inboard runway at the 1996 demand and 26 arrivals at Future 1.**

Simulation of dual approaches in VFR-1, *with restricted use of 11 in the SW Flow*, showed some delay savings -- an average of 0.3 minutes at the 1996 demand and 2.8 minutes at Future 1. However, we believed the use of an LDA in this situation was unlikely because of the complexity of the operation. When arrivals to Runway 11 cannot LAHSO (cannot hold short of 22L), they have a 15NM in-trail separation. Adding a 3rd arrival stream in this scenario would be very difficult. Therefore, **we did not include the delay savings for VFR-1R in the annual savings.**

**For this data package, we reran the Future 1 simulation for VFR-1, *with the unrestricted use of 11 in the SW Flow*. In both the NE and SW Flows, this improvement could save approximately 1 minute per operation at the 1996 demand and 2 minutes per operation at Future 1.**

*Annual Delay Savings for PKG (D): **With a fleet mix cost of $2,200 per hour, Parallel Dual Visual Approaches can save $ 8.5 million at the 1996 demand and $ 22.9 million at Future 1.***

### *(G) PROPS CAN DO IMMEDIATE DIVERGENT TURNS*

**ADSIM was used to simulate the 1996 and Future 1 demand levels. Those results were shown in previous data packages.**

**The FAA Queuing Model was used to simulate Future 2.**

This improvement permits props on the parallel runways to diverge, eliminating the existing prop/jet departure penalty. The D/D separation becomes 1.0 minute instead of the current 1.6 minutes. This operation would be possible if the noise restrictions were relaxed and the NY airspace were changed.

***Annual Delay Savings: With a fleet mix cost of $2,200 per hour, Diverging Props Immediately can save $ 21.0 million at the 1996 demand, $ 62.9 million at Future 1, and $ 173.4 million at Future 2.***

***(I1) VERTIPORT & TILT ROTOR AIRCRAFT – independent of other EWR ops – Future 2***
*Simulated without the use of 11/29.*

The following assumptions were made when simulating this improvement:

- There were no operations on 11/29.
- All Tilt Rotor arrivals and departures used the Continental Express area.
- Vertiport runway was approximately 500 feet long.
- Vertiport was located at parking lot "E", parallel to 4L/22R and 4R/22L.
- All Large Commuter Air Carriers arrived and departed on the Vertiport runway.
- Vertiport runway was independent of all other runways.
- Vertiport had 170 arrivals and 170 departures per day.
- Vertiport was simulated at Future 2 only.

**At the Future 2 demand, the *average VFR-1 daily delays* were 45.4 minutes per arrival, 20.0 minutes per departure, and 32.7 minutes for both.** These delays were significantly lower than those for the Future 2 Calibration (87.2 minutes per arrival, 49.9 minutes per departure, and 68.6 minutes for both.)

**The average VFR-1 delays for Vertiport & Tilt Rotors exceeded 30 minutes at the Future 2 demand. Therefore, this improvement will not make Future 2 levels of operations achievable.**

**It should be noted that the average VFR-1 delay at Future 2 is approximately the same as the average VFR-1 Calibration delay at Future 1.**

***Annual Delay Savings:* With a fleet mix cost of $2,200 per hour, Vertiport & Tilt Rotor Aircraft can save $ 904.4 million at Future 2.**

> **Note: On January 14, the FAA Technical Center presented the results for this improvement at NASA Ames (using a preliminary fleet mix cost of $1,700). The Tilt Rotor group at Ames may request the Technical Center to do some additional simulations for them. For example: simulating the above improvement with the addition of 11/29 (assuming the Vertiport could be located such that those additional operations were possible).**

## EWR FLEET MIX COST = $ 2,200 PER HOUR (IN 1997 DOLLARS)

The EWR Fleet Mix Cost represents the 1997 (4th quarter) direct operating costs of the airlines serving EWR. The costs include: cockpit crew; fuel & oil; rentals; insurance; taxes; total flying operations; maintenance, and depreciation. The costs were based on the Form 41 filings with DOT, compiled by GKMG Consulting Services, and published by Aviation Daily. The cost of the EWR Fleet Mix was computed by the FAA Technical Center. See Appendix D for details.

### *EFFECT OF FLEET MIXES ON FLOW RATES FOR A SINGLE RUNWAY :*

At the January meeting, the Design Team asked the Technical Center to compute the expected arrival and departure flow rates for a single runway to show the adverse affect of the Future 1 fleet mix on flow rates. **The results are as follows:**

| With a Single Runway: | 1996 Mix | Future 1 Mix | Difference |
|---|---|---|---|
| VFR-1 Arrival Rate/Hour | 40 | 37.5 | - 2.5 |
| IFR-1 Arrival Rate/Hour | 33 | 32 | - 1 |
| VFR/IFR Departure Rates/Hour | 48 | 44 | - 4 |

### *COMMENTS:*

Based on the arrival delays in VFR-1 at the 1996 and Future 1 demands, the Technical Center believes that EWR is on or very close to the knee of the delay curve now.

The Future 1 delays are extremely large, even in VFR-1. These delays are the result of the increased numbers of operations, as well as the reduced flow rates due to the fleet mix (which has double the percentage of Heavies and 757s).

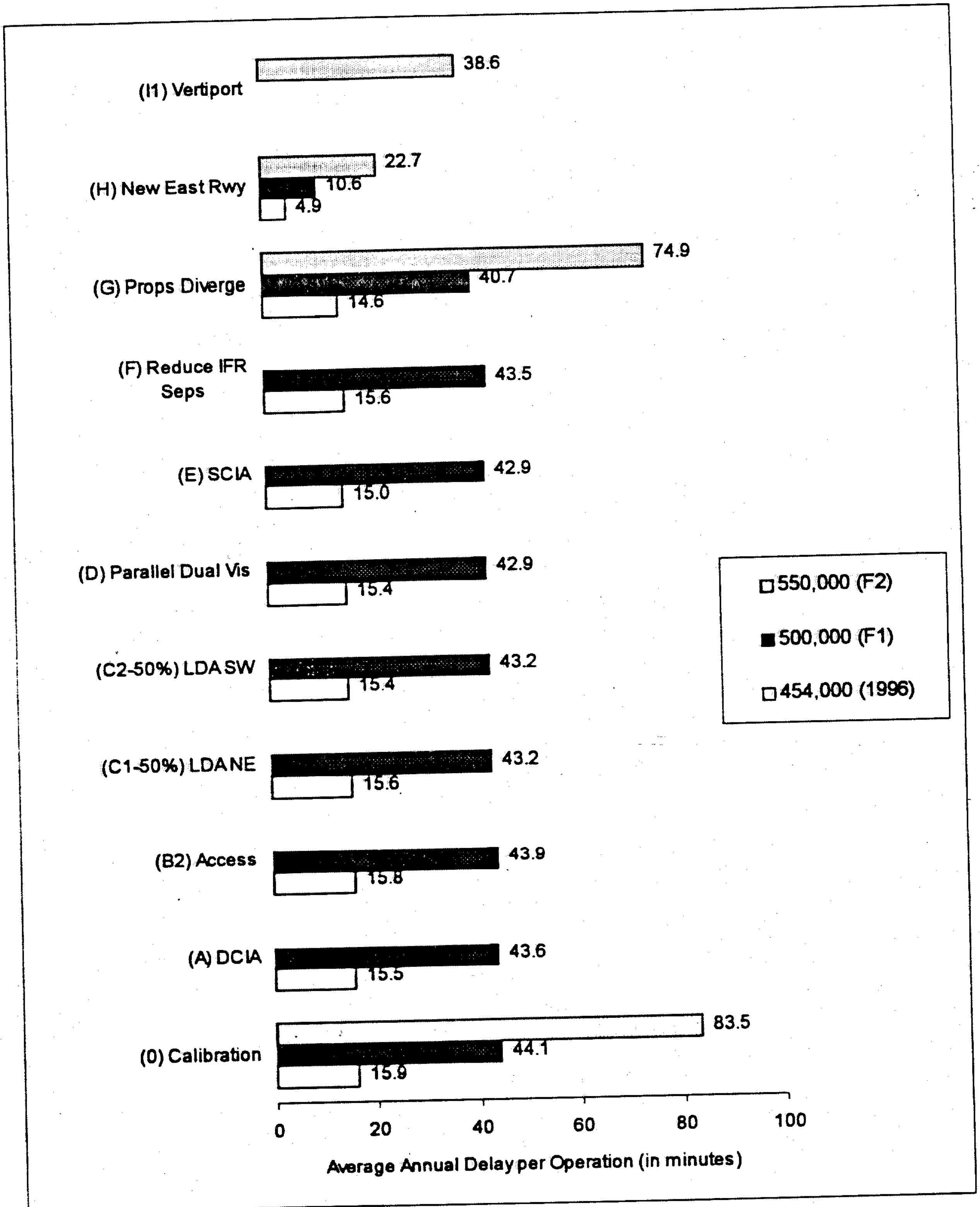
**With some gate holding, the ground network still works at Future 1. The major cause of delays is insufficient runway capacity, which cannot satisfy the demand.**

***At the September 1998 meeting, the Design Team agreed to simulate Future 2 using a variation of the ADSIM model-- the FAA Queuing Model.***

**Appendix C contains the calculations for the annual delays and the annual delay costs. The appendix also shows the percentage of annual delay for each configuration and weather condition. This information may aid in the analysis of EWR delays.**

*NOTE:* ***Appendix C contains the calculations for the annual delay costs. The costs are based on the EWR fleet mix cost of $2,200 per hour. Appendix D contains the calculations for the EWR fleet mix costs.***

## EXHIBIT 7 - EWR AVERAGE DELAY PER OPERATION (in minutes) – BARGRAPH




**Note:** **Pkg (I1), Tilt Rotor, was simulated at Future 2 only. The Future 2 delay is less than the Future 1 delay for Calibration.**

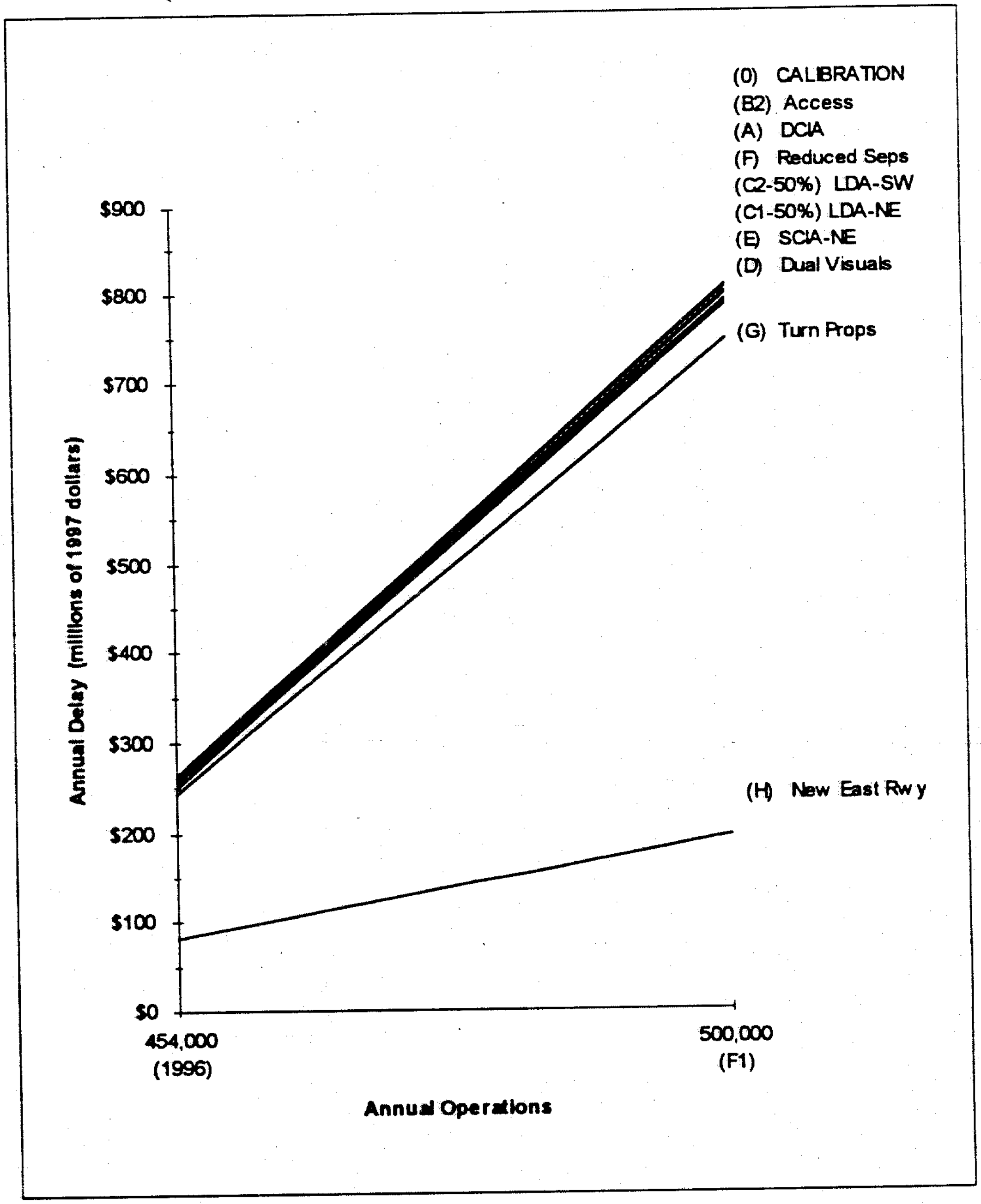
# EXHIBIT 8 - EWR AVERAGE DELAY PER OPERATION (in minutes) --TABLE

| IMPROVEMENT STUDIED | 454,000 (1996) Minutes | 500,000 (F1) Minutes | 550,000 (F2) Minutes |
|---|---|---|---|
| (0) CALIBRATION | 15.9 | 44.1 | 83.5 |
| (A) DCIA IN SW Flow | 15.5 | 43.6 | — |
| (B2) Access across Drainage Ditch | 15.8 | 43.9 | — |
| (C1) LDA NE Flow -- Offset to 4s | | | |
| (C1-0%) Used 0% of time in VFR2 | 15.6 | 43.4 | — |
| (C1-50%) Used 50% of time in VFR2 | 15.6 | 43.2 | — |
| (C2) LDA SW Flow -- Offset to 22s | | | |
| (C2-0%) Used 0% of time in VFR2 | 15.7 | 43.6 | — |
| (C2-50%) Used 50% of time in VFR2 | 15.4 | 43.2 | — |
| (D) Parallel Dual Visual Approaches | 15.4 | 42.9 | — |
| (E) SCIA in NE Flow | 15.0 | 42.9 | — |
| (F) Reduce Minimum IFR Separations | 15.6 | 43.5 | — |
| (G) Props Can Diverge Immediately --Prop/Jet Departure Penalty Eliminated. | 14.6 | 40.7 | 74.9 |
| (H) New East Rwy --Indep Arrivals to Parallels in All WX. | 4.9 | 10.6 | 22.7 |
| (I1) Vertiport & Tilt Rotor -- wo 11/29 | Not Simulated | Not Simulated | 38.6 |

## EXHIBIT 9 - EWR ANNUAL DELAY COSTS – GRAPH

## 2 DEMAND LEVELS – WITHOUT TILT ROTOR

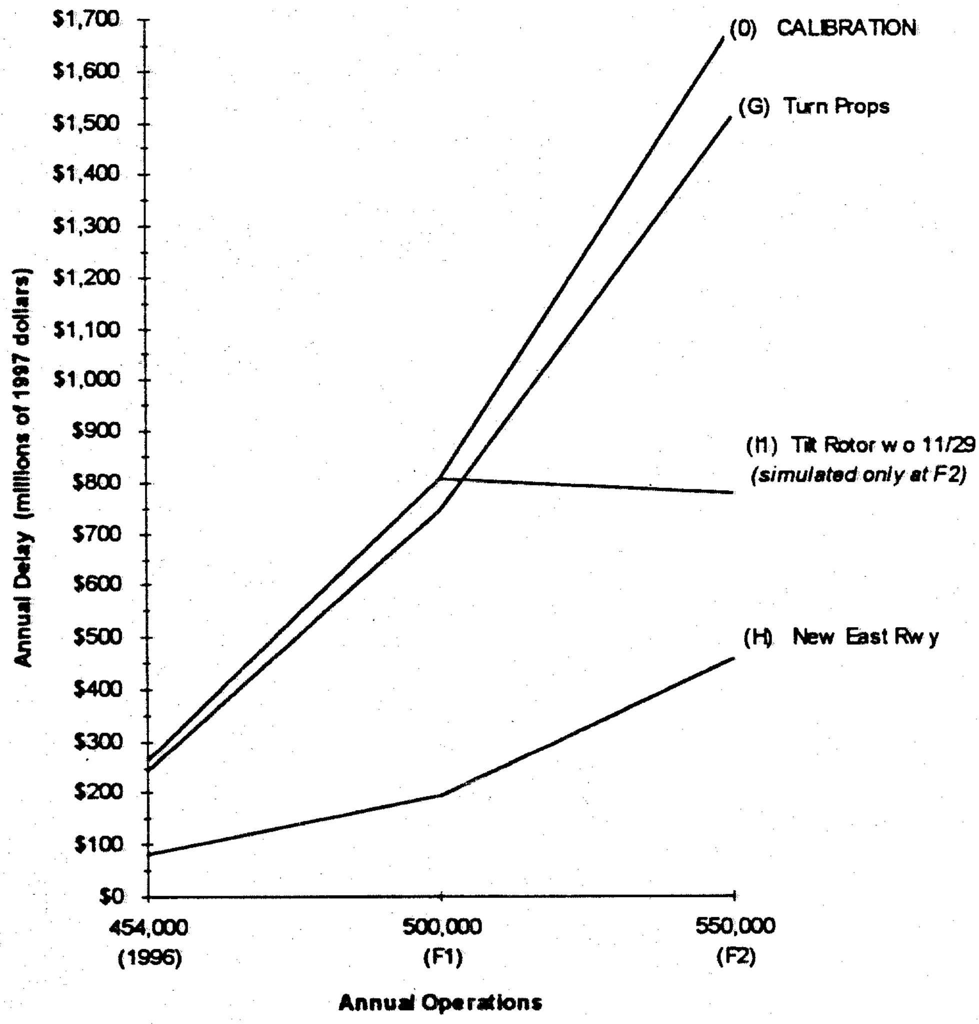
### (USING EWR FLEET MIX COST OF $2,200 PER HOUR)



## EXHIBIT 9 - EWR ANNUAL DELAY COSTS – GRAPH (Cont.)

## 3 DEMAND LEVELS – WITH TILT ROTOR

### (USING EWR FLEET MIX COST OF $2,200 PER HOUR)




**Note: Pkg (I1), Tilt Rotor, was simulated at Future 2 only. The Future 2 delay is less than the Future 1 cost for Calibration.**

# EXHIBIT 10 - EWR ANNUAL DELAY COSTS & SAVINGS -- TABLE

## (USING EWR FLEET MIX COST OF $2,200 PER HOUR)

## (HOURS OF DELAY PER YEAR, MILLIONS OF 1997 DOLLARS)

| | —— 454 (1996) —— | | | | —— 500 (Future 1) —— | | | | —— 550 (Future 2) —— | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | – C O S T S – | | –S A V I N G S– | | – C O S T S – | | –S A V I N G S– | | – C O S T S – | | –S A V I N G S– | |
| IMPROVEMENT STUDIED | HOURS | MILL $ | HOURS | MILL $ | HOURS | MILL $ | HOURS | MILL $ | HOURS | MILL $ | HOURS | MILL $ |
| (0) CALIBRATION | 120,286 | $264.6 | – | – | 367,519 | $808.5 | – | – | 765,034 | $1,683.1 | – | – |
| (A) DCIA IN SW Flow | 116,915 | $257.2 | 3,371 | $7.4 | 363,673 | $800.1 | 3,846 | $8.5 | – | – | – | – |
| (B2) Access across Drainage Ditch | 119,237 | $262.3 | 1,049 | $2.3 | 365,978 | $605.2 | 1,541 | $3.4 | – | – | – | – |
| (C1) LDA NE Flow – Offset to 4s | | | | | | | | | | | | |
| (C1-0%) Used 0% of time in VFR2 | 118,022 | $259.6 | 2,264 | $5.0 | 361,579 | $795.5 | 5,940 | $13.1 | – | – | – | – |
| (C1-50%) Used 50% of time in VFR2 | 117,836 | $259.2 | 2,450 | $5.4 | 359,686 | $791.3 | 7,833 | $17.2 | – | – | – | – |
| (C2) LDA SW Flow – Offset to 22s | | | | | | | | | | | | |
| (C2-0%) Used 0% of time in VFR2 | 118,694 | $261.1 | 1,592 | $3.5 | 363,055 | $798.7 | 4,464 | $9.8 | – | – | – | – |
| (C2-50%) Used 50% of time in VFR2 | 116,304 | $255.9 | 3,982 | $8.8 | 359,770 | $791.5 | 7,749 | $17.0 | – | – | – | – |
| (D) Parallel Dual Visual Approaches | 116,430 | $256.1 | 3,856 | $8.5 | 357,115 | $785.7 | 10,404 | $22.9 | – | – | – | – |
| (E) SCIA in NE Flow | 113,756 | $250.3 | 6,530 | $14.4 | 357,801 | $787.2 | 9,718 | $21.4 | – | – | – | – |
| (F) Reduce Minimum IFR Separations | 118,185 | $260.0 | 2,101 | $4.6 | 362,564 | $797.6 | 4,955 | $10.9 | – | – | – | – |
| (G) Props Can Diverge Immediately –Prop/Jet Departure Penalty Eliminated. | 110,726 | $243.6 | 9,560 | $21.0 | 338,911 | $745.6 | 28,608 | $62.9 | 686,194 | $1,509.6 | 78,840 | $173.4 |
| (H) New East Rwy –Indep Arrivals to Parallels in All WX. | 37,227 | $81.9 | 83,059 | $182.7 | 88,639 | $195.0 | 278,880 | $613.5 | 207,805 | $457.2 | 557,229 | $1,225.9 |
| (I1) Vertiport & Tilt Rotor – wo 11/29 | Not Simulated at This Demand Level | | | | Not Simulated at This Demand Level | | | | 353,963 | $778.7 | 411,071 | $904.4 |

ALL SAVINGS ARE RELATIVE TO PKG (0), CALIBRATION, UNLESS OTHERWISE NOTED.

NOTE: These dollar savings are computed from the hours of annual delay savings.

# EXHIBIT 11 - EWR EXPERIMENTAL DESIGN

(Revised 3/11/99)

**ADSIM SIMULATIONS**

| PKG | 1996 DEMAND<br>454,000 ANNUAL OPS | NE FLOW<br>ARR = 4R, 4L, (11)<br>DEP = 4L, 4R, 29<br>VFR-1 with 11 31.3% | VFR-2 with 11 6.8% | IFR-1a 2.4% | IFR-1b 2.4% | SW FLOW<br>ARR = 22L, 22R, (11)<br>DEP = 22L, 22R, 29<br>VFR-1 with 11 22.1% | VFR-1 Rest 11 24.1% | VFR-2 with 11 4.5% | VFR-2 w/o 11 2.9% | IFR-1a 1.8% | IFR-1b 1.7% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (0) | CALIBRATION (BASE-CASE) | 101 | 102 | 103 | =103 | 105 | 106 | 107 | 108 | 109 | =109 | |
| (A) | DCIA (In SW Flow) | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | **119** | =(0) | affects SW IFR-1a-in **DP10** |
| (B2) | Added Access to 11/29--Taxi Imp | **141** | **142** | =(0) | =(0) | =(0) | **146** | =(0) | =(0) | =(0) | =(0) | **141, 142, 146 in DP10** |
| (B4) | More Uniformly Distribute Traffic | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | not simulated at this demand |
| (B5) | 1996 Fleet Mix at Future Demands | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | not simulated at this demand |
| (C) | LDA Offset | | | | | | | | | | | **227-228 in DP10** |
| | (C1) LDA Offset to 4s | =221 | 222 | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | affects NE Flow |
| | (C2) LDA Offset to 22s | =(0) | =(0) | =(0) | =(0) | =225 | =226 | **227** | **228** | =(0) | =(0) | affects SW Flow |
| (D) | Parallel Dual Vis. Approaches | 221 | =(0) | =(0) | =(0) | 225 | 226 | =(0) | =(0) | =(0) | =(0) | affects VFR-1 |
| (E) | SCIA (in NE Flow) | =(0) | =(0) | 233 | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | affects NE IFR-1a |
| (F) | Reduced Minimum Sep.--2 NM | =(0) | 242 | 243 | =243 | =(0) | =(0) | 247 | 248 | 249 | =249 | affects VFR-2, IFR-1 |
| (G) | Props Can Do Divergent Turns | 251 | 252 | 253 | =253 | 255 | 256 | 257 | 258 | 259 | =259 | |
| (H) | New East Rwy--Indep IFR Arrivals | 301 | 302 | 303 | =303 | 305 | =305 | =308 | 308 | 309 | =309 | |
| (I1) | Vertiport & Tilt Rotor Aircraft—wo 11/29 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | not simulated at this demand |

NOTE: =(0): Results equal those of Improvement PKG (0), Calibration, for that Weather Condition and Flow Direction.
=103: Results equal those of Experiment 103.

# EXHIBIT 11 - EWR EXPERIMENTAL DESIGN (Cont.)

(Revised 3/24/99)

| | | NE FLOW | | | | SW FLOW | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ADSIM SIMULATIONS | ARR = **4R**, 4L, (11)<br>DEP = 4L, **4R**, 29 | | | | ARR = **22L**, 22R, (11)<br>DEP = 22L, **22R**, 29 | | | | | | |
| | FUTURE 1 DEMAND | VFR-1 with 11 | VFR-2 with 11 | IFR-1a | IFR-1b | VFR-1 with 11 | VFR-1 Rest 11 | VFR-2 with 11 | VFR-2 w/o 11 | IFR-1a | IFR-1b | |
| PKG | 500,000 ANNUAL OPS | 31.3% | 6.8% | 2.4% | 2.4% | 22.1% | 24.1% | 4.5% | 2.9% | 1.8% | 1.7% | |
| (0) | CALIBRATION (BASE-CASE) | 401 | 402 | 403 | =403 | 405 | 406 | 407 | 408 | 409 | =409 | |
| (A) | DCIA (in SW Flow) | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | **419** | =(0) | affects SW IFR-1a-in **DP10** |
| (B2) | Added Access to 11/29 -- Taxi Imp | **441** | **442** | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | **441-442 in DP10** |
| (B4) | More Uniformly Distribute Traffic | **431** | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | only NE VFR1 simulated--DP10 |
| (B5) | 1996 Fleet Mix at Future Demands | ---- | ---- | ---- | ---- | **455** | ---- | ---- | ---- | ---- | ---- | **Queuing Model-455 in DP10** |
| (C) | LDA Offset | | | | | | | | | | | **527-528 in DP10** |
| | (C1) LDA Offset to 4s | =521 | 522 | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | affects NE Flow |
| | (C2) LDA Offset to 22s | =(0) | =(0) | =(0) | =(0) | =525 | =526 | **527** | **528** | =(0) | =(0) | affects SW Flow |
| (D) | Parallel Dual Vis. Approaches | 521 | =(0) | =(0) | =(0) | **525** | 526 | =(0) | =(0) | =(0) | =(0) | **525 in DP10**<br>affects VFR-1 |
| (E) | SCIA (in NE Flow) | =(0) | =(0) | 533 | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | =(0) | affects NE IFR-1a |
| (F) | Reduced Minimum Sep.--2 NM | =(0) | 542 | 543 | =543 | =(0) | =(0) | 547 | 548 | 549 | =549 | affects VFR-2, IFR-1 |
| (G) | Props Can Do Divergent Turns | 551 | 552 | 553 | =553 | 555 | 556 | 557 | 558 | 559 | =559 | |
| (H) | New East Rwy--Indep IFR Arrivals | 601 | 602 | 603 | =603 | 605 | =605 | =608 | 608 | 609 | =609 | |
| (I1) | Vertiport & Tilt Rotor Aircraft--wo 11/29 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | not simulated at this demand |

NOTE: =(0): Results equal those of Improvement PKG (0), Calibration, for that Weather Condition and Flow Direction.
=403: Results equal those of Experiment 403.

# EXHIBIT 11 - EWR EXPERIMENTAL DESIGN (Cont.)

(Revised 3/24/99)

| | FAA QUEUING MODEL/ADSIM | NE FLOW<br>ARR = **4R**, 4L, (11)<br>DEP = 4L, **4R**, 29 | | | | SW FLOW<br>ARR = **22L**, 22R, (11)<br>DEP = 22L, **22R**, 29 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PKG | FUTURE 2 DEMAND<br>550,000 ANNUAL OPS | VFR-1 with 11<br>31.3% | VFR-2 with 11<br>6.8% | IFR-1a<br>2.4% | IFR-1b<br>2.4% | VFR-1 with 11<br>22.1% | VFR-1 Rest 11<br>24.1% | VFR-2 with 11<br>4.5% | VFR-2 w/o 11<br>2.9% | IFR-1a<br>1.8% | IFR-1b<br>1.7% | |
| (0) | CALIBRATION (BASE-CASE) | =705 | =707 | =709 | =709 | 705 | 706 | 707 | 708 | 709 | =709 | FAA QUEUING MODEL |
| (A) | DCIA (in SW Flow) | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | not simulated at this demand |
| (B2) | Added Access to 11/29 -- Taxi Imp | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | not simulated at this demand |
| (B4) | More Uniformly Distribute Traffic | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | not simulated at this demand |
| (B5) | 1996 Fleet Mix at Future Demands | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | not simulated at this demand |
| (C) | LDA Offset | | | | | | | | | | | |
| | (C1) LDA Offset to 4s | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | not simulated at this demand |
| | (C2) LDA Offset to 22s | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | not simulated at this demand |
| (D) | Parallel Dual Vis. Approaches | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | not simulated at this demand |
| (E) | SCIA (in NE Flow) | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | not simulated at this demand |
| (F) | Reduced Minimum Sep.--2 NM | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | not simulated at this demand |
| (G) | Props Can Do Divergent Turns | =855 | =857 | =859 | =853 | **855** | **856** | **857** | **858** | **859** | =859 | **Queuing Model--855-859 in DP10** |
| (H) | New East Rwy--Indep IFR Arrivals | =905 | =908 | =909 | =909 | 905 | =905 | =908 | 908 | 909 | =909 | ADSIM |
| (I1) | Vertiport & Tilt Rotor Aircraft—wo 11/29 | =915 | =918 | =919 | =919 | **915** | =915 | =918 | **918** | **919** | =919 | **ADSIM--wo 11/29--in DP10** |

NOTE: =(0): Results equal those of Improvement PKG (0), Calibration, for that Weather Condition and Flow Direction.
=905: Results equal those of Experiment 905.

# EXHIBIT 12 - EWR COMPARISON OF DAILY DELAYS & SAVINGS (in minutes)

Notes: Experiment numbers: 100s thru 300s correspond to 454,000 demand; 400s thru 600s to 500,000 demand; 700s thru 900s to 550,000 demand.
An "N" next to the savings denotes a new run with respect to the last data package. All savings are relative to PKG (0).
ARR delays include air & ground delays. DEP delays include ground & gate hold delays.

| | | EXP | 4 5 4 (1996) | | | | | | | | 5 0 0 (F1) | | | | | | | | 5 5 0 (F2) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | # | ARR TOT | ARR AVG | DEP TOT | DEP AVG | ARR & DEP TOT | ARR & DEP AVG | SAVINGS | | ARR TOT | ARR AVG | DEP TOT | DEP AVG | ARR & DEP TOT | ARR & DEP AVG | SAVINGS | | ARR AVG | DEP AVG | ARR & DEP TOT | ARR & DEP AVG | SAVINGS | |
| **CON-1 (NE) -- VFR-1** | | | | | | | | | | | | | | | | | | | | | | | | |
| (0) | CALIBRATION | 101 | 7,129 | 9.8 | 5,632 | 7.8 | 12,761 | **8.8** | | | 33,702 | 42.2 | 15,561 | 19.5 | 49,263 | **30.8** | | | Results = (0) Calibration--SW VFR1 | | | | | |
| (B2) | Access | 141 | 7,051 | 9.7 | 5,524 | 7.6 | 12,575 | **8.7** | 186 | N | 33,258 | 41.6 | 15,177 | 19.0 | 48,435 | **30.3** | 828 | N | Not simulated at this demand | | | | | N |
| (B4) | Uniform Distribution | 131 | Not simulated at this demand | | | | | | | | 34,001 | 42.6 | 14,112 | 17.7 | 48,113 | **30.1** | 1,150 | N | Not simulated at this demand | | | | | |
| (A,C2) | DCIA-SW, LDA-SW | =101 | Results = (0) Calibration | | | | | | | | Results = (0) Calibration | | | | | | | | Not simulated at this demand | | | | | |
| (D,C1) | Dual Vis, LDA-NE | 221 | 5,141 | 7.1 | 6,233 | 8.6 | 11,374 | **7.8** | 1,387 | | 25,376 | 31.8 | 20,249 | 25.4 | 45,625 | **28.6** | 3,638 | | Not simulated at this demand | | | | | |
| (E) | SCIA | =101 | Results = (0) Calibration | | | | | | | | Results = (0) Calibration | | | | | | | | Not simulated at this demand | | | | | |
| (F) | Reduce Min Sep | =101 | Results = (0) Calibration | | | | | | | | Results = (0) Calibration | | | | | | | | Not simulated at this demand | | | | | |
| (G) | Turn Props | 251 | 7,384 | 10.2 | 4,577 | 6.3 | 11,961 | **8.2** | 800 | | 32,636 | 40.9 | 10,974 | 13.8 | 43,610 | **27.3** | 5,653 | | Results=(G) Turn Props--SW VFR1 | | | | | N |
| (H) | New East Rwy | 301 | 2,169 | 3.0 | 3,149 | 4.3 | 5,318 | **3.7** | 7,443 | | 3,286 | 4.1 | 11,270 | 14.1 | 14,556 | **9.1** | 34,707 | | Results=(H) East Rwy--SW VFR1 | | | | | |
| (I1) | Tilt Rotor wo 11/29 | =315 | Not Simulated at This Demand | | | | | | | N | Not Simulated at This Demand | | | | | | | N | Results=(I1) Tilt Rotor--SW VFR1 | | | | | N |
| **CON-1 (NE) -- VFR-2** | | | | | | | | | | | | | | | | | | | | | | | | |
| (0) | CALIBRATION | 102 | 13,260 | 18.3 | 8,142 | 11.2 | 21,402 | **14.7** | | | 64,968 | 81.3 | 19,257 | 24.1 | 84,225 | **52.7** | | | Results = (0) Calib--SW VFR2 w 11 | | | | | |
| (B2) | Access | 142 | 12,846 | 17.7 | 7,918 | 10.9 | 20,764 | **14.3** | 638 | N | 65,081 | 81.5 | 18,610 | 23.3 | 83,691 | **52.4** | 534 | N | Not simulated at this demand | | | | | N |
| (A) | DCIA in SW Flow | =102 | Results = (0) Calibration | | | | | | | | Results = (0) Calibration | | | | | | | | Not simulated at this demand | | | | | |
| (C1) | LDA--NE Flow | 222 | 9,552 | 13.2 | 10,804 | 14.9 | 20,356 | **14.0** | 1,046 | | 49,552 | 62.0 | 23,998 | 30.1 | 73,550 | **46.1** | 10,675 | | Not simulated at this demand | | | | | |
| (D,C2) | Dual Vis, LDA-SW | =102 | Results = (0) Calibration | | | | | | | | Results = (0) Calibration | | | | | | | | Not simulated at this demand | | | | | |
| (E) | SCIA | =102 | Results = (0) Calibration | | | | | | | | Results = (0) Calibration | | | | | | | | Not simulated at this demand | | | | | |
| (F) | Reduce Min Sep | 242 | 12,535 | 17.3 | 8,446 | 11.6 | 20,981 | **14.4** | 421 | | 61,760 | 77.3 | 17,623 | 22.1 | 79,383 | **49.7** | 4,842 | | Not simulated at this demand | | | | | |
| (G) | Turn Props | 252 | 12,470 | 17.2 | 4,914 | 6.8 | 17,384 | **12.0** | 4,018 | | 63,614 | 79.6 | 11,117 | 13.9 | 74,731 | **46.8** | 9,494 | | Results=(G) Turn Props--SW VFR2 w 11 | | | | | N |
| (H) | New East Rwy | 302 | 6,750 | 9.3 | 3,005 | 4.1 | 9,755 | **6.7** | 11,647 | | 8,294 | 10.4 | 11,024 | 13.8 | 19,318 | **12.1** | 64,907 | | Results=(H) East Rwy--SW VFR2 w 11 | | | | | |
| (I1) | Tilt Rotor wo 11/29 | =318 | Not Simulated at This Demand | | | | | | | N | Not Simulated at This Demand | | | | | | | N | Results=(I1) Tilt Rotor--SW VFR2 wo 11 | | | | | N |
| **CON-1 (NE) -- IFR-1** | | | | | | | | | | | | | | | | | | | | | | | | |
| (0) | CALIBRATION | 103 | 69,424 | 95.6 | 5,056 | 7.0 | 74,480 | **51.3** | | | 150,502 | 188.4 | 10,546 | 13.2 | 161,048 | **100.8** | | | Results = (0) Calibration--SW IFR1 | | | | | |
| (B2) | Access | =103 | Results = (0) Calibration | | | | | | | N | Results = (0) Calibration | | | | | | | N | Not simulated at this demand | | | | | N |
| (A) | DCIA in SW Flow | =103 | Results = (0) Calibration | | | | | | | | Results = (0) Calibration | | | | | | | | Not simulated at this demand | | | | | |
| (D,C) | Dual Visuals, LDA | =103 | Results = (0) Calibration | | | | | | | | Results = (0) Calibration | | | | | | | | Not simulated at this demand | | | | | |
| (E) | SCIA | 233 | 13,077 | 18.0 | 9,250 | 12.7 | 22,327 | **15.4** | 52,153 | | 63,241 | 79.2 | 20,187 | 25.3 | 83,428 | **52.2** | 77,620 | | Not simulated at this demand | | | | | |
| (F) | Reduce Min Sep | 243 | 67,320 | 92.7 | 5,048 | 7.0 | 72,368 | **49.8** | 2,112 | | 145,368 | 181.9 | 11,075 | 13.9 | 156,443 | **98.0** | 4,605 | | Not simulated at this demand | | | | | |
| (G) | Turn Props | 253 | Results = (0) Calibration | | | | | | | | 149,784 | 187.5 | 9,392 | 11.9 | 159,176 | **99.7** | 1,872 | | Results=(G) Turn Props--SW IFR1 | | | | | N |
| (H) | New East Rwy | 303 | 6,886 | 9.5 | 5,654 | 7.8 | 12,540 | **8.6** | 61,940 | | 8,784 | 11.0 | 14,541 | 18.2 | 23,325 | **14.6** | 137,723 | | Results=(H) East Rwy--SW IFR1 | | | | | |
| (I1) | Tilt Rotor wo 11/29 | =319 | Not Simulated at This Demand | | | | | | | N | Not Simulated at This Demand | | | | | | | N | Results=(I1) Tilt Rotor--SW IFR1 | | | | | N |

## EXHIBIT 12 - EWR COMPARISON OF DAILY DELAYS & SAVINGS (in minutes) -- (Cont.)

| | | EXP | 4 5 4 (1996) | | | | | | | | 5 0 0 (F1) | | | | | | | | 5 5 0 (F2) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ARR | | DEP | | ARR & DEP | | | | ARR | | DEP | | ARR & DEP | | | | ARR | DEP | ARR & DEP | | | |
| | | # | TOT | AVG | TOT | AVG | TOT | AVG | SAVINGS | | TOT | AVG | TOT | AVG | TOT | AVG | SAVINGS | | AVG | AVG | TOT | AVG | SAVINGS | |
| **CON-2 (SW) -- VFR-1** | | | | | | | | | | | | | | | | | | | | | | | | |
| (0) | CALIBRATION | 105 | 7,605 | 10.5 | 6,968 | 9.6 | 14,573 | **10.0** | | | 36,594 | 45.8 | 16,941 | 21.2 | 53,535 | **33.6** | | | 87.2 | 49.9 | 120,498 | **68.6** | | |
| (B2) | Access | 105 | Results = (0) Calibration | | | | | | | N | Results = (0) Calibration | | | | | | | N | Not simulated at this demand | | | | | N |
| (B5) | 1996 FLEET MIX | 155 | Not simulated at this demand | | | | | | | | 31,530 | 39.5 | 16,030 | 20.1 | 47,560 | **29.8** | 5,975 | N | Not simulated at this demand | | | | | |
| (A,C1) | DCIA-SW, LDA-NE | =105 | Results = (0) Calibration | | | | | | | | Results = (0) Calibration | | | | | | | | Not simulated at this demand | | | | | |
| (D,C2) | Dual Vis, LDA-SW | 225 | 5,589 | 7.7 | 7,603 | 10.5 | 13,192 | **9.1** | 1,381 | | 27,605 | 34.6 | 22,058 | 27.6 | 49,663 | **31.1** | 3,872 | N | Not simulated at this demand | | | | | |
| (E,F) | SCIA, Reduce Sep | =105 | Results = (0) Calibration | | | | | | | | Results = (0) Calibration | | | | | | | | Not simulated at this demand | | | | | |
| (G) | Turn Props | 255 | 7,518 | 10.4 | 5,673 | 7.8 | 13,191 | **9.1** | 1,382 | | 35,599 | 44.6 | 12,777 | 16.0 | 48,376 | **30.3** | 5,159 | | 85.1 | 33.7 | 104,385 | **69.4** | 16,113 | N |
| (H) | New East Rwy | 305 | 2,162 | 3.0 | 4,163 | 5.7 | 6,325 | **4.4** | 8,248 | | 3,241 | 4.1 | 12,993 | 16.3 | 16,234 | **10.2** | 37,301 | | 10.2 | 29.8 | 35,101 | **20.0** | 85,397 | |
| (I1) | Tilt Rotor wo 11/29 | 315 | Not Simulated at This Demand | | | | | | | N | Not Simulated at This Demand | | | | | | | N | 45.4 | 20.0 | 57,457 | **32.7** | 63,041 | N |
| **CON-2 (SW) -- VFR1-REST 11** | | | | | | | | | | | | | | | | | | | | | | | | |
| (0) | CALIBRATION | 106 | 10,625 | 14.6 | 9,874 | 13.6 | 20,499 | **14.1** | | | 39,983 | 50.0 | 24,129 | 30.2 | 64,112 | **40.1** | | | 92.4 | 69.0 | 141,841 | **80.7** | | |
| (B2) | Access | 146 | 10,490 | 14.5 | 9,596 | 13.2 | 20,086 | **13.8** | 413 | N | Results = (0) Calibration | | | | | | | N | Not simulated at this demand | | | | | N |
| (A,C,D) | DCIA, LDA, Duals | =106 | Results = (0) Calibration | | | | | | | | Results = (0) Calibration | | | | | | | | Not simulated at this demand | | | | | |
| (E,F) | SCIA, Reduce Sep | =106 | Results = (0) Calibration | | | | | | | | Results = (0) Calibration | | | | | | | | Not simulated at this demand | | | | | |
| (G) | Turn Props | 256 | 10,393 | 14.3 | 6,911 | 9.5 | 17,304 | **11.9** | 3,195 | | 40,033 | 50.1 | 18,404 | 23.1 | 58,437 | **36.6** | 5,675 | | 92.6 | 48.5 | 123,916 | **70.6** | 17,925 | N |
| (H) | New East Rwy | 305 | Results=(H) East Rwy--SW VFR1(unrest 11) | | | | | | 14,174 | | Results=(H) East Rwy--SW VFR1 (unrest 11) | | | | | | 47,878 | | =(H) East Rwy--VFR1 (unrest) | | | | 106,740 | |
| (I1) | Tilt Rotor wo 11/29 | =315 | Not Simulated at This Demand | | | | | | | N | Not Simulated at This Demand | | | | | | | N | =(I1)Tilt Rotor--VFR1(unrest) | | | | 84,384 | N |
| **CON-2 (SW) -- VFR2 w 11** | | | | | | | | | | | | | | | | | | | | | | | | |
| (0) | CALIBRATION | 107 | 15,023 | 20.7 | 8,454 | 11.6 | 23,477 | **16.2** | | | 74,441 | 93.2 | 17,368 | 21.8 | 91,809 | **57.5** | | | 151.1 | 52.8 | 179,174 | **102.0** | | |
| (B2) | Access | =107 | Results = (0) Calibration | | | | | | | N | Results = (0) Calibration | | | | | | | N | Not simulated at this demand | | | | | N |
| (A,C1) | DCIA, LDA-NE | =107 | Results = (0) Calibration | | | | | | | | Results = (0) Calibration | | | | | | | | Not simulated at this demand | | | | | |
| (C2) | LDA-SW | 227 | 10,882 | 15.0 | 11,154 | 15.4 | 22,036 | **15.2** | 1,441 | N | 60,390 | 75.6 | 25,039 | 31.5 | 85,429 | **53.5** | 6,380 | N | Not simulated at this demand | | | | | |
| (D,E) | Duals, SCIA | =107 | Results = (0) Calibration | | | | | | | | Results = (0) Calibration | | | | | | | | Not simulated at this demand | | | | | |
| (F) | Reduce Min Sep | 247 | 13,922 | 19.2 | 8,995 | 12.4 | 22,917 | **15.8** | 560 | | 70,643 | 88.4 | 18,614 | 23.3 | 89,257 | **55.9** | 2,552 | | Not simulated at this demand | | | | | |
| (G) | Turn Props | 257 | 13,924 | 19.2 | 6,258 | 8.6 | 20,182 | **13.9** | 3,295 | | 73,689 | 92.3 | 12,813 | 16.1 | 86,502 | **54.2** | 5,307 | | 150.0 | 40.9 | 167,689 | **95.4** | 11,485 | N |
| (H) | New East Rwy | 308 | Results = (H) East Rwy--SW VFR2 (wo 11) | | | | | | 12,663 | | Results = (H) East Rwy--SW VFR2 (wo 11) | | | | | | 70,562 | | =(H) East Rwy--VFR2 (wo 11) | | | | 125,072 | |
| (I1) | Tilt Rotor wo 11/29 | =318 | Not Simulated at This Demand | | | | | | | N | Not Simulated at This Demand | | | | | | | N | =(I1)Tilt Rotor--VFR2 wo 11 | | | | 77,146 | N |

# EXHIBIT 12 - EWR COMPARISON OF DAILY DELAYS & SAVINGS (in minutes) – (Cont.)

**4 5 4 (1996)**

| | | EXP # | ARR TOT | ARR AVG | DEP TOT | DEP AVG | ARR & DEP TOT | ARR & DEP AVG | ARR & DEP SAVINGS | |
|---|---|---|---|---|---|---|---|---|---|---|
| **CON-2 (SW) – VFR2 wo 11** | | | | | | | | | | |
| (0) | CALIBRATION | 108 | 70,217 | 96.7 | 3,406 | 4.7 | 73,623 | **50.7** | | |
| (B2) | Access | =108 | Results = (0) Calibration | | | | | | | N |
| (A,C1) | DCIA-SW, LDA-NE | =108 | Results = (0) Calibration | | | | | | | |
| (C2) | LDA–SW | 228 | 39,797 | 54.8 | 4,459 | 6.1 | 44,256 | **30.5** | 29,367 | N |
| (D,E) | Dual Visuals, SCIA | =108 | Results = (0) Calibration | | | | | | | |
| (F) | Reduce Min Sep | 248 | 66,661 | 91.8 | 3,357 | 4.6 | 70,018 | **48.2** | 3,605 | |
| (G) | Turn Props | 258 | 69,684 | 96.0 | 2,931 | 4.0 | 72,615 | **50.0** | 1,008 | |
| (H) | New East Rwy | 308 | 6,792 | 9.4 | 4,022 | 5.5 | 10,814 | **7.4** | 62,809 | |
| (I1) | Tilt Rotor wo 11/29 | 318 | Not Simulated at This Demand | | | | | | | N |
| **CON-2 (SW) – IFR-1** | | | | | | | | | | |
| (0) | CALIBRATION | 109 | 71,313 | 98.2 | 5,268 | 7.3 | 76,601 | **52.8** | | |
| (B2) | Access | =109 | Results = (0) Calibration | | | | | | | N |
| (A) | DCIA– SW IFR-1A | 119 | 30,703 | 42.3 | 9,997 | 13.8 | 40,700 | **28.0** | 35,901 | N |
| (C,D,E) | LDA, Duals, SCIA | =109 | Results = (0) Calibration | | | | | | | |
| (F) | Reduce Min Sep | 249 | 66,993 | 92.3 | 5,518 | 7.6 | 72,511 | **49.9** | 4,090 | |
| (G) | Turn Props | 259 | 70,118 | 96.6 | 4,875 | 6.7 | 74,993 | **51.6** | 1,608 | |
| (H) | New East Rwy | 309 | 6,897 | 9.5 | 6,933 | 9.6 | 13,830 | **9.5** | 62,771 | |
| (I1) | Tilt Rotor wo 11/29 | 319 | Not Simulated at This Demand | | | | | | | N |

**5 0 0 (F1)**

| | | EXP # | ARR TOT | ARR AVG | DEP TOT | DEP AVG | ARR & DEP TOT | ARR & DEP AVG | ARR & DEP SAVINGS | |
|---|---|---|---|---|---|---|---|---|---|---|
| **CON-2 (SW) – VFR2 wo 11** | | | | | | | | | | |
| (0) | CALIBRATION | 108 | 149,566 | 187.2 | 6,938 | 8.7 | 156,504 | **98.0** | | |
| (B2) | Access | =108 | Results = (0) Calibration | | | | | | | N |
| (A,C1) | DCIA-SW, LDA-NE | =108 | Results = (0) Calibration | | | | | | | |
| (C2) | LDA–SW | 228 | 113,590 | 142.2 | 9,391 | 11.8 | 122,981 | **77.0** | 33,523 | N |
| (D,E) | Dual Visuals, SCIA | =108 | Results = (0) Calibration | | | | | | | |
| (F) | Reduce Min Sep | 248 | 144,856 | 181.3 | 7,008 | 8.8 | 151,864 | **95.1** | 4,640 | |
| (G) | Turn Props | 258 | 147,191 | 184.2 | 5,911 | 7.4 | 153,102 | **95.9** | 3,402 | |
| (H) | New East Rwy | 308 | 8,749 | 10.9 | 12,498 | 15.7 | 21,247 | **13.3** | 135,257 | |
| (I1) | Tilt Rotor wo 11/29 | 318 | Not Simulated at This Demand | | | | | | | N |
| **CON-2 (SW) – IFR-1** | | | | | | | | | | |
| (0) | CALIBRATION | 109 | 149,566 | 187.2 | 11,066 | 13.9 | 160,632 | **100.6** | | |
| (B2) | Access | =109 | Results = (0) Calibration | | | | | | | N |
| (A) | DCIA– SW IFR-1A | 119 | 100,115 | 125.3 | 19,560 | 24.5 | 119,675 | **74.9** | 40,957 | N |
| (C,D,E) | LDA, Duals, SCIA | =109 | Results = (0) Calibration | | | | | | | |
| (F) | Reduce Min Sep | 249 | 145,135 | 181.7 | 11,194 | 14.0 | 156,329 | **97.9** | 4,303 | |
| (G) | Turn Props | 259 | 147,259 | 184.3 | 9,532 | 11.9 | 156,791 | **98.2** | 3,841 | |
| (H) | New East Rwy | 309 | 9,496 | 11.9 | 17,114 | 21.5 | 26,610 | **16.7** | 134,022 | |
| (I1) | Tilt Rotor wo 11/29 | 319 | Not Simulated at This Demand | | | | | | | N |

**5 5 0 (F2)**

| | | EXP # | ARR AVG | DEP AVG | ARR & DEP TOT | ARR & DEP AVG | ARR & DEP SAVINGS | |
|---|---|---|---|---|---|---|---|---|
| **CON-2 (SW) – VFR2 wo 11** | | | | | | | | |
| (0) | CALIBRATION | 108 | 247.4 | 21.9 | 236,687 | **134.7** | | |
| (B2) | Access | =108 | Not simulated at this demand | | | | | N |
| (A,C1) | DCIA-SW, LDA-NE | =108 | Not simulated at this demand | | | | | |
| (C2) | LDA–SW | 228 | Not simulated at this demand | | | | | |
| (D,E) | Dual Visuals, SCIA | =108 | Not simulated at this demand | | | | | |
| (F) | Reduce Min Sep | 248 | Not simulated at this demand | | | | | |
| (G) | Turn Props | 258 | 244.3 | 16.2 | 228,978 | **130.3** | 7,709 | N |
| (H) | New East Rwy | 308 | 32.2 | 29.4 | 54,102 | **30.8** | 182,585 | |
| (I1) | Tilt Rotor wo 11/29 | 318 | 104.5 | 11.6 | 102,028 | **58.1** | 134,659 | N |
| **CON-2 (SW) – IFR-1** | | | | | | | | |
| (0) | CALIBRATION | 109 | 247.4 | 40.7 | 253,154 | **144.1** | | |
| (B2) | Access | =109 | Not simulated at this demand | | | | | N |
| (A) | DCIA– SW IFR-1A | 119 | Not simulated at this demand | | | | | N |
| (C,D,E) | LDA, Duals, SCIA | =109 | Not simulated at this demand | | | | | |
| (F) | Reduce Min Sep | 249 | Not simulated at this demand | | | | | |
| (G) | Turn Props | 259 | 244.3 | 34.6 | 245,111 | **139.4** | 8,043 | N |
| (H) | New East Rwy | 309 | 33.4 | 34.5 | 59,625 | **33.9** | 193,529 | |
| (I1) | Tilt Rotor wo 11/29 | 319 | 103.5 | 17.7 | 106,448 | **60.6** | 146,706 | N |

# EXHIBIT 13 - EWR DAILY DELAYS AND TRAVEL TIMES (in minutes)

(Revised on 3/10/99)

| Demand Level | Annual Ops | Daily Operations ARR | DEP | TOTAL |
|---|---|---|---|---|
| 1996 | 454,000 | 726 | 726 | 1,452 |
| Future 1 | 500,000 | 799 | 798 | 1,597 |
| Future 2 | 550,000 | 879 | 878 | 1,757 |

| | | | | | |
|---|---|---|---|---|---|
| CON1 | NE | VFR1 | ARR = 4R,11 | DEP = 4L, 29 | |
| CON1 | NE | VFR2 | ARR = 4R,11 | DEP = 4L, 29 | |
| CON1 | NE | IFR1 | ARR = 4R | DEP = 4L, 29 | |
| CON2 | SW | VFR1 | ARR = 22L, 11 | DEP = 22R, 29 | |
| CON2 | SW | VFR1-R | ARR = 22L, (11) | DEP = 22R, 29 | Restricted Use of 11. Simulated with some arrivals on 11. |
| CON2 | SW | VFR2 w 11 | ARR = 22L, 11 | DEP = 22R, 29 | |
| CON2 | SW | VFR2 wo 11 | ARR = 22L | DEP = 22R, 29 | |
| CON2 | SW | IFR1 | ARR = 22L | DEP = 22R, 29 | |

## *RESULTS from ADSIM*

| EXPERIMENT # | | | ARRIVALS FLOW RATE | AIR DELAY | TAXI-IN DELAY | RWY-XNG DELAY | / DEPARTURES FLOW RATE | RUNWAY DELAY | TAXI-OUT DELAY | RWY-XNG DELAY | ENRTE /GTE-HLD | GTE-HLD RWY-CNG | / TOTAL / GROUND DELAYS / | TOTAL TRAVEL TIMES ARRIVAL AIR | ARRIVAL GROUND | DEPARTURE GROUND | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***(A)*** | ***DCIA - Dependent Converging Instrument Approaches -- 1996 and Future 1 (affects only SW IFR-1a)*** | | | | | | | | | | | | | | | | |
| 119CT | SW IFR1 | TOTAL | 726.0 | 28259.9 | 2350.3 | 93.0 | 725.9 | 8015.0 | 1970.0 | 12.1 | 0.0 | 0.0 | 12440.3 | 35491.8 | 6514.2 | 13724.3 | 55730.3 |
| 419CT | SW IFR1 | TOTAL | 799.0 | 95872.3 | 4141.7 | 101.4 | 798.0 | 13359.1 | 5139.0 | 15.3 | 0.0 | 1046.4 | 23803.0 | 103623.7 | 8696.1 | 23215.7 | 135535.5 |
| ***(B2)*** | ***Additional Access to 11/29 Across Drainage Ditch -- 1996 and Future 1 (only VFR1 and VFR2, with RWY 11, were simulated)*** | | | | | | | | | | | | | | | | |
| 141AT | NE VFR1 | TOTAL | 726.0 | 6853.2 | 109.9 | 88.0 | 726.0 | 4898.7 | 614.7 | 10.1 | 0.0 | 0.0 | 5721.3 | 14076.4 | 4185.1 | 8861.9 | 27123.4 |
| 142AT | NE VFR2 | TOTAL | 726.0 | 12618.6 | 140.7 | 86.7 | 726.0 | 7306.7 | 603.6 | 7.2 | 0.0 | 0.0 | 8144.9 | 19870.6 | 4229.8 | 11283.6 | 35384.0 |
| 145AT | SW VFR1 | RESULTS = CALIBRATION -- SW VFR1 | | | | | | | | | | | | | | | |
| 146AT | SW VFR1-R | TOTAL | 726.0 | 9996.6 | 375.2 | 117.9 | 726.0 | 7887.3 | 1702.5 | 6.0 | 0.0 | 0.0 | 10089.0 | 17220.8 | 4579.8 | 13280.8 | 35081.4 |
| 147 | SW VFR2 w 11 | RESULTS = CALIBRATION -- SW VFR2 W 11 | | | | | | | | | | | | | | | |
| 441BT | NE VFR1 | TOTAL | 799.0 | 32355.2 | 805.8 | 97.5 | 797.9 | 13033.5 | 1475.0 | 9.6 | 0.0 | 658.6 | 16079.8 | 40360.8 | 5392.1 | 18789.1 | 64542.1 |
| 442AT | NE VFR2 | TOTAL | 799.0 | 63210.5 | 1782.0 | 89.1 | 798.0 | 15666.4 | 2488.7 | 7.1 | 0.0 | 447.5 | 20480.8 | 71210.8 | 6381.7 | 22318.2 | 99910.7 |
| 445 | SW VFR1 | RESULTS = CALIBRATION -- SW VFR1 | | | | | | | | | | | | | | | |
| 446 | SW VFR1-R | RESULTS = CALIBRATION -- SW VFR1-R | | | | | | | | | | | | | | | |
| 447 | SW VFR2 w 11 | RESULTS = CALIBRATION -- SW VFR2 W 11 | | | | | | | | | | | | | | | |

# EXHIBIT 13 - EWR DAILY DELAYS AND TRAVEL TIMES (Cont.) (in minutes)

## *(B4) More Uniform Distribution of Traffic within the Hour -- Future 1 (only VFR-1 was simulated)*

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 431BT | NE VFR1 | TOTAL | 799.0 | 32895.6 | 1005.3 | 100.0 | 798.0 | 11065.9 | 1715.9 | 11.4 | 0.0 | 1318.8 | 15217.3 | 40877.1 | 5595.6 | 17845.2 | 64317.9 |

## *(C2) LDA Offset Approaches to 22s (affects only SW Flow) -- 1996 and Future 1*

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| =225AT | SW VFR1 | RESULTS = DUAL VISUALS -- SW VFR1 | | | | | | | | | | | | | | | |
| =226AT | SW VFR1-R | RESULTS = DUAL VISUALS -- SW VFR1-R (= CALIBRATION) | | | | | | | | | | | | | | | |
| 227GT | SW VFR2 w 11 | TOTAL | 726.0 | 8817.4 | 1954.1 | 110.7 | 726.0 | 6515.5 | 2677.4 | 9.6 | 0.0 | 1951.0 | 13218.1 | 16058.4 | 6118.9 | 14908.9 | 37086.2 |
| 228CT | SW VFR2 wo 11 | TOTAL | 726.0 | 39624.0 | 38.3 | 134.8 | 726.0 | 3480.3 | 973.7 | 5.1 | 0.0 | 0.0 | 4632.1 | 46850.1 | 4405.8 | 8215.8 | 59471.7 |
| =525-- | SW VFR1 | RESULTS = DUAL VISUALS -- SW VFR1 (= CALIBRATION) | | | | | | | | | | | | | | | |
| =526-- | SW VFR1-R | RESULTS = DUAL VISUALS -- SW VFR1-R (= CALIBRATION) | | | | | | | | | | | | | | | |
| 527FN | SW VFR2 w 11 | TOTAL | 798.9 | 55574.5 | 4684.8 | 131.0 | 796.0 | 15249.3 | 6080.7 | 10.9 | 0.0 | 3698.2 | 29854.9 | 63592.3 | 9239.7 | 29041.1 | 101873.0 |
| 528ET | SW VFR2 wo 11 | TOTAL | 799.0 | 113403.3 | 55.9 | 130.8 | 797.9 | 7630.1 | 1248.1 | 3.2 | 0.0 | 509.4 | 9577.5 | 121355.5 | 4821.3 | 13577.4 | 139754.2 |

## *(D) Parallel Dual Visual Approaches (affects NE and SW Flows) -- 1996 and Future 1*

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 221GT | NE VFR1 | TOTAL | 726.0 | 4889.9 | 153.8 | 97.2 | 726.0 | 5581.3 | 642.1 | 9.4 | 0.0 | 0.0 | 6483.8 | 12138.1 | 4233.3 | 9681.2 | 26052.6 |
| 225AT | SW VFR1 | TOTAL | 726.0 | 4466.2 | 1007.9 | 115.3 | 726.0 | 6188.0 | 1405.6 | 9.4 | 0.0 | 0.0 | 8726.2 | 11709.4 | 5188.2 | 11351.6 | 28249.2 |
| 226AT | SW VFR1-R | UNLIKELY OPERATION -- Assume delays equal those of CALIBRATION although there was a small delay savings. | | | | | | | | | | | | | | | |
| 521DT | NE VFR1 | TOTAL | 799.0 | 24874.2 | 384.3 | 117.9 | 798.0 | 12985.6 | 2423.9 | 8.6 | 0.0 | 4831.0 | 20751.4 | 32766.7 | 4975.0 | 23981.9 | 61723.6 |
| 525WN-- | SW VFR1 | TOTAL | 799.0 | 26407.3 | 1053.2 | 144.7 | 798.0 | 14360.8 | 4660.4 | 12.5 | 0.0 | 3024.2 | 23255.8 | 34378.9 | 5605.8 | 26244.8 | 66229.4 |
| 526-- | SW VFR1-R | UNLIKELY OPERATION -- Assume delays equal those of CALIBRATION although there was a small delay savings. | | | | | | | | | | | | | | | |

## *(I1) Vertiport & Tilt Rotor Aircraft -- independent of other EWR operations -- Future 2*
*Simulated without the use of 11/29.*

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 915AT | SW VFR1 | TOTAL | 879.0 | 39408.9 | 377.0 | 128.5 | 877.9 | 14658.1 | 2353.4 | 0.0 | 0.0 | 531.5 | 18048.4 | 48091.7 | 4948.1 | 21486.1 | 74525.9 |
| 918AT | SW VFR2 | TOTAL | 879.0 | 91720.4 | 30.1 | 107.6 | 878.0 | 8484.4 | 1470.7 | 0.0 | 0.0 | 215.0 | 10307.8 | 100366.0 | 4585.3 | 14104.6 | 119055.9 |
| 919AT | SW IFR1 | TOTAL | 879.0 | 90758.5 | 69.7 | 103.9 | 878.0 | 13470.8 | 1574.7 | 0.0 | 0.0 | 470.0 | 15689.2 | 99577.3 | 4617.8 | 19448.6 | 123643.6 |

## EXHIBIT 13 - EWR DAILY DELAYS AND TRAVEL TIMES (Cont.) (in minutes)

### *RESULTS from FAA QUEUING MODEL*

**(B5) *1996 FLEET MIX AT FUTURE DEMANDS – Future 1 Demand (500,000 Annual Ops)***

| SCD550 | SCENARIO | EXP. # | ARR DLY | AVG ARR | DEP DLY | AVG DEP | A&D DLY | AVG A&D |
|---|---|---|---|---|---|---|---|---|
| SW VFR1 | (B5) FLEET MIX | 455A | 31,530.0 | 39.5 | 16,029.9 | 20.1 | 47,559.9 | 29.8 |

**(G) *PROPS CAN DO IMMEDIATE DIVERGENT TURNS – Future 2 Demand (550,000 Annual Ops)***

| SCD550 | SCENARIO | EXP. # | ARR DLY | AVG ARR | DEP DLY | AVG DEP | A&D DLY | AVG A&D |
|---|---|---|---|---|---|---|---|---|
| SW VFR1 | (G)TURN PROP | 855A | 74,817.0 | 85.1 | 29,568.3 | 33.7 | 104,385.3 | 59.4 |
| SW VFR1-R | (G)TURN PROP | 856A | 81,353.1 | 92.6 | 42,562.8 | 48.5 | 123,915.9 | 70.5 |
| SW VFR2 w 11 | (G)TURN PROP | 857A | 131,809.2 | 150.0 | 35,879.7 | 40.9 | 167,688.9 | 95.4 |
| SW VFR2 wo 11 | (G)TURN PROP | 858A | 214,758.3 | 244.3 | 14,220.0 | 16.2 | 228,978.3 | 130.3 |
| SW IFR1 | (G)TURN PROP | 859A | 214,758.3 | 244.3 | 30,352.8 | 34.6 | 245,111.1 | 139.4 |

For a given weather condition, Results for NE Flow = Results for SW Flow.

## 4. DESIGN TEAM SCHEDULE

Exhibit 14 lists the meetings concerning the completion of significant tasks, outputs, and target dates of the EWR Design Team schedule. These milestones and meetings will be held at key decision points, and will help the Design Team monitor the progress of the study.

### EXHIBIT 14 - DESIGN TEAM SCHEDULE

| Date | Event | Objective | Task | Responsibility | Output |
|---|---|---|---|---|---|
| 11/18/96 | 1. | Kick Off Meeting. Review Design Team Purpose. Identify Objectives & Potential Improvements. | Review Technical Plan, & Potential Improvements. Agree on Scope of Work, Assumptions, Forecasts, & Data Requirements. Review & Agree on Purpose and Inputs. | Entire Design Team. | Initial List of Potential Improvements. Agree on Study Direction. |
| 12/9/96 thru 12/13/96 | 2. | Perform Data Collection. | On-Site Data Collection. | Tech Center. | Establish Parameters for Analysis. |
| 1/14 /97 | 3. | Determine Scope of Study, Select Model. Review Results of Data Collection. | Review Results. Review Data Package 1. | Entire Design Team. | Agree on Inputs & Direction. |
| 4/10/97 | 4. | Review Results of Data Collection, Model Inputs, & Potential Improvements. | Review Data Package 2. | Entire Design Team. | Agree on Inputs & Direction. |
| 6/18/97 | 5. | Review Model Inputs & Potential Improvements. | Review Data Package 3 | Entire Design Team. | Agree on Inputs & Direction. |
| 8/28/97 | 5. | Review Inputs, Improvements, & Capacity Analysis. | Review Data Package 4 | Entire Design Team. | Agree on Inputs, Direction, & Results. |
| 11/19/97 | 5. | Review Inputs, Improvements, & ADSIM Calibration. | Review Data Package 5 | Entire Design Team. | Agree on Inputs, Direction, & Results. |
| 1/28/98 | 6. | Review Inputs, Improvements & ADSIM Results. | Review Data Package 6 | Entire Design Team. | Agree on Inputs, Direction, & Results. |
| 4/29/98 | 7. | Review Improvements & ADSIM Results. | Review Data Package 7 | Entire Design Team. | Agree on Direction, & Results. |
| 9/16/98 | 8. | Review Improvements & ADSIM Results. | Review Data Package 8 | Entire Design Team. | Agree on Direction, & Results. |
| 11/12/98 | 9. | Review Improvements & ADSIM Results. | Review Data Package 9 | Entire Design Team. | Agree on Direction, & Results. |
| 03/31/99 (previous date was 01/28/99) | 10. | Review Improvements & ADSIM Results & Gate Analysis. | Review Data Package 10 Review Handout – Gate Analysis Review Draft of Final Report | Entire Design Team. | Agree on Results & Final Report. |
| / /99 | 11. | □ □ □ | | | |
| / /99 | ?. | Complete & Publish Final Report. | Publish & Distribute Final Report. | FAA HQ. | Final Report. |

* Number of meetings and target dates are tentative and may be adjusted as progress is achieved.

# APPENDIX A

# ACCEPTED MODEL INPUTS

## AIRCRAFT CLASSIFICATIONS

**Accepted by EWR Team on 4/10/97.**
**BA41 reclassified as LC – Revised on 7/31/97.**

| | | |
|---|---|---|
| H | = HEAVY | **Heavy aircraft.**<br>Heavy aircraft weighing more than 255,000 pounds (e.g., L1011, DC10, B747, B767, DC8S, A300). |
| 757 | = 757 | **B757.**<br>B757 only. |
| LJ | = LARGE JET | **Large jets.**<br>Large jet aircraft weighing more than 41,000 pounds and up to 255,000 pounds (e.g., DC9, B737, B727, MD80). |
| LC | = LARGE COMMUTER | **Large Commuters. Includes Small Regional Jets.**<br>Large commuter aircraft weighing more than 41,000 pounds and up to 255,000 pounds (e.g., ATR-42*, DH8, DH7, CRJ, BA41*, SF34* ). |
| M | = MEDIUM | **Small Commuters. Includes Business Jets.**<br>Small commuter aircraft weighing more than 12,500 and less than 41,000 pounds (e.g., BA31, BE02, E120, LR31, LR36). |
| S | = SMALL | **Small twin & single engine props.**<br>Small, single or twin engine aircraft weighing 12,500 pounds or less (e.g. BE58, BE90, C340, C441, AC21, BE20, C172, C210, DO27). |

Notes:

**Aircraft Classifications were agreed upon by Design Team at 4/10/97 meeting. They agreed to include Small Regional Jets in Class LC. At the Design Team's request, the Technical Center modified the list of aircraft types in Class LJ to include reflect the types of aircraft operating at EWR. For wake turbulence application, FAA Handbook 7110.65 considers LJ & LC as "large" and M & S as "small".**

These aircraft classes will enable us to define the model inputs more accurately and more clearly by distinguishing the key differences in operational characteristics. Class names, rather than class numbers, will be used in the data packages. The following describes the new class names which will be used in the study and the class numbers used in previous documents.

| | |
|---|---|
| HEAVY: | (old Class 1 in Data Pkg. 1) |
| 757: | (old Class 2 in Data Pkg. 1) |
| LARGE JET: | (old Class 3 in Data Pkg. 1) |
| LARGE COMMUTER: | (old Class 3 in Data Pkg. 1) |
| MEDIUM: | (old Class 4 in Data Pkg. 1) |
| SMALL: | (old Class 5 & 6 in Data Pkg. 1) |

The critical factor in determining aircraft class should be approach speeds and how arrivals are separated at the point of closest approach (at threshold, except for a "small" following a "heavy").

*The aircraft ATR-42 and SF34 are exempt from the small category and are classified as large aircraft for separation purposes. (Source: FAA memo from ANM-531.4). They are classified as LARGE COMMUTER in this study. **July 1997, the Tower told the Technical Center to reclassify the BA41 as LC for this study.**

Weights refer to maximum certified takeoff weights.

**RUNWAY EXIT DATA – 4R and 4L** — **Accepted by EWR Team on 6/28/97.**

## Exit Utilization (percent) and Runway Occupancy Times (seconds)

**Runway 4R**

| | Exit<br>Distance | G<br>3600' | J<br>4400' hs | K<br>5900' | L<br>6450' hs | Y<br>6750' | TOTAL |
|---|---|---|---|---|---|---|---|
| (H) | Utilization | | | 42% | 50% | 8% | 100% |
| | ROT | | | 59 | 56 | 74 | 59 sec |
| | Count | | | 5 | 6 | 1 | 12 |
| (757) | Utilization | | 9% | 56% | 35% | | 100% |
| | ROT | | 34 | 60 | 56 | | 56 sec |
| | Count | | 2 | 13 | 8 | | 23 |
| (LJ) | Utilization | | 17% | 51% | 31% | 1% | 100% |
| | ROT | | 33 | 54 | 52 | 71 | 50 sec |
| | Count | | 14 | 43 | 26 | 1 | 84 |
| (LC) | Utilization | 6% | 69% | | 25% | | 100% |
| | ROT | 36 | 35 | | 56 | | 40 sec |
| | Count | 1 | 11 | | 4 | | 16 |
| (M) | Utilization | 7% | 73% | | 20% | | 100% |
| | ROT | 33 | 39 | | 56 | | 40 sec |
| | Count | 1 | 11 | | 3 | | 15 |
| (S) | Utilization | 7% | 93% | | | | 100 % |
| | ROT | 36 | 40 | | | | 40 |
| | Count | E | E | | | | E |

**Runway 4L**

| | Exit<br>Distance | G<br>3600' | H<br>4500' hs | J<br>5150' | K<br>5950' | O<br>5950' hs | M<br>6750' rhs | Y<br>6750' | W<br>7400' | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| (H) | Utilization | | | | | 90% | | 10% | | 100% |
| | ROT | | | | | 48 | | 74 | | 51 sec |
| | Count | | | | | E | | E | | E |
| (757) | Utilization | | 10% | 20% | | 70% | | | | 100% |
| | ROT | | 35 | 50 | | 48 | | | | 47 sec |
| | Count | | E | E | | E | | | | E |
| (LJ) | Utilization | | 25% | 50% | | 25% | | | | 100% |
| | ROT | | 35 | 50 | | 50 | | | | 46 sec |
| | Count | | 1 | 3 | | E | | | | E |
| (LC) | Utilization | 6% | 70% | 24% | | | | | | 100% |
| | ROT | 36 | 36 | 52 | | | | | | 40 sec |
| | Count | E | 1 | E | | | | | | E |
| (M) | Utilization | 20% | 65% | 15% | | | | | | 100% |
| | ROT | 36 | 39 | 52 | | | | | | 40 sec. |
| | Count | E | E | E | | | | | | E |
| (S) | Utilization | 50% | 50% | | | | | | | 100% |
| | ROT | 36 | 40 | | | | | | | 38 sec |
| | Count | E | E | | | | | | | E |

Notes:

Distance in FT. from Threshold. Conditions were VFR and dry.
ROTs in total columns are calculated using weighted averages.

Legend:

hs - High Speed Exit (angled exit)
rhs - Reverse High Speed Exit (reverse angled exit)
E - Estimate of Utilizations, ROTs, and Counts are for simulation purposes.

***Estimated values for 4R/4L were generated by the FAA Technical Center and modified by the EWR Tower on 5/29/97.***

**RUNWAY EXIT DATA – 22R and 22L** **Accepted by EWR Team on 6/28/97.**

Exit Utilization (percent) and Runway Occupancy Times (seconds)

**Runway 22R**

| | Exit / Distance | G 3400' | F 4600' hs | E 5000' | C 6350' hs | N 6950' | V 7700' | TOTAL |
|---|---|---|---|---|---|---|---|---|
| (H) | Utilization | | | | 90% | 10% | | 100% |
| | ROT | | | | 50 | 74 | | 52 sec |
| | Count | | | | E | E | | E |
| (757) | Utilization | | 10% | | 90% | | | 100% |
| | ROT | | 42 | | 48 | | | 47 |
| | Count | | E | | E | | | E |
| (LJ) | Utilization | 10% | 20% | | 70% | | | 100% |
| | ROT | 36 | 40 | | 49 | | | 46 sec |
| | Count | 1 | 2 | | 7 | | | 10 |
| (LC) | Utilization | | 50% | | 50% | | | 100% |
| | ROT | | 40 | | 49 | | | 45 sec |
| | Count | | E | | E | | | E |
| (M) | Utilization | | 80% | | 20% | | | 100% |
| | ROT | | 40 | | 49 | | | 42 sec |
| | Count | | E | | E | | | E |
| (S) | Utilization | | 100% | | | | | 100% |
| | ROT | | 38 | | | | | 38 sec |
| | Count | | E | | | | | E |

**Runway 22L**

| | Exit / Distance | G 3400' | E 4200' hs | N 6100' hs | V 7300' hs | TOTAL |
|---|---|---|---|---|---|---|
| (H) | Utilization | | | 87% | 13% | 100% |
| | ROT | | | 49 | 56 | 50 sec |
| | Count | | | 13 | 2 | 15 |
| (757) | Utilization | | 10% | 90% | | 100% |
| | ROT | | 42 | 47 | | 47 sec |
| | Count | | 3 | 28 | | 31 |
| (LJ) | Utilization | | 12% | 85% | 3% | 100% |
| | ROT | | 34 | 44 | 53 | 43 sec |
| | Count | | 22 | 159 | 6 | 187 |
| (LC) | Utilization | 24% | 56% | 20% | | 100% |
| | ROT | 36 | 32 | 45 | | 36 sec |
| | Count | 10 | 23 | 8 | | 41 |
| (M) | Utilization | 2% | 46% | 52% | | 100% |
| | ROT | 36 | 33 | 47 | | 40 sec |
| | Count | 1 | 20 | 23 | | 44 |
| (S) | Utilization | | 100% | | | 100% |
| | ROT | | 35 | | | 35 sec |
| | Count | | 1 | | | 1 |

Notes:

Distance in FT. from Threshold. Conditions were VFR and dry.
ROTs in total columns are calculated using weighted averages.

Legend:

hs - High Speed Exit (angled exit)
rhs - Reverse High Speed Exit (reverse angled exit)
E - Estimate of Utilizations, ROTs, and Counts are for simulation purposes.

***Estimated values for 22R/22L were generated by the FAA Technical Center and modified by the EWR Tower on 5/29/97.***

**RUNWAY EXIT DATA – 11 and 29** **Accepted by EWR Team on 8/28/97.**

Exit Utilization (percent) and Runway Occupancy Times (seconds)

**Runway 11**

| | Exit / Distance | S 3650' | R 4350' | P 4900' | ZA/ZB 5900' | Z 6600' | TOTAL |
|---|---|---|---|---|---|---|---|
| (H) | Utilization | | | | 60% | 40% | 100% |
| | ROT | | | | 56 | 64 | 59 sec |
| | Count | | | | E | E | E |
| (757) | Utilization | | | 30% | 70% | | 100% |
| | ROT | | | 48 | 56 | | 54 sec |
| | Count | | | E | E | | E |
| (LJ) | Utilization | | 10% | 30% | 60% | | 100% |
| | ROT | | 44 | 48 | 54 | | 52 sec |
| | Count | | E | E | E | | E |
| (LC) | Utilization | | 100% | | | | 100% |
| | ROT | | 44 | | | | 44 sec |
| | Count | | 1 | | | | 1 |
| (M) | Utilization | 100% | | | | | 100% |
| | ROT | 43 | | | | | 43 sec |
| | Count | 1 | | | | | 1 |
| (S) | Utilization | 100 % | | | | | 100% |
| | ROT | 43 | | | | | 43 sec |
| | Count | E | | | | | E |

**Runway 29**

| | Exit / Distance | T 3700' hs | U 4550' | BB 5400' | W 6400' | TOTAL | |
|---|---|---|---|---|---|---|---|
| (H) | Utilization | | | 60% | 40% | 100% | Revised (H) |
| | ROT | | | 52 | 62 | 56 sec | on 7/15/97 |
| | Count | | | E | E | E | |
| (757) | Utilization | | | 60% | 40% | 100% | |
| | ROT | | | 52 | 62 | 56 sec | |
| | Count | | | E | E | E | |
| (LJ) | Utilization | | 20% | 60% | 20% | 100% | |
| | ROT | | 40 | 52 | 60 | 51 sec | |
| | Count | | E | E | E | E | |
| (LC) | Utilization | 100% | | | | 100% | |
| | ROT | 37 | | | | 37 sec | |
| | Count | 13 | | | | 13 | |
| (M) | Utilization | 100% | | | | 100% | |
| | ROT | 39 | | | | 39 sec | |
| | Count | 4 | | | | 4 | |
| (S) | Utilization | 100% | | | | 100% | |
| | ROT | 39 | | | | 39 sec | |
| | Count | E | | | | E | |

Notes:

Distance in FT. from Threshold. Conditions were VFR and dry.
ROTs in total columns are calculated using weighted averages.

Legend:

hs - High Speed Exit (angled exit)
rhs - Reverse High Speed Exit (reverse angled exit)
E - Estimate of Utilizations, ROTs, and Counts are for simulation purposes.

***On 7/15/97, the Technical Center modified the values for Runway 29 based on the Tower's comment that most Heavies on Runway 29 take exit BB.***

## EWR VFR (VISUAL) SEPARATIONS

**Accepted by EWR Team on 6/28/97.**
**D/D separations – Revised on 8/28/97.**

**(In-trail Separations on Same Runway)**

| A/A (NM)* | *LEAD ARR* | *TRAIL ARR*— | HVY | 757 | LJ | LC | MED | SM | for all runways |
|---|---|---|---|---|---|---|---|---|---|
| | HVY | *(7110.65–Heavy)* | 3.99 | 4.88 | 5.06 | 5.06 | 5.99 | 6.42 | |
| | 757 | *(7110.65–757)* | 3.99 | 4.24 | 4.24 | 4.24 | 4.36 | 4.32 | |
| | LJ | *(7110.65–Large)* | 3.18 | 3.08 | 3.19 | 3.19 | 4.36 | 4.32 | |
| | LC | *(7110.65–Large)* | 3.18 | 3.08 | 3.19 | 3.19 | 4.36 | 4.32 | |
| | MED | *(7110.65–Small)* | 3.18 | 3.08 | 3.19 | 3.19 | 3.19 | 3.38 | |
| | SM | *(7110.65–Small)* | 3.18 | 3.08 | 3.19 | 3.19 | 3.19 | 3.38 | |

| D/D (MIN) | *LEAD DEP* | *TRAIL DEP*— | HVY | 757 | LJ | LC | MED | SM | for 11/29 |
|---|---|---|---|---|---|---|---|---|---|
| | HVY | *(7110.65–Heavy)* | 1.50 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | |
| | 757 | *(7110.65–757)* | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 | 1.5 using radar |
| | LJ | *(7110.65–Large)* | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.83 | |
| | LC | *(7110.65–Large)* | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.83 | |
| | MED | *(7110.65–Small)* | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.58 | |
| | SM | *(7110.65–Small)* | 0.83 | 0.75 | 0.75 | 0.75 | 0.75 | 0.58 | |

**Departures on parallel runways use Radar separations – Revised 8/28/97.**
**Departures on Runway 29 use 2 minute separations – Revised 8/28/97.**

| D/A (NM) | *LEAD DEP* | *TRAIL ARR*— | HVY | 757 | LJ | LC | MED | SM | for all runways |
|---|---|---|---|---|---|---|---|---|---|
| | HVY | *(7110.65–Heavy)* | 1.57 | 1.46 | 1.52 | 1.52 | 1.52 | 1.52 | |
| | 757 | *(7110.65–757)* | 1.57 | 1.46 | 1.52 | 1.52 | 1.52 | 1.52 | |
| | LJ | *(7110.65–Large)* | 1.57 | 1.46 | 1.52 | 1.52 | 1.52 | 1.52 | |
| | LC | *(7110.65–Large)* | 1.57 | 1.46 | 1.52 | 1.52 | 1.52 | 1.52 | |
| | MED | *(7110.65–Small)* | 1.57 | 1.46 | 1.52 | 1.52 | 1.52 | 1.52 | |
| | SM | *(7110.65–Small)* | 1.37 | 1.28 | 1.32 | 1.32 | 1.32 | 1.32 | |

A/D (Min.) separations are the Runway Occupancy Times (ROTs) from Observed Field Data of December 1996.

*Values include missed approach buffer, which is approximately 1 NM.

The A/A and D/A separations are based on the EWR approach speeds 145, 135, 140, 140, 140, 140. The D/D separations are based on departure occupancy times. D/A separations are based on departure occupancy times and arrival approach speeds. Therefore, Medium (Small Commuters) have the same separations as LC (Large Commuters). The A/A separations for Medium are based on the minimum separations of a Small and the missed approach buffer for a Medium, which has an approach speed of 140 knots.

Classes:

- HVY = Heavy
- 757 = 757
- LJ = Large Jet
- LC = Large Commuter (Large Commuters & Small Regional Jets)
- MED = Medium – Small Commuters & Business Jets (treated as Small for separations purposes)
- SM = Small twin & single engine props

**EWR IFR (RADAR) SEPARATIONS**

**Accepted by EWR Team on 6/28/97.**
**D/D separations – Revised on 8/28/97.**

**(In-trail Separations on Same Runway)**

| A/A (NM)* | *LEAD ARR* | *TRAIL ARR—* | HVY | 757 | LJ | LC | MED | SM | for all runways |
|---|---|---|---|---|---|---|---|---|---|
| | HVY | *(7110.65–Heavy)* | 5.20 | 6.12 | 6.16 | 6.16 | 7.16 | 7.16 | |
| | 757 | *(7110.65–757)* | 5.20 | 5.12 | 5.16 | 5.16 | 6.16 | 6.16 | |
| | LJ | *(7110.65–Large)* | 3.70 | 3.62 | 3.66 | 3.66 | 5.16 | 5.16 | |
| | LC | *(7110.65–Large)* | 3.70 | 3.62 | 3.66 | 3.66 | 5.16 | 5.16 | |
| | MED | *(7110.65–Small)* | 3.70 | 3.62 | 3.66 | 3.66 | 3.66 | 3.66 | |
| | SM | *(7110.65–Small)* | 3.70 | 3.62 | 3.66 | 3.66 | 3.66 | 3.66 | |

| D/D (MIN) | *LEAD DEP* | *TRAIL DEP—* | HVY | 757 | LJ | LC | MED | SM | for all runways |
|---|---|---|---|---|---|---|---|---|---|
| | HVY | *(7110.65–Heavy)* | 1.50 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | |
| | 757 | *(7110.65–757)* | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 | 1.5 using radar |
| | LJ | *(7110.65–Large)* | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| | LC | *(7110.65–Large)* | 1.60 | 1.60 | 1.60 | 1.00 | 1.00 | 1.00 | Includes Prop/Jet |
| | MED | *(7110.65–Small)* | 1.60 | 1.60 | 1.60 | 1.00 | 1.00 | 1.00 | Separation Based on |
| | SM | *(7110.65–Small)* | 1.60 | 1.60 | 1.60 | 1.00 | 1.00 | 1.00 | EWR/Data Collection |

**Departures on parallel runways use Radar separations – Revised 8/28/97.**
**Departures on Runway 29 use 2 minute separations – Revised 8/28/97.**

| D/A (NM) | *LEAD DEP* | *TRAIL ARR—* | HVY | 757 | LJ | LC | MED | SM | for all runways |
|---|---|---|---|---|---|---|---|---|---|
| | HVY | *(7110.65–Heavy)* | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | |
| | 757 | *(7110.65–757)* | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | |
| | LJ | *(7110.65–Large)* | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | |
| | LC | *(7110.65–Large)* | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | |
| | MED | *(7110.65–Small)* | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | |
| | SM | *(7110.65–Small)* | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | |

A/D (Min.) separations are the Runway Occupancy Times (ROTs) from Observed Field Data of December 1996.

*Values include missed approach buffer, which is approximately 1 NM.

The A/A and D/A separations are based on the EWR approach speeds 145, 135, 140, 140, 140, 140.

**WHO CAN USE THE REDUCED IFR SEPARATIONS (between similar class, non-Heavy aircraft):**

| *LEAD* | *TRAIL—* | HVY | 757 | LJ | LC | MED | SM |
|---|---|---|---|---|---|---|---|
| HVY | *(7110.65–Heavy)* | — | — | — | — | — | — |
| 757 | *(7110.65–757)* | — | — | — | — | — | — |
| LJ | *(7110.65–Large)* | YES | YES | YES | YES | — | — |
| LC | *(7110.65–Large)* | YES | YES | YES | YES | — | — |
| MED | *(7110.65–Small)* | YES | YES | YES | YES | YES | YES |
| SM | *(7110.65–Small)* | YES | YES | YES | YES | YES | YES |

Classes:

- HVY = Heavy
- 757 = 757
- LJ = Large Jet
- LC = Large Commuter (Large Commuters & Small Regional Jets)
- MED = Medium – Small Commuters & Business Jets (**treated as Small for separations purposes**)
- SM = Small twin & single engine props

**DEPENDENCIES for PARALLEL RUNWAYS** **Accepted by EWR Team on 8/28/97.**

**There are A/D and D/A dependencies between the parallel runways because they are closely spaced.**

**Wake vortex dependencies apply to A/A and D/D operations on EWR's closely spaced parallel runways – 4R/4L, 4L/4R, 22R/22L, and 22L/22R.**

WAKE VORTEX DEPENDENCY APPLIES BETWEEN THESE TYPES OF AIRCRAFT

| *LEAD* | *TRAIL*— | HVY | 757 | LJ | LC | MED | SM |
|---|---|---|---|---|---|---|---|
| HVY | *(7110.65–Heavy)* | YES | YES | YES | YES | YES | YES |
| 757 | *(7110.65–757)* | YES | YES | YES | YES | YES | YES |
| LJ | *(7110.65–Large)* | — | — | — | — | YES | YES |
| LC | *(7110.65–Large)* | — | — | — | — | YES | YES |
| MED | *(7110.65–Small)* | — | — | — | — | — | — |
| SM | *(7110.65–Small)* | — | — | — | — | — | — |

**A/A:** **VFR-1, VFR-2, IFR-1:** **Full Dependency for the above pairs of aircraft.**

**D/D:** **VFR-1, VFR-2, IFR-1:** **Full Dependency for the above pairs of aircraft.**

**A/D:** **VFR-1, VFR-2:** **N/A.**
**IFR-1:** **Landing assured for above pairs of aircraft. (12 seconds=0.2 minutes.) A departure can roll 12 seconds after the arrival crosses threshold.**

**D/A:** **VFR-1, VFR-2:** **N/A.**
**IFR-1:** **Full Dependency for the above pairs of aircraft.**

**ADDITIONAL DEPARTURE DEPENDENCIES on Parallels:** **Accepted by EWR Team on 1/28/98.**

There is a full dependency between departures on 4R and 4L in all weather conditions. All departures on the parallels go out in a single departure stream because of the departure airspace routes. Similarly, there is a full dependency between departures on 22R and 22L in all weather conditions.

**DEPENDENCIES between 11 & 29** **Accepted by EWR Team on 11/19/97.**

**NE & SW Flows – Calibration:** **There is no interleaving of arrivals on 11 and departures on 29.** The VFR D/A separations reflect the transition from departures on 29 to arrivals on 11: when the last departure on 29 starts its roll, the arrival to 11 must be 15 NM from threshold.

- **Arrival to 11 followed by a Departure on 29:**
  VFR-1 & VFR-2: An arrival to 11 must exit the runway before a departure on 29 can start its roll.
  IFR-1: N/A because no arrivals to 11 in IFR-1.
  **A/D separation: VFR-1 & VFR-2: 1 minute.** **IFR1: N/A.**

- **Departure on 29 followed by an Arrival to 11:**
  VFR-1 & VFR-2: When a departure on 29 starts its roll, an arrival to 11 must be 15 NM from threshold. **(Updated by Tracon on 8/28/97.)**
  IFR-1: N/A because no arrivals to 11 in IFR-1.
  **D/A separation: VFR-1 & VFR-2: 15 NM.** **IFR1: N/A.**

NOTE: **There are no dependencies associated with Arrivals on 29 or Departures on 11 because the Design Team agreed that these operations would not be simulated.**

**D/D SEPARATIONS on 29:** **Accepted by EWR Team on 11/19/97.**

The D/D Separations were modified at the August meeting: **there is a 2 minute D/D separation for all departures on 29 in all weather conditions.**

The new separation provides 5NM in-trail to departures on 29 so they can merge with departures on the parallels. Pages A-6 and A-7 (in Appendix A) were modified to reflect this change in the D/D separations.

**NOTES:** **Accepted by EWR Team on 11/19/97.**

**The Tower and the Tracon provided the following information which should help the Technical Center determine runway assignments and calibrate the model:**

- **There is no interleaving of arrivals on 11 and departures on 29.** The VFR D/A separations reflect the transition from departures on 29 to arrivals on 11: when the last departure on 29 starts its roll, the arrival to 11 must be 15 NM from threshold.

- **In the NE Flow, *eastbound* departures are not allowed on 29 because of the difficulty of merging departures on 29 with departures on 4s. Therefore, the NE Flow has fewer departures on 29 (in all weather conditions) than the SW Flow.**

- NE Flow in VFR-2: **The number of departures on 29 is greatly reduced during periods when EWR has arrivals on 11 and departures on 29, and TEB has arrivals on ILS Runway 6.** Departures on 29 must be released between arrivals on TEB's Runway 6. This will also affect EWR in IFR-1a conditions, when DCIA (an improvement) is simulated with arrivals on 11.

LAHSO – CALIBRATION: **Accepted by EWR Team on 11/19/97.**

LAND and HOLD SHORT OPERATIONS – Calibration:

**At the August meeting, the Design Team agreed that the EWR simulations should assume that any aircraft arriving on Runway 11 can land and hold short of 4/22.**

**The following describe the simulation of arrivals on 11:**

NE & SE flows: **Only aircraft who can LAHSO will be permitted to arrive on 11.**
**All PROPS can LASHO on 11.**
**Props are in Classes LC (Large Commuter), MEDIUM, & SMALL.**
**Regional Jets & Biz Jets *CANNOT* LAHSO on 11.**

CALIBRATION SIMULATIONS: **Accepted by EWR Team on 1/28/98.**

**The calibration simulations will not have mixed operations on the parallels.** There are approximately 5 departures per day that must use the outboard runway. Therefore, the sidestep is an irregular occurrence.

**EWR APPROACH SPEEDS (Knots)** **Accepted by EWR Team on 6/28/97.**

**The speed is given in knots for each class of aircraft flying along the common approach defined below.** The standard deviation is 5 knots. The model uses three standard deviations in selecting approach speeds. Therefore, the speeds may vary by 15 knots, plus or minus.

**The approach speeds were developed from the ANAMS data at EWR. On 5/29/97, the EWR Tower reviewed these speeds and stated they were reasonable.**

| | Class | H | 757 | LJ | LC | M | S |
|---|---|---|---|---|---|---|---|
| EWR - 1997 Observed | Knots | 145 | 135 | 140 | 140 | 140 | 140 |

**LENGTH OF FINAL COMMON APPROACH (NM)** **Accepted by EWR Team on 6/28/97.**

**For the simulations, the length of the final common approach is defined as the length along which speed control *cannot* be used to separate aircraft.**

At the April meeting, the Design Team stated the approach lengths were 5NM. They also said there was a 3NM final in VFR1 for Class S aircraft arriving on Runway 11. The ANAMS data verified those approach lengths and the EWR Tower accepted them on 5/29/97.

The ANAMS data indicated that Class S aircraft on Runway 11 in VFR had an average speed of 137 knots. Because there are approximately 10 Class S arrivals per day at EWR and the simulations would generate the same results, the Technical Center recommends using 5NM and 140 knot for Class S arrivals on all runways in VFR.

| | Class | H | 757 | LJ | LC | M | S |
|---|---|---|---|---|---|---|---|
| EWR | VFR | 5 | 5 | 5 | 5 | 5 | 5 |
| EWR | IFR | 5 | 5 | 5 | 5 | 5 | 5 |

**DEPARTURE RUNWAY OCCUPANCY TIMES (Sec)** **Accepted by EWR Team on 6/28/97.**

**These are the minimum times a departure is on the runway.** Runway crossing times and aircraft separations cannot violate these minimums. These values are used to develop the D/A (departure-to-arrival) separations. **On 5/29/97, the EWR Tower stated these values are reasonable and provide the appropriate separations.**

| | Class | H | 757 | LJ | LC | M | S |
|---|---|---|---|---|---|---|---|
| Standard | Seconds | 39 | 39 | 39 | 39 | 39 | 34 |

Source: Standard values used in most design team studies.

H = Heavy
757 = 757
LJ = Large Jet
LC = Large Commuter (Large Commuters & Small Regional Jets)
M = Medium – Small Commuters & Business Jets **(treated as Small for separations purposes)**
S = Small twin & single engine props

## ARRIVAL AIRCRAFT LATENESS DISTRIBUTION

**Accepted by EWR Team on 6/28/97.**

**(Arrival Variability Distribution – Revised 6/12/97)**

| Amount by which actual arrival time at threshold exceeds expected arrival time at threshold (Minutes) | Distribution of aircraft lateness (%) | Cumulative (%) | |
|---|---|---|---|
| -30 | 0.8% | 0.8% | Early |
| -20 | 2.0% | 2.8% | |
| -15 | 3.2% | 6.0% | |
| -10 | 6.4% | 12.4% | |
| -5 | 10.9% | 23.3% | |
| -2 | 8.0% | 31.3% | On Time |
| 0 | 5.5% | 36.8% | |
| 5 | 12.8% | 49.6% | Late |
| 10 | 10.2% | 59.8% | |
| 15 | 8.9% | 68.7% | |
| 30 | 11.3% | 80.0% | |
| 45 | 6.1% | 86.1% | |
| 60 | 3.6% | 89.7% | |
| 75 | 7.1% | 96.8% | |
| 90 | 1.8% | 98.6% | |
| 120 | 1.4% | 100.0 % | |

The arrival aircraft lateness distribution is shown as a cumulative probability. For each arrival, the lateness distribution is sampled and the resulting time is added to the scheduled arrival time. This input varies the arrival time of an aircraft during each iteration of the simulation. This table is read as follows: 0.8% of the aircraft arrived at the threshold at least 30 minutes early; 2.0% arrived between 20-30 minutes early; and 2.8% arrived at least 20 minutes early; etc.

**To simulate more realistic conditions, a lateness distribution (arrival variability distribution) is added to the scheduled arrival time. The distribution should represent the average deviation from the scheduled arrival time, excluding delays at the destination airport (EWR).**

**This distribution was presented in Data Package 3 and accepted by the Design Team on 6/28/97. It was developed from a 1996 Cater Delay Report by removing the average arrival taxi time. Thus, this distribution reflects the actual time at threshold versus expected time at threshold.**

Source: 1996 EWR Cater Data – Actual Time at Threshold versus Expected Time at Threshold.

**EWR AIRCRAFT GATE SERVICE TIMES** **Accepted by EWR Team on 8/28/97.**

**(Minimum Turn-Around Times in Minutes – Revised 8/20/97)**

**The gate service times (minimum turn-around times) represent the minimum time it takes to service an aircraft – from the time it arrives at the gate until pushback.**

**To simulate more realistic conditions, the departure time of a continuing arrival is adjusted to assure the aircraft meets its minimum turn-around time. If an aircraft arrives on time, its departure time is not adjusted.**

Newark has many International flights which require lengthy turn-around times. Over half of the Heavy aircraft have minimum turn-around times which are at least 1 hour (60 minutes). ADSIM will allow the Design Team to simulate EWR operations using the 3 gate service time distributions for Heavies described below.

For Small aircraft (small twin and single engine props), the minimum turn-around time is for Small cargo operations.

| H – DOMESTIC | | H – Int'l (Change Terminals) | | H – Other Int'l (Terminal B) | |
|---|---|---|---|---|---|
| Cumulative | | Cumulative | | Cumulative | |
| Time | Prob. | Time | Prob. | Time | Prob. |
| 45 | 0.55 | 120 | 0.19 | 60 | 0.33 |
| 50 | 0.73 | 140 | 0.28 | 90 | 0.61 |
| 60 | 1.00 | 150 | 1.00 | 100 | 0.71 |
| | | | | 120 | 1.00 |

**GATE SERVICE TIMES FOR HEAVIES**

**(used by ADSIM)**

Source: Updated 8/20/97
H – Domestic: Domestic Airlines
H – Int'l: CO & Alitalia
H – Other Int'l: Other International Flights

| 757 | | LJ | | LC | | M | | S | |
|---|---|---|---|---|---|---|---|---|---|
| Cumulative | | Cumulative | | Cumulative | | Cumulative | | Cumulative | |
| Time | Prob. | Time | Prob. | Time | Prob. | Time | Prob. | Time | Prob. |
| 45 | 0.22 | 30 | 0.31 | 20 | 0.16 | 15 | 0.29 | 45 | 1.00 |
| 50 | 0.87 | 35 | 0.88 | 30 * | 1.00 | 20 | 0.41 | | |
| 60 * | 1.00 | 40 | 0.91 | | | 30 | 1.00 | | |
| | | 45 * | 1.00 | | | | | | |

* Note:

Five percent (5%) of 757s are International flights which have minimum turn-around times of 150 minutes. Two percent (2%) of Large Jets are International flights which have minimum turn-around times of 90 minutes. Four percent (4%) of Large Commuters are Air Canada flights which have minimum turn-around times of 55 minutes. These times may be used when simulating International operations.

Source: Provided by the Airlines Serving EWR in March 1997.

## SIMULATED DEMAND CHARACTERISTICS

**Accepted by EWR Team on 8/28/97.**

### ANNUAL & DAILY DEMAND

| DEMAND LEVEL | ANNUAL OPERATIONS | DAILY OPERATIONS | EQUIVALENT DAYS |
|---|---|---|---|
| 1996 | 454,000 | 1,452 | 313 |
| FUTURE 1 | 500,000 | 1,597 | 313 |
| FUTURE 2 | 550,000 | 1,757 | 313 |

NOTE: (Annual Operations) / (Daily Operations) = Equivalent Days

### EWR DEMAND CHARACTERISTICS

#### Annual Distribution of Traffic

| DEMAND | AIR CARRIER | | COMMUTER/AIR TAXI | | GA & MILITARY | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| 1996 | 323,000 | 71.1% | 111,000 | 24.4% | 20,000 | 4.4% | 454,000 | 100.0% |
| FUTURE 1 | 350,000 | 70.0% | 130,000 | 26.0% | 20,000 | 4.0% | 500,000 | 100.0% |
| FUTURE 2 | 379,000 | 68.9% | 151,000 | 27.5% | 20,000 | 3.6% | 550,000 | 100.0% |

NOTES: **1996 distribution was based on the 1996 CATER data & Port's statistics.**
**Commuter & GA/MI counts were changed so that Air Taxis are included with Commuters.**
FAA Technical Center developed the FUTURE 1 & FUTURE2 distributions based on the following growth assumptions of the Port's forecasts for EWR:

* The number of GA & MI annual operations would remain constant.
* 41.7% of the increase in annual operations would be Commuters/Air Taxis.
* 58.3% of the increase in annual operations would be Air Carriers.
* 1996 would have 421,000 Air Carrier/Commuter/Air Taxi annual operations.
* FUTURE 1 would have 467,000 Air Carrier/Commuter/Air Taxi annual operations.
* FUTURE 2 would have 517,000 Air Carrier/Commuter/Air Taxi annual operations.

#### Daily Distribution of Traffic

| AIR CARRIER & COMMUTER/AIR TAXI | | GA & MILITARY | | TOTAL | |
|---|---|---|---|---|---|
| 1,388 | 95.6% | 64 | 4.4% | 1,452 | 100.0% |
| 1,533 | 96.0% | 64 | 4.0% | 1,597 | 100.0% |
| 1,693 | 96.4% | 64 | 3.6% | 1,757 | 100.0% |

 **Accepted by EWR Team on 8/28/97.**

**Overall – Daily Fleet Mix By Class** **7/31/97– Revised all mixes (BA41 is now a LC)**

| H | | 757 | | LJ | | LC | | M | | S | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 124 | 8.5% | 118 | 8.1% | 772 | 53.2% | 304 | 20.9% | 114 | 7.9% | 20 | 1.4% | 1,452 | 100.0% | Baseline |
| 254 | 15.9% | 284 | 17.8% | 584 | 36.6% | 336 | 21.0% | 119 | 7.5% | 20 | 1.3% | 1,597 | 100.0% | Future 1 |
| 282 | 16.1% | 314 | 17.9% | 644 | 36.7% | 370 | 21.1% | 127 | 7.2% | 20 | 1.1% | 1,757 | 100.0% | Future 2 |

**Air Carrier/Commuter/Air Taxi – Daily Fleet Mix By Class** **7/31/97– Revised all mixes (BA41 is now a LC)**

| H | | 757 | | LJ | | LC | | M | | S | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 124 | 8.9% | 118 | 8.5% | 768 | 55.3% | 294 | 21.2% | 80 | 5.8% | 4 | .3% | 1,388 | 100.0% | Baseline |
| 254 | 16.6% | 284 | 18.5% | 580 | 37.8% | 326 | 21.3% | 85 | 5.5% | 4 | .3% | 1,533 | 100.0% | Future 1 |
| 282 | 16.7% | 314 | 18.5% | 640 | 37.8% | 360 | 21.3% | 93 | 5.5% | 4 | .2% | 1,693 | 100.0% | Future 2 |

**GA & Military – Daily Fleet Mix By Class**

| H | | 757 | | LJ | | LC | | M | | S | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | .0% | 0 | .0% | 4 | 6.3% | 10 | 15.6% | 34 | 53.1% | 16 | 25.0% | 64 | 100.0% | Baseline |
| 0 | .0% | 0 | .0% | 4 | 6.3% | 10 | 15.6% | 34 | 53.1% | 16 | 25.0% | 64 | 100.0% | Future 1 |
| 0 | .0% | 0 | .0% | 4 | 6.3% | 10 | 15.6% | 34 | 53.1% | 16 | 25.0% | 64 | 100.0% | Future 2 |

NOTES: **7/31/97 – Fleet Mixes were revised at all demands; BA41 was reclassified as a Large–an LC in EWR study.**

Baseline Demand Characteristics developed from CATER data.

- Overall fleet mix – from Cater data, Calendar Year 1996.
- GA/MI fleet mix – from Cater data, 8/22/96 – assumed daily mix similar to annual mix.
- AC/Commuter/AT fleet mix – computed from the other Baseline fleet mixes.

Future 1 Demand Characteristics developed as follows: – Revised 7/7/97

- GA/MI fleet mix – same as GA/MI fleet mix in Baseline Demand.
- AC/Commuter/AT fleet mix – estimated from forecast data provided by the Port.
- Overall fleet mix – computed from the other Future 1 fleet mixes.

Future 2 Demand Characteristics developed as follows: – Revised 7/7/97

- GA/MI fleet mix – same as GA/MI fleet mix in Baseline Demand.
- AC/Commuter/AT fleet mix – same as Future 1 AC/Commuter/AT fleet mix.
- Overall fleet mix – computed from the other Future 2 fleet mixes.

**HOUR COUNTS – 1996 DEMAND (SCD-454)** **Accepted by EWR Team on 11/19/97.**

| LOCAL HOUR | ARRIVALS HOUR COUNTS | | | DEPARTURES HOUR COUNTS | | | TOTAL HOUR COUNTS | | |
|---|---|---|---|---|---|---|---|---|---|
| | AC | GA/MI | TOTAL | AC | GA/MI | TOTAL | AC | GA/MI | TOTAL |
| 0 | 18 | 3 | 21 | 0 | 1 | 1 | 18 | 4 | 22 |
| 1 | 4 | 1 | 5 | 3 | 1 | 4 | 7 | 2 | 9 |
| 2 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 2 |
| 3 | 4 | 0 | 4 | 14 | 0 | 14 | 18 | 0 | 18 |
| 4 | 3 | 0 | 3 | 7 | 0 | 7 | 10 | 0 | 10 |
| 5 | 10 | 0 | 10 | 4 | 0 | 4 | 14 | 0 | 14 |
| 6 | 10 | 3 | 13 | 20 | 2 | 22 | 30 | 5 | 35 |
| 7 | 20 | 2 | 22 | 48 | 1 | 49 | 68 | 3 | 71 |
| 8 | 56 | 3 | 59 | 60 | 1 | 61 | 116 | 4 | 120 |
| 9 | 17 | 6 | 23 | 62 | 0 | 62 | 79 | 6 | 85 |
| 10 | 15 | 3 | 18 | 18 | 3 | 21 | 33 | 6 | 39 |
| 11 | 57 | 2 | 59 | 18 | 1 | 19 | 75 | 3 | 78 |
| 12 | 29 | 1 | 30 | 60 | 2 | 62 | 89 | 3 | 92 |
| 13 | 44 | 0 | 44 | 21 | 2 | 23 | 65 | 2 | 67 |
| 14 | 42 | 0 | 42 | 47 | 1 | 48 | 89 | 1 | 90 |
| 15 | 47 | 0 | 47 | 46 | 4 | 50 | 93 | 4 | 97 |
| 16 | 60 | 2 | 62 | 46 | 2 | 48 | 106 | 4 | 110 |
| 17 | 33 | 1 | 34 | 59 | 2 | 61 | 92 | 3 | 95 |
| 18 | 70 | 0 | 70 | 37 | 0 | 37 | 107 | 0 | 107 |
| 19 | 35 | 1 | 36 | 60 | 4 | 64 | 95 | 5 | 100 |
| 20 | 40 | 1 | 41 | 36 | 0 | 36 | 76 | 1 | 77 |
| 21 | 30 | 2 | 32 | 12 | 3 | 15 | 42 | 5 | 47 |
| 22 | 24 | 1 | 25 | 8 | 0 | 8 | 32 | 1 | 33 |
| 23 | 25 | 0 | 25 | 8 | 1 | 9 | 33 | 1 | 34 |
| | 694 | 32 | 726 | 694 | 32 | 726 | 1388 | 64 | 1452 |

**NOTES:** **AC counts include Air Carrier, Commuter, and Air Taxi.**

**AC –** **OAG counts were supplemented to get AC counts.**
**OAG counts included Federal Express counts.**
**Federal Express supplied their schedules for 8/22/96.**

**GA/MI –** **They were based on the hourly EWR Tower counts for 8/22/96.**

## HOUR COUNTS – FUTURE 1 DEMAND (SCD-500) Accepted by EWR Team on 1/28/98.

| LOCAL HOUR | ARRIVALS HOUR COUNTS | | | DEPARTURES HOUR COUNTS | | | TOTAL HOUR COUNTS | | |
|---|---|---|---|---|---|---|---|---|---|
| | AC | GA/MI | TOTAL | AC | GA/MI | TOTAL | AC | GA/MI | TOTAL |
| 0 | 20 | 3 | 23 | 0 | 1 | 1 | 20 | 4 | 24 |
| 1 | 4 | 1 | 5 | 3 | 1 | 4 | 7 | 2 | 9 |
| 2 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 2 |
| 3 | 4 | 0 | 4 | 15 | 0 | 15 | 19 | 0 | 19 |
| 4 | 3 | 0 | 3 | 8 | 0 | 8 | 11 | 0 | 11 |
| 5 | 11 | 0 | 11 | 4 | 0 | 4 | 15 | 0 | 15 |
| 6 | 11 | 3 | 14 | 22 | 2 | 24 | 33 | 5 | 38 |
| 7 | 22 | 2 | 24 | 53 | 1 | 54 | 75 | 3 | 78 |
| 8 | 62 | 3 | 65 | 66 | 1 | 67 | 128 | 4 | 132 |
| 9 | 19 | 6 | 25 | 69 | 0 | 69 | 88 | 6 | 94 |
| 10 | 18 | 3 | 21 | 20 | 3 | 23 | 38 | 6 | 44 |
| 11 | 63 | 2 | 65 | 20 | 1 | 21 | 83 | 3 | 86 |
| 12 | 32 | 1 | 33 | 66 | 2 | 68 | 98 | 3 | 101 |
| 13 | 49 | 0 | 49 | 23 | 2 | 25 | 72 | 2 | 74 |
| 14 | 46 | 0 | 46 | 52 | 1 | 53 | 98 | 1 | 99 |
| 15 | 52 | 0 | 52 | 51 | 4 | 55 | 103 | 4 | 107 |
| 16 | 66 | 2 | 68 | 51 | 2 | 53 | 117 | 4 | 121 |
| 17 | 36 | 1 | 37 | 65 | 2 | 67 | 101 | 3 | 104 |
| 18 | 77 | 0 | 77 | 41 | 0 | 41 | 118 | 0 | 118 |
| 19 | 39 | 1 | 40 | 66 | 4 | 70 | 105 | 5 | 110 |
| 20 | 44 | 1 | 45 | 40 | 0 | 40 | 84 | 1 | 85 |
| 21 | 33 | 2 | 35 | 13 | 3 | 16 | 46 | 5 | 51 |
| 22 | 27 | 1 | 28 | 9 | 0 | 9 | 36 | 1 | 37 |
| 23 | 28 | 0 | 28 | 9 | 1 | 10 | 37 | 1 | 38 |
| | 767 | 32 | 799 | 766 | 32 | 798 | 1533 | 64 | 1597 |

NOTES: AC counts include Air Carrier, Commuter, and Air Taxi.

AC – Future 1 AC hour counts are 10.4% higher than 1996 AC hour counts.

GA/MI – GA/MI hour counts are the same at all 3 demand levels.

**HOUR COUNTS – FUTURE 2 DEMAND (SCD-550)** **Accepted by EWR Team on 1/28/98.**

| LOCAL HOUR | ARRIVALS HOUR COUNTS | | | DEPARTURES HOUR COUNTS | | | TOTAL HOUR COUNTS | | |
|---|---|---|---|---|---|---|---|---|---|
| | AC | GA/MI | TOTAL | AC | GA/MI | TOTAL | AC | GA/MI | TOTAL |
| 0 | 22 | 3 | 25 | 0 | 1 | 1 | 22 | 4 | 26 |
| 1 | 4 | 1 | 5 | 3 | 1 | 4 | 7 | 2 | 9 |
| 2 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 2 |
| 3 | 4 | 0 | 4 | 17 | 0 | 17 | 21 | 0 | 21 |
| 4 | 3 | 0 | 3 | 9 | 0 | 9 | 12 | 0 | 12 |
| 5 | 12 | 0 | 12 | 5 | 0 | 5 | 17 | 0 | 17 |
| 6 | 12 | 3 | 15 | 24 | 2 | 26 | 36 | 5 | 41 |
| 7 | 24 | 2 | 26 | 59 | 1 | 60 | 83 | 3 | 86 |
| 8 | 68 | 3 | 71 | 73 | 1 | 74 | 141 | 4 | 145 |
| 9 | 22 | 6 | 28 | 76 | 0 | 76 | 98 | 6 | 104 |
| 10 | 21 | 3 | 24 | 22 | 3 | 25 | 43 | 6 | 49 |
| 11 | 70 | 2 | 72 | 22 | 1 | 23 | 92 | 3 | 95 |
| 12 | 35 | 1 | 36 | 73 | 2 | 75 | 108 | 3 | 111 |
| 13 | 54 | 0 | 54 | 25 | 2 | 27 | 79 | 2 | 81 |
| 14 | 51 | 0 | 51 | 57 | 1 | 58 | 108 | 1 | 109 |
| 15 | 57 | 0 | 57 | 56 | 4 | 60 | 113 | 4 | 117 |
| 16 | 73 | 2 | 75 | 56 | 2 | 58 | 129 | 4 | 133 |
| 17 | 40 | 1 | 41 | 72 | 2 | 74 | 112 | 3 | 115 |
| 18 | 85 | 0 | 85 | 45 | 0 | 45 | 130 | 0 | 130 |
| 19 | 43 | 1 | 44 | 73 | 4 | 77 | 116 | 5 | 121 |
| 20 | 49 | 1 | 50 | 44 | 0 | 44 | 93 | 1 | 94 |
| 21 | 36 | 2 | 38 | 15 | 3 | 18 | 51 | 5 | 56 |
| 22 | 30 | 1 | 31 | 10 | 0 | 10 | 40 | 1 | 41 |
| 23 | 31 | 0 | 31 | 10 | 1 | 11 | 41 | 1 | 42 |
| | 847 | 32 | 879 | 846 | 32 | 878 | 1693 | 64 | 1757 |

NOTES: AC counts include Air Carrier, Commuter, and Air Taxi.

AC – Future 2 AC hour counts are 10.4% higher than the Future 1 AC hour counts.

GA/MI – GA/MI hour counts are the same at all 3 demand levels.

**EWR HOUR COUNT SUMMARY for 3 demand levels** **Accepted by EWR Team on 1/28/98.**

| LOCAL HOUR | SCD-454 (1996) HOUR COUNTS | | | SCD-500 (FUTURE 1) HOUR COUNTS | | | SCD-550 (FUTURE 2) HOUR COUNTS | | |
|---|---|---|---|---|---|---|---|---|---|
| | ARR | DEP | TOTAL | ARR | DEP | TOTAL | ARR | DEP | TOTAL |
| 0 | 21 | 1 | 22 | 23 | 1 | 24 | 25 | 1 | 26 |
| 1 | 5 | 4 | 9 | 5 | 4 | 9 | 5 | 4 | 9 |
| 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 |
| 3 | 4 | 14 | 18 | 4 | 15 | 19 | 4 | 17 | 21 |
| 4 | 3 | 7 | 10 | 3 | 8 | 11 | 3 | 9 | 12 |
| 5 | 10 | 4 | 14 | 11 | 4 | 15 | 12 | 5 | 17 |
| 6 | 13 | 22 | 35 | 14 | 24 | 38 | 15 | 26 | 41 |
| 7 | 22 | 49 | 71 | 24 | 54 | 78 | 26 | 60 | 86 |
| 8 | **59** | **61** | **120 *** | **65** | **67** | **132 *** | **71** | **74** | **145 *** |
| 9 | 23 | 62 | 85 | 25 | 69 | 94 | 28 | 76 | 104 * |
| 10 | 18 | 21 | 39 | 21 | 23 | 44 | 24 | 25 | 49 |
| 11 | 59 | 19 | 78 | 65 | 21 | 86 | 72 | 23 | 95 |
| 12 | 30 | 62 | 92 | 33 | 68 | 101 * | 36 | 75 | 111 * |
| 13 | 44 | 23 | 67 | 49 | 25 | 74 | 54 | 27 | 81 |
| 14 | 42 | 48 | 90 | 46 | 53 | 99 | 51 | 58 | 109 * |
| 15 | 47 | 50 | 97 | 52 | 55 | 107 * | 57 | 60 | 117 * |
| 16 | 62 | 48 | 110 * | 68 | 53 | 121 * | 75 | 58 | 133 * |
| 17 | 34 | 61 | 95 | 37 | 67 | 104 * | 41 | 74 | 115 * |
| 18 | 70 | 37 | 107 * | 77 | 41 | 118 * | 85 | 45 | 130 * |
| 19 | 36 | 64 | 100 * | 40 | 70 | 110 * | 44 | 77 | 121 * |
| 20 | 41 | 36 | 77 | 45 | 40 | 85 | 50 | 44 | 94 |
| 21 | 32 | 15 | 47 | 35 | 16 | 51 | 38 | 18 | 56 |
| 22 | 25 | 8 | 33 | 28 | 9 | 37 | 31 | 10 | 41 |
| 23 | 25 | 9 | 34 | 28 | 10 | 38 | 31 | 11 | 42 |
| | 726 | 726 | 1452 | 799 | 798 | 1597 | 879 | 878 | 1757 |

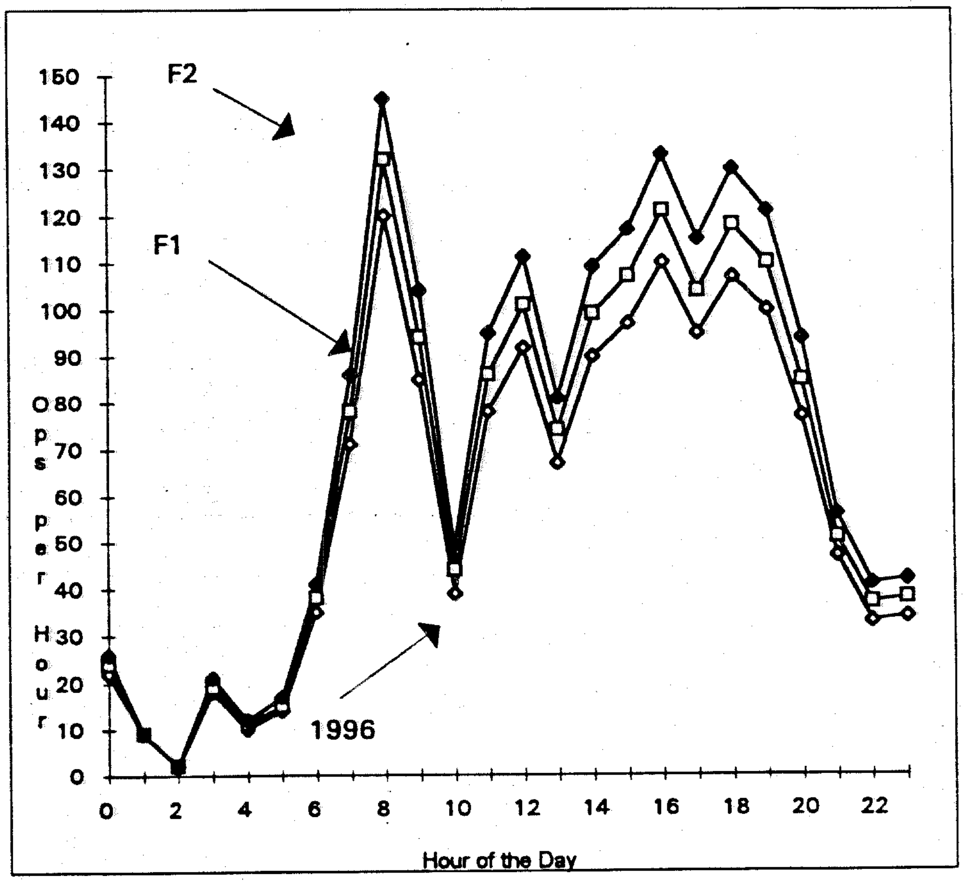
NOTES: **Counts include AC (Air Carrier/Commuter/Air Taxi), GA, and MI.**

**1996 –**
**Highest hour count is 120 – at 8am.**
**4 hours have counts of at least 100. See *.**
**Between 3pm and 8pm, the number of hourly ops ranges from 95 to 110.**

**Future 1 –**
**Highest hour count is 132 – at 8am.**
**7 hours have counts of at least 100. See *.**
**Between 3pm and 8pm, the number of hourly ops ranges from 104 to 121.**

**Future 2 –**
**Highest hour count is 145 – at 8am.**
**9 hours have counts of at least 100. See *.**
**Between 3pm and 8pm, the number of hourly ops ranges from 115 to 133.**

| HOUR | 1996 | F1 | F2 |
|---|---|---|---|
| 0 | 22 | 24 | 26 |
| 1 | 9 | 9 | 9 |
| 2 | 2 | 2 | 2 |
| 3 | 18 | 19 | 21 |
| 4 | 10 | 11 | 12 |
| 5 | 14 | 15 | 17 |
| 6 | 35 | 38 | 41 |
| 7 | 71 | 78 | 86 |
| 8 | 120 | 132 | 145 |
| 9 | 85 | 94 | 104 |
| 10 | 39 | 44 | 49 |
| 11 | 78 | 86 | 95 |
| 12 | 92 | 101 | 111 |
| 13 | 67 | 74 | 81 |
| 14 | 90 | 99 | 109 |
| 15 | 97 | 107 | 117 |
| 16 | 110 | 121 | 133 |
| 17 | 95 | 104 | 115 |
| 18 | 107 | 118 | 130 |
| 19 | 100 | 110 | 121 |
| 20 | 77 | 85 | 94 |
| 21 | 47 | 51 | 56 |
| 22 | 33 | 37 | 41 |
| 23 | 34 | 38 | 42 |
| | 1452 | 1597 | 1757 |




NOTES: AC – Future 1 AC hour counts are 10.4% higher than 1996 AC hour counts.
Future 2 AC hour counts are 10.4% higher than the Future 1 AC hour counts.

GA/MI – GA/MI hour counts are the same at all 3 demand levels.

As agreed upon by the Design Team, no attempt was made to smooth out hourly counts at higher demands. AC, GA/MI maintain their own peaking characteristics.

**WEATHER CATEGORIES AND MINIMA** Accepted by EWR Team on 11/19/97.

## (Operational Procedures and Minima -- EWR CALIBRATION)

(Revised on 10/2/97)

**VFR-1:**

**77.5 %**

**Ceiling ≥ 3,500' *and* Visibility ≥ 5 miles.**

Visual (VFR-1) separations for A/A, A/D, and D/A.
Radar (IFR1) separations for D/D on all runways.
LARGE COMMUTERS (and smaller aircraft) depart 29 at Intersection Romeo.
Regional Jets cannot depart at Intersection Romeo. They depart on 4/22.
Simultaneous approaches to 11 and either 4R or 4L.
Simultaneous approaches to 11 and either 22R or 22L (with LAHSO).

**VFR-2:**

**14.2 %**

**Less than VFR-1, *and*, Ceiling ≥ 1,000' *and* Visibility ≥ 3 miles.**

Radar (IFR) separations for A/A & D/D on all runways.
Visual (VFR-1) separations for A/D & D/A.
Simultaneous approaches to 11 and either 4R or 4L.
Simultaneous approaches to 11 and either 22R or 22L (with LAHSO).

**IFR-1a:**

**4.1 %**

**Less than VFR-2, *and*, Ceiling ≥ 600' *and* Visibility ≥ 2 miles.**

**These are the CAT I minima for Runway 11. Currently, there are no arrivals on 11 in IFR-1a.**

IFR separations.

**IFR-1b:**

**<4.2 %**

**Less than IFR-1a, *and*, Ceiling ≥ 200' *and* Visibility ≥ 3/8 miles.**

**What percent of the time is EWR *below* IFR-1a (CAT I minima for 11) and *above* CAT I minima for 4/22s?**

IFR separations.

**IFR-2:**

**? %**

**Less than IFR-1b. Weather is CAT II or below.**

**What percent of the time is EWR *below* IFR-1b (CAT I minima for 4/22s)?**

IFR separations.

Note:

| | | |
|---|---|---|
| CAT I ILS: | Runway 11: | Minima are 604' & 2 miles. |
| CAT I ILS: | Runways 4s & 22s : | Minima are 200' and 3/8 mile. |
| CAT II ILS: | Runway 4R: | Minima are 162'/16'. |

Notes: ***<u>On 11/19/97, the Design Team agreed not to simulate IFR-2.</u>*** **For simulation purposes, CAT II is similar to CAT I in IFR-1b, with one exception -- there is only one CAT II arrival runway. Simulating IFR-1b captures most of the annual delays associated with CAT II. None of the improvements affect CAT II. The Technical Center recommended simulating IFR-1b 4.2% of the year and not simulating IFR-2. The 1995 Study utilized the same technique.**

**At the June meeting, the Design Team stated CRDA is available but would not be used until 1998.**

**Source of weather categories, minimums, and percent occurrence: Based on EWR Study, 1995.**

**<u>WEATHER CATEGORIES & CONFIGURATIONS (Observed)</u>** **Accepted by EWR Team on 11/19/97.**

(REVISED 10/3/97)

**The following data represent the daytime runway use, by weather category, based on the 1995 EWR study. It was based on 12 years of *observed* data.**

**EXISTING DAYTIME RUNWAY USE BY WEATHER CATEGORY (based on 1995 EWR Study)**

| | | VFR-1 | VFR-2 | IFR-1a | ≤IFR-1b | TOTAL |
|---|---|---|---|---|---|---|
| 4, 11, 29 | (winds permit LAHSOs on 11) | 16.5% | 5.8% | 2.2% | 2.3% | 26.8% |
| 4, 11, 29 | (winds prevent LAHSOs on 11) | 8.4% | 0.6% | 0.1% | 0.0% | 9.1% |
| 4, 29 | (winds prevent use of 11) | 5.3% | 0.2% | 0.0% | 0.0% | 5.5% |
| | **NE Flow Subtotal** | **30.2%** | **6.6%** | **2.3%** | **2.3%** | **41.4%** |
| 22, 11, 29 | (winds permit LAHSOs on 11) | 21.3% | 4.3% | 1.2% | 1.3% | 28.1% |
| 22, 11, 29 | (winds prevent LAHSOs on 11) | 15.1% | 2.0% | 0.4% | 0.3% | 17.8% |
| 22, 29 | (winds prevent use of 11) | 8.1% | 0.8% | 0.1% | 0.1% | 9.1% |
| | **SW Flow Subtotal** | **44.5%** | **7.1%** | **1.7%** | **1.7%** | **55.0%** |
| 4 only or 22 only | | 1.9% | 0.4% | 0.1% | 0.2% | 2.6% |
| 11 only or 29 only | | 0.9% | 0.1% | 0.0% | 0.0% | 1.0% |
| | **TOTAL** | **77.5%** | **14.2%** | **4.1%** | **4.2%** | **100.0%** |

**Notes:**

1. Runway use percentages were based on the following wind component restrictions:

| | <u>Max Crosswind</u> | <u>Max Tailwind</u> |
|---|---|---|
| 4 & 22 | 20 knots | Calm |
| 11 with LAHSO | 15 knots | **Calm (See note 5)** |
| 11 & 29 without LAHSO | 15 knots | 10 knots |

2. Use of 11 & 29 restricted to LC/MED/SM aircraft when 4 or 22 were available for use.
3. Daytime hours are 6am to 11pm.
4. Winds prevent use of 29 approximately 1.5% of the year. Because of its small percent of occurrence, this configuration was not modeled explicitly in the 1995 study.
5. **On 8/28/97, Design Team revised Max Tailwind to "Calm" for 11 with LAHSO.**
6. **Design Team will try to reconfirm percentages of occurrence of 11 with LAHSO.**
7. **Design Team will try to determine percentage of occurrence of IFR-2.**

**Source of weather categories, minimums, and percent occurrence: Based on EWR Study, 1995.** The percentages were developed by Leigh Fisher Associates (LFA) for the 1995 Study. LFA tabulated the hourly weather data for January 1, 1981, through December 31, 1993, from the National Climatic Data Center, Asheville, North Carolina. The tabulations reflect percent of occurrence during daytime hours, 6am to 11pm.

**EWR AIRLINE GATE ASSIGNMENTS**

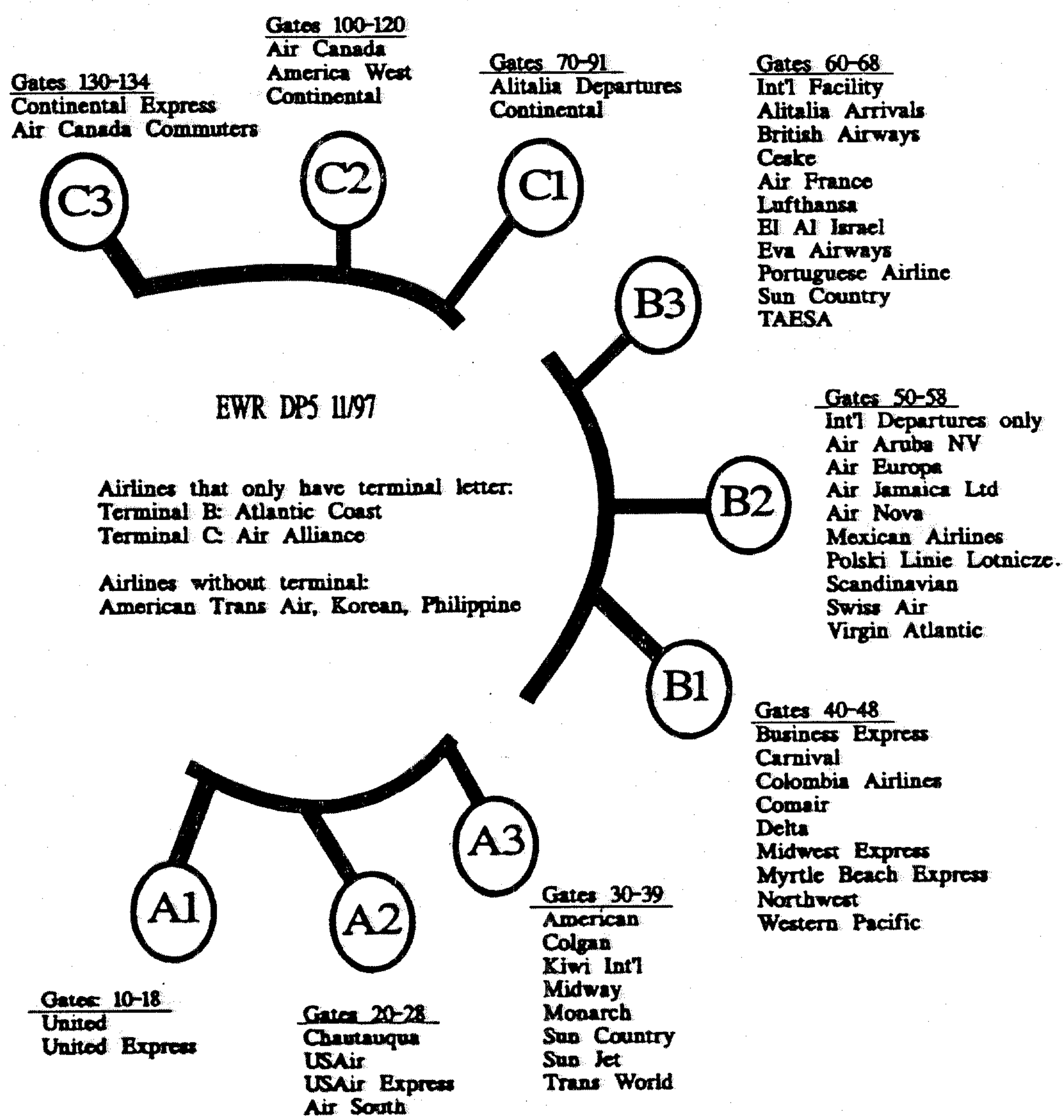
**Accepted by EWR Team on 8/28/97.**
**Updated C2 & C3 on 10/28/97.**

| AIRLINE(S) | OAG CODE | FAA CODE | TERMINAL/GATES |
|---|---|---|---|
| Air Alliance | | AAQ | C2: C100-C115 |
| AirBC | ZX | ABL | ? |
| Air Canada | AC | ACA | C2: C100-C115 |
| Air Canada Commuters | AC | ACA | C3 |
| Air Nova | QK | ARN | C2: C100-C115 |
| Alitalia | AZ | AZA | B3 & C1: B60-B68, C70*-C79 |
| American | AA | AAL | A3: A30-A35 |
| America West | HP | AWE | C2: C120 |
| America West Commuters | HP | AWE | C3 |
| Business Express | | GAA | B1: B43-B48 |
| Carnival | KW | CAA | B1: B40-B42 |
| Chautauqua | | CHQ | A2: A25-A26 |
| Colgan Air | 9X | CJC | A3: A36-A39 |
| Comair | | COM | B1: B43-B48 |
| Continental | CO | COA | C1 & C2: C70*-C120 |
| Continental Express | CO | BTA | C3: C130-C134 |
| Delta | DL | DAL | B1: B43-B48 |
| International Departures only | | | B:2 B51-B57 (Int'l) |
| International Facility | | | B3: B60-B68 (Int'l) |
| Jet Express | JI | YPX | A3 |
| Jet Train Corporation | LF | JTN | A3 |
| Kiwi International | KP | KIA | A3: A30-A35 |
| Midway | | MDW | A3: A30-A35 |
| Midwest Air Express | YX | MEP | B1: B40-B42 |
| Monarch | | MON | A3: A36-A39 |
| Myrtle Beach | | | B1: B40-B42 |
| Northwest | NW | NWA | B1: B40-B42 |
| Trans World Airlines | TW | TWA | A3: A36-A39 |
| Scandinavian Airlines | SK | SAS | B3 |
| Sun Country (Charter) | SY | SCX | A3: A36-A39 |
| Sun Jet | | SJI | A3: A36-A39 |
| SwissAir | SR | SWR | B1 & B2: B43-B48, B51-57 |
| United | UA | UAL | A1: A10-A18 |
| United Express (Atlantic Coast) | UA | UAL | A1: A10-A18 |
| US Airways | US | USA | A2: A20-A24, A27-A28 |
| USAir Express (Allegheny, Commutair, Henson) | US | USA | A2: A25-A26 |
| Western Pacific | | KMR | B1: B43-B48 |

**Notes: 10/28/97: Updated C2 and C3.**
**9/5/97: Updated Jet Express, Jet Train Corp., and Scandinavian Airlines.**
* Gate C70 is not operational.
The International Facility is located in Terminal B. Not all International Carriers are shown.
Cargo operators: EB (Emery), ER (DHL), FX, 1A, 1F (Airborne), 1V, 5X (UPS), 8W.

**EWR GATE MAP**

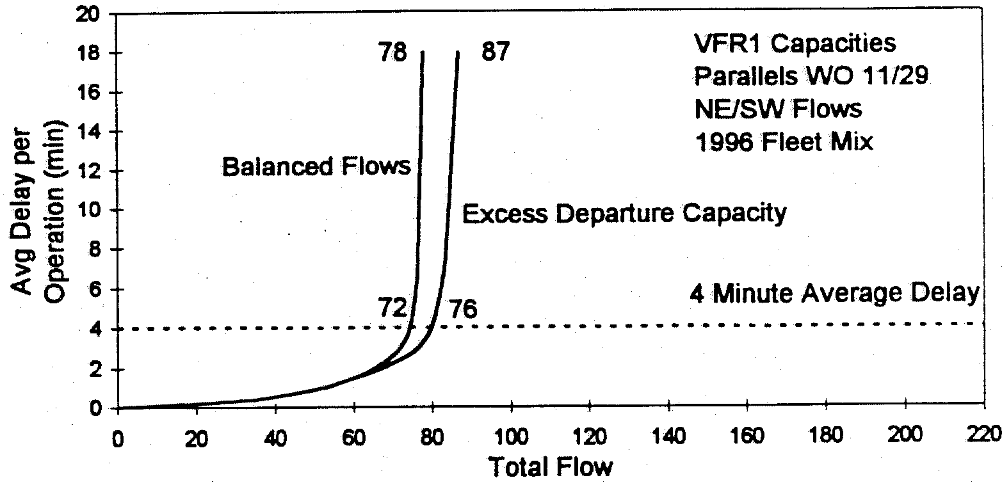
**Accepted by EWR Team on 8/28/97.**
**Updated Gates C2 & C3 on 10/28/97**

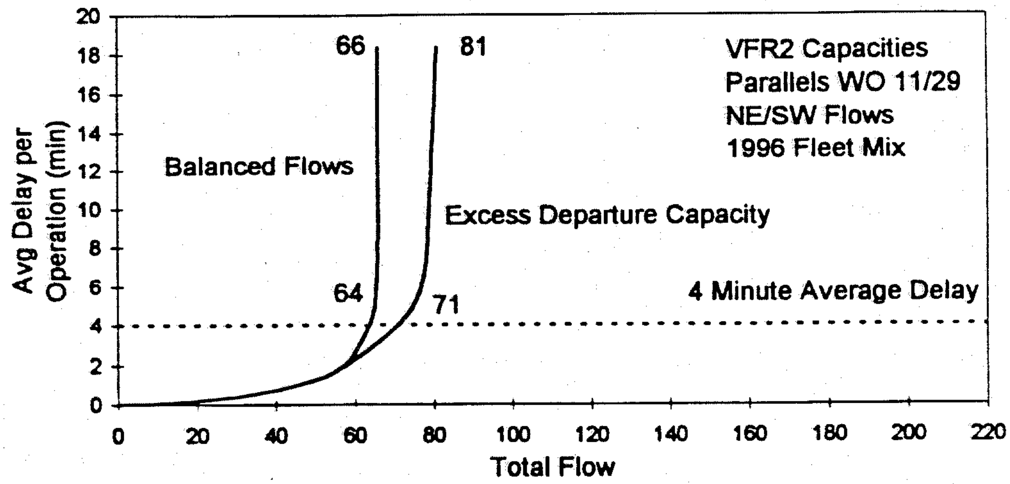


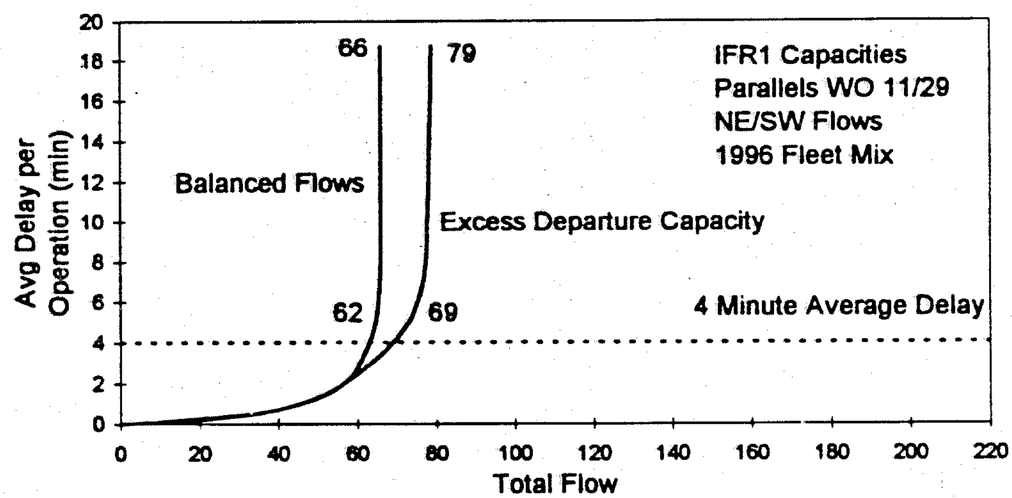
# APPENDIX B

# ACCEPTED RESULTS

(EWR Existing Airport – Current Fleet Mix – 50/50 Split – Parallels WO 11/29)



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# EWR ADSIM RESULTS -- DAILY DELAYS AND TRAVEL TIMES (in minutes) -- ACCEPTED BY DESIGN TEAM

| Demand Level | Annual Ops | Daily Operations ARR | DEP | TOTAL |
|---|---|---|---|---|
| 1996 | 454,000 | 726 | 726 | 1,452 |
| Future 1 | 500,000 | 799 | 798 | 1,597 |
| Future 2 | 550,000 | 879 | 878 | 1,757 |

| | | | | | |
|---|---|---|---|---|---|
| CON1 | NE | VFR1 | ARR = 4R,11 | DEP = 4L, 29 | |
| CON1 | NE | VFR2 | ARR = 4R,11 | DEP = 4L, 29 | |
| CON1 | NE | IFR1 | ARR = 4R | DEP = 4L, 29 | |
| CON2 | SW | VFR1 | ARR = 22L, 11 | DEP = 22R, 29 | |
| CON2 | SW | VFR1-R | ARR = 22L, (11) | DEP = 22R, 29 | Restricted Use of 11. Simulated with some arrivals on 11. |
| CON2 | SW | VFR2 w 11 | ARR = 22L, 11 | DEP = 22R, 29 | |
| CON2 | SW | VFR2 wo 11 | ARR = 22L | DEP = 22R, 29 | |
| CON2 | SW | IFR1 | ARR = 22L | DEP = 22R, 29 | |

| EXPERIMENT # | | | ARRIVALS FLOW RATE | AIR DELAY | TAXI-IN DELAY | RWY-XNG DELAY | / DEPARTURES FLOW /RATE | RUNWAY DELAY | TAXI-OUT DELAY | RWY-XNG DELAY | ENRTE /GTE-HLD | GTE-HLD RWY-CNG | / TOTAL GROUND DELAYS / | TOTAL TRAVEL TIMES ARRIVAL AIR | ARRIVAL GROUND | DEPARTURE GROUND | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **(0) CALIBRATION -- 1996 Demand (454,000 Annual Ops)** | | | | | | | | | | | | | | | | | |
| 101KT | NE VFR1 | TOTAL | 726.0 | 6914.7 | 124.2 | 89.6 | 726.0 | 4984.3 | 639.5 | 8.4 | 0.0 | 0.0 | 5845.9 | 14143.8 | 4217.8 | 9074.9 | 27436.6 |
| 102LT | NE VFR2 | TOTAL | 726.0 | 13047.1 | 129.8 | 83.4 | 726.0 | 7503.0 | 631.6 | 7.3 | 0.0 | 0.0 | 8355.1 | 20286.4 | 4217.7 | 11621.0 | 36125.1 |
| 103FT | NE IFR1 | TOTAL | 726.0 | 69329.7 | 18.5 | 75.6 | 726.0 | 4562.2 | 490.4 | 3.2 | 0.0 | 0.0 | 5149.9 | 76556.7 | 4136.0 | 8287.8 | 88980.4 |
| 105OT | SW VFR1 | TOTAL | 726.0 | 6696.6 | 800.0 | 108.0 | 726.0 | 5583.4 | 1374.2 | 10.9 | 0.0 | 0.0 | 7876.5 | 13939.5 | 4984.5 | 10714.7 | 29638.7 |
| 106ET | SW VFR1-R | TOTAL | 726.0 | 10116.4 | 390.2 | 118.5 | 726.0 | 8083.4 | 1783.9 | 6.5 | 0.0 | 0.0 | 10382.5 | 17336.2 | 4611.7 | 13607.2 | 35555.2 |
| 107AT | SW VFR2 w 11 | TOTAL | 726.0 | 13071.3 | 1850.1 | 101.8 | 726.0 | 6878.7 | 1566.8 | 8.7 | 0.0 | 0.0 | 10406.1 | 20318.9 | 6025.5 | 12216.1 | 38560.5 |
| 108AT | SW VFR2 wo 11 | TOTAL | 726.0 | 70115.7 | 14.3 | 87.2 | 726.0 | 2546.8 | 855.2 | 4.3 | 0.0 | 0.0 | 3507.8 | 77344.9 | 4390.7 | 7171.5 | 88907.1 |
| 109ET | SW IFR1 | TOTAL | 726.0 | 71204.8 | 28.0 | 80.3 | 726.0 | 4391.2 | 891.9 | 4.6 | 0.0 | 0.0 | 5396.0 | 78411.2 | 4381.2 | 9042.9 | 91835.2 |
| **(0) CALIBRATION -- Future 1 Demand (500,000 Annual Ops)** | | | | | | | | | | | | | | | | | |
| 401FT | NE VFR1 | TOTAL | 799.0 | 32213.4 | 1388.0 | 100.5 | 798.0 | 13428.3 | 1786.2 | 9.4 | 0.0 | 337.5 | 17049.8 | 40131.9 | 5999.3 | 19257.0 | 65388.2 |
| 402DT | NE VFR2 | TOTAL | 799.0 | 62809.3 | 2072.9 | 85.3 | 798.0 | 15779.3 | 2808.8 | 8.7 | 0.0 | 660.5 | 21415.5 | 70794.2 | 6676.6 | 22939.1 | 100409.8 |
| 403OT | NE IFR1 | TOTAL | 799.0 | 150189.3 | 233.4 | 79.5 | 798.0 | 9620.3 | 697.0 | 1.6 | 0.0 | 227.0 | 10858.9 | 157874.6 | 4843.9 | 14084.8 | 176803.4 |
| 405HT | SW VFR1 | TOTAL | 799.0 | 35222.6 | 1251.9 | 119.5 | 798.0 | 13234.0 | 3221.3 | 12.5 | 0.0 | 472.8 | 18312.1 | 43196.4 | 5796.8 | 21118.8 | 70112.0 |
| 406DT | SW VFR1-R | TOTAL | 799.0 | 39182.6 | 673.2 | 127.2 | 797.9 | 15175.2 | 5484.1 | 10.4 | 0.0 | 3458.8 | 24928.9 | 47137.8 | 5283.1 | 28251.2 | 80672.1 |
| 407ET | SW VFR2 w 11 | TOTAL | 799.0 | 70767.1 | 3565.1 | 108.8 | 798.0 | 13285.6 | 3929.1 | 10.9 | 0.0 | 142.0 | 21041.5 | 78653.9 | 8091.8 | 21434.6 | 108180.3 |
| 408CT | SW VFR2 wo 11 | TOTAL | 799.0 | 149414.0 | 58.3 | 93.8 | 798.0 | 5843.3 | 1005.6 | 2.9 | 0.0 | 86.0 | 7089.9 | 157139.2 | 4835.3 | 11136.9 | 173111.3 |
| 409DT | SW IFR1 | TOTAL | 799.0 | 147531.2 | 147.7 | 87.7 | 798.0 | 9567.3 | 1265.3 | 3.7 | 0.0 | 229.5 | 11301.2 | 155193.3 | 4912.2 | 15249.9 | 175355.4 |

For delay calculations, we will consider 409DT ARR delays equal to 408CT ARR delays -- it eliminates differences due only

## (C1) *LDA Offset Approaches to 4s (affects only NE Flow) – 1996 and Future 1*

VFR-1 delays were the same as those in PKG (D), *Dual Parallel Visual Approaches.*

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| =221GT | NE VFR1 | RESULTS = DUAL VISUALS -- NE VFR1 | | | | | | | | | | | | | | | |
| 222BT | NE VFR2 | TOTAL | 726.0 | 8806.5 | 650.4 | 94.8 | 726.0 | 9910.7 | 886.2 | 6.9 | 0.0 | 0.0 | 11549.0 | 16051.5 | 4744.2 | 14287.4 | 35083.1 |
| =521DT | NE VFR1 | RESULTS = DUAL VISUALS -- NE VFR1 | | | | | | | | | | | | | | | |
| 522DT | NE VFR2 | TOTAL | 799.0 | 48081.2 | 1367.8 | 103.5 | 798.0 | 17302.2 | 3823.4 | 8.6 | 0.0 | 2863.6 | 25469.0 | 56011.2 | 5957.6 | 27761.8 | 89730.7 |

## (E) SCIA (in NE Flow) -- 1996 and Future 1

SCIA benefits the NE Flow in IFR-1A by allowing EWR to operate as it does in NE VFR-2.

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 233AT | NE IFR1 | TOTAL | 726.0 | 12801.8 | 191.9 | 83.5 | 726.0 | 8567.6 | 675.6 | 6.8 | 0.0 | 0.0 | 9525.3 | 20051.1 | 4285.8 | 12732.7 | 37069.6 |
| 533AT | NE IFR1 | TOTAL | 799.0 | 61233.1 | 1914.1 | 93.3 | 797.91 | 6962.5 | 2668.1 | 8.0 | 0.0 | 548.5 | 22194.4 | 69248.5 | 6528.8 | 23981.4 | 99758.7 |

## (F) *Reduce Minimum In-Trail IFR Separation To 2.0 NM – 1996 and Future 1*

This improvement permits reduced in-trail IFR separations of 2.0 NM for similar class non-heavy aircraft. We simulated this scenario with reduced occupancy times by assuming that aircraft would exit within 6,500 feet of threshold. This technique eliminated the high occupancy times (>70 seconds for Heavies) associated with exit Y on 4R/L and exit N on 22R.

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 242AT | NE VFR2 | TOTAL | 726.0 | 12272.3 | 178.4 | 84.5 | 726.0 | 7777.6 | 661.7 | 7.0 | 0.0 | 0.0 | 8709.1 | 19525.2 | 4263.3 | 11927.6 | 35716.1 |
| 243DT | NE IFR1 | TOTAL | 726.0 | 67218.2 | 26.8 | 75.3 | 726.0 | 4556.0 | 488.5 | 3.0 | 0.0 | 0.0 | 5149.5 | 74394.6 | 4126.3 | 8268.1 | 86788.9 |
| 247AT | SW VFR2 w 11 | TOTAL | 726.0 | 11439.0 | 2378.6 | 104.0 | 726.0 | 7161.6 | 1825.2 | 8.2 | 0.0 | 0.0 | 11477.5 | 18678.3 | 6554.2 | 12732.1 | 37964.7 |
| 248AT | SW VFR2 wo 11 | TOTAL | 726.0 | 66554.5 | 16.8 | 89.3 | 726.0 | 2474.9 | 878.4 | 4.0 | 0.0 | 0.0 | 3463.4 | 73657.8 | 4391.6 | 7111.5 | 85160.9 |
| 249DT | SW IFR1 | TOTAL | 726.0 | 66886.1 | 23.8 | 82.9 | 725.9 | 4642.2 | 871.3 | 4.7 | 0.0 | 0.0 | 5624.7 | 73935.7 | 4396.2 | 9272.8 | 87604.7 |
| 542AT | NE VFR2 | TOTAL | 799.0 | 60228.0 | 1442.0 | 90.2 | 798.0 | 15251.0 | 2038.1 | 8.7 | 0.0 | 325.0 | 19155.1 | 68241.2 | 6046.7 | 21434.0 | 95721.9 |
| 543JT | NE IFR1 | TOTAL | 799.0 | 145072.4 | 214.0 | 81.9 | 797.9 | 10132.4 | 710.3 | 2.0 | 0.0 | 230.5 | 11371.0 | 153006.5 | 4832.2 | 14620.5 | 172459.2 |
| 547CT | SW VFR2 w 11 | TOTAL | 799.0 | 66759.3 | 3770.0 | 113.6 | 797.9 | 14385.7 | 3928.3 | 11.9 | 0.0 | 288.0 | 22497.5 | 74772.8 | 8380.0 | 22658.2 | 105811.0 |
| 548DT | SW VFR2 wo 11 | TOTAL | 799.0 | 144720.0 | 44.2 | 92.1 | 798.0 | 5950.3 | 955.3 | 2.7 | 0.0 | 99.5 | 7144.1 | 152677.6 | 4873.9 | 11201.7 | 168753.3 |
| 549FT | SW IFR1 | TOTAL | 799.01 | 44888.3 | 155.9 | 91.2 | 798.0 | 9722.5 | 1299.6 | 3.6 | 0.0 | 168.5 | 11441.3 | 152691.4 | 4978.2 | 15381.7 | 173051.3 |

## *(G) Props Can Do Immediate Divergent Turns – 1996 and Future I*

This improvement permits props on the parallel runways to diverge, eliminating the existing prop/jet departure penalty. The D/D separation becomes 1.0 minute instead of the current 1.6 minutes. This operation would be possible if the noise restrictions were relaxed and the NY airspace were changed.

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 251AT | NE VFR1 | TOTAL | 726.0 | 7204.9 | 91.7 | 87.3 | 726.0 | 3943.5 | 625.0 | 8.7 | 0.0 | 0.0 | 4756.3 | 14442.4 | 4186.0 | 8016.4 | 26644.9 |
| 252AT | NE VFR2 | TOTAL | 726.0 | 12336.1 | 48.0 | 85.7 | 726.0 | 4317.0 | 590.0 | 6.9 | 0.0 | 0.0 | 5047.6 | 19583.0 | 4141.6 | 8395.9 | 32120.5 |
| 253AT | NE IFR1 | TOTAL | 726.0 | 71157.4 | 11.3 | 74.8 | 726.0 | 3949.6 | 460.9 | 2.6 | 0.0 | 0.0 | 4499.3 | 78385.1 | 4120.9 | 7638.9 | 90144.9 |

For delay calculations, we will consider 253AT delays equal to CALIBRATION delays -- it eliminates differences due only to random number generator.

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 255AT | SW VFR1 | TOTAL | 726.0 | 6964.5 | 443.1 | 110.9 | 726.0 | 4385.2 | 1278.7 | 8.7 | 0.0 | 0.0 | 6226.7 | 14207.4 | 4632.1 | 9426.6 | 28266.2 |
| 256AT | SW VFR1-R | TOTAL | 726.0 | 10110.2 | 162.1 | 121.0 | 726.0 | 5561.1 | 1344.1 | 5.7 | 0.0 | 0.0 | 7194.0 | 17342.5 | 4386.0 | 10670.0 | 32398.5 |
| 257AT | SW VFR2 w 11 | TOTAL | 726.0 | 12953.6 | 863.1 | 107.7 | 726.0 | 4841.4 | 1407.5 | 9.0 | 0.0 | 0.0 | 7228.8 | 20196.9 | 5047.4 | 10005.5 | 35249.8 |
| 258AT | SW VFR2 wo 11 | TOTAL | 726.0 | 69563.1 | 29.7 | 91.3 | 725.9 | 2040.2 | 886.4 | 4.0 | 0.0 | 0.0 | 3051.7 | 76792.7 | 4400.7 | 6689.7 | 87883.1 |
| 259AT | SW IFR1 | TOTAL | 726.0 | 70004.1 | 28.2 | 85.6 | 726.0 | 3983.8 | 886.9 | 4.5 | 0.0 | 0.0 | 4989.1 | 77238.0 | 4400.8 | 8633.4 | 90272.2 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 551AT | NE VFR1 | TOTAL | 799.0 | 32091.2 | 443.7 | 100.8 | 798.0 | 10019.3 | 902.3 | 8.2 | 0.0 | 44.0 | 11518.4 | 40024.5 | 5043.9 | 14713.9 | 59782.3 |
| 552AT | NE VFR2 | TOTAL | 799.0 | 63203.8 | 318.2 | 91.8 | 798.0 | 10224.6 | 877.0 | 7.4 | 0.0 | 8.5 | 11527.5 | 71237.3 | 4911.6 | 14910.6 | 91059.5 |
| 553AT | NE IFR1 | TOTAL | 799.0 | 149577.5 | 124.9 | 81.3 | 798.0 | 8670.5 | 596.2 | 1.7 | 0.0 | 124.0 | 9598.6 | 157206.7 | 4734.1 | 12937.3 | 174878.0 |
| 555AT | SW VFR1 | TOTAL | 799.0 | 34956.2 | 519.0 | 124.0 | 798.0 | 7643.4 | 3101.8 | 11.2 | 0.0 | 2020.8 | 13420.2 | 42905.0 | 5067.4 | 16971.4 | 64943.8 |
| 556AT | SW VFR1-R | TOTAL | 799.0 | 39380.4 | 524.4 | 127.9 | 798.0 | 12954.4 | 3605.6 | 10.9 | 0.0 | 1833.4 | 19056.6 | 47281.8 | 5130.0 | 22507.7 | 74919.5 |
| 557AT | SW VFR2 w 11 | TOTAL | 798.7 | 70856.9 | 2721.7 | 110.2 | 796.0 | 9938.3 | 2846.1 | 10.7 | 0.0 | 18.0 | 15645.0 | 78742.0 | 7256.5 | 16879.3 | 102877.8 |
| 558AT | SW VFR2 wo 11 | TOTAL | 799.0 | 147048.0 | 50.0 | 93.3 | 798.0 | 4937.9 | 944.5 | 2.9 | 0.0 | 26.0 | 6054.6 | 154791.0 | 4820.7 | 10103.0 | 169714.7 |
| 559AT | SW IFR1 | TOTAL | 799.0 | 147076.1 | 92.6 | 90.6 | 798.0 | 8326.2 | 1078.9 | 3.5 | 0.0 | 123.0 | 9714.7 | 154883.8 | 4856.5 | 13712.8 | 173453.1 |

## (H) *New East Runway – Independent Arrivals In All Weather Conditions – 1996 and Future 1*

The addition of this new runway permits 2 independent parallel arrival streams in all weather conditions. Arrivals on the New East Runway are independent of all departures on the existing runways. At the 1996 demand, 25% of the arrivals used the new runway. At the Future 1 demand, 34% of the arrivals used the new runway.

The East Flow was simulated with 2 arrival runways (4L & 4E) and 2 departure runways (4R & 29). Similarly, the West Flow was simulated with 2 arrival runways (22R & 22E) and 2 departure runways (22L & 29). These configurations provided greater delay savings than could be obtained by putting arrivals on Runway 11.

Note: The new runway could provide additional delay savings if departing props could do divergent turns.

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 301ET | NE VFR1 | TOTAL | 726.0 | 2036.8 | 19.7 | 112.3 | 726.0 | 2633.8 | 512.1 | 3.5 | 0.0 | 0.0 | 3281.4 | 9264.8 | 4071.4 | 6581.8 | 19918.0 |
| 302DT | NE VFR2 | TOTAL | 726.0 | 6640.9 | 11.8 | 97.1 | 725.9 | 2476.9 | 524.9 | 3.2 | 0.0 | 0.0 | 3113.8 | 13879.6 | 4041.0 | 6434.6 | 24355.2 |
| 303DT | NE IFR1 | TOTAL | 726.0 | 6741.4 | 36.0 | 109.0 | 726.0 | 5120.3 | 530.4 | 3.5 | 0.0 | 0.0 | 5799.3 | 13984.5 | 4079.7 | 9081.7 | 27145.9 |
| 305CT | SW VFR1 | TOTAL | 726.0 | 1953.5 | 80.8 | 128.1 | 725.9 | 2601.5 | 1414.1 | 146.9 | 0.0 | 0.0 | 4371.4 | 9180.7 | 4716.3 | 7761.1 | 21658.2 |
| =305CT | VFR1-R | RESULTS = EAST RUNWAY -- SW VFR1 | | | | | | | | | | | | | | | |
| =308BT | VFR2 w 11 | RESULTS = EAST RUNWAY -- SW VFR2 wo 11 | | | | | | | | | | | | | | | |
| 308BT | SW VFR2 wo 11 | TOTAL | 726.0 | 6600.3 | 83.4 | 108.7 | 725.9 | 2485.6 | 1390.2 | 146.5 | 0.0 | 0.0 | 4214.5 | 13843.6 | 4684.9 | 7617.6 | 26146.0 |
| 309BT | SW IFR1 | TOTAL | 726.0 | 6654.0 | 124.2 | 118.8 | 726.0 | 4999.9 | 1796.8 | 136.3 | 0.0 | 0.0 | 7176.1 | 13891.9 | 4744.4 | 10522.3 | 29158.6 |
| 601ET | NE VFR1 | TOTAL | 799.0 | 2732.1 | 369.6 | 184.4 | 798.0 | 10267.2 | 816.6 | 3.2 | 0.0 | 182.5 | 11823.6 | 10697.0 | 5339.0 | 15047.7 | 31083.7 |
| 602FT | NE VFR2 | TOTAL | 799.0 | 7934.7 | 198.1 | 161.2 | 798.0 | 9832.0 | 820.8 | 3.2 | 0.0 | 368.6 | 11384.0 | 15910.3 | 5143.8 | 14797.7 | 35851.8 |
| 603FT | NE IFR1 | TOTAL | 799.0 | 8101.8 | 478.6 | 167.7 | 798.0 | 12585.8 | 1143.9 | 3.6 | 0.0 | 807.4 | 15187.0 | 16067.0 | 5427.8 | 18312.2 | 39807.0 |
| 605BT | SW VFR1 | TOTAL | 799.0 | 2606.4 | 443.5 | 190.9 | 798.0 | 9321.4 | 3217.2 | 137.5 | 0.0 | 316.8 | 13627.1 | 10571.0 | 5935.4 | 17002.2 | 33508.6 |
| =605BT | SW VFR1-R | RESULTS = EAST RUNWAY -- SW VFR1 | | | | | | | | | | | | | | | |
| =608BT | SW VFR2 w 11 | RESULTS = EAST RUNWAY -- SW VFR2 wo 11 | | | | | | | | | | | | | | | |
| 608BT | SW VFR2 wo 11 | TOTAL | 799.0 | 8064.9 | 510.7 | 173.9 | 798.0 | 9160.9 | 3071.1 | 134.9 | 0.0 | 131.0 | 13182.5 | 16040.9 | 6005.8 | 16500.4 | 38547.1 |
| 609BT | SW IFR1 | TOTAL | 799.0 | 8209.3 | 1097.7 | 189.0 | 798.0 | 12415.7 | 4223.1 | 130.0 | 0.0 | 345.5 | 18401.1 | 16179.1 | 6583.5 | 21122.8 | 43885.4 |

NE FLOW = SW FLOW AT FUTURE 2

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 905CT | SW VFR1 | TOTAL | 879.0 | 8209.8 | 485.3 | 223.1 | 878.0 | 13068.7 | 7826.5 | 187.8 | 0.0 | 5099.4 | 26890.9 | 16998.4 | 6400.5 | 30623.2 | 54022.1 |
| 908BT | SW VFR2 | TOTAL | 879.0 | 26605.5 | 1513.8 | 193.1 | 878.0 | 16220.3 | 7627.8 | 174.0 | 0.0 | 1768.0 | 27497.0 | 35376.0 | 7391.9 | 30217.4 | 72985.3 |
| 909DT | SW IFR1 | TOTAL | 879.0 | 27479.0 | 1653.3 | 197.7 | 877.9 | 17825.3 | 8436.5 | 162.1 | 0.0 | 3871.4 | 32146.3 | 36246.2 | 7538.0 | 34711.6 | 78495.8 |

## ***RESULTS from FAA QUEUING MODEL***

### *(0) CALIBRATION – Future 2 Demand (550,000 Annual Ops)*

| SCD550 | SCENARIO | EXP. # | ARR DLY | AVG ARR | DEP DLY | AVG DEP | A&D DLY | AVG A&D |
|---|---|---|---|---|---|---|---|---|
| SW VFR1 | (0) CALIB | **705A** | 76,658.1 | 87.2 | 43,839.6 | 49.9 | 120,497.7 | 68.6 |
| SW VFR1-R | (0) CALIB | **706A** | 81,244.8 | 92.4 | 60,596.4 | 69.0 | 141,841.2 | 80.7 |
| SW VFR2 w 11 | (0) CALIB | **707A** | 132,825.6 | 151.1 | 46,348.8 | 52.8 | 179,174.4 | 102.0 |
| SW VFR2 wo 11 | (0) CALIB | **708A** | 217,456.2 | 247.4 | 19,231.2 | 21.9 | 236,687.4 | 134.6 |
| SW IFR1 | (0) CALIB | **709A** | 217,456.2 | 247.4 | **35,697.3** | **40.7** | 253,153.5 | 144.0 |

For a given weather condition, Results for NE Flow = Results for SW Flow.

# APPENDIX C

# ANNUAL DELAY CALCULATIONS

# EWR - Annual Delay Costs (with EWR fleet mix cost of $2,200 per hour used starting 2/24/99)

**(0) EWR CALIBRATION–1996 DMD** 02-24-99

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | |
|---|---|---|---|---|---|---|---|
| 101 NE VFR1 | 12,761 | 313 | 0.313 | 60 | 20,836 | 17% | |
| 102 NE VFR2 | 21,402 | 313 | 0.068 | 60 | 7,592 | 06% | |
| 103 NE IFR-1A | 74,480 | 313 | 0.024 | 60 | 9,325 | 08% | |
| NE IFR-1B = 103 NE IFR-1A | 74,480 | 313 | 0.024 | 60 | 9,325 | 08% | |
| 105 SW VFR1 | 14,573 | 313 | 0.221 | 60 | 16,801 | 14% | |
| 106 SW VFR1-RESTRICT 11 | 20,499 | 313 | 0.241 | 60 | 25,772 | 21% | |
| 107 SW VFR2 w 11 | 23,477 | 313 | 0.045 | 60 | 5,511 | 05% | |
| 108 SW VFR2 wo 11 | 73,623 | 313 | 0.029 | 60 | 11,138 | 09% | |
| 109 SW IFR-1A | 76,601 | 313 | 0.018 | 60 | 7,193 | 06% | |
| SW IFR-1B = 109 SW IFR-1A | 76,601 | 313 | 0.017 | 60 | 6,793 | 06% | 100.0 |
| | | | 1.000 | | 120,286 Hrs | $264.6 MILLION | |
| | | | | | | 15.9 minutes – avg delay per op | |

(0) EWR CALIBRATION–SCD500 (F1) DMD 02-24-99

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | |
|---|---|---|---|---|---|---|---|
| 401 NE VFR1 | 49,263 | 313 | 0.313 | 60 | 80,437 | 22% | |
| 402 NE VFR2 | 84,225 | 313 | 0.068 | 60 | 29,877 | 08% | |
| 403 NE IFR-1A | 161,048 | 313 | 0.024 | 60 | 20,163 | 05% | |
| NE IFR-1B = 403 NE IFR-1A | 161,048 | 313 | 0.024 | 60 | 20,163 | 05% | |
| 405 SW VFR1 | 53,535 | 313 | 0.221 | 60 | 61,720 | 17% | |
| 406 SW VFR1-RESTRICT 11 | 64,112 | 313 | 0.241 | 60 | 80,603 | 22% | |
| 407 SW VFR2 w 11 | 91,809 | 313 | 0.045 | 60 | 21,552 | 06% | |
| 408 SW VFR2 wo 11 | 156,504 | 313 | 0.029 | 60 | 23,676 | 06% | |
| 409 SW IFR-1A | 160,632 | 313 | 0.018 | 60 | 15,083 | 04% | |
| SW IFR-1B = 409 SW IFR-1A | 160,632 | 313 | 0.017 | 60 | 14,245 | 04% | 100.( |
| | | | 1.000 | | 367,519 Hrs | $808.5 MILLION | |
| | | | | | | 44.1 minutes – avg delay per op | |

(0) EWR CALIBRATION–SCD550 (F2) DMD 02-24-99 QUEUING MODEL

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | |
|---|---|---|---|---|---|---|---|
| 705 SW/NE VFR1 | 120,498 | 313 | 0.534 | 60 | 335,671 | 44% | |
| 706 SW VFR1-RESTRICT 11 | 141,841 | 313 | 0.241 | 60 | 178,325 | 23% | |
| 707 SW/NE VFR2 w 11 | 179,174 | 313 | 0.113 | 60 | 105,620 | 14% | |
| 708 SW VFR2 wo 11 | 236,687 | 313 | 0.029 | 60 | 35,807 | 05% | |
| 709 SW IFR-1A | 253,154 | 313 | 0.042 | 60 | 55,466 | 07% | |
| SW/NE IFR-1B = 809 SW IFR-1A | 253,154 | 313 | 0.041 | 60 | 54,145 | 07% | 100.( |
| | | | 1.000 | | 765,034 Hrs | $1,683.1 MILLION | |
| | | | | | | 83.5 minutes – avg delay per op | |

**(A) DCIA in SW Flow--1996 DMD** 03-11-99

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|
| =101 NE VFR1 | 12,761 | 313 | 0.313 | 60 | 20,836 | 18% | | |
| =102 NE VFR2 | 21,402 | 313 | 0.068 | 60 | 7,592 | 06% | | |
| =103 NE IFR-1A | 74,480 | 313 | 0.024 | 60 | 9,325 | 08% | | |
| NE IFR-1B = 103 in (0) CALIB | 74,480 | 313 | 0.024 | 60 | 9,325 | 08% | | |
| =105 SW VFR1 | 14,573 | 313 | 0.221 | 60 | 16,801 | 14% | | |
| =106 SW VFR1-RESTRICT 11 | 20,499 | 313 | 0.241 | 60 | 25,772 | 22% | | |
| =107 SW VFR2 w 11 | 23,477 | 313 | 0.045 | 60 | 5,511 | 05% | | |
| =108 SW VFR2 wo 11 | 73,623 | 313 | 0.029 | 60 | 11,138 | 10% | | |
| 119 SW IFR-1A | 40,700 | 313 | 0.018 | 60 | 3,822 | 03% | *DCIA* | |
| SW IFR-1B = 109 in (0) CALIB | 76,601 | 313 | 0.017 | 60 | 6,793 | 06% | | 100.0 |
| | | | 1.000 | | 116,915 Hrs | $257.2 MILLION | | |
| | | | | | | 15.5 minutes -- avg delay per op | | |

(A) DCIA in SW Flow--SCD500 (F1) DMD 03-11-99

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|
| =401 NE VFR1 | 49,263 | 313 | 0.313 | 60 | 80,437 | 22% | | |
| =402 NE VFR2 | 84,225 | 313 | 0.068 | 60 | 29,877 | 08% | | |
| =403 NE IFR-1A | 161,048 | 313 | 0.024 | 60 | 20,163 | 06% | | |
| NE IFR-1B = 403 in (0) CALIB | 161,048 | 313 | 0.024 | 60 | 20,163 | 06% | | |
| =405 SW VFR1 | 53,535 | 313 | 0.221 | 60 | 61,720 | 17% | | |
| =406 SW VFR1-RESTRICT 11 | 64,112 | 313 | 0.241 | 60 | 80,603 | 22% | | |
| =407 SW VFR2 w 11 | 91,809 | 313 | 0.045 | 60 | 21,552 | 06% | | |
| =408 SW VFR2 wo 11 | 156,504 | 313 | 0.029 | 60 | 23,676 | 07% | | |
| 419 SW IFR-1A | 119,675 | 313 | 0.018 | 60 | 11,237 | 03% | *DCIA* | |
| SW IFR-1B = 409 in (0) CALIB | 160,632 | 313 | 0.017 | 60 | 14,245 | 04% | | 100. |
| | | | 1.000 | | 363,673 Hrs | $800.1 MILLION | | |
| | | | | | | 43.6 minutes -- avg delay per op | | |

**(B2) Access Across Drainage Ditch--1996 DMD** 03-11-99

| Experiments | | | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 141 | NE | VFR1 | 12,575 | 313 | 0.313 | 60 | 20,533 | 18% | ***ACCESS*** | |
| 142 | NE | VFR2 | 20,764 | 313 | 0.068 | 60 | 7,366 | 06% | ***ACCESS*** | |
| =103 | NE | IFR-1A | 74,480 | 313 | 0.024 | 60 | 9,325 | 08% | | |
| NE IFR-1B = 103 in (0) CALIB | | | 74,480 | 313 | 0.024 | 60 | 9,325 | 08% | | |
| =105 | SW | VFR1 | 14,573 | 313 | 0.221 | 60 | 16,801 | 14% | | |
| 146 | SW | VFR1-RESTRICT 11 | 20,086 | 313 | 0.241 | 60 | 25,252 | 22% | ***ACCESS*** | |
| =107 | SW | VFR2 w 11 | 23,477 | 313 | 0.045 | 60 | 5,511 | 05% | | |
| =108 | SW | VFR2 wo 11 | 73,623 | 313 | 0.029 | 60 | 11,138 | 10% | | |
| =109 | SW | IFR-1A | 76,601 | 313 | 0.018 | 60 | 7,193 | 06% | | |
| SW IFR-1B = 109 in (0) CALIB | | | 76,601 | 313 | 0.017 | 60 | 6,793 | 06% | | 102.0 |
| | | | | | 1.000 | | 119,237 Hrs | $262.3 MILLION | | |

15.8 minutes -- avg delay per op

(B2) Access Across Drainage Ditch--SCD500 (F1) DMD 03-11-99

| Experiments | | | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 441 | NE | VFR1 | 48,435 | 313 | 0.313 | 60 | 79,085 | 22% | ***ACCESS*** | |
| 442 | NE | VFR2 | 83,691 | 313 | 0.068 | 60 | 29,688 | 08% | ***ACCESS*** | |
| =403 | NE | IFR-1A | 161,048 | 313 | 0.024 | 60 | 20,163 | 06% | | |
| NE IFR-1B = 403 in (0) CALIB | | | 161,048 | 313 | 0.024 | 60 | 20,163 | 06% | | |
| =405 | SW | VFR1 | 53,535 | 313 | 0.221 | 60 | 61,720 | 17% | | |
| =406 | SW | VFR1-RESTRICT 11 | 64,112 | 313 | 0.241 | 60 | 80,603 | 22% | ***ACCESS=CALIB*** | |
| =407 | SW | VFR2 w 11 | 91,809 | 313 | 0.045 | 60 | 21,552 | 06% | | |
| =408 | SW | VFR2 wo 11 | 156,504 | 313 | 0.029 | 60 | 23,676 | 07% | | |
| =409 | SW | IFR-1A | 160,632 | 313 | 0.018 | 60 | 15,083 | 04% | | |
| SW IFR-1B = 409 in (0) CALIB | | | 160,632 | 313 | 0.017 | 60 | 14,245 | 04% | | 100.6 |
| | | | | | 1.000 | | 365,978 Hrs | $805.2 MILLION | | |

43.9 minutes -- avg delay per op

(C1-0%) EWR LDA NE--Offset to 4s--1996 DMD 02-24-99 LDA--0% in VFR2

LDA--0% in VFR2

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|
| =221 NE VFR1 | 11,374 | 313 | 0.313 | 60 | 18,572 | 16% | *LDA--NE* | |
| =102 NE VFR2 | 21,402 | 313 | 0.068 | 60 | 7,592 | 06% | *No LDA in VFR2* | |
| =103 NE IFR-1A | 74,480 | 313 | 0.024 | 60 | 9,325 | 08% | | |
| NE IFR-1B = 103 in (0) CALIB | 74,480 | 313 | 0.024 | 60 | 9,325 | 08% | | |
| =105 SW VFR1 | 14,573 | 313 | 0.221 | 60 | 16,801 | 14% | | |
| =106 SW VFR1-RESTRICT 11 | 20,499 | 313 | 0.241 | 60 | 25,772 | 22% | | |
| =107 SW VFR2 w 11 | 23,477 | 313 | 0.045 | 60 | 5,511 | 05% | | |
| =108 SW VFR2 wo 11 | 73,623 | 313 | 0.029 | 60 | 11,138 | 09% | | |
| =109 SW IFR-1A | 76,601 | 313 | 0.018 | 60 | 7,193 | 06% | | |
| SW IFR-1B = 109 in (0) CALIB | 76,601 | 313 | 0.017 | 60 | 6,793 | 06% | | 100.0 |
| | | | 1.000 | | 118,022 Hrs | $259.6 MILLION | | |
| | | | | | | 15.6 minutes -- avg delay per op | | |

(C1-0%) EWR LDA NE--to 4s--SCD500 (F1) DMD 02-24-99 LDA--0% in VFR2

LDA--0% in VFR2

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|
| =521 NE VFR1 | 45,625 | 313 | 0.313 | 60 | 74,497 | 21% | *LDA--NE* | |
| =402 NE VFR2 | 84,225 | 313 | 0.068 | 60 | 29,877 | 08% | *No LDA in VFR2* | |
| =403 NE IFR-1A | 161,048 | 313 | 0.024 | 60 | 20,163 | 06% | | |
| NE IFR-1B = 403 in (0) CALIB | 161,048 | 313 | 0.024 | 60 | 20,163 | 06% | | |
| =405 SW VFR1 | 53,535 | 313 | 0.221 | 60 | 61,720 | 17% | | |
| =406 SW VFR1-RESTRICT 11 | 64,112 | 313 | 0.241 | 60 | 80,603 | 22% | | |
| =407 SW VFR2 w 11 | 91,809 | 313 | 0.045 | 60 | 21,552 | 06% | | |
| =408 SW VFR2 wo 11 | 156,504 | 313 | 0.029 | 60 | 23,676 | 07% | | |
| =409 SW IFR-1A | 160,632 | 313 | 0.018 | 60 | 15,083 | 04% | | |
| SW IFR-1B = 409 in (0) CALIB | 160,632 | 313 | 0.017 | 60 | 14,245 | 04% | | 100.0 |
| | | | 1.000 | | 361,579 Hrs | $795.5 MILLION | | |
| | | | | | | 43.4 minutes -- avg delay per op | | |

**(C1-50%) EWR LDA NE–Offset to 4s–1996 DMD** 02-24-99 **LDA–50% in VFR2**

| LDA–50% in VFR2 Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|
| =221 NE VFR1 | 11,374 | 313 | 0.313 | 60 | 18,572 | 16% | ***LDA–NE*** | |
| 222 NE VFR2 | 20,356 | 313 | 0.034 | 60 | 3,610 | 03% | ***50%–LDA in VFR2*** | |
| =102 NE VFR2 | 21,402 | 313 | 0.034 | 60 | 3,796 | 03% | ***50%–No LDA in VFR2*** | |
| =103 NE IFR-1A | 74,480 | 313 | 0.024 | 60 | 9,325 | 08% | | |
| NE IFR-1B = 103 in (0) CALIB | 74,480 | 313 | 0.024 | 60 | 9,325 | 08% | | |
| =105 SW VFR1 | 14,573 | 313 | 0.221 | 60 | 16,801 | 14% | | |
| =106 SW VFR1-RESTRICT 11 | 20,499 | 313 | 0.241 | 60 | 25,772 | 22% | | |
| =107 SW VFR2 w 11 | 23,477 | 313 | 0.045 | 60 | 5,511 | 05% | | |
| =108 SW VFR2 wo 11 | 73,623 | 313 | 0.029 | 60 | 11,138 | 09% | | |
| =109 SW IFR-1A | 76,601 | 313 | 0.018 | 60 | 7,193 | 06% | | |
| SW IFR-1B = 109 in (0) CALIB | 76,601 | 313 | 0.017 | 60 | 6,793 | 06% | | 99.9 |
| | | | 1.000 | | 117,836 Hrs | $259.2 MILLION | | |

15.6 minutes – avg delay per op

(C1-50%) EWR LDA NE–to 4s–SCD500 (F1) DMD 02-24-99 LDA–50% in VFR2

| LDA–50% in VFR2 Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|
| =521 NE VFR1 | 45,625 | 313 | 0.313 | 60 | 74,497 | 21% | ***LDA–NE*** | |
| 522 NE VFR2 | 73,550 | 313 | 0.034 | 60 | 13,045 | 04% | ***50%–LDA in VFR2*** | |
| =402 NE VFR2 | 84,225 | 313 | 0.034 | 60 | 14,939 | 04% | ***50%–No LDA in VFR2*** | |
| =403 NE IFR-1A | 161,048 | 313 | 0.024 | 60 | 20,163 | 06% | | |
| NE IFR-1B = 403 in (0) CALIB | 161,048 | 313 | 0.024 | 60 | 20,163 | 06% | | |
| =405 SW VFR1 | 53,535 | 313 | 0.221 | 60 | 61,720 | 17% | | |
| =406 SW VFR1-RESTRICT 11 | 64,112 | 313 | 0.241 | 60 | 80,603 | 22% | | |
| =407 SW VFR2 w 11 | 91,809 | 313 | 0.045 | 60 | 21,552 | 06% | | |
| =408 SW VFR2 wo 11 | 156,504 | 313 | 0.029 | 60 | 23,676 | 07% | | |
| =409 SW IFR-1A | 160,632 | 313 | 0.018 | 60 | 15,083 | 04% | | |
| SW IFR-1B = 409 in (0) CALIB | 160,632 | 313 | 0.017 | 60 | 14,245 | 04% | | 100.( |
| | | | 1.000 | | 359,686 Hrs | $791.3 MILLION | | |

43.2 minutes – avg delay per op

**(C2-0%) EWR LDA SW--Offset to 22s--1996 DMD** 02-24-99 **LDA--0% in VFR2**

**LDA--0% in VFR2**

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|---|
| =101 NE VFR1 | 12,761 | 313 | 0.313 | 60 | 20,836 | | 18% | | |
| =102 NE VFR2 | 21,402 | 313 | 0.068 | 60 | 7,592 | | 06% | | |
| =103 NE IFR-1A | 74,480 | 313 | 0.024 | 60 | 9,325 | | 08% | | |
| NE IFR-1B = 103 in (0) CALIB | 74,480 | 313 | 0.024 | 60 | 9,325 | | 08% | | |
| =225 SW VFR1 | 13,192 | 313 | 0.221 | 60 | 15,209 | | 13% | *LDA-SW* | |
| =106 SW VFR1-RESTRICT 11 | 20,499 | 313 | 0.241 | 60 | 25,772 | | 22% | *LDA-SW =CALIB* | |
| =107 SW VFR2 w 11 | 23,477 | 313 | 0.045 | 60 | 5,511 | | 05% | *No LDA in VFR2* | |
| =108 SW VFR2 wo 11 | 73,623 | 313 | 0.029 | 60 | 11,138 | | 09% | *No LDA in VFR2* | |
| =109 SW IFR-1A | 76,601 | 313 | 0.018 | 60 | 7,193 | | 06% | | |
| SW IFR-1B = 109 in (0) CALIB | 76,601 | 313 | 0.017 | 60 | 6,793 | | 06% | | 100.0 |
| | | | 1.000 | | 118,694 Hrs | $261.1 | MILLION | | |
| | | | | | | 15.7 | minutes -- avg delay per op | | |

(C2-0%) EWR LDA SW--to 22s--SCD500 (F1) DMD 02-24-99 LDA--0% in VFR2

LDA--0% in VFR2

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|---|
| =401 NE VFR1 | 49,263 | 313 | 0.313 | 60 | 80,437 | | 22% | | |
| =402 NE VFR2 | 84,225 | 313 | 0.068 | 60 | 29,877 | | 08% | | |
| =403 NE IFR-1A | 161,048 | 313 | 0.024 | 60 | 20,163 | | 06% | | |
| NE IFR-1B = 403 in (0) CALIB | 161,048 | 313 | 0.024 | 60 | 20,163 | | 06% | | |
| =525 SW VFR1 | 49,663 | 313 | 0.221 | 60 | 57,256 | 12-04-98 | 16% | *LDA-SW =CALIB* | |
| =406 SW VFR1-RESTRICT 11 | 64,112 | 313 | 0.241 | 60 | 80,603 | | 22% | *LDA-SW =CALIB* | |
| =407 SW VFR2 w 11 | 91,809 | 313 | 0.045 | 60 | 21,552 | | 06% | *No LDA in VFR2* | |
| =408 SW VFR2 wo 11 | 156,504 | 313 | 0.029 | 60 | 23,676 | | 07% | *No LDA in VFR2* | |
| =409 SW IFR-1A | 160,632 | 313 | 0.018 | 60 | 15,083 | | 04% | | |
| SW IFR-1B = 409 in (0) CALIB | 160,632 | 313 | 0.017 | 60 | 14,245 | | 04% | | 100.( |
| | | | 1.000 | | 363,055 Hrs | $798.7 | MILLION | | |
| | | | | | | 43.6 | minutes -- avg delay per op | | |

(D) EWR PARALLEL *DUAL VISUALS*—1996 DMD 02-24-99

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|---|
| 221 NE VFR1 | 11,374 | 313 | 0.313 | 60 | 18,572 | | 16% | ***Dual Visuals*** | |
| =102 NE VFR2 | 21,402 | 313 | 0.068 | 60 | 7,592 | | 07% | | |
| =103 NE IFR-1A | 74,480 | 313 | 0.024 | 60 | 9,325 | | 08% | | |
| NE IFR-1B = 103 in (0) CALIB | 74,480 | 313 | 0.024 | 60 | 9,325 | | 08% | | |
| 225 SW VFR1 | 13,192 | 313 | 0.221 | 60 | 15,209 | | 13% | ***Dual Visuals*** | |
| =106 SW VFR1-RESTRICT 11 | 20,499 | 313 | 0.241 | 60 | 25,772 | | 22% | ***Duals=CALIB*** | |
| =107 SW VFR2 w 11 | 23,477 | 313 | 0.045 | 60 | 5,511 | | 05% | | |
| =108 SW VFR2 wo 11 | 73,623 | 313 | 0.029 | 60 | 11,138 | | 10% | | |
| =109 SW IFR-1A | 76,601 | 313 | 0.018 | 60 | 7,193 | | 06% | | |
| SW IFR-1B = 109 in (0) CALIB | 76,601 | 313 | 0.017 | 60 | 6,793 | | 06% | | 100.0 |
| | | | 1.000 | | 116,430 Hrs | $256.1 | MILLION | | |

15.4 minutes – avg delay per op

(D) EWR PARALLEL *DUAL VISUALS*—SCD500 (F1) DMD 02-24-99

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|---|
| 521 NE VFR1 | 45,625 | 313 | 0.313 | 60 | 74,497 | | 21% | ***Dual Visuals*** | |
| =402 NE VFR2 | 84,225 | 313 | 0.068 | 60 | 29,877 | | 08% | | |
| =403 NE IFR-1A | 161,048 | 313 | 0.024 | 60 | 20,163 | | 06% | | |
| NE IFR-1B = 403 in (0) CALIB | 161,048 | 313 | 0.024 | 60 | 20,163 | | 06% | | |
| 525 SW VFR1 | 49,663 | 313 | 0.221 | 60 | 57,256 | 12-04-98 | 16% | ***Duals=CALIB (9 Iterations)*** | |
| =406 SW VFR1-RESTRICT 11 | 64,112 | 313 | 0.241 | 60 | 80,603 | | 23% | ***Duals=CALIB*** | |
| =407 SW VFR2 w 11 | 91,809 | 313 | 0.045 | 60 | 21,552 | | 06% | | |
| =408 SW VFR2 wo 11 | 156,504 | 313 | 0.029 | 60 | 23,676 | | 07% | | |
| =409 SW IFR-1A | 160,632 | 313 | 0.018 | 60 | 15,083 | | 04% | | |
| SW IFR-1B = 409 in (0) CALIB | 160,632 | 313 | 0.017 | 60 | 14,245 | | 04% | | 100.0 |
| | | | 1.000 | | 357,115 Hrs | $785.7 | MILLION | | |

42.9 minutes – avg delay per op

**(E) EWR SCIA in NE Flow--1996 DMD** 02-24-99

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|
| =101 NE VFR1 | 12,761 | 313 | 0.313 | 60 | 20,836 | 18% | | |
| =102 NE VFR2 | 21,402 | 313 | 0.068 | 60 | 7,592 | 07% | | |
| 233 NE IFR-1A | 22,327 | 313 | 0.024 | 60 | 2,795 | 02% | *SCIA* | |
| NE IFR-1B = 103 in (0) CALIB | 74,480 | 313 | 0.024 | 60 | 9,325 | 08% | | |
| =105 SW VFR1 | 14,573 | 313 | 0.221 | 60 | 16,801 | 15% | | |
| =106 SW VFR1-RESTRICT 11 | 20,499 | 313 | 0.241 | 60 | 25,772 | 23% | | |
| =107 SW VFR2 w 11 | 23,477 | 313 | 0.045 | 60 | 5,511 | 05% | | |
| =108 SW VFR2 wo 11 | 73,623 | 313 | 0.029 | 60 | 11,138 | 10% | | |
| =109 SW IFR-1A | 76,601 | 313 | 0.018 | 60 | 7,193 | 06% | | |
| SW IFR-1B = 109 in (0) CALIB | 76,601 | 313 | 0.017 | 60 | 6,793 | 06% | | 100.0 |
| | | | 1.000 | | 113,756 Hrs | $250.3 MILLION | | |
| | | | | | | 15.0 minutes -- avg delay per op | | |

(E) EWR SCIA in NE Flow--SCD500 (F 1) DMD 02-24-99

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|
| =401 NE VFR1 | 49,263 | 313 | 0.313 | 60 | 80,437 | 22% | | |
| =402 NE VFR2 | 84,225 | 313 | 0.068 | 60 | 29,877 | 08% | | |
| 533 NE IFR-1A | 83,428 | 313 | 0.024 | 60 | 10,445 | 03% | *SCIA* | |
| NE IFR-1B = 403 in (0) CALIB | 161,048 | 313 | 0.024 | 60 | 20,163 | 06% | | |
| =405 SW VFR1 | 53,535 | 313 | 0.221 | 60 | 61,720 | 17% | | |
| =406 SW VFR1-RESTRICT 11 | 64,112 | 313 | 0.241 | 60 | 80,603 | 23% | | |
| =407 SW VFR2 w 11 | 91,809 | 313 | 0.045 | 60 | 21,552 | 06% | | |
| =408 SW VFR2 wo 11 | 156,504 | 313 | 0.029 | 60 | 23,676 | 07% | | |
| =409 SW IFR-1A | 160,632 | 313 | 0.018 | 60 | 15,083 | 04% | | |
| SW IFR-1B = 409 in (0) CALIB | 160,632 | 313 | 0.017 | 60 | 14,245 | 04% | | 100.0 |
| | | | 1.000 | | 357,801 Hrs | $787.2 MILLION | | |
| | | | | | | 42.9 minutes -- avg delay per op | | |

**COSTS ASSUME SCIA CAN BE USED DOWN TO IFR-1A MIMIMA.**

(F) EWR REDUCE MIN IN-TRAIL IFR SEPS--1996 DMD 02-24-99

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|---|
| =101 NE VFR1 | 12,761 | 313 | 0.313 | 60 | 20,836 | | 18% | | |
| 242 NE VFR2 | 20,981 | 313 | 0.068 | 60 | 7,443 | | 06% | *Reduce Seps* | |
| 243 NE IFR-1A | 72,368 | 313 | 0.024 | 60 | 9,060 | | 08% | *Reduce Seps* | |
| =243 NE IFR-1B = 243 in PKG (F) | 72,368 | 313 | 0.024 | 60 | 9,060 | | 08% | *Reduce Seps* | |
| =105 SW VFR1 | 14,573 | 313 | 0.221 | 60 | 16,801 | | 14% | | |
| =106 SW VFR1-RESTRICT 11 | 20,499 | 313 | 0.241 | 60 | 25,772 | | 22% | | |
| 247 SW VFR2 w 11 | 22,917 | 313 | 0.045 | 60 | 5,380 | | 05% | *Reduce Seps* | |
| 248 SW VFR2 wo 11 | 70,018 | 313 | 0.029 | 60 | 10,593 | | 09% | *Reduce Seps* | |
| 249 SW IFR-1A | 72,511 | 313 | 0.018 | 60 | 6,809 | | 06% | *Reduce Seps* | |
| =249 SW IFR-1B = 249 in PKG (F) | 72,511 | 313 | 0.017 | 60 | 6,431 | | 05% | *Reduce Seps* | 100.0 |
| | | | 1.000 | | 118,185 Hrs | $260.0 | MILLION | | |
| | | | | | | 15.6 | minutes -- avg delay per op | | |

(F) EWR REDUCE MIN IN-TRAIL IFR SEPS--(SCD500) F1 DMD 02-24-99

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|---|
| =401 NE VFR1 | 49,263 | 313 | 0.313 | 60 | 80,437 | | 22% | | |
| 542 NE VFR2 | 79,383 | 313 | 0.068 | 60 | 28,160 | | 08% | *Reduce Seps* | |
| 543 NE IFR-1A | 156,443 | 313 | 0.024 | 60 | 19,587 | | 05% | *Reduce Seps* | |
| =543 NE IFR-1B = 543 in PKG (F) | 156,443 | 313 | 0.024 | 60 | 19,587 | | 05% | *Reduce Seps* | |
| =405 SW VFR1 | 53,535 | 313 | 0.221 | 60 | 61,720 | | 17% | | |
| =406 SW VFR1-RESTRICT 11 | 64,112 | 313 | 0.241 | 60 | 80,603 | | 22% | | |
| 547 SW VFR2 w 11 | 89,257 | 313 | 0.045 | 60 | 20,953 | | 06% | *Reduce Seps* | |
| 548 SW VFR2 wo 11 | 151,864 | 313 | 0.029 | 60 | 22,974 | | 06% | *Reduce Seps* | |
| 549 SW IFR-1A | 156,329 | 313 | 0.018 | 60 | 14,679 | | 04% | *Reduce Seps* | |
| =549 SW IFR-1B = 549 in PKG (F) | 156,329 | 313 | 0.017 | 60 | 13,864 | | 04% | *Reduce Seps* | 100.0 |
| | | | 1.000 | | 362,564 Hrs | $797.6 | MILLION | | |
| | | | | | | 43.5 | minutes -- avg delay per op | | |

(G) PROPS--DIVERGENT TURNS--1996 DMD 02-24-99

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|
| 251 NE VFR1 | 11,961 | 313 | 0.313 | 60 | 19,530 | 18% | Props Diverge | |
| 252 NE VFR2 | 17,384 | 313 | 0.068 | 60 | 6,167 | 06% | Props Diverge | |
| 253 NE IFR-1A =103 in CALIB | 74,480 | 313 | 0.024 | 60 | 9,325 | 08% | Props Diverge | |
| =253 NE IFR-1B = 253 in PKG (G) | 74,480 | 313 | 0.024 | 60 | 9,325 | 08% | Props Diverge | |
| 255 SW VFR1 | 13,191 | 313 | 0.221 | 60 | 15,208 | 14% | Props Diverge | |
| 256 SW VFR1-RESTRICT 11 | 17,304 | 313 | 0.241 | 60 | 21,755 | 20% | Props Diverge | |
| 257 SW VFR2 w 11 | 20,182 | 313 | 0.045 | 60 | 4,738 | 04% | Props Diverge | |
| 258 SW VFR2 wo 11 | 72,615 | 313 | 0.029 | 60 | 10,985 | 10% | Props Diverge | |
| 259 SW IFR-1A | 74,993 | 313 | 0.018 | 60 | 7,042 | 06% | Props Diverge | |
| =259 SW IFR-1B = 259 in PKG (G) | 74,993 | 313 | 0.017 | 60 | 6,651 | 06% | Props Diverge | 100.0 |
| | | | 1.000 | | 110,726 Hrs | $243.6 MILLION | | |
| | | | | | | 14.6 minutes -- avg delay per op | | |

(G) PROPS--DIVERGENT TURNS--(SCD-500) F1 DMD 02-24-99

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|
| 551 NE VFR1 | 43,610 | 313 | 0.313 | 60 | 71,207 | 21% | Props Diverge | |
| 552 NE VFR2 | 74,731 | 313 | 0.068 | 60 | 26,510 | 08% | Props Diverge | |
| 553 NE IFR-1A | 159,176 | 313 | 0.024 | 60 | 19,929 | 06% | Props Diverge | |
| =553 NE IFR-1B = 553 in PKG (G) | 159,176 | 313 | 0.024 | 60 | 19,929 | 06% | Props Diverge | |
| 555 SW VFR1 | 48,376 | 313 | 0.221 | 60 | 55,772 | 16% | Props Diverge | |
| 556 SW VFR1-RESTRICT 11 | 58,437 | 313 | 0.241 | 60 | 73,468 | 22% | Props Diverge | |
| 557 SW VFR2 w 11 | 86,502 | 313 | 0.045 | 60 | 20,306 | 06% | Props Diverge | |
| 558 SW VFR2 wo 11 | 153,102 | 313 | 0.029 | 60 | 23,162 | 07% | Props Diverge | |
| 559 SW IFR-1A | 156,791 | 313 | 0.018 | 60 | 14,723 | 04% | Props Diverge | |
| =559 SW IFR-1B = 559 in PKG (G) | 156,791 | 313 | 0.017 | 60 | 13,905 | 04% | Props Diverge | 100.( |
| | | | 1.000 | | 338,911 Hrs | $745.6 MILLION | | |
| | | | | | | 40.7 minutes -- avg delay per op | | |

(G) PROPS--DIVERGENT TURNS--(SCD-550) F2 DMD 02-24-99 QUEUING MODEL

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|
| 855 SW/NE VFR1 | 104,385 | 313 | 0.534 | 60 | 290,785 | 42% | Props Diverge | |
| 856 SW VFR1-RESTRICT 11 | 123,916 | 313 | 0.241 | 60 | 155,789 | 23% | Props Diverge | |
| 857 SW/NE VFR2 w 11 | 167,689 | 313 | 0.113 | 60 | 98,850 | 14% | Props Diverge | |
| 858 SW VFR2 wo 11 | 228,978 | 313 | 0.029 | 60 | 34,641 | 05% | Props Diverge | |
| 859 SW/NE IFR-1A | 245,111 | 313 | 0.042 | 60 | 53,704 | 08% | Props Diverge | |
| SW/NE IFR-1B = 859 SW IFR-1A | 245,111 | 313 | 0.041 | 60 | 52,425 | 08% | Props Diverge | 100 |
| | | | 1.000 | | 686,194 Hrs | $1,509.6 MILLION | | |
| | | | | | | 74.9 minutes -- avg delay per op | | |

(H) NEW EAST RWY--Indep IFR Arrivals--1996 DMD 03-26-99

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|
| 301 NE VFR1 | 5,318 | 313 | 0.313 | 60 | 8,683 | 23% | New East Rwy | |
| 302 NE VFR2 | 9,755 | 313 | 0.068 | 60 | 3,460 | 9% | New East Rwy | |
| 303 NE IFR-1A | 12,540 | 313 | 0.024 | 60 | 1,570 | 4% | New East Rwy | |
| =303 NE IFR-1B = 303 in PKG (H) | 12,540 | 313 | 0.024 | 60 | 1,570 | 4% | New East Rwy | |
| 305 SW VFR1 | 6,325 | 313 | 0.221 | 60 | 7,292 | 20% | New East Rwy | |
| =305 SW VFR1-RESTRICT 11 | 6,325 | 313 | 0.241 | 60 | 7,952 | 21% | New East Rwy | |
| =308 SW VFR2 w 11 | 10,814 | 313 | 0.045 | 60 | 2,539 | 7% | New East Rwy | |
| 308 SW VFR2 wo 11 | 10,814 | 313 | 0.029 | 60 | 1,636 | 4% | New East Rwy | |
| 309 SW IFR-1A | 13,830 | 313 | 0.018 | 60 | 1,299 | 3% | New East Rwy | |
| =309 SW IFR-1B = 309 in PKG (H) | 13,830 | 313 | 0.017 | 60 | 1,226 | 3% | New East Rwy | 100. |
| | | | 1.000 | | 37,227 Hrs | $81.9 MILLION | | |
| | | | | | | 4.9 minutes -- avg delay per op | | |

(H) NEW EAST RWY--Indep IFR Arrivals--(SCD-500) F1 DMD 02-24-99

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|
| 601 NE VFR1 | 14,556 | 313 | 0.313 | 60 | 23,767 | 27% | New East Rwy | |
| 602 NE VFR2 | 19,318 | 313 | 0.068 | 60 | 6,853 | 08% | New East Rwy | |
| 603 NE IFR-1A | 23,289 | 313 | 0.024 | 60 | 2,916 | 03% | New East Rwy | |
| =603 NE IFR-1B = 603 in PKG (H) | 23,289 | 313 | 0.024 | 60 | 2,916 | 03% | New East Rwy | |
| 605 SW VFR1 | 16,234 | 313 | 0.221 | 60 | 18,716 | 21% | New East Rwy | |
| =605 SW VFR1-RESTRICT 11 | 16,234 | 313 | 0.241 | 60 | 20,410 | 23% | New East Rwy | |
| =608 SW VFR2 w 11 | 21,247 | 313 | 0.045 | 60 | 4,988 | 06% | New East Rwy | |
| 608 SW VFR2 wo 11 | 21,247 | 313 | 0.029 | 60 | 3,214 | 04% | New East Rwy | |
| 609 SW IFR-1A | 26,610 | 313 | 0.018 | 60 | 2,499 | 03% | New East Rwy | |
| =609 SW IFR-1B = 609 in PKG (H) | 26,610 | 313 | 0.017 | 60 | 2,360 | 03% | New East Rwy | 100. |
| | | | 1.000 | | 88,639 Hrs | $195.0 MILLION | | |
| | | | | | | 10.6 minutes -- avg delay per op | | |

(H) NEW EAST RWY--Indep IFR Arrivals--(SCD-550) F2 DMD 02-24-99 12-30-98 Corrected Experiment #

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|
| 905 SW/NE VFR1 | 35,101 | 313 | 0.534 | 60 | 97,781 | 47% | New East Rwy | |
| =905 SW VFR1-RESTRICT 11 | 35,101 | 313 | 0.241 | 60 | 44,130 | 21% | New East Rwy | |
| =908 SW/NE VFR2 w 11 | 54,102 | 313 | 0.113 | 60 | 31,892 | 15% | New East Rwy | |
| 908 SW VFR2 wo 11 | 54,102 | 313 | 0.029 | 60 | 8,185 | 04% | New East Rwy | |
| 909 SW/NE IFR-1A | 59,625 | 313 | 0.042 | 60 | 13,064 | 06% | New East Rwy | |
| SW/NE IFR-1B = 909 SW IFR-1A | 59,625 | 313 | 0.041 | 60 | 12,753 | 06% | New East Rwy | 100. |
| | | | 1.000 | | 207,805 Hrs | $457.2 MILLION | | |
| | | | | | | 22.7 minutes -- avg delay per op | | |

**(I1) VERTIPORT & TILT ROTOR wo 11/29s--(SCD-454) 1996 DMD** 02-24-99 **NOT SIMULATED AT THIS DEMAND**

(I1) VERTIPORT & TILT ROTOR wo 11/29s--(SCD-500) F1 DMD 02-24-99 NOT SIMULATED AT THIS DEMAND

(I1) VERTIPORT & TILT ROTOR wo 11/29s--(SCD-550) F2 DMD 02-24-99

| Experiments | Delay Min Per Day | * Equiv Days | * Annual Use | / Minutes Per Hr | = Annual Delay Costs | Percent of Annual Delay | | |
|---|---|---|---|---|---|---|---|---|
| 915 SW/NE VFR1 | 57,457 | 313 | 0.534 | 60 | 160,058 | 45% | *Tilt Rotor wo 11/29* | |
| =915 SW VFR1-RESTRICT 11 | 57,457 | 313 | 0.241 | 60 | 72,236 | 20% | *Tilt Rotor wo 11/29* | |
| =918 SW/NE VFR2 w 11 | 102,028 | 313 | 0.113 | 60 | 60,144 | 17% | *Tilt Rotor wo 11/29* | |
| 918 SW VFR2 wo 11 | 102,028 | 313 | 0.029 | 60 | 15,435 | 04% | *Tilt Rotor wo 11/29* | |
| 919 SW/NE IFR-1A | 106,448 | 313 | 0.042 | 60 | 23,323 | 07% | *Tilt Rotor wo 11/29* | |
| SW/NE IFR-1B = 919 SW IFR-1A | 106,448 | 313 | 0.041 | 60 | 22,767 | 06% | *Tilt Rotor wo ...* | 100.0 |
| | | | 1.000 | | 353,963 Hrs | $778.7 MILLION | | |
| | | | | | | 38.6 minutes -- avg delay per op | | |

# APPENDIX D

# FLEET MIX COSTS

## 1996 Demand Level

| CLASS | NUMBER OF COMPUTED A/C | RATIO | COST/HOUR EACH A/C | AVERAGE COST/MIN | WEIGHTED COST PER HOUR | NOTES |
|---|---|---|---|---|---|---|
| HEAVY OAG | 124 | 0.085 | $6,036 | $100.60 | $513.06 | |
| 757 OAG | 118 | 0.081 | $2,670 | $44.50 | $216.27 | |
| LJ OAG | 768 | 0.529 | $2,237 | $37.28 | $1,183.37 | |
| LJ GA | 4 | 0.003 | $1,923 | $32.05 | $5.77 | |
| LC OAG | 294 | 0.202 | $945 | $15.75 | $190.89 | |
| LC GA | 10 | 0.007 | $1,180 | $19.67 | $8.26 | |
| MEDIUM OAG | 80 | 0.055 | $1,169 | $19.48 | $64.30 | |
| MEDIUM GA | 34 | 0.023 | $854 | $14.23 | $19.64 | |
| SMALL OAG | 4 | 0.003 | $381 | $6.35 | $1.14 | |
| SMALL GA | 16 | 0.011 | $392 | $6.53 | $4.31 | |
| *totals* | 1,452 | 0.999 | | | $2,207.01 | |
| | | | Fleet Mix Cost | Per Hour: | **$2,207.00** | |
| | | | Fleet Mix Cost | Per Minute: | **$36.78** | |

## Future 1

| CLASS | NUMBER OF COMPUTED A/C | RATIO | COST/HOUR EACH A/C | AVERAGE COST/MIN | WEIGHTED COST PER HOUR | NOTES |
|---|---|---|---|---|---|---|
| HEAVY OAG | 254 | 0.159 | $6,036 | $100.60 | $959.72 | |
| 757 OAG | 284 | 0.178 | $2,670 | $44.50 | $475.26 | |
| LJ OAG | 580 | 0.363 | $2,237 | $37.28 | $812.03 | |
| LJ GA | 4 | 0.003 | $1,923 | $32.05 | $5.77 | |
| LC OAG | 326 | 0.204 | $945 | $15.75 | $192.78 | |
| LC GA | 10 | 0.006 | $1,180 | $19.67 | $7.08 | |
| MEDIUM OAG | 85 | 0.053 | $1,169 | $19.48 | $61.96 | |
| MEDIUM GA | 34 | 0.021 | $854 | $14.23 | $17.93 | |
| SMALL OAG | 4 | 0.003 | $381 | $6.35 | $1.14 | |
| SMALL GA | 16 | 0.010 | $392 | $6.53 | $3.92 | |
| *totals* | 1,597 | 1.000 | | | $2,537.59 | |
| | | | Fleet Mix Cost | Per Hour: | $2,538.00 | |
| | | | Fleet Mix Cost | Per Minute: | $42.29 | |

## Future 2

| CLASS | NUMBER OF COMPUTED A/C | RATIO | COST/HOUR EACH A/C | AVERAGE COST/MIN | WEIGHTED COST PER HOUR | NOTES |
|---|---|---|---|---|---|---|
| HEAVY OAG | 282 | 0.161 | $6,036 | $100.60 | $971.79 | |
| 757 OAG | 314 | 0.179 | $2,670 | $44.50 | $477.93 | |
| LJ OAG | 640 | 0.364 | $2,237 | $37.28 | $814.27 | |
| LJ GA | 4 | 0.002 | $1,923 | $32.05 | $3.85 | |
| LC OAG | 360 | 0.205 | $945 | $15.75 | $193.73 | |
| LC GA | 10 | 0.006 | $1,180 | $19.67 | $7.08 | |
| MEDIUM OAG | 93 | 0.053 | $1,169 | $19.48 | $61.96 | |
| MEDIUM GA | 34 | 0.019 | $854 | $14.23 | $16.23 | |
| SMALL OAG | 4 | 0.002 | $381 | $6.35 | $0.76 | |
| SMALL GA | 16 | 0.009 | $392 | $6.53 | $3.53 | |
| *totals* | 1,757 | 1.000 | | | $2,551.11 | |
| | | | Fleet Mix Cost | Per Hour: | $2,551.00 | |
| | | | Fleet Mix Cost | Per Minute: | $42.52 | |

**Tech Center recommends using the fleet cost of $ 2,200 per hour for all demands.**
Then costs will be reasonable even if future fleet mixes are not those expected.

# EWR - Aircraft Operating Costs

## (4th Quarter 1997 Direct Operating Costs, unless Noted Otherwise)

### HEAVY - OAG

| SPECIFIC TYPE USED | TYPE | AIRLINE | COUNT | SOURCE | COST | TOTAL COST/HOUR | COMMENTS |
|---|---|---|---|---|---|---|---|
| A300/A310 | AB3 | AA | 8 | AA | $4,451 | $35,608 | |
| Airbus 310 | 310 | FX/SR/TP | 12 | AA | $6,048 | $72,576 | MEM 1996 cargo cost used |
| Airbus 340 | 340 | LH | 2 | AA | $4,451 | $8,902 | No INDUSTRY cost available |
| B-747 | 747 | AF/BA/LY/VS | 8 | IND | $7,395 | $59,160 | Int'l. cost=Avg. of all 747 series |
| B-747 Freighter | 74F | 5X/UPS | 2 | Cargo | $8,694 | $17,388 | MEM 1996 cargo cost used |
| B-747 Mixed Config. | 74M | BR | 2 | Cargo | $8,694 | $17,388 | MEM 1996 cargo cost used |
| B-767 | 767 | 5X/AZ | 6 | Cargo | $3,897 | $23,382 | MEM 1996 cargo cost used |
| B-767 | 767 | DL/LO/SK | 14 | IND | $3,579 | $50,106 | Avg. IND. cost of 767-200/300 |
| B-777 | 777 | UA | 2 | UA | $4,203 | $8,406 | |
| DC-10 | D10 | AZ | 15 | IND | $4,956 | $74,340 | IND. avg. for DC-10-10/30 used |
| DC-10 | D10 | CO | 4 | CO | $4,564 | $18,256 | Continental DC-10-30 cost used |
| DC-10 | D10 | FX | 26 | IND | $7,988 | $207,688 | MEM 1996 cargo cost used |
| DC-10 | D10 | UA | 4 | UA | $6,132 | $24,528 | Cost=Avg. cost of DC-10-10/30 |
| DC-8 Freighter | D8F | 1F | 4 | Cargo | $8,132 | $32,528 | MEM 1996 cargo cost used |
| DC-8 Freighter | D8F | 5X | 8 | Cargo | $8,132 | $65,056 | MEM 1996 cargo cost used |
| MD11 | M11 | AZ/FX | 7 | AA/DL | $4,735 | $33,145 | IND. avg. cost for AA&DL used |
| *totals* | | | 124 | | | $748,457 | |
| | | | Average | Aircraft Cost | Per Hour : | $6,036 | |

### 757 - OAG

| SPECIFIC TYPE USED | TYPE | AIRLINE | COUNT | SOURCE | COST | TOTAL COST/HOUR | COMMENTS |
|---|---|---|---|---|---|---|---|
| B-757-200 | 757 | AA | 20 | AA | $2,520 | $50,400 | |
| B-757-200 | 757 | AE/AZ | 8 | IND | $2,675 | $21,400 | INDUSTRY average cost used |
| B-757-200 | 757 | CO | 31 | CO | $2,411 | $74,741 | |
| B-757-200 | 757 | DL | 12 | DL | $2,491 | $29,892 | |
| B-757-200 | 757 | HP | 10 | HP | $2,365 | $23,650 | |
| B-757-200 | 757 | NW | 4 | NW | $2,370 | $9,480 | |
| B-757-200 | 757 | UA | 24 | UA | $3,027 | $72,648 | |
| B-757-200 | 757 | 5X/UPS | 4 | Cargo | $4,486 | $17,944 | MEM 1996 cargo cost used |
| B-757-200 | 757 | US | 2 | US | $3,442 | $6,884 | |
| *totals* | | | 115 | | | $307,039 | |
| | | | Average | Aircraft Cost | Per Hour : | $2,670 | |

## LJ - OAG

| SPECIFIC TYPE USED | TYPE | AIRLINE | COUNT | SOURCE | COST | TOTAL COST/HOUR | COMMENTS |
|---|---|---|---|---|---|---|---|
| FOKKER 100 | 100 | AA/JI | 14 | IND | $2,230 | $31,220 | IND. avg.=avg. cost of AA&US |
| BAE-146 | 146 | AC/CO | 7 | CO | $1,584 | $11,088 | NASPAC 1997 |
| B-727-200 | 727 | AA | 6 | AA | $3,192 | $19,152 | |
| B-727-200 | 727 | AZ/CO | 45 | CO | $2,506 | $112,770 | CO cost will be used |
| B-727-200 | 727 | DL | 12 | DL | $2,371 | $28,452 | |
| B-727-200 | 727 | FX | 18 | Cargo | $5,431 | $97,758 | MEM 1996 cargo cost used |
| B-727-200 | 727 | HP/JM/KP/KW | 44 | IND | $2,572 | $113,168 | INDUSTRY average cost used |
| B-727-200 | 727 | MX/NW/SY | 6 | IND | $2,572 | $15,432 | INDUSTRY average cost used |
| B-727-200 | 727 | TW | 2 | TW | $1,911 | $3,822 | |
| B-727-200 | 727 | UA/W7 | 28 | UA | $2,815 | $78,820 | UA system cost will be used |
| B-727 Freighter | 72F | 8W/ER | 4 | Cargo | $5,431 | $21,724 | MEM 1996 cargo cost used |
| B-737 | 737 | AC/AZ/CO | 260 | CO | $1,905 | $495,300 | CO weighted cost 200/300/500 |
| B-737 | 737 | HP/KW | 22 | HP | $1,726 | $37,972 | HP weighted cost 200/300& IND. |
| B-737 | 737 | UA | 2 | UA | $2,329 | $4,658 | UA B737-200 cost used |
| B-737 | 737 | US/W7/WV | 30 | US | $2,491 | $74,730 | USAir B737-300 cost used |
| Airbus 320 | 32S | AC/HP | 12 | HP | $2,113 | $25,356 | HP cost will be used |
| Airbus 320 | 32S | NW | 14 | NW | $2,274 | $31,836 | |
| Airbus 320 | 32S | UA | 6 | UA | $2,331 | $13,986 | |
| DC-9 | DC9 | AC | 14 | IND | $1,923 | $26,922 | INDUSTRY average cost used |
| DC-9 | DC9 | CO | 4 | CO | $2,232 | $8,928 | |
| DC-9 | DC9 | LF | 16 | IND | $1,923 | $30,768 | INDUSTRY average cost used |
| DC-9 | DC9 | NW | 14 | NW | $1,574 | $22,036 | |
| DC-9 | DC9 | TW | 4 | TW | $1,839 | $7,356 | |
| DC-9 | DC9 | YX | 10 | IND | $1,923 | $19,230 | DC-9-30 industry avg.cost used |
| DC-9 FREIGHTER | D9F | 1F | 2 | Cargo | $2,205 | $4,410 | MEM 1996 cargo cost used |
| MD-80 | M80 | AA | 30 | AA | $2,078 | $62,340 | |
| MD-80 | M80 | CO | 110 | CO | $2,271 | $249,810 | |
| MD-80 | M80 | DL/FQ/HP | 16 | DL | $1,987 | $31,792 | |
| MD-80 | M80 | TW | 6 | TW | $2,157 | $12,942 | |
| MD-80 | M80 | US | 2 | US | $3,113 | $6,226 | |
| | *totals* | | 760 | | | $1,700,004 | |
| | | | Average | Aircraft Cost | Per Hour : | $2,237 | |

## LJ - GA

| SPECIFIC TYPE USED | TYPE | AIRLINE | COUNT | SOURCE | COST | TOTAL COST/HOUR | COMMENTS |
|---|---|---|---|---|---|---|---|
| DC9-30 | DC9 | MI | 4 | IND | $1,923 | $7,692 | DC9 is std. type for lrg. GA jets |
| | | | 4 | | | $7,692 | |
| | | | Average | Aircraft Cost | Per Hour : | $1,923 | |

## LC - OAG

| SPECIFIC TYPE USED | TYPE | AIRLINE | COUNT | SOURCE | COST | TOTAL COST/HOUR | COMMENTS |
|---|---|---|---|---|---|---|---|
| ATR42 | ATR | CX/ZX | 162 | Commuter | $900 | $145,800 | MEM 1996 commuter cost used |
| CRJ | CRJ | AJ/CJ/DJ | 43 | IND | $608 | $26,144 | Canadair 3rd qtr. Reg. Jet cost |
| DASH-8 | DH8 | AX/SX | 10 | US | $893 | $8,930 | 10% inc. over 1994 PDX cost |
| FOKKER 27 | F27 | FX | 16 | Cargo | $2,500 | $40,000 | MEM 1996 cargo cost used |
| JETSTREAM 41 | J41 | UX/UA | 34 | Commuter | $900 | $30,600 | MEM 1996 commuter cost used |
| SF340 | SF3 | SX/US | 22 | Commuter | $900 | $19,800 | MEM 1996 commuter cost used |
| *totals* | | | 287 | | | $271,274 | |

Average Aircraft Cost Per Hour : $945

## LC - GA

| SPECIFIC TYPE USED | TYPE | AIRLINE | COUNT | SOURCE | COST | TOTAL COST/HOUR | COMMENTS |
|---|---|---|---|---|---|---|---|
| GA Lear Jets | LJ | GA | 10 | NBAA | $1,180 | $11,800 | MEM 1996 cargo cost used |
| *totals* | | | 10 | | | $11,800 | |

Average Aircraft Cost Per Hour : $1,180

## MEDIUM - OAG

| SPECIFIC TYPE USED | TYPE | AIRLINE | COUNT | SOURCE | COST | TOTAL COST/HOUR | COMMENTS |
|---|---|---|---|---|---|---|---|
| BEECHCRAFT 1900 | BE1 | 9X/CX/SX | 48 | Commuter | $900 | $43,200 | MEM 1996 commuter cost used |
| EMBRAER 120 | EM2 | CX | 28 | Commuter | $900 | $25,200 | MEM 1996 commuter cost used |
| BAe JETSTREAM 31 | J31 | UX | 4 | Commuter | $524 | $25,152 | 10% inc. over 1994 PDX cost |
| *totals* | | | 80 | | | $93,552 | |
| | | | Average | Aircraft Cost | Per Hour : | $1,169 | |

## MEDIUM - GA

| SPECIFIC TYPE USED | TYPE | AIRLINE | COUNT | SOURCE | COST | TOTAL COST/HOUR | COMMENTS |
|---|---|---|---|---|---|---|---|
| GA Lear Jets | LJ | GA | 34 | NBAA | $854 | $29,036 | NBAA 1996 C650 cost used |
| *totals* | | | 34 | | | $29,036 | |
| | | | Average | Aircraft Cost | Per Hour : | $854 | |

## SMALL - OAG

| SPECIFIC TYPE USED | TYPE | AIRLINE | COUNT | SOURCE | COST | TOTAL COST/HOUR | COMMENTS |
|---|---|---|---|---|---|---|---|
| CNA | CNA | FM | 4 | Cargo | $381 | $1,524 | MEM 1996 cargo cost used |
| *totals* | | | 4 | | | $1,524 | |
| | | | Average | Aircraft Cost | Per Hour : | $381 | |

## SMALL - GA

| SPECIFIC TYPE USED | TYPE | AIRLINE | COUNT | SOURCE | COST | TOTAL COST/HOUR | COMMENTS |
|---|---|---|---|---|---|---|---|
| SMALL GA | PA31 | GA | 5 | NBAA | $300 | $1,500 | Cost for GA ~ 9,000 lbs. |
| SMALL GA | PA42-720 | GA | 11 | NBAA | $434 | $4,774 | Cost for GA ≤ 12,500 lbs. |
| *totals* | | | 16 | | | $6,274 | |
| | | | Average | Aircraft Cost | Per Hour : | $392 | |