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NEWARK

INTERNATIONAL AIRPORT

Data Package Number 3

Airport Capacity Enhancement Design Team Study

June 1997

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

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Information in this document is subject to change as Design Team analysis progresses.

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)

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LIST OF EXHIBITS

1. POTENTIAL IMPROVEMENTS AND AIRPORT DIAGRAM

Exhibit 1 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 Runway Delay Simulation Model (RDSIM) and/or Airfield Delay Simulation Model (ADSIM) will be used for simulating the Newark International Airport.

Exhibit 2 presents a diagram of the existing airport.

The Experimental Design will consist of three demand levels (daily aircraft schedules). The runway configurations and traffic distributions may change for each demand level dependent upon the time frame of the runway extension efforts.

The Experimental Design normally includes runs for VFR and IFR conditions and for operations in both directions on each runway. The Design Team may decide that some of these runs can be eliminated if, for example, analysis of NE and SW runway operations produce nearly equivalent results. Combining improvements into logical packages may also help reduce the required experiments to a manageable number.

EXHIBIT 1 - POTENTIAL IMPROVEMENTS

AIRFIELD IMPROVEMENTS — PROPOSED MODEL

- **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.

FACILITIES AND EQUIPMENT IMPROVEMENTS

LDA 24° Offset Approach
– to inboard runway by non-heavy aircraft & commuters.
Allow parallel arrival streams during arrival peaks in less than VFR1 weather (i.e., down to 2,000' or 3,000' ceiling) in NE and SW flows.

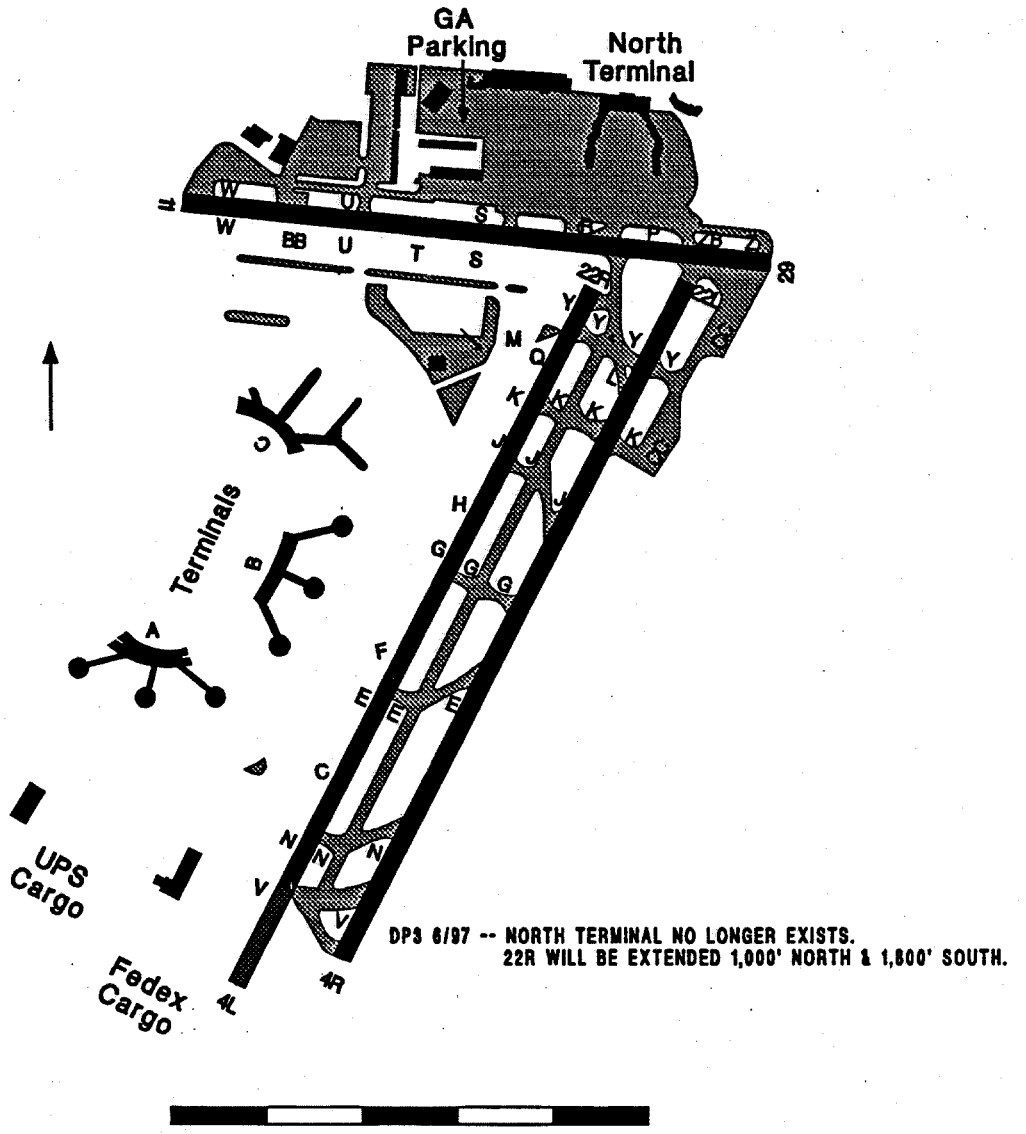
OPERATIONAL IMPROVEMENTS

- **Parallel Simultaneous Visual Approaches (using wake vortex technology).**
  LDA may be an aid to this operation.
- **SCIA – Simultaneous Converging Instrument Approaches.**
  Down to IFR1 minimums using FMS (which reduces TERPS criteria).
  Down to IFR1 minimums using GPS.
- **DCIA – Dependent Converging Instrument Approaches.**
  This may be simulated as part of the Do-Nothing case.
  Look at ground movement alternatives for arrivals to 11 and 4R, and departures to 22L.
  Would DCIA enable departures on 22s to be released more efficiently between successive arrivals on 11?
- **Reduce Minimum In-Trail IFR Separation to 2.0 NM – between similar class non-heavy aircraft.**

USER OR POLICY IMPROVEMENTS

Notes: Wait for simulation results for longer term strategic type of alternatives:
- **Effect of fleet mix changes on EWR capacity and/or delay.**
- **Schedule or banking changes, such as more uniform distribution of traffic.**
- **Segregation of commuters.**
- **Gate sharing.**
- **Tilt rotor aircraft.**
- **Minimum size aircraft.**

EXHIBIT 2 - AIRPORT DIAGRAM (EWR)



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2. MODEL INPUTS

Model inputs developed for Newark consist of information regarding airfield, aircraft operational procedures, ATC procedures, aircraft traffic demand and aircraft gate assignments on the ground and in the terminal area.

Exhibit 3 defines the aircraft classifications.

Exhibit 4 depicts the runways and runway exits at the existing airport.

Exhibit 5 shows the runway exit usage and the arrival runway occupancy times (ROTs) by aircraft class. Each entry for an aircraft class in the tables is composed of three lines: the first line gives the percentage of time an aircraft of a given class used each exit, the second line contains the average arrival occupancy times for each exit, and third line contains the number of occurrences.

Exhibit 6 presents EWR Do-Nothing runway configurations.

Exhibit 7 describes Air Traffic Control (ATC) dependencies for parallel runway separations.

Exhibits 8 and 9, respectively, present the VFR and IFR aircraft separations for EWR. The separations include:

arrival to arrival (A/A)
departure to departure (D/D)
departure to arrival (D/A)
arrival to departure (A/D)

Exhibit 10 describes miscellaneous input data such as length of common approach on final, approach speeds, and departure runway occupancy times.

Exhibit 11 describes the operational procedures and minima for the various weather categories at EWR.

Exhibit 12 presents gate service times at EWR.

Exhibit 13 depicts the arrival aircraft lateness distribution at EWR.

Exhibit 14 presents the simulated demand characteristics.

Exhibit 15 shows the EWR airline gate assignments.

EXHIBIT 3 - AIRCRAFT CLASSIFICATIONS

H	**= HEAVY**	**Heavy aircraft.** Heavy aircraft weighing more than 255,000 pounds (e.g., L1011, DC10, B747, B767, DC8S, A300).
757	**= 757**	**B757.** B757 only.
LJ	**= LARGE JET**	**Large jets.** 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.** Large commuter aircraft weighing more than 41,000 pounds and up to 255,000 pounds (e.g., ATR-42*, DH8, DH7, CRJ, SF34*).
M	**= MEDIUM**	**Small Commuters. Includes Business Jets.** Small commuter aircraft weighing more than 12,500 and less than 41,000 pounds (e.g., BA31, BA41, BE02, DA20, E120, LR31, LR36).
S	**= SMALL**	**Small twin & single engine props.** 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.

Weights refer to maximum certified takeoff weights.

EXHIBIT 4 - RUNWAYS AND RUNWAY EXITS (EWR)

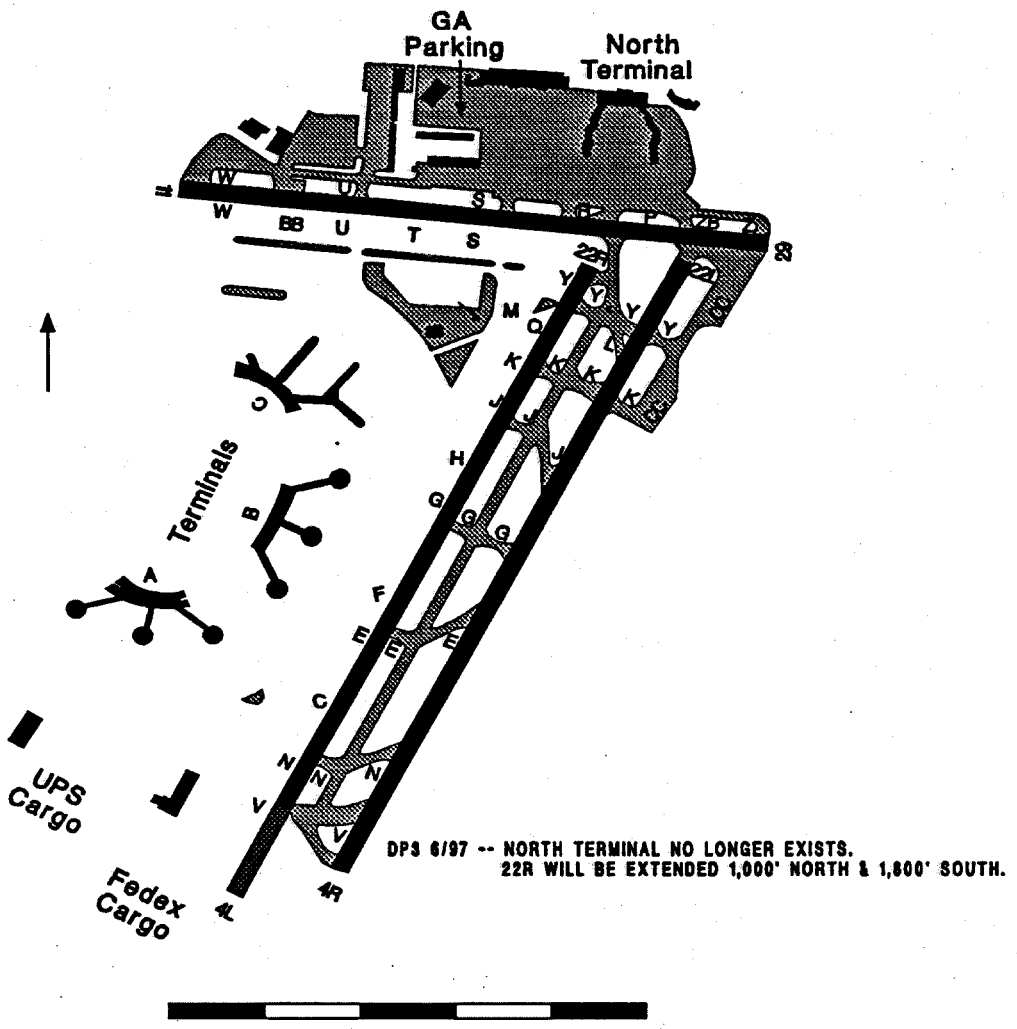

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EXHIBIT 5 - RUNWAY EXIT DATA

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

Runway 4R

	Exit Distance	G 3600'	J 4400' hs	K 5900'	L 6450' hs	Y 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 Distance	E 1950'	G 3600'	H 4500' hs	J 5150'	K 5950'	O 5950' hs	M 6750' rhs	Y 6750'	W 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.

EXHIBIT 5 - RUNWAY EXIT DATA (Cont.)

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.

EXHIBIT 5 - RUNWAY EXIT DATA (Cont.)

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

Runway 11

	Exit Distance	U 1950'	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	R 2000'	S 2750'	T 3700' hs	U 4550'	BB 5400'	W 6400'	TOTAL
(H)	Utilization						100%	100%
	ROT						62	62 sec
	Count						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.

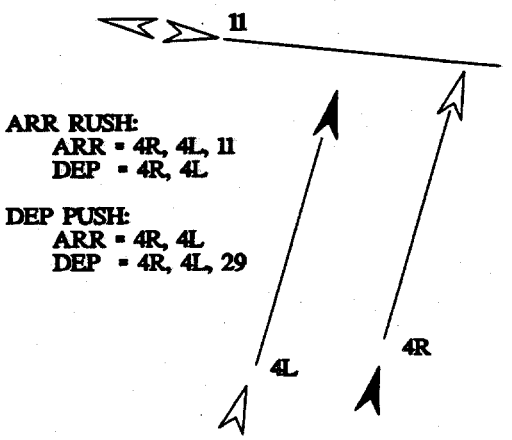
Legend:

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.

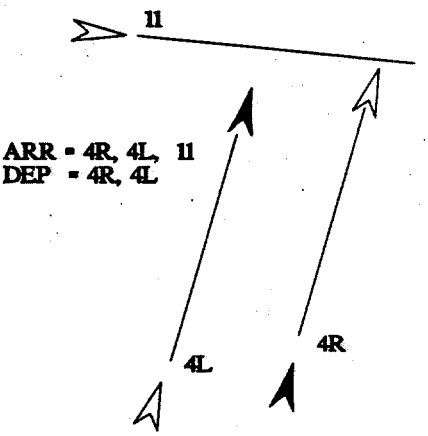
Estimated values for 11/29 were generated by the FAA Technical Center. They are subject to review by the EWR Tower.

EXHIBIT 6 - RUNWAY CONFIGURATIONS (EWR DO-NOTHING)

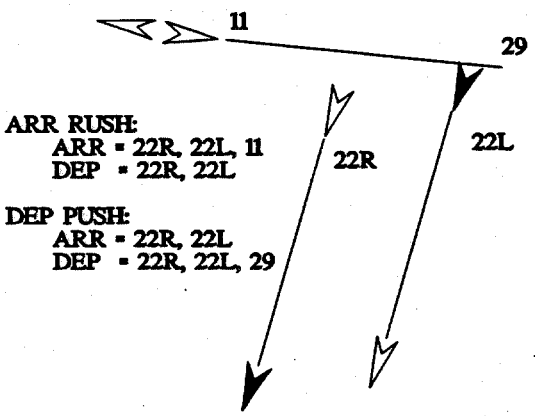
NE – VFR1 & VFR2



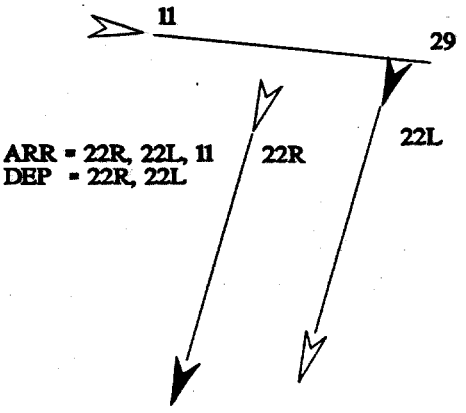
NE – IFR1 (with SCIAs)



SW – VFR1 & VFR2



SW – IFR1 (with DCIAs)



◄ = PRIMARY ARR OR DEP RUNWAY

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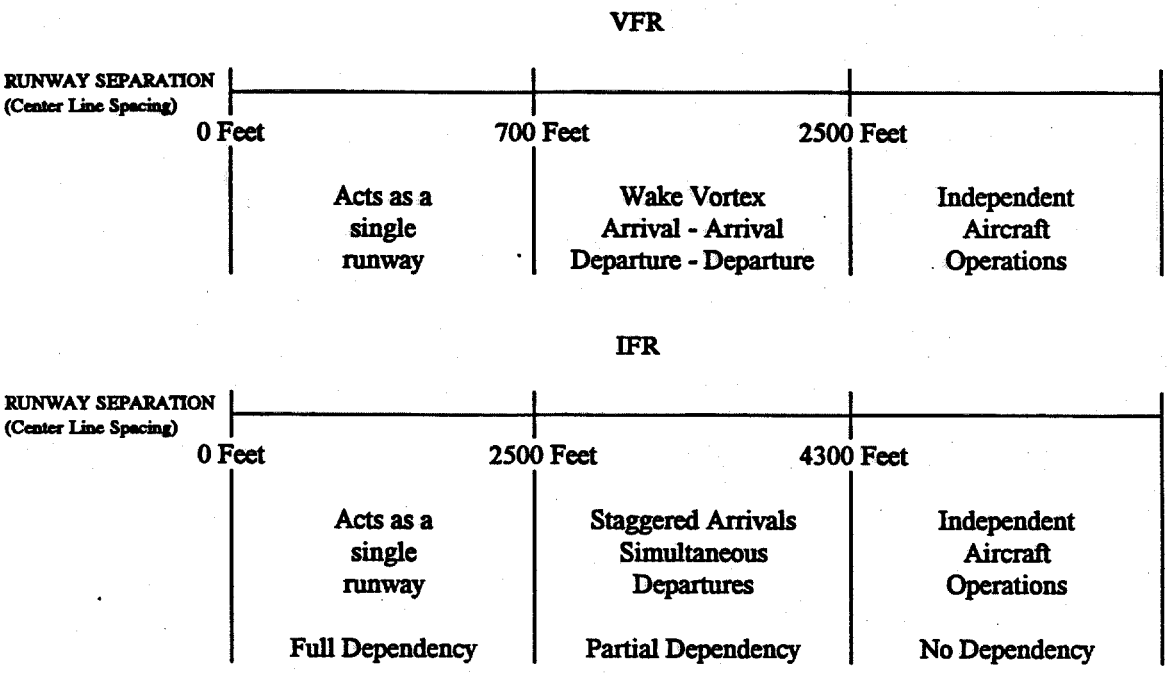
EXHIBIT 7 - ATC DEPENDENCIES FOR PARALLEL RUNWAYS



Source: Based on the "Interpretation of Air Traffic Control Handbook" (7110.65F).

EXHIBIT 8 - EWR VFR (VISUAL) SEPARATIONS

(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 or 2.0 ?
	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 parallels use Radar separations.

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 Jets
- LC = Large Commuters
- MED = Medium -- Small Commuters & Business Jets **(treated as Small for separations purposes)**
- SM = Small twin & single engine props

EXHIBIT 9 - EWR IFR (RADAR) SEPARATIONS

(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 or 2.0 ?**
	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**

All departures use Radar separations.

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 Jets
- LC = Large Commuters
- MED = Medium – Small Commuters & Business Jets **(treated as Small for separations purposes)**
- SM = Small twin & single engine props

EXHIBIT 10 - MISCELLANEOUS INPUT DATA FOR EWR

APPROACH SPEEDS (Knots):

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 (Nautical Miles):

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 (Seconds):

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
M = Medium (Small Commuters & Business Jets.)
S = Small twin & single engine props

EXHIBIT 11 - WEATHER CATEGORIES AND MINIMA

(Operational Procedures and Minima – EWR)

The weather categories, minimums, and percent occurrence are 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.

Additional information was provided by the FAA Technical Center and EWR Tower. This exhibit has not been reviewed by the Tower and may be revised.

On 5/29/97, the EWR Tower stated CRDA is available but not yet in use.

VFR-1: **77.5 %**
Ceiling $\geq$ 3,500' *and* Visibility $\geq$ 5 miles.
Visual (VFR-1) separations.
D/D on 11/29 – Visual (VFR-1) separations.
D/D on parallels – radar (IFR1) separations.
Simultaneous approaches to 11 and either 4R or 4L.
Simultaneous approaches to 11 and either 22R or 22L.
Jet arrival on 11 and a departure on 4, jet holds short or else a dependency.
Prop arrivals on 11 can hold short 4/22s.
Can Business Jets and Regional Jets arrive on 11 and hold short of 4/22s?

VFR-2: **14.2 %**
Less than VFR-1, *and*, Ceiling $\geq$ 1,000' *and* Visibility $\geq$ 3 miles.
Radar (IFR) separations for A/A & D/D on all runways.
Visual (VFR1) separations for A/D & D/A.
Simultaneous approaches may be permitted to 11 and either 4R or 4L.
In VFR-2, would the Tower use 11 in SW flow (with 22s)?
CRDA may permit simultaneous approaches to 11 and either 22R or 22L.
CRDA would reduce the A/A separations on 11 (to 5 NM from 15NM); the separations are required to insert a departure on 22 between successive arrivals on 11.

IFR-1: **4.1 %**
Less than VFR-2b, *and*, Ceiling $\geq$ 600' *and* Visibility $\geq$ 2 miles.
SCIA approaches to 11 and 4. DCIA approaches to 11 and 22.
IFR separations.

IFR-2: **4.2 %**
Less than IFR-1.
IFR separations.

Note:

CAT I ILS:	Runway 11:	Minima are 604' & 2NM.
CAT I ILS:	Runway 4/22 :	Minima are 200' and 3/8 NM.
CAT II ILS:	Runway 4:	Minima are 162'/16'.

EXHIBIT 12 - EWR AIRCRAFT GATE SERVICE TIMES

(Minimum Turn-Around Times in Minutes)

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 2 hours (120 minutes).

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

H		757		LJ		LC		M		S	
Cumulative		Cumulative		Cumulative		Cumulative		Cumulative		Cumulative	
Time	Prob.	Time	Prob.	Time	Prob.	Time	Prob.	Time	Prob.	Time	Prob.
45	0.19	45	0.22	30	0.31	20	0.16	15	0.29	45	1.00
50	0.29	50	0.87	35	0.88	30 *	1.00	20	0.41		
60	0.45	60 *	1.00	40	0.91			30	1.00		
90	0.47			45 *	1.00						
120	0.54										
140	0.59										
150	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.

EXHIBIT 13 - EWR ARRIVAL AIRCRAFT LATENESS DISTRIBUTION

(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%	
-20	2.0%	2.8%	
-15	3.2%	6.0%	Early
-10	6.4%	12.4%	
-5	10.9%	23.3%	
- 2	8.0%	31.3%	
0	5.5%	36.8%	On Time
5	12.8%	49.6%	
10	10.2%	59.8%	
15	8.9%	68.7%	
30	11.3%	80.0%	
45	6.1%	86.1%	Late
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).

Data Package 2 presented the distribution developed from a 1996 Cater Delay Report, which compared the OAG scheduled arrival time (at the gate) to the actual arrival time at threshold. To provide more realistic values, the Technical Center adjusted that lateness distribution by removing the average arrival taxi time from the distribution. (The average arrival taxi time is a weighted average of the arrival taxi times in the 1996 Cater III data). The revised lateness distribution is shown above.

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

EXHIBIT 14 - SIMULATED DEMAND CHARACTERISTICS

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%

EXHIBIT 14 - SIMULATED DEMAND CHARACTERISTICS (Cont.)

Overall -- Daily Fleet Mix By Class

H		757		LJ		LC		M		S		Total		
124	8.5%	118	8.1%	772	53.2%	274	18.9%	144	9.9%	20	1.4%	1,452	100.0%	Baseline
170	10.6%	136	8.5%	816	51.1%	304	19.0%	151	9.5%	20	1.3%	1,597	100.0%	Future 1
186	10.6%	146	8.3%	884	50.3%	352	20.0%	169	9.6%	20	1.1%	1,757	100.0%	Future 2

Air Carrier/Commuter/Air Taxi -- Daily Fleet Mix By Class

H		757		LJ		LC		M		S		Total		
124	8.9%	118	8.5%	768	55.3%	264	19.0%	110	7.9%	4	.3%	1,388	100.0%	Baseline
170	11.1%	136	8.9%	812	53.0%	294	19.2%	117	7.6%	4	.3%	1,533	100.0%	Future 1
186	11.0%	146	8.6%	880	52.0%	342	20.2%	135	8.0%	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: Baseline Demand Characteristics developed from CATER data.
Overall fleet mix -- from Cater data, Calendar Year
GA/MI fleet mix -- from Cater data, 8/22/96 -- assumed daily mix similar to annual mix.
Air Carrier/Commuter/Air Taxi fleet mix -- computed from the other Baseline fleet mixes.

Future 1 (or Future 2) Demand Characteristics developed as follows:
GA/MI fleet mix -- same as GA/MI fleet mix in Baseline Demand.
Air Carrier/Commuter/Air Taxi fleet mix -- estimated from forecast data
Overall fleet mix -- computed from the other Future 1 (or Future 2) fleet mixes.

The percentages of LC & M increased at Future 2 because the Port forecast that 41.7 % of the increased operations would be Commuters. For every additional 1,400 Air Carrier operations, there would be 1,000 additional Commuter operations.

EXHIBIT 15 - EWR AIRLINE GATE ASSIGNMENTS

AIRLINE(S)	OAG CODE	FAA CODE	TERMINAL/GATES
Air Alliance		AAQ	C100-C115
AirBC	ZX	ABL	
Air Canada	AC	ACA	C100-C115
Air Canada Commuters	AC	ACA	C100-C115
Air Nova	QK	ARN	C100-C115
Alitalia	AZ	AZA	C70*-C79
American	AA	AAL	A30-A35
America West	HP	AWE	C120
America West Commuters	HP	AWE	C120
Business Express		GAA	B43-B48
Carnival	KW	CAA	B40-B42
Chautauqua		CHQ	A25-A26
Colgan Air	9X	CJC	A36-A39
Comair		COM	B43-B48
Continental	CO	COA	C70*-C115
Continental Express		BTA	C70*-C115
Delta	DL	DAL	B43-B48
International Departures only			B51-B57 (Int'l)
International Facility			B60-B68 (Int'l)
Jet Express	JI	YPX	
Jet Train Corporation	LF	JTN	
Kiwi International	KP	KIA	A30-A35
Midway		MDW	A30-A35
Midwest Air Express	YX	MEP	B40-B42
Monarch		MON	A36-A39
Myrtle Beach			B40-B42
Northwest	NW	NWA	A40-A42
Trans World Airlines	TW	TWA	A36-A39
Scandinavian Airlines	SK	SAS	
Sun Country (Charter)	SY	SCX	A36-A39
Sun Jet		SJI	A36-A39
SwissAir	SR	SWR	B43-B48, B51-57
United	UA	UAL	A10-A18
United Express (Atlantic Coast)	UA	UAL	A10-A18
US Airways	US	USA	A20-A24, A27-A28
USAir Express (Allegheny, Commutair, Henson)	US	USA	A25-A26
Western Pacific		KMR	B43-B48

Notes: **Updated 5/2/97. The Design Team will provide additions and corrections.**
Does UA also use gates A20-A24, A27, and A28?
Does US Airways also use gates A25-A26?
* 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.

3. DESIGN TEAM SCHEDULE

Exhibit 16 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 16 - DESIGN TEAM SCHEDULE

Date	Event	Objective	Task	Responsibility	Output
11/18/96	1.	Kick Off Meeting. Review Design Team Purpose. Identify Objectives and Possible Improvements.	Review Technical Plan, and Potential Improvements. Agree on General Parameters of Scope of Work, Assumptions, Forecasts and Data Requirements. Review and Agree on Purpose and Inputs.	Entire Design Team	Initial List of Potential Improvements. Agreement on study direction.
12/9/96 thru 12/13/96	2.	Perform Data Collection.	On-Site Data Collection.	Tech. Ctr.	Establish parameters for analysis.
1/14 /97	3.	Determine Scope of Study, Select Model, and Review Results of Data Collection.	Review Results. Review Data Package 1.	Entire Design Team	Agreement on inputs and direction.
4/10/97	4.	Review results of Data Collection, model inputs, and potential improvements.	Review Data Package 2.	Entire Design Team	Agreement on inputs and direction.
6/18/97	5.	Review model inputs and potential improvements.	Review Data Package 3	Entire Design Team	Agreement on inputs and direction.
/ /	6.	□ □ □			
/ /98	?.	Complete and Publish Final Report.	Publish and Distribute Final Report.	FAA HQ.	Final Report.

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