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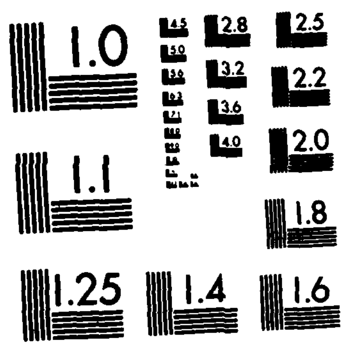

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OCEANIC AREA SYSTEM IMPROVEMENT STUDY (OASIS)

Volume VII: North Atlantic Region Flight Cost Model Results

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SEPTEMBER 1981
FINAL REPORT

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16. Abstract

The Oceanic (and selected Non-Oceanic) Area System Improvement Study (OASIS), conducted by SRI International under contract with the Federal Aviation Administration (FAA), was part of a broad oceanic aeronautical system improvement study program coordinated by the "Committee to Review the Application of Satellite and Other Techniques to Civil Aviation" (also called the Aviation Review Committee or the ARC). The OASIS Project, with inputs from the international aviation community, examined current and potential future oceanic air traffic control (ATC) systems in the North Atlantic (NAT), Central East Pacific (CEP), and Caribbean (CAR) regions. This phase of the Aviation Review Committee program began in late-1978 and was completed in mid-1981.

The thrust of the Aviation Review Committee program, which OASIS broadly supported, was to analyze the present ATC systems; examine future system requirements; identify areas where the present systems might be improved; and develop and analyze potential system improvement options. The time frame of this study is the period 1979 to 2005.

This report presents an analysis of NAT air traffic flight costs through the year 2005 based on results obtained from the computerized Flight Cost Model (FCM). The flight costs associated with present and alternative ATC separation minima are estimated. The report also presents data, generated by the FCM, which describe flight operating characteristics, including route and flight level utilization and diversions.

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Oceanic Area System Improvement Study (OASIS)

Final Report

This report is one of a set of companion documents which includes the following volumes:

Volume I
Executive Summary and Improvement Alternatives Development and Analysis

Volume II
North Atlantic Region Air Traffic Services System Description

Volume III
Central East Pacific Region Air Traffic Services System Description

Volume IV
Caribbean Region Air Traffic Services System Description

Volume V
North Atlantic, Central East Pacific, and Caribbean Regions Communication Systems Description

Volume VI
North Atlantic, Central East Pacific, and Caribbean Regions Navigation Systems Description

Volume VII
North Atlantic Region Flight Cost Model Results

Volume VIII
Central East Pacific Region Flight Cost Model Results

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Flight Cost Model Description

Volume X
North Atlantic, Central East Pacific, and Caribbean Regions Aviation Traffic Forecasts

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PREFACE

The Oceanic Area System Improvement Study (OASIS) was conducted in coordination with the "Committee to Review the Application of Satellite and Other Techniques to Civil Aviation (also called the Aviation Review Committee or the ARC)." This study examined the operational, technological, and economic aspects of the current and proposed future oceanic air traffic systems in the North Atlantic (NAT), Caribbean (CAR), and Central East Pacific (CEP) regions and assessed the relative merits of alternative improvement options. A key requirement of this study was to develop a detailed description of the present air traffic system. In support of this requirement, and in cooperation with working groups of the Committee, questionnaires were distributed to the providers and users of the oceanic air traffic systems. Responses to these questionnaires, special reports prepared by system provider organizations, other publications, and field observations made by the OASIS staff were the basis for the systems descriptions presented in this report. The descriptions also were based on information obtained during Working Group A and B meetings and workshops sponsored by Working Group A. The information given in this report documents the state of the oceanic air traffic system in mid 1979.

In the course of this work valuable contributions, advice, data, and opinions were received from a number of sources both in the United States and outside it. Valuable information and guidance were received and utilized from the International Civil Aviaiton Organization (ICAO), the North Atlantic Systems Planning Group (NAT/SPG), the North Atlántic Traffic Forecast Group (NAT/TFG), several administrations, the International Air Transport Association (IATA), the airlines, the International Federation of Airline Pilots Association (IFALPA), other aviation associated organizations, and especially from the "Committee to Review the Application of Satellite and Other Techniques to Civil Aviation."

It is understood of course, and should be noted, that participation in this work or contribution to it does not imply either endorsement or agreement to the findings by any contributors or policy agreement by any administration which graciously chose to contribute.

ILLUSTRATIONS

TABLES

TABLES (continued)

TABLES (continued)

TABLES (Concluded)

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This work was performed by SRI International under the leadership of Dr. George J. Couluris. The application of the Flight Cost Model (FCM) to the North Atlantic Region was performed by Ms. Janet Tornow under the direction of Dr. Kai Y. Wang and with technical assistance from Dr. John C. Bobick and Mr. Donato A. D'Esopo. Mr. Paul W. Wong, Mr. David B. Koretz, Ms. Mina Chan, Ms. Marika E. Garskis, Mr. Bert Laurence, Ms. Linda Gill and Mr. Andre Dermant contributed to the programming and data preparation efforts. Ms. Geri Childs prepared this report. The project was conducted under the administrative supervision of Dr. Robert S. Ratner and Mr. Joel R. Norman.

GLOSSARY OF ACRONYMS

ACC	Area control center
ATA	Air Transport Association of America
ATC	Air traffic services
CAA	Civil Aviation Authority
CTA	Control area
EB	Eastbound
FAA	Federal Aviation Administration
FCM	Flight Cost Model
FIR	Flight information region
FL	Flight level
ft	Feet
IAC	Instantaneous aircraft count
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
min	Minutes
NAT	North Atlantic
nmi	Nautical miles
OASIS	Oceanic Area System Improvement Study
O-D	Origin-destination
OTS	Organized track system
UK	United Kingdom
US	United States
WB	Westbound

1.0 Introduction

The Flight Cost Model (FCM) is a set of computer programs prepared especially for the OASIS project to estimate flight operating costs. The FCM was used to simulate the operation of the present North Atlantic Region (NAT) Air Traffic Services (ATS) system and several other system operating alternatives (representing alternative separation minima) on a representative July (peak) day and a representative November (off-peak) day in 1979 (baseline year), and with traffic forecast to 1984 and 2005. The July sample day operation in each of the three sample years was simulated for eight system alternatives. The November sample day in each year was simulated only for the present system (60-120nmi/15min/2000ft separation minima) for comparison purposes.

(Note: References to separation minima describe systems relative to the nominal longitudinal minimum corresponding to the Mach number technique; e.g., the 60nmi lateral/10min longitudinal/2000ft vertical separation minima system refers to the 10 min Mach number technique longitudinal separation requirement. However, in all runs of the FCM, the non-Mach number technique separation minimum is assumed to be 5 min greater than the nominal separation indicated. In the previous example, a 15 min minimum is applied by the FCM to aircraft not qualifying for the Mach number technique in the nominal 60nmi/10min/2000 ft system.)

2.0 FCM Operation

FCM input statistics were based on data describing actual operations obtained for the July 1979 and November 1979 sample days and forecasts of future traffic loadings. The sample day data include: meteorological information (wind speed and direction and temperature by grid and altitude based on computer tapes obtained from the US National Weather Service); traffic distributions by origin-destination airport, departure time and aircraft type (obtained from published schedules and statistics specially provided by ATS units); planned landing weights (provided by airlines), aircraft fuel burn/ weight/altitude performance relationships (provided by airlines); and aircraft operating cost data (provided by IATA, ATA and published material). The major input data items relating to traffic and cost characteristics are tabulated in Appendix A.

The FCM simulated the various types of flights active in the NAT upper airspace including air carrier, military and general aviation flights. As part of the simulation process, the FCM developed flight plans for each flight based on planned landing weight, weather, route constraints and flight performance characteristics. The FCM then tracked each flight through domestic and oceanic airspace from takeoff to landing, modeling the maintenance of separation minima and conflict resolution actions (i.e., diversions and delays), and estimated the fuel burn, flight time and associated fuel, crew and maintenance-accrual costs. Representative flight performance characteristics for the following aircraft classes were based on the data provided by airlines and aircraft manufacturers: B747, DC10, L1011, B707, DC8, B747SP and two proposed future aircraft, a B747 stretch (ST) and a new long narrow body (NEW1) aircraft. Flight performance characteristics for certain other aircraft including air carrier (i.e., mostly IL62 and a few VC10, B720 and DC9 types), military and general aviation aircraft were not provided and fuel and time costs for these aircraft were not estimated by the FCM; B707 and B727 flight performance characteristics, as appropriate, were used to simulate the flight profiles of these non-costed air carrier types, so as to include their contribution to system traffic. Flight profiles for the military and general aviation aircraft were based on flight strip data. Fuel prices were based on the fuel charges reported for the various origin airports. The daily flight cost results produced by the FCM pertain only to the costed flights (i.e., excluding IL62, VC10, B720, DC9, military and general aviation aircraft) and therefore are slight underestimates of the air carrier direct operating flight expenses for fuel, crew and maintenance. The traffic distribution is shown in Table 1.

Table 1

NAT TRAFFIC COMPOSITION, JULY SAMPLE DAY

	Traffic Loading		
	1979	1984	2005
Total Number of Flights	728	822	1294
Air Carrier	94%	95%	97%
Military	4%	4%	2%
General aviation	2%	1%	1%
Number of Air Carrier Flights	685	779	1251
Costed air carrier	96%	96%	97%
Number of Costed Air Carrier Flights	656	751	1219
Wide body costed air carrier	50%	76%	95%

The traffic loading data is based on growth factors developed by the traffic forecasting workshop convened by the Aviation Review Committee and documented in reference 3. Also, see section 4.1 of this report for an introductory description of the area and traffic flows covered.

3.0 Results and Analysis

3.1 Introduction

The remainder of this report summarizes the FCM cost results with emphasis placed on the flight cost and operating differences among the eight system alternatives. Supporting data are included in Appendix B.

3.2 Overall Costs

The FCM was used to simulate three modes of flight operation: ideal, planned, and actual (i.e., standard) procedures. The FCM ideal flight mode estimates the flight costs that would be experienced if each aircraft were to fly an approximately optimum flight path from takeoff to landing. The ideal flight mode simulates an operational situation in which flights are not constrained by OTS routing requirements and are not constrained by lateral and longitudinal separation minima. However, because of limitations due to the FCM program structure and data input complications, ideal mode flights are assumed to fly step-climb profiles (not cruise-climb) subject to 1000ft vertical separation requirements and hemispheric-type flight rules. The hemispheric rules assume alternating direction of flights on successive flight levels (i.e., all eastbound flights are separated by 2000ft with a westbound flight level in between).

The FCM planned flight mode estimates the flight costs that would occur if each aircraft were to follow its preferred flight plan. The planned flight mode assumes that ATC routing and hemispheric altitude constraints are in effect but that the longitudinal separation minima is not applied.

The FCM actual flight mode estimates the costs that would be experienced in the real world where separation minima are applied and standard operating procedures are followed. The actual mode assumes that flights would be diverted or delayed to resolve potential violations of separation minima.

The ideal run of FCM represents a nearly unconstrained (unlimited capacity) flight capability; the planned flight run represents a theoretical conflict-free organized track system where separation standards are arbitrarily small; and the actual flight run represents potential conflicts and their resolution.

The FCM overall NAT cost results for the July sample day are summarized in Table 2 which shows the estimated daily fuel, crew and maintenance-accrual cost totals for all costed aircraft for each system operating alternative in each sample year. The corresponding daily average costs per flight are also shown. The flight costs are based on estimated fuel, crew and maintenance prices in effect in mid-1979 (see Appendix A). The daily cost data shown in Table 2 are in 1979 US dollars (i.e., 1979 prices are assumed in future years). For comparison purposes, the cost data shown for future years do not include inflation effects and are not discounted to their 1979 present value. Note that all dollar amounts in the text of this report are in 1979 US dollars.

The operating alternative designated 60nmi/10min/1000*ft, which represents a scenario with 1000 ft vertical minimum separation in the NAT oceanic area and 2000 ft elsewhere, was run only for the July 1979 sample day. Cost figures shown for 1984 and 2005 in Tables 2, 3 and 4 are extrapolations.

The ideal flight mode results show that the theoretical minimum daily flight cost regardless of system operating alternative is US$ 11.0 million in 1979 and increases to $13.7 million in 1984 and $29.3 million in 2005. The increase is due to the 86 percent increase in costed traffic over the 27 year period as well as a change in fleet mix. The wide body aircraft proportion of costed traffic increases from 50 to 95 percent over the 1979 to 2005 time period and causes the ideal average flight cost to increase from US$ 16.77 to 24.06 (thousands) per flight over the same period.

The planned flight mode requires aircraft to fly established tracks and route systems in areas where they exist and random tracks elsewhere. The resulting planned costs are affected by route geometric design constraints due to lateral and vertical separation minima, navigation aid locations and airspace reservations as well as by the procedures used to define track locations. The OTS planned costs, for example, if actually flown, would depend on the accuracy of the meteorological data and methods used to set the tracks each day. The planned costs also are affected by aircraft operator flight planning techniques and practices (including anticipation of step climbs, diversions, and delays) and the accuracy of the meteorological forecast data. The actual flight costs include the planned costs and the additional costs caused by necessary ATC intervention (e.g., diversions and delays),

The FCM estimates of planned and actual costs are based on a modeled airspace environment in which the separation minima (and associated ATC diversion and delay strategies, OTS tracks and general route network structure) and the traffic loading (including flight frequency and aircraft type distribution) can be changed from one run to another. The meteorological conditions are held constant for all flight planning and tracking runs as are the flight planning and operating practices. All flight plans are based on a minimum fuel burn objective and step

Table 2

FCM DAILY FLIGHT COSTS, JULY SAMPLE DAY

Year	Flight Operating Mode	Daily Cost by System Operating Alternative							
		120-60 NMI 15 Min. 2000 Ft	60 NMI 15 Min 2000 Ft	60 NMI 10 Min 2000 Ft	30 NMI 10 Min 2000 Ft	30 NMI 5 Min 2000 Ft	60 NMI 15 Min 1000 Ft	60 NMI 10 Min 1000 Ft	60 NMI 10 Min 1000* Ft
		Daily Flight Cost (1979 US $000)†							
1979	Ideal	11002	11002	11002	11002	11002	11002	11002	11002
	Planned	11106	11106	11106	11094	11094	11064	11064	11083
	Actual	11158	11150	11136	11120	11111	11081	11075	11094
1984	Ideal	13702	13702	13702	13702	13702	13702	13702	13702
	Planned	13837	13836	13836	13824	13824	13780	13780	13804
	Actual	13904	13893	13878	13860	13849	13804	13797	13821
2005	Ideal	29327	29327	29327	29327	29327	29327	29327	29327
	Planned	29567	29569	29569	29541	29541	29430	29430	29481
	Actual	29790	29768	29734	29682	29653	29554	29530	29581
		Daily Average Flight Cost (1979 US $000 per Flight)†							
1979	Ideal	16.77	16.77	16.77	16.77	16.77	16.77	16.77	16.77
	Planned	16.93	16.93	16.93	16.91	16.91	16.87	16.87	16.89
	Actual	17.01	17.00	16.98	16.95	16.94	16.89	16.88	16.91
1984	Ideal	18.25	18.25	18.25	18.25	18.25	18.25	18.25	18.25
	Planned	18.42	18.42	18.42	18.41	18.41	18.35	18.35	18.38
	Actual	18.51	18.50	18.48	18.46	18.44	18.38	18.37	18.40
2005	Ideal	24.06	24.06	24.06	24.06	24.06	24.06	24.06	24.06
	Planned	24.26	24.26	24.26	24.23	24.23	24.14	24.14	24.18
	Actual	24.44	24.42	24.39	24.35	24.33	24.24	24.22	24.26

* 1000 ft vertical separation minimum in oceanic airspace, 2000 ft elsewhere.

† Constant 1979 $ US excluding inflation and discount rate.

TABLE 3

FCM DAILY FLIGHT COSTS RELATIVE TO IDEAL MODE, JULY SAMPLE DAY

Year	Flight Operating Mode	Relative Daily Cost by System Operating Alternative							
		120-60 NMI 15 Min 2000 Ft	60 NMI 15 Min 2000 Ft	60 NMI 10 Min 2000 Ft	30 NMI 10 Min 2000 Ft	30 NMI 5 Min 2000 Ft	60 NMI 15 Min 1000 Ft	60 NMI 10 Min 1000 Ft	60 NMI 10 Min 1000* Ft
		Daily Flight Cost Difference Relative to the Ideal Cost in Year Indicated (1979 US $000)†							
1979	Planned	104	104	104	92	92	62	62	81
	Actual	156	148	134	118	109	79	73	92
1984	Planned	135	134	134	122	122	78	78	102
	Actual	202	191	176	158	147	102	95	119
2005	Planned	240	242	242	214	214	103	103	154
	Actual	463	441	407	355	326	227	203	254
		Daily Average Flight Cost Difference Relative to the Ideal Cost in Year Indicated (1979 US $000 per Flight)†							
1979	Planned	0.16	0.16	0.16	0.14	0.14	0.10	0.10	0.12
	Actual	0.24	0.23	0.21	0.18	0.17	0.12	0.11	0.14
1984	Planned	0.17	0.17	0.17	0.16	0.16	0.10	0.10	0.13
	Actual	0.26	0.25	0.23	0.21	0.19	0.13	0.12	0.15
2005	Planned	0.20	0.20	0.20	0.17	0.17	0.08	0.08	0.12
	Actual	0.38	0.36	0.33	0.29	0.27	0.18	0.16	0.20

* 1000 ft vertical separation minimum in oceanic airspace, 2000 ft elsewhere.

† Constant 1979 $ US excluding inflation and discount rate.

TABLE 4

FCM DAILY FLIGHT COSTS RELATIVE TO 60-120/15/2000 SYSTEM, JULY SAMPLE DAY

Year	Flight Operating Mode	Relative Daily Cost by System Operating Alternative						
		60 NMI 15 Min 2000 Ft	60 NMI 10 Min 2000 Ft	30 NMI 10 Min 2000 Ft	30 NMI 5 Min 2000 Ft	60 NMI 15 Min 1000 Ft	60 NMI 10 Min 1000 Ft	60 NMI 10 Min 1000* Ft
		Daily Flight Cost Difference Relative to 60-120/15/2000 system in year indicated (1979 $000)†						
1979	Planned	0	0	12	12	42	42	23
	Actual	8	22	38	47	77	83	64
1984	Planned	1	1	13	13	57	57	33
	Actual	11	26	44	55	100	107	83
2005	Planned	(2)	(2)	26	26	137	137	86
	Actual	22	56	108	137	236	260	209
		Daily Average Flight Cost Difference Relative to 60-120/15/2000 system in year indicated (1979 $000)†						
1979	Planned	0	0	0.02	0.02	0.06	0.06	0.04
	Actual	0.01	0.03	0.06	0.07	0.12	0.13	0.10
1984	Planned	0	0	0.01	0.01	0.07	0.07	0.04
	Actual	0.01	0.03	0.05	0.07	0.13	0.14	0.11
2005	Planned	0	0	0.03	0.03	0.12	0.12	0.08
	Actual	0.02	0.05	0.09	0.11	0.20	0.22	0.18

* 1000 ft vertical separation minimum in oceanic airspace, 2000 ft elsewhere.
† Constant 1979 $ US excluding inflation and discount rate.

climb procedures are followed; cruise climb is not allowed. Therefore, comparisons of FCM costs across systems reflect changes in separation minima and comparisons from one year to another reflect changes in traffic loading.

3.3 Theoretical Cost Penalties

Because the lowest flight cost attainable under ideal circumstances is that represented by the ideal cost, the cost differences between the ideal cost and the planned and actual costs represent the maximum possible cost penalties that theoretically could be avoided by any system improvements for each of the two different modes. These cost penalties for the July sample day are shown in Table 3 which presents the total cost difference between planned and ideal costs and between actual and ideal costs. Recall that the costs shown are not inflated and not discounted for comparison purposes.

The Table 3 data indicate that the potential cost differences associated with planned costs are a majority of the total flight cost penalty. For example, the data for the 60nmi/10min/2000ft system in 1984 show that the estimated planned cost difference accounts for 76 percent (US$ 134 thousand) of the difference between ideal and actual daily costs ($176 thousand). Note that the planned cost proportion of total cost generally decreases in later years, and lowest cost penalty in each year is associated with the 1000 ft vertical separation minimum.

These results indicate that significant savings could be obtained by alleviating the operational conditions that contribute to the planned cost penalties. However, the planned costs are highly dependent on the basic route structure; and any option that would eliminate formal routes in a dense traffic corridor such as the OTS would require revolutionary advances in ATC automation. Planned cost penalties also may be reduced by some amount through improvements in planning procedures, meteorological forecasting, OTS alignment practices, and route system geometric design. The route system geometry depends on separation minima; the implications of reduced separations on planned costs as well as actual are addressed below.

3.4 System Cost Comparisons

In the real world environment, reductions in planned cost penalties are possible by establishing new tracks and routes and providing more cruise flight levels. Additional routes created by closer lateral spacings of tracks would provide a greater choice in flight track planning and would enable aircraft to operate closer to their optimal tracks. Similarly, additional legal altitudes created by closer vertical spacing of flight levels would provide a greater flexibility in flight level selection and step climb opportunities and would enable the aircraft flight profiles to approximate more closely their optimum cruise climb profiles. These improvements would be obtainable through improvements allowing reductions in the lateral and vertical separation minima, simulated as operational alternatives in the FCM runs.

In addition to the planned cost penalty component, the actual cost penalties addressed by FCM include those associated with ATC intervention. The magnitude of the ATC intervention cost depends on two factors: the frequency of detected violations of separation minima (i.e., potential conflicts), and the severity of the diversions and delays required to resolve potential conflicts. Clearly, the frequency of potential conflicts would be reduced by reductions in separation minima. In the case of the alternative systems modeled, potential conflict frequency reductions due to reducing vertical separation minima show up as a reduction in planned cost penalties. However, longitudinal and lateral separation minima reductions would contribute to the actual cost savings through fewer potential conflicts in the horizontal plane. Also, the availability of more tracks and altitudes for flight planning would tend to reduce the concentration of aircraft on particular flight paths.

The improved track and altitude capacity provided by reduced lateral and vertical separations would reduce the actual cost of diversions caused by potential conflicts. The reduced longitudinal separation would provide additional usable time slots that could be used by diverted aircraft, could reduce delay time requirements, and could provide more and better merge opportunities.

The impact of separation minima reduction is shown in Table 4 which presents the difference in daily flight costs between the current 60-120nmi/15min/2000ft system and each of the other six system alternatives for the July sample day. The planned flight cost reductions for each of the six alternatives are calculated relative to the current system planned cost; the actual cost reductions are calculated similarly.

The allocation of cost reductions between planned cost and actual cost savings reflects the impact of track and altitude compaction and longitudinal separation reduction, respectively. The planned costs show insignificant reductions from implementation of the 60NMI lateral spacing, regardless of longitudinal separation. The 60nmi system does not provide as dramatic a geometric redesign potential relative to the current 60-120nmi composite system as do the 30nmi lateral and 1000ft vertical options. The redesign potential is demonstrated in 1984 by the $13 thousand daily planned cost reduction relative to the 60-120nmi/15min/2000ft when lateral spacings are halved and by the $57 thousand reduction when vertical spacings are halved everywhere. Note that the maximum actual cost reductions shown in Table 4 are attained by the 60nmi/10min/1000ft system and are $83, $107 and $260 thousand in 1979, 1984 and 2005 respectively. The lateral reduction impact on planned cost accounts for 24% ($13 thousand in 1984) of the maximum actual cost reductions ($55 thousand in 1984). A vertical (in lieu of the lateral reduction) impact in planned cost reduction accounts for 53% ($57 thousand in 1984) of the total reductions achievable ($107 thousand in 1984). Changes in the longitudinal separation minima do not generate planned cost reductions.

The relationship among the various reduced longitudinal, lateral and vertical separation minima simulated is demonstrated by successive reductions in actual cost as separation minima are reduced. Of the various system operating alternatives, the 60nmi/10min/1000ft system shows the greatest daily actual cost saving in each year ($83, $107 and $260 thousand in 1979, 1984 and 2005 respectively). In general, the actual daily cost savings achievable by halving vertical separations are greater than twice those achievable by halving lateral separations. In all cases where lateral and vertical separations are fixed, some cost savings are obtained by longitudinal minimum reduction. However, the impact of longitudinal reductions are proportionately less as lateral and vertical minima are reduced. For example, in 1984, a reduction of 5 min in the longitudinal minima produces 136, 25 and 7 percent greater reductions in daily flight cost in the 60nmi/x/2000ft, 30nmi/x/2000ft, and 60nmi/x/1000ft systems, respectively.

3.5 Seasonal Cost Variations

The FCM was applied to a November sample day for the years 1979, 1984 and 2005 using the present 60-120nmi/15min/2000ft as a basis for comparing cost magnitudes by year with those of the July sample day. The number of costed flights in each November sample day is 68 percent of that in the July sample day and the daily cost summed over all flights is correspondingly less than in July as shown in Table 5. The November 1979 sample day flight cost is 74 percent of the July 1979 daily cost, but the daily average flight cost is greater in the November than the July 1979 sample day. This increased cost per aircraft in November versus July 1979 is attributed in part to the difference in the daily meteorological condition and associated OTS setting and in part to the slight difference in fleet composition; 60 percent of the November sample day costed traffic is composed of widebody aircraft as opposed to 50 percent in July. However, by the year 2005 the proportion of wide body aircraft in November is the same as July (i.e., 95 percent). By the year 2005, the July daily average cost per flight becomes greater than that of November. Congestion penalty costs may contribute to this situation.

3.6 Traffic Operations

The impacts of the system changes on track and altitude utilization and diversions, step climb requests and clearances, longitudinal spacing distributions and related operational data are presented in Appendix C.

Table 5

FCM COST COMPARISONS FOR NOVEMBER AND JULY SAMPLE DAY
BASED ON 60-120/15/2000 SYSTEM OPERATION

Sample Day	Number of Costed Flights	Daily Flight Cost (Thousands of 1979 US Dollars)	Daily Average Flight Cost (Thousands of 1979 US Dollars per flight)
July 1979	656	11,158	17.01
November 1979	449	8,204	18.27
July 1984	751	13,904	18.51
November 1984	512	9,760	19.06
July 2005	1,219	29,790	24.44
November 2005	830	19,548	23.55

APPENDIX A

FCM INPUT DATA--SUPPLEMENTAL INFORMATION

Appendix A presents in part the traffic loading, cost rate and OTS description data that were used for inputs into FCM. Tables A-1 and A-2 present the current and forecasted traffic distributions by aircraft type and origin and destination flow pattern. Fuel prices and crew and maintenance cost rates are shown in Tables A-3 and A-4. The fuel prices shown in Table A-3 are the fuel charges reported for each of over 100 origin airports for February 1979; these prices were inflated by an additional 29% in the FCM applications to represent mid-1979 fuel costs.

The two OTS alignments used on the July sample day are shown in Figures A-1 and A-2 for the current system and the corresponding OTS alignments assumed for the system alternatives are shown in Figures A-3 through A-8. The OTS alignments used on the November sample day are shown in Figures A-9 and A-10 for the current system. The assigned directions of flight shown for each track in Figures A-1 through A-10 are the actual and assumed published flight level assignments; standard hemispheric separation rules are assumed to be in effect at other flight levels.

Table A-1

DISTRIBUTION OF FLIGHTS BY AIRCRAFT TYPE

	Daily Number of Flights							
	1979		1984		1995		2005	
AIRCRAFT TYPE	JULY	NOVEMBER	JULY	NOVEMBER	JULY	NOVEMBER	JULY	NOVEMBER
B707	186	93	79	47	7	3	2	3
B727	43	24	55	26	56	33	55	35
B747	204	162	295	205	468	304	536	369
DC10	89	70	153	105	176	136	132	104
DC8	96	64	51	40	4	1	0	0
GEN AV	12	13	12	13	12	13	12	13
L1011	34	32	111	87	150	107	132	95
MILITARY	31	30	31	30	31	30	31	30
B747SP	4	7	7	3	10	7	17	24
B747ST	0	0	2	0	108	60	339	194
NEW1	0	0	0	0	6	4	8	6
NOCO*	29	27	27	23	30	23	32	23
TOTAL ALL	728	522	823	579	1,058	721	1,296	896
TOTAL COSTED†	656	449	751	512	983	655	1,219	830

*Non-costed aircarrier (IL62, VC10, B720, DC9).
†Excludes NOCO, General Aviation and Military aircraft.

Table A-2

DISTRIBUTION OF COSTED FLIGHTS BY ORIGIN-DESTINATION FLOW

	Daily Number of Costed Flights					
	July			November		
	1979	1984	2005	1979	1984	2005
1. Scandinavia-North America	30	33	52	21	28	42
2. Europe-Eastern North America	252	281	394	180	205	291
3. Europe-Mid North America	73	82	152	23	24	38
4. Europe-Western North America	33	40	94	29	31	76
5. Europe-Caribbean	25	31	58	19	20	31
6. Iberia-USA	27	32	50	13	18	28
7. Iberia-Canada	6	10	14	3	3	6
8. Iberia-Caribbean	18	20	40	16	18	31
9. North America-Africa	4	6	16	4	6	14
10. Europe-Iceland	17	19	21	9	12	13
11. Europe-Azores	15	16	20	4	6	6
12. US/Canada-Caribbean/S. America	155	180	304	127	140	251
13. Mideast/Africa-Caribbean/S. America	1	1	4	1	1	3
14. Greenland-USA/Canada	0	0	0	0	0	0
ALL	656	751	1,219	449	512	830

Table A-3

ESTIMATED FUEL PRICE BY ORIGIN AIRPORT, FEBRUARY 1979

AIRPORT CODE	FUEL PRICE ($/1000LB)	AIRPORT LOCATION
AGP	80.97	MALAGA, SPAIN
AMM	108.70	AMMAN, JORDAN
AMS	73.55	AMSTERDAM, NETHERLANDS
ANC	71.03	ANCHORAGE, ALASKA, USA
ANU	75.94	ANTIGUA, WEST INDIES
ARN	70.59	STOCKHOLM, SWEDEN
ATH	85.40	ATHENS, GREECE
ATL	71.03	ATLANTA, GA, USA
AUA	75.94	ARUBA, NETH. ANTILLES
BAL	71.03	BALTIMORE, MD. USA
BAQ	75.94	BARRANQUILLA, COLOMBIA
BCN	76.47	BARCELONA, SPAIN
BDA	71.03	BERMUDA
BEL	101.34	BELEM, BRAZIL
BGI	75.94	BARBADOS, BARBADOS
BGO	77.25	BERGEN, NORWAY
BGR	71.03	BANGOR, ME. USA
BOG	75.94	BOGOTA, COLOMBIA
BOS	71.03	BOSTON, MASS. USA
BRU	79.34	BRUSSELS, BELGIUM
CAI	111.34	CAIRO, EGYPT
CAY	75.94	CAYENNE, FR. GUIANA
CCS	75.94	CARACAS, VENEZUELA
CDG	78.93	PARIS, FRANCE
CGN	80.37	COLOGNE, REP. OF GERMANY
CMN	98.13	CASABLANCA, MOROCCO
CPH	77.00	COPENHAGEN, DENMARK
CUR	75.94	CURACAO, NETH. ANTILLES
DEN	71.03	DENVER, COLORADO, USA
DFW	71.03	DALLAS/FT. WORTH, TEXAS, USA
DHA	66.33	DHAHRAN, SAUDI ARABIA
DKR	95.37	DAKAR, SENEGAL
DTW	71.03	DETROIT, MICHIGAN, USA
EWR	71.03	NEW YORK, NY-NEWARK ARPT., USA
EZE	86.48	BUEANOS AIRES, ARG-EZEIZA ARPT.
FCO	83.63	ROME, ITALY
FDF	75.94	FORT DE FRANCE, MARTINIQUE

Table A-3 (Continued)

FPO	75.94	FREEPORT, BAHAMAS
FRA	80.91	FRANKFURT, REP. OF GERMANY
GEN	77.25	OSLO, NORWAY
GIG	101.34	RIO DE JANEIRO, BRAZIL
GOT	70.59	GOTHENBURG, SWEDEN
GVA	85.28	GENEVA, SWITZERLAND
HAM	83.32	HAMBURG, REP. OF GERMANY
HAV	75.94	HAVANA, CUBA
HEL	87.60	HELSINKI, FINLAND
IAD	71.03	WASHINGTON, D. C. USA
IAH	71.03	HOUSTON, TEXAS, USA
JFK	71.03	NEW YORK, NY, USA
KEF	78.36	REYKJAVIK, ICELAND
KIN	75.94	KINGSTON, JAMAICA
KOK	87.60	KOKKOLA, FINLAND
LAX	71.03	LOS ANGELES, CALIFORNIA, USA
LGW	75.93	LONDON, ENGLAND
LHR	73.20	LONDON, ENGLAND
LIM	111.60	LIMA, PERU
LIS	107.39	LISBON, PORTUGAL
LUX	79.34	LUXEMBOURG, LUXEMBOURG
LYS	84.64	LYON, FRANCE
MAD	77.04	MADRID, SPAIN
MAN	78.38	MANCHESTER, ENGLAND
MBJ	75.94	MONTEGO BAY, JAMAICA
MCI	71.03	KANSAS CITY, MO., USA
MEX	55.52	MEXICO CITY, MEXICO
MIA	71.03	MIAMI, FLA. USA
MXP	101.67	MILAN, ITALY
NAS	75.94	NASSAU, BAHAMAS
ORD	71.03	CHICAGO, ILL., USA
ORY	78.57	PARIS, FRANCE
PAP	75.94	PORT AU PRINCE, HAITI
PBM	75.94	PARAMARIBO, SURINAM
PHL	71.03	PHILADELPHIA, PA., USA
PHX	71.03	PHEONIX, ARIZONA, USA
PIK	75.93	GLASGOW, SCOT.
POS	75.94	PORT OF SPAIN, TRINI.& TOB.
PRG	97.56	PRAGUE, CZECHOSLOVAKIA
PSA	79.68	PISA, ITALY

Table A-3 (Continued)

PTP	75.94	POINTE A PITRE, GUADALOUPE
RBA	98.13	RABAT, MOROCCO
REC	101.34	RECIFE, BRAZIL
ROB	87.27	MONROVIA, LIBERIA
SCQ	77.04	SANTIAGO, SPAIN
SDQ	75.94	SANTO DOMINGO, DOM. REP.
SEA	71.03	SEATTLE, WASH., USA
SFJ	78.38	SONDRESTROMFJORD, GREENLAND
SFO	71.03	SAN FRANCISCO, CA., USA
SID	95.37	SAL ISLAND, CAPE VERDE IS.
SJU	75.94	SAN JUAN, PUERTO RICO
SMA	80.97	SANTA MARIA, AZORES
SNN	73.76	SHANNON, IRELAND
STR	81.92	STUTTGART, REP. OF GERMANY
STX	75.94	ST. CROIX, VIRGIN IS.
SVO	80.36	MOSCOW, USSR
SXM	75.94	ST. MAARTEN, NETH ANTILLES
TER	88.46	TERCEIRA, AZORES
TFS	79.62	TENERIFE, CANARY IS.
TLV	98.49	TEL AVIV, ISRAEL
UAK	78.38	NARSSARSSUAQ, GREENLAND
UIO	75.94	QUITO, ECUADOR
UVF	75.94	ST. LUCIA, W.I.
VCP	99.84	SAO PAULO, BRAZIL
WAW	82.50	WARSAW, POLAND
YEG	66.51	EDMONTON, CANADA
YHZ	64.32	HALIFAX, CANADA
YMX	64.32	MONTREAL, CANADA
YQX	64.32	GANDER, CANADA
YVR	66.51	VANCOUVER, CANADA
YWG	59.09	WINNIPEG, CANADA
YYC	66.51	CALGARY, CANADA
YYZ	59.09	TORONTO, CANADA
ZAG	81.78	ZAGREB, YUGOSLAVIA
ZRH	82.62	ZURICH, SWITZERLAND

Table A-4

CREW AND MAINTENANCE COST RATE

Aircraft Type	Crew Cost (1979 $/hr)	Maintenance Cost (1979 $/hr)
B747	647	528
DC10	563	442
L1011	534	422
B747SP	872	99
DC8	473	414
B707	341	500
B727	341	128
B747ST	841*	686*
NEW1	443†	650†

*30% greater than 3747 based on passenger seat growth.

†30% greater than B707 based on passenger seat growth.

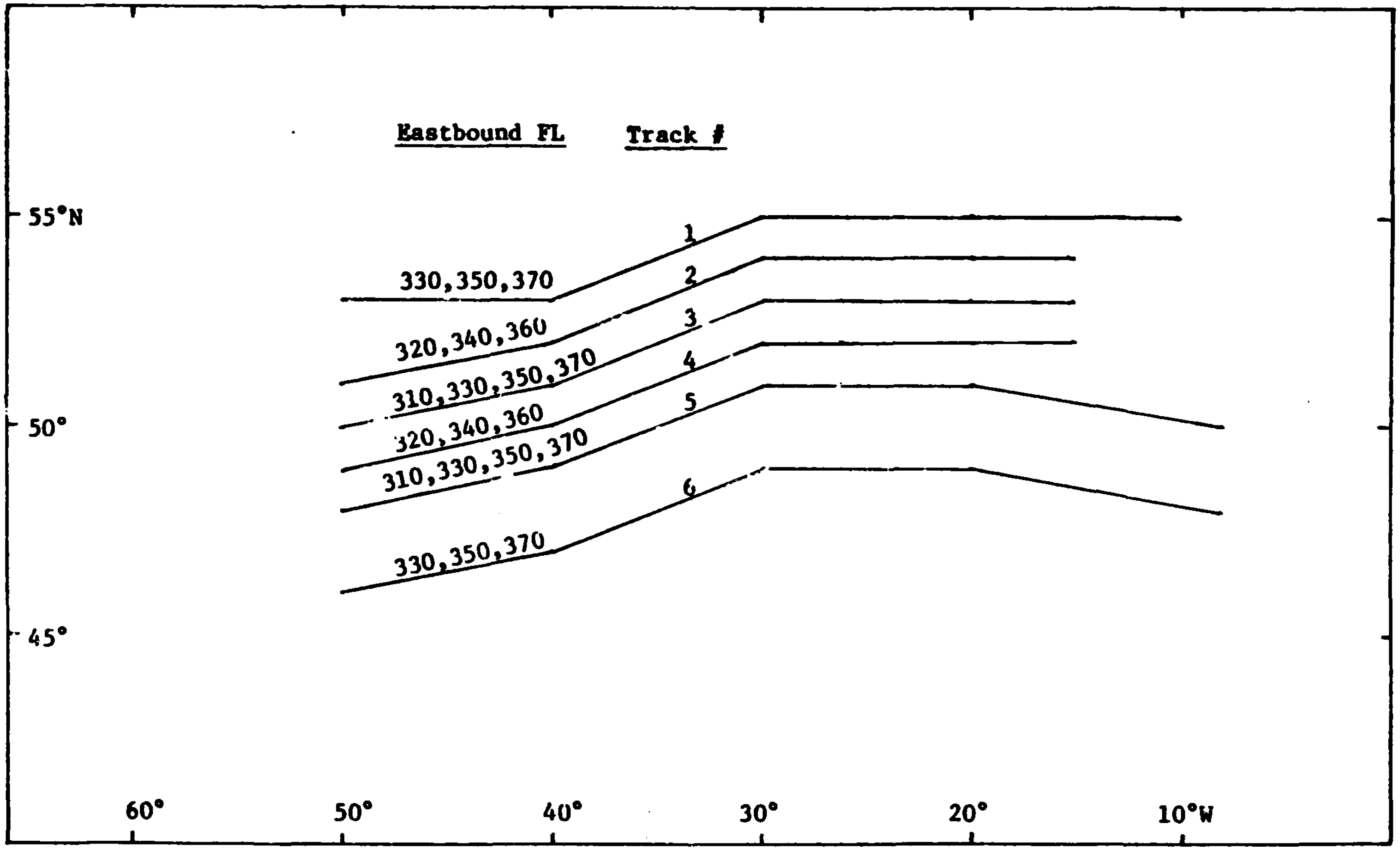

Figure A-1. 60-120 nmi/2000 ft Eastbound OTS, July Sample Day

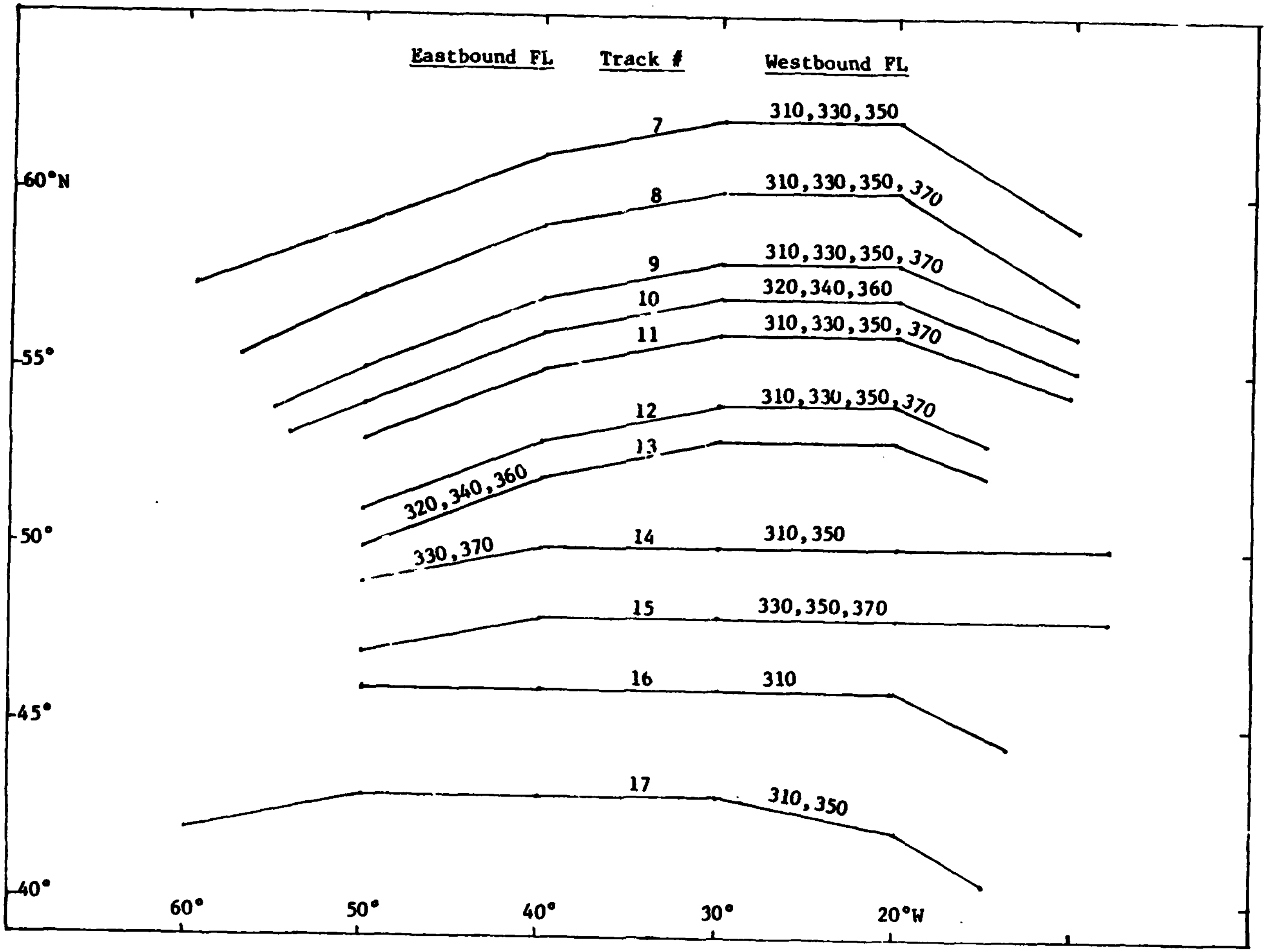

Figure A-2. 60-120 nmi/2000 ft Westbound OTS, July Sample Day

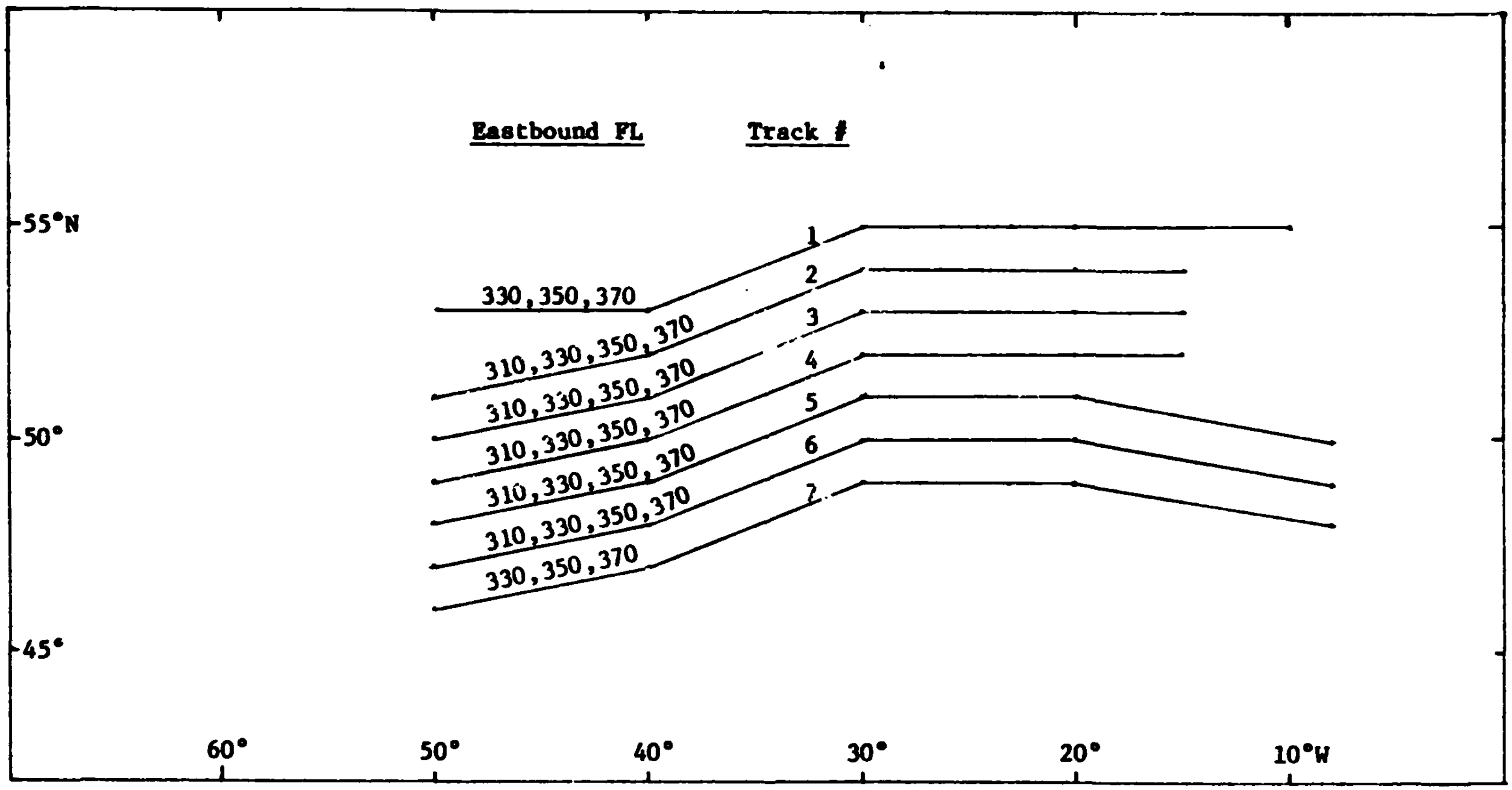

Figure A-3. 60 nmi/2000 ft Eastbound OTS, July Sample Day

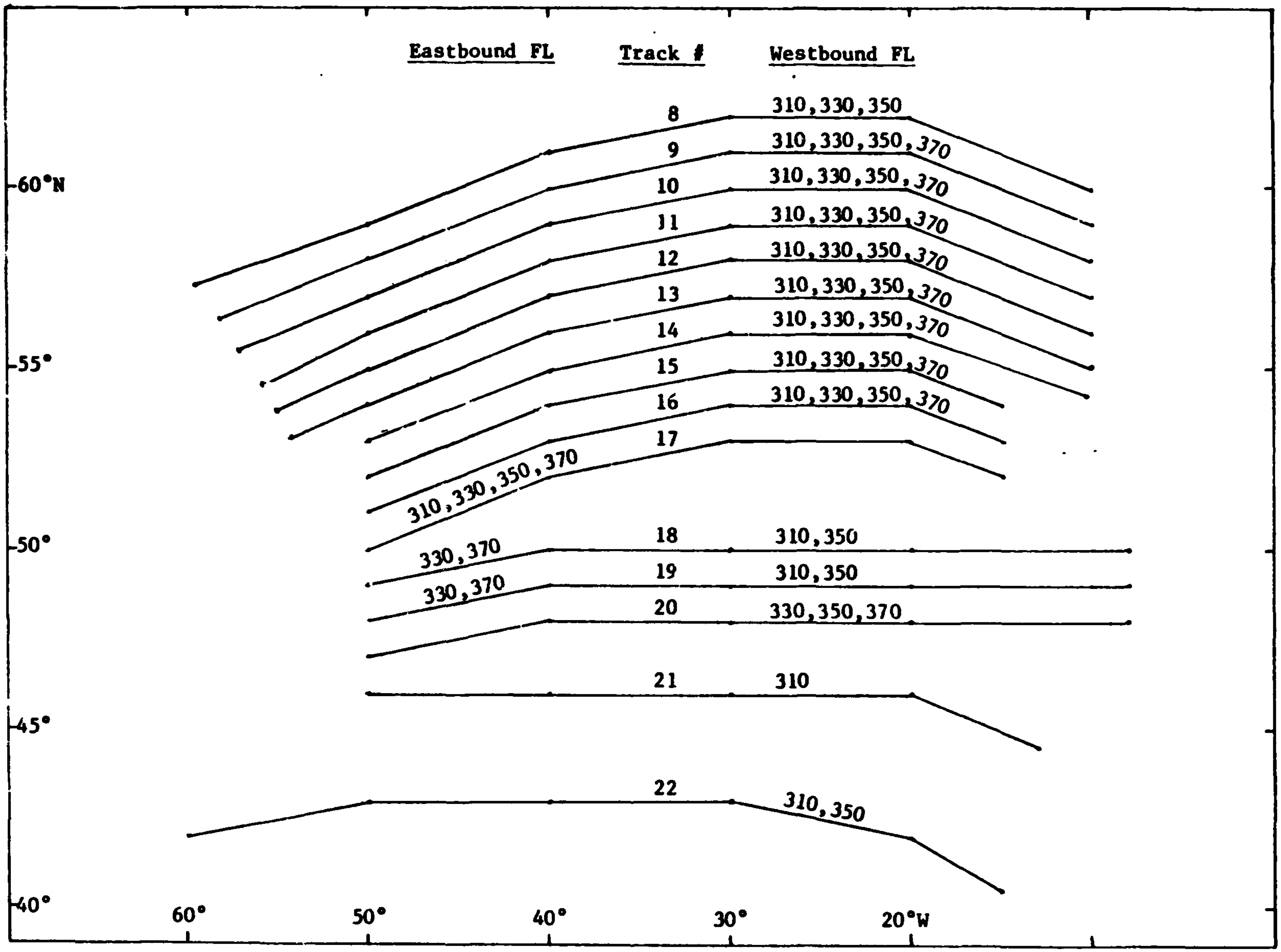

Figure A-4. 60 nmi/2000 ft Westbound OTS, July Sample Day

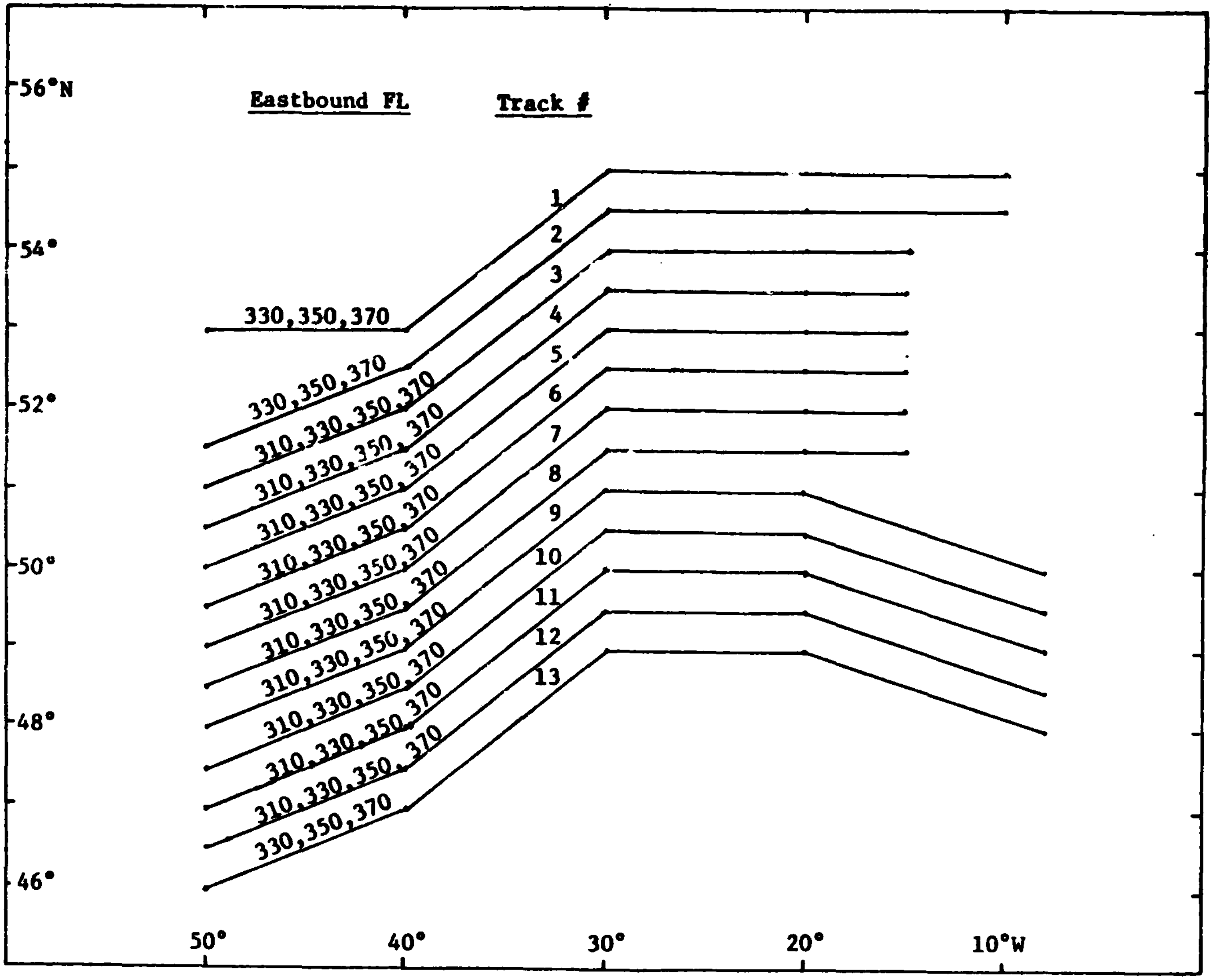

Figure A-5. 30 nmi/2000 ft Eastbound OTS, July Sample Day

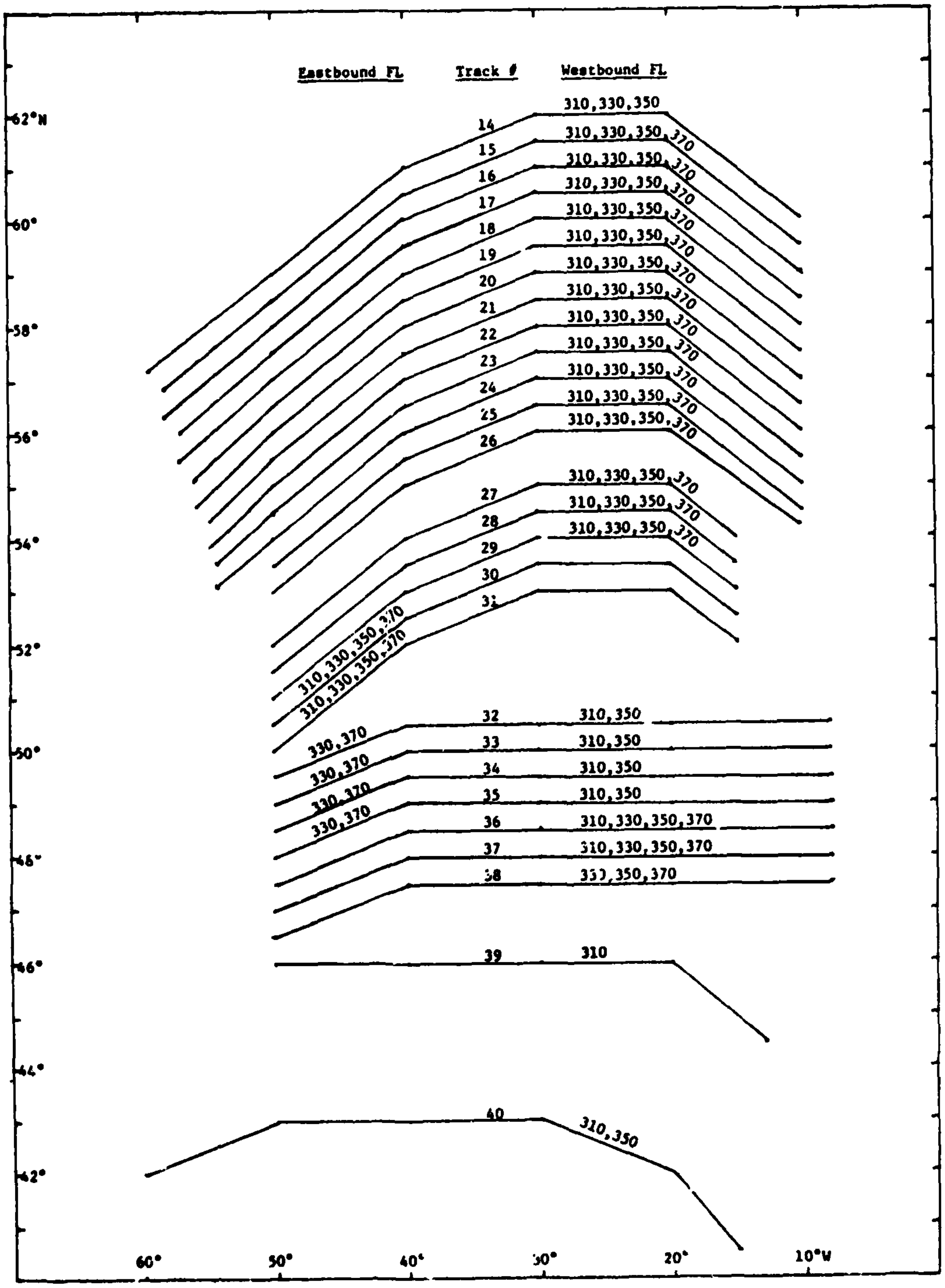

Figure A-6. 30 nmi/2000 ft Westbound OTS, July Sample Day

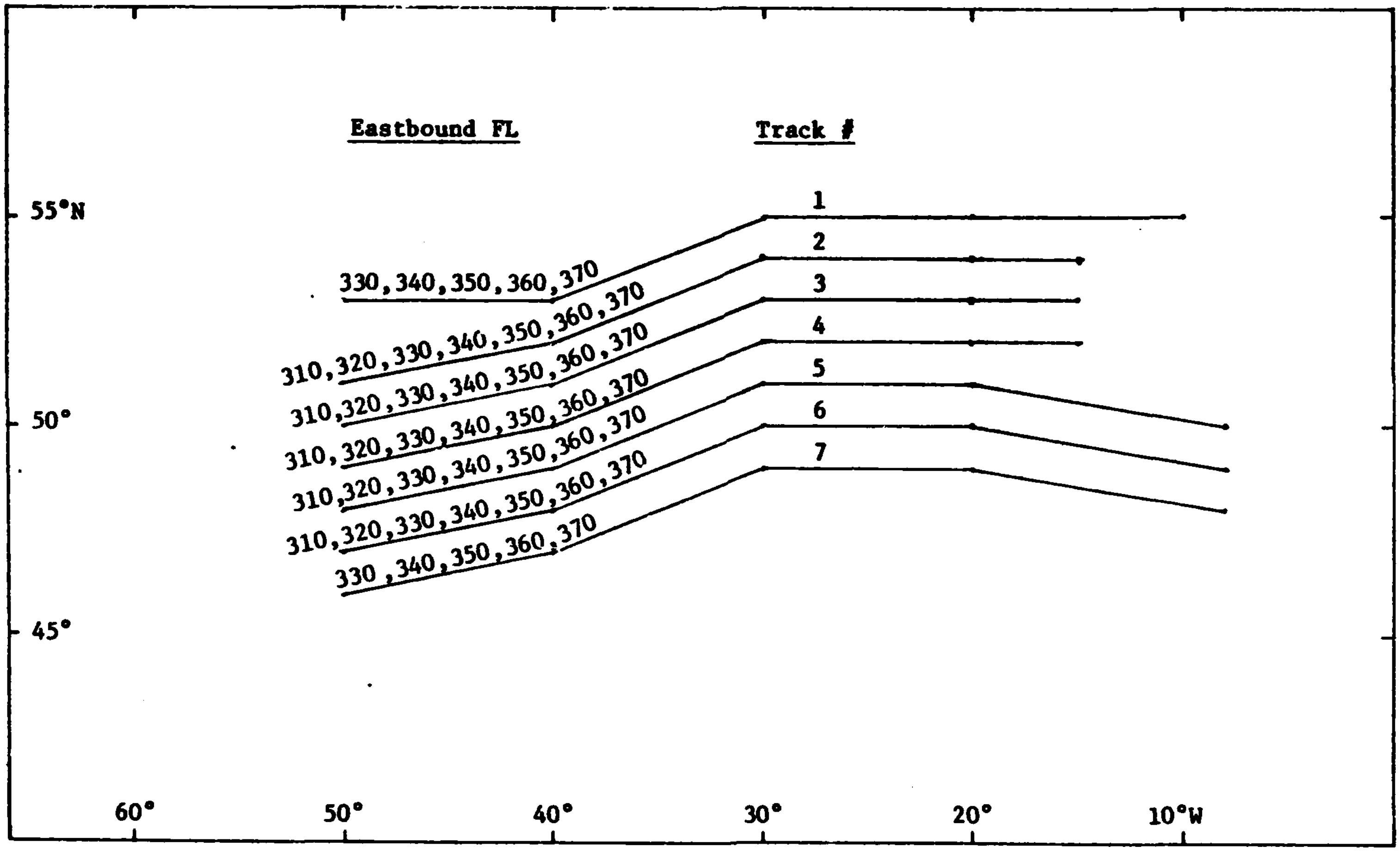

Figure A-7. 60 nmi/1000 ft Eastbound OTS, July Sample Day

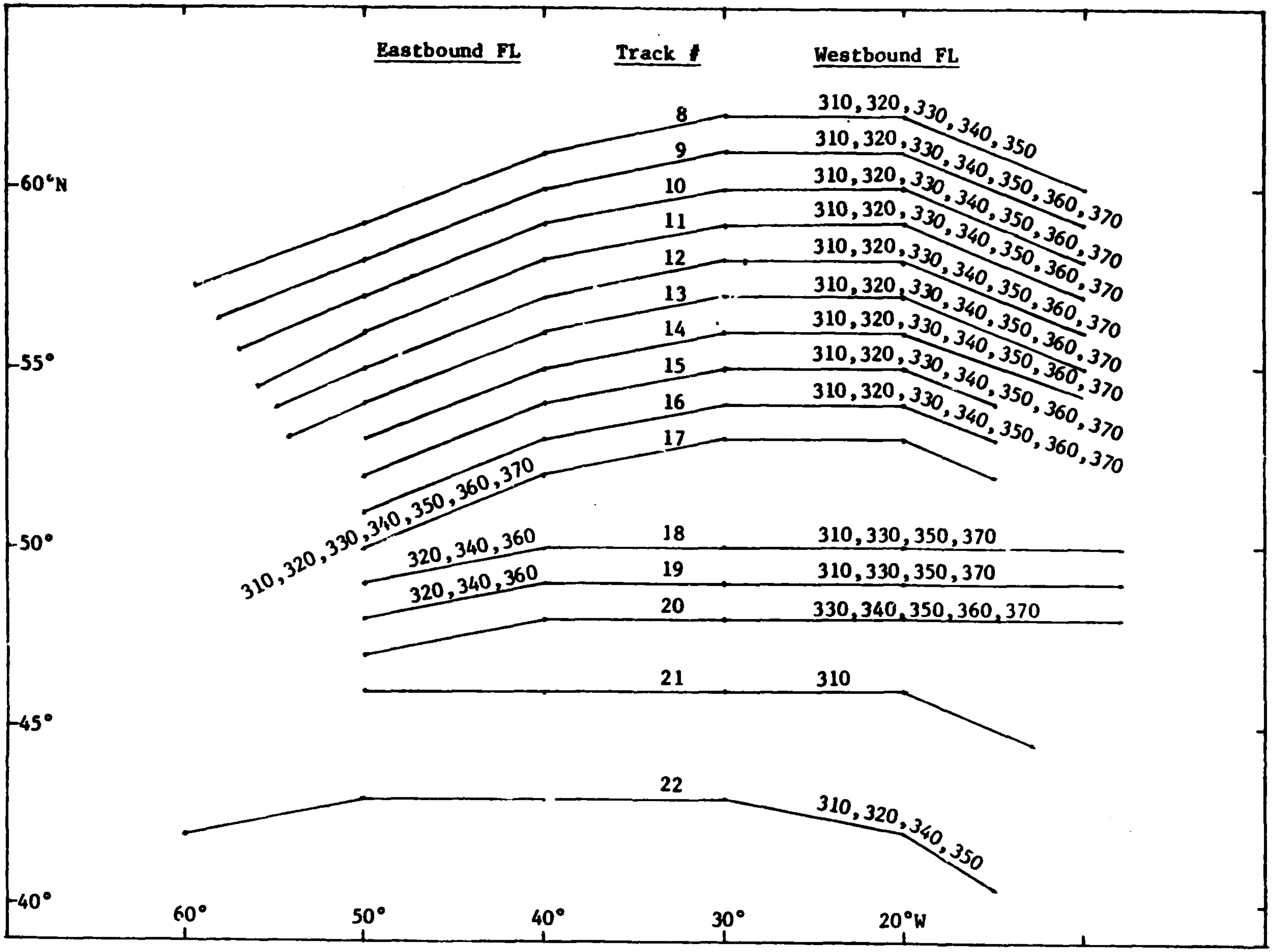

Figure A-8. 60 nmi/1000 ft Westbound OTS, July Sample Day

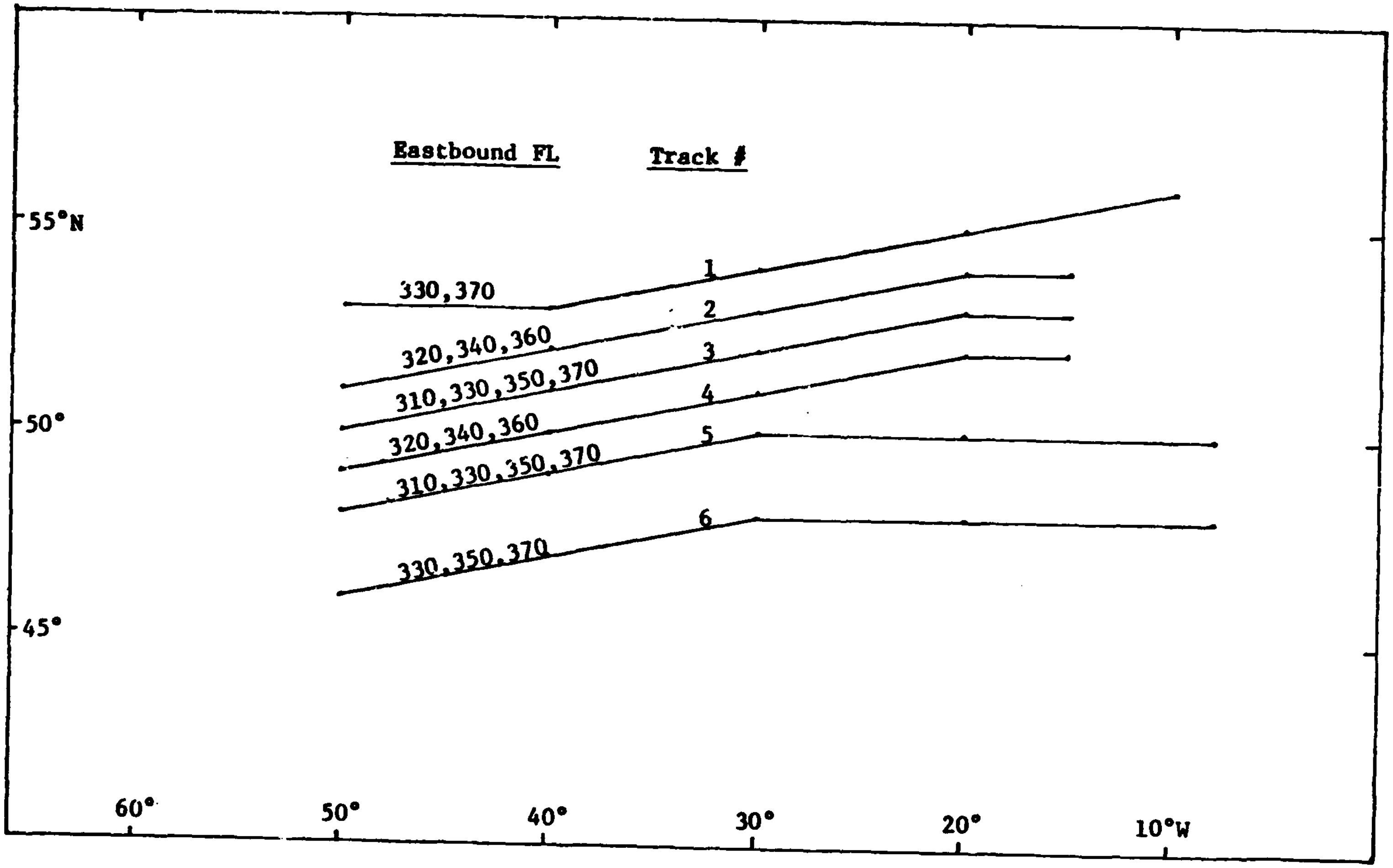

Figure A-9. 60-120 nmi/2000 ft Eastbound OTS, November Sample Day

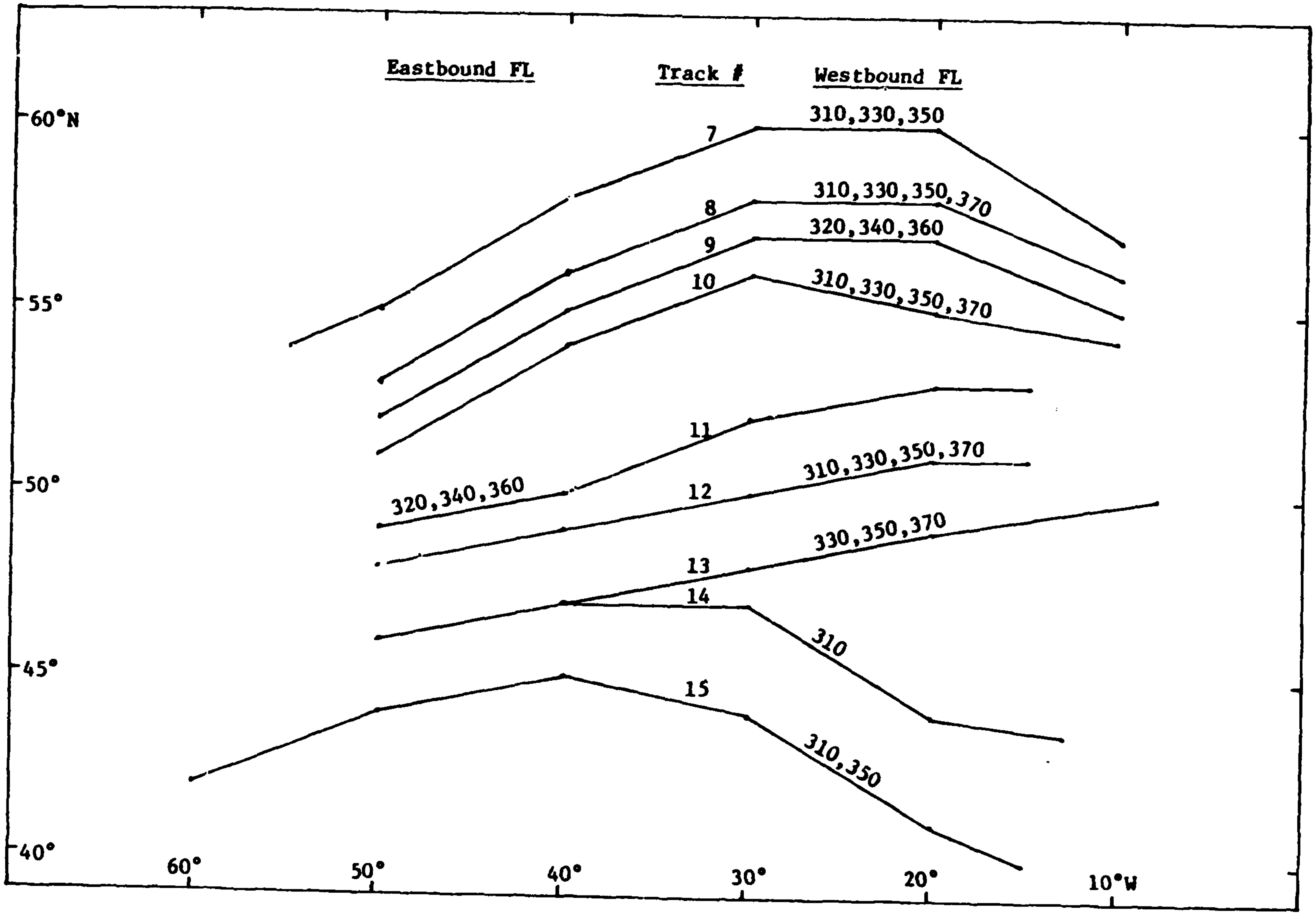

Figure A-10. 60-120 nmi/2000 ft Westbound OTS, November Sample Day

Appendix B
FCM Flight Cost Results -- Supplemental Information

B.1 General

This appendix presents FCM preliminary results describing traffic loadings, FCM planned flight costs, FCM actual flight costs, daily flight costs relative to the baseline system (60-120 nmi/15 min/2000 ft system), and FCM actual flight costs relative to ideal costs for the NAT for the July sample day. In addition, results showing the sensitivity of flight costs to clearance strategy and step climb communication delay time are presented. The data presented are estimates produced by the FCM simulation and are not data reports of real-world operations.

B.1.1 Special Note

The operating system alternative denoted by 60nmi/10min/1000*ft simulates halving the vertical separation minimum to 1000ft in the NAT oceanic area alone, and leaving it at 2000 ft in domestic airspace and in the other oceanic CTA/FIR's which became indirectly involved in the study. As mentioned earlier, this system alternative was simulated for the July 1979 sample day only; therefore cost breakdowns are not available for 1984 or 2005.

B.2 Traffic Loadings--July Sample Day

The daily number of costed flights which were analyzed by the FCM for the sample July day in 1979, 1984 and 2005 are shown in Tables B-1, B-2, and B-3, respectively. For each year, the numbers of OTS and non-OTS flights in each origin-destination flow for each of the eight separation cases are shown.

To minimize computer costs, flights between origin-destination (O-D) pairs which always or nearly always use the OTS were constrained to plan a flight on the track system. Flights between O-D pairs which do not generally use the track system or use the track system only sometimes were allowed to choose an OTS or a random track in searching for a minimum fuel plan.

For this reason, a flight could choose to use the OTS in one case and not in another. Hence, some variation in the numbers of OTS and non-OTS flights might be expected. However, as seen from these tables, very little variation actually occurred.

In comparing Tables B-1, B-2, and B-3, it is seen that the number of flights increases into the future. In addition, the mix of aircraft is different for the 1979, 1984 and 2005 schedules. Future schedules are composed of a greater proportion of the larger widebody aircraft. Hence the average aircraft size increases with time.

B.3 Planned Flight Costs--July Sample Day

Tables B-4, B-5, and B-6 show the planned daily flight costs by flow for each separation case for 1979, 1984, and 2005, respectively, for the July sample day. These costs are shown on a total and on a per flight basis. The costs are those that would be incurred if all flights were permitted to fly their flight plans. OTS constraints are imposed on flight plans as appropriate. Flights may not plan to cross the track system at OTS altitudes (i.e., between flight levels 310 and 370). Flights may plan to join or leave the northernmost and southernmost tracks at OTS flight levels. Also, flights may plan to join the track system from flight levels above or below the OTS. Flights are free to choose step climbs with the only constraint being that they must be planned at position fixes (generally 10 degrees of longitude apart).

Since flight planning is independent of longitudinal separation, the planned costs are the same for cases with the same lateral and vertical separations. As is expected, the planned costs decrease for reduced lateral or vertical separations. In general, a greater reduction in planned costs is realized in decreasing vertical separations to 1000 feet than reducing lateral separation to 30 nmi from the 60 nmi/2000 feet separation case.

One might expect that planned flight cost for the 60 nmi/2000 feet cases would be less than or equal to those for the 60-120 nmi/2000 feet case. As can be seen from Tables B-4, B-5, and B-6, this is not true in all cases. For example, in 1979 the planned flight costs for the 60/2000 cases are greater than those for the 60-120/2000 case for the Europe-Mid North America and Europe-Iceland flows. These results are due to two causes. Firstly, the 60-120/2000 OTS consisted of composite tracks with even and odd flight levels, while the 60/2000 OTS had only odd flight levels. This difference in flight levels may be advantageous to some flights and detrimental to others. Secondly, the envelope of the OTS (i.e., the airspace between the northernmost and southernmost tracks) was slightly larger for the 60/2000 case. This increase occurred because the European ocean entry point of the northernmost track for the westbound track setting was 60 nmi further north for the 60/2000 case (and all other cases) than for the 60-120/2000 case. This change in track position was advantageous to some flows (e.g., the Scandinavia-North America flow) and disadvantageous to other flows (e.g., the Europe-Mid North America and Europe-Iceland flows).

As can be seen by comparing Tables B-4 through B-6, planned daily flight costs increase with time. This is because the number of flights grows with time and the average cost per flight increases with time since the average aircraft size is larger in future years.

B.4 Actual Flight Costs--July Sample Day

The FCM estimated actual daily flight costs by flow for each separation case for 1979, 1984, and 2005 for the sample July day are shown in Tables B-7, B-8, and B-9 respectively. These tables are analogous to the previous three tables, except that the costs shown in these tables include the costs of diverting from the flight plan to resolve potential conflicts with other aircraft in order to insure adequate separations and adherence to procedural rules.

Comparison of the actual costs with planned costs indicate that actual costs are at least as great as planned costs. This is expected because there would generally be a cost penalty associated with diversions from the flight plan.

As in the case of the planned flight costs, the actual flight costs will generally increase in future years since the number of flights and average size of aircraft increase. In addition, the difference between planned and actual flight costs in future years should be expected to increase since the absolute cost penalty for a diversion generally is greater for larger aircraft.

B.5 Actual Flight Costs Relative to the Baseline System--July Sample Day

Table B-10 shows the actual daily flight costs for each of the alternative systems relative to the 60-120/15/2000 system for the 1979 July sample day. These costs are provided for each flow on a total and per flight basis. Analogous costs are provided in Tables B-11 and B-12 for 1984 and 2005, respectively. These cost results indicate the benefit of using an alternative system instead of maintaining the current 120-60/15/2000 system.

One would expect the benefit of the 60/10/2000 system to be at least as great as the 60/15/2000 system, the benefit of the 30/5/2000 system to be at least as great as the 30/10/2000 system, the benefit of the 60/10/1000 system to be at least as great as the 60/15/1000 system, and the 1000 feet separation cases to be at least as beneficial as their corresponding 2000 feet separation cases. These expectations hold true for the entire system as well as most of the individual flows.

Reasons why the above generalizations can be expected to be violated include those presented earlier regarding the differences in legal altitudes and envelope of the OTS for the 60-120 nmi case versus other cases. In addition, the order in which aircraft are cleared, aircraft packing, and interaction among aircraft vary from case to case. The effects of such variation average out over many flights. Hence, the costs over all flights should provide accurate comparisons. However, the effects of such variations may not average out over a smaller number of flights.

B.6 Actual Relative to Ideal Flight Costs--July Sample Day

The FCM was used to estimate the cost of operating in an unconstrained or ideal flight mode in the 60 nmi/1000 ft system network. For this ideal case, no track system is in place and no lateral or longitudinal separation minimum is required. Flights are free to use any domestic routing. Hemispheric-type flight rules are assumed with all odd flight levels (290, 310, 330, etc.) legal for eastbound traffic and all even flight levels (280, 300, 320, etc.) legal for westbound traffic. In Table B-13, differences between the actual and the ideal flight costs for each case for the 1979 July sample day are shown on a total and per flight basis by origin and destination flow. Similar costs are presented in Tables B-14 and B-15 for 1984 and 2005, respectively. These differences reflect the potential for cost reductions by relaxation of system and procedural constraints.

The actual flight costs relative to the ideal costs vary as expected. The less stringent separation requirements are closer in cost to the ideal flight mode case. The flows which are forced to cross the OTS have larger per flight relative costs than those which are served by the OTS.

One anomaly obvious in Tables B-13 and B-14 is that the ideal flight cost for the Mideast/Africa-Caribbean/South American flow is apparently greater than the actual cost in the 30 nmi lateral separation cases. This flow consists of a single flight in 1979 and 1984. It happens that for this particular flight, a lower cost flight plan was generated for the 30/2000 cases than for the 60/1000 case with hemispheric-type flight levels which was used to approximate an unconstrained system. This anomaly is to be expected because the FCM estimation of unconstrained cost provides only an upper bound to the unconstrained costs.

B.7 Sensitivity Analyses

Table B-16 provides results of FCM sensitivity analyses of flight costs for the 60 nmi/10 min/2000 ft system for the July sample day. As seen from these results, tactical control in the entire NAT does result in a slight decrease in daily flight cost when compared to the standard operating mode, as described in Table B-16. A decrease in the step climb communication delay time from 6 minutes to 1 minute results in no change in daily flight costs. This occurs because the decreased cost of fuel is offset by the increased cost for crew and maintenance (since true airspeed decreases as altitude increases at a fixed mach number). It is expected that the cost sensitivities for other separation cases would be similar to those performed for this system.

B.8 Manual Adjustments

Some of the flights in the Iberia-USA and Iberia-Canada flows were inadvertently constrained by incorrect input data to choose an OTS flight plan in the FCM computer runs. For the Iberia-USA flow, flights incorrectly constrained to the track system accounted for 14 of 27 costed flights in 1979, 16 of 32 in 1984, and 25 of 50 in 2005. For the Iberia-Canada flow, such flights included 2 of 6 costed flights in 1979, 4 of 10 in 1984, and 6 of 14 in 2005. The flight counts and cost counts and cost data presented in this appendix for these two flows have been manually adjusted to reflect the results that would have occurred if these flights had not been constrained to the OTS.

These adjustments include revision of the OTS versus non-OTS flight counts in Tables B-1, B-2, and B-3, and decrementing the planned flight costs in Tables B-4, B-5, and B-6 by the excess cost of a flight constrained to the OTS instead of planning a random flight track. The actual flight costs shown in Tables B-7 through B-9 were decremented by this same amount. The effect of these adjustments are carried over to Tables B-10 through B-15.

B.9 FCM Results--November Sample Day

The number of flights, planned cost and actual cost data estimated by FCM for the November sample day are shown in Tables B-17, B-18 and B-19. The data in these three tables were adjusted to account for the Iberia-USA and Iberia-Canada flow constrints discussed above. These adjustments were made in proportion to the modifications calculated for the July sample day. An FCM analysis of the ideal flight costs for the November sample day was not performed.

Table B-1

1979 DAILY FLIGHTS FLOW SUMMARY, JULY SAMPLE DAY

Origin-Destination Flow	Number of Flights	1979 Number of OTS Flights: 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*	1979 Number of Non-OTS Flights: 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*
1. Scandinavia-North America	30	14	14	14	14	14	14	14	14	16	16	16	16	16	16	16	16
2. Europe-Eastern North America	352	242	242	242	242	242	242	242	242	10	10	10	10	10	10	10	10
3. Europe-Mid North America	73	56	56	56	56	56	56	56	56	17	17	17	17	17	17	17	17
4. Europe-Western North America	33	3	3	3	3	3	3	3	3	30	30	30	30	30	30	30	30
5. Europe-Caribbean	25	1	1	1	1	1	1	1	1	24	24	24	24	24	24	24	24
6. Iberia-USA	27	5	5	5	5	5	5	5	5	22	22	22	22	22	22	22	22
7. Iberia-Canada	6	2	2	2	2	2	2	2	2	4	4	4	4	4	4	4	4
8. Iberia-Caribbean	18	0	0	0	0	0	0	0	0	18	18	18	18	18	18	18	18
9. North America-Africa	4	0	0	0	0	0	0	0	0	4	4	4	4	4	4	4	4
10. Europe-Iceland	17	0	0	0	0	0	0	0	0	17	17	17	17	17	17	17	17
11. Europe-Azores	15	0	0	0	0	0	0	0	0	15	15	15	15	15	15	15	15
12. US/Canada-Caribbean/S. America	155	0	0	0	0	0	0	0	0	155	155	155	155	155	155	155	155
13. Mideast/Africa-Carib/S. America	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
ALL	656	323	323	323	323	323	323	323	323	333	333	333	333	333	333	333	333

Table B-2

1984 DAILY FLIGHTS FLOW SUMMARY, JULY SAMPLE DAY

		1984 Number of OTS Flights							1984 Number of Non-OTS Flights						
Origin-Destination Flow	Number of Flights	60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000
1. Scandinavia-North America	33	16	16	16	16	16	16	16	17	17	17	17	17	17	17
2. Europe-Eastern North America	281	271	271	271	271	271	271	271	10	10	10	10	10	10	10
3. Europe-Mid North America	62	60	60	60	60	60	60	60	22	22	22	22	22	22	22
4. Europe Western North America	40	5	5	5	5	5	5	5	35	35	35	35	35	35	35
5. Europe-Caribbean	31	1	2	2	1	1	1	1	30	29	29	30	30	30	30
6. Iberia-USA	32	7	7	7	7	7	7	7	25	25	25	25	25	25	25
7. Iberia-Canada	10	3	3	3	3	3	3	3	7	7	7	7	7	7	7
8. Iberia-Caribbean	20	0	0	0	0	0	0	0	20	20	20	20	20	20	20
9. North America-Africa	6	1	1	1	1	1	0	0	5	5	5	5	5	6	6
10. Europe-Iceland	19	0	0	0	0	0	0	0	19	19	19	19	19	19	19
11. Europe-Azores	16	0	0	0	0	0	0	0	16	16	16	16	16	16	16
12. US/Canada-Caribbean/S.America	180	0	0	0	0	0	0	0	180	180	180	180	180	180	180
13. Mideast/Africa-Carib/S.America	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1
ALL	751	364	365	365	364	364	363	363	387	386	386	387	387	388	388

Table B-3

2005 DAILY FLIGHTS FLOW SUMMARY, JULY SAMPLE DAY

Origin-Destination Flow	Number of Flights	2005 Number of OTS Flights 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	2005 Number of Non-OTS Flights 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000
1. Scandinavia-North America	52	22	22	22	22	22	23	23	30	30	30	30	30	29	29
2. Europe-Eastern North America	394	378	378	378	378	378	377	377	16	16	16	16	16	17	17
3. Europe-Mid North America	152	105	104	104	105	105	106	106	47	48	48	47	47	46	46
4. Europe-Western North America	94	17	17	17	17	17	17	17	77	77	77	77	77	77	77
5. Europe-Caribbean	58	4	5	5	3	3	5	5	54	53	53	55	55	53	53
6. Iberia-USA	50	12	12	12	12	12	12	12	38	38	38	38	38	38	38
7. Iberia-Canada	14	5	5	5	5	5	5	5	9	9	9	9	9	9	9
8. Iberia-Caribbean	40	1	1	1	1	1	1	1	39	39	39	39	39	39	39
9. North America-Africa	16	1	1	1	1	1	0	0	15	15	15	15	15	16	16
10. Europe-Iceland	21	0	0	0	0	0	0	0	21	21	21	21	21	21	21
11. Europe-Azores	20	0	0	0	0	0	0	0	20	20	20	20	20	20	20
12. US/Canada-Caribbean/S.America	304	0	0	0	0	0	0	0	304	304	304	304	304	304	304
13. Mideast/Africa-Carib/S.America	4	0	0	0	0	0	0	0	4	4	4	4	4	4	4
ALL	1219	545	545	545	545	545	545	545	674	674	674	675	675	673	673

Table B-4

1979 ESTIMATED PLANNED DAILY FLIGHT COST BY FLOW, JULY SAMPLE DAY

Origin-Destination Flow	Number of Flights	1979 Daily Costs (1979 $000) 60-120 NMI 14 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*	1979 Average Cost (1979 $000 per Flight) 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 1000	60 15 1000	60 10 1000	60 10 1000*
1. Scandinavia-North America	30	578	575	575	575	575	575	575	575	19.24	19.16	19.16	19.16	19.16	19.12	19.12	19.11
2. Europe-Eastern North America	252	5118	5118	5118	5113	5113	5101	5101	5104	20.31	20.31	20.31	20.29	20.29	20.24	20.24	20.25
3. Europe-Mid North America	73	1505	1507	1507	1505	1505	1501	1501	1503	20.62	20.64	20.64	20.62	20.62	20.56	20.56	20.58
4. Europe-Western North America	3[illegible]	1002	1002	1002	1002	1002	998	998	999	30.36	30.37	30.37	30.36	30.36	30.24	30.24	30.27
5. Europe-Caribbean	25	568	568	568	567	567	562	562	563	22.72	22.72	22.72	22.68	23.68	22.49	22.49	22.51
6. Iberia-USA	27	467	467	467	466	466	466	466	466	17.33	17.33	17.33	17.29	17.29	17.25	17.25	17.26
7. Iberia-Canada	6	99	99	99	99	99	98	98	98	16.55	16.57	16.57	16.53	16.53	16.48	16.48	16.48
8. Iberia-Caribbean	18	373	373	373	373	373	371	371	372	20.68	20.68	20.68	20.69	20.69	20.62	20.62	20.63
9. North America-Africa	4	96	96	96	95	95	95	95	95	23.90	23.90	23.90	23.82	23.82	23.75	23.75	23.71
10. Europe-Iceland	17	82	83	83	83	83	83	83	81	4.86	4.87	4.87	4.86	4.86	4.36	4.86	4.83
11. Europe-Azores	15	64	64	64	64	64	63	63	63	4.22	4.22	4.22	4.22	4.22	4.19	4.19	4.19
12. US/Canada-Caribbean/S. America	155	1138	1138	1138	1137	1137	1137	1137	1137	7.34	7.34	7.34	7.34	7.34	7.34	7.34	7.34
13. Mideast/Africa-Carib/S. America	1	16	16	16	15	15	16	16	16	15.21	15.21	15.21	15.05	15.05	15.18	15.18	15.23
ALL	656	11106	11106	11106	11094	11094	11064	11064	11069	16.93	16.93	16.93	16.91	16.91	16.87	16.87	16.87

Note: Columns may not sum to given totals because of round-off.

Table B-5

1984 ESTIMATED PLANNED DAILY FLIGHT COST, JULY SAMPLE DAY

Origin-Destination Flow	Number of Flights	1984 Daily Costs (1979 $000) 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	1984 Average Cost (1979 $000 per Flight) 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 1000	60 15 1000	60 10 1000
1. Scandinavia-North America	33	700	698	698	697	697	695	695	21.22	21.14	21.14	21.13	21.13	21.06	21.06
2. Europe-Eastern North America	281	6278	6278	6278	6272	6272	6254	6254	22.34	22.34	22.34	22.32	22.32	22.26	22.26
3. Europe-Mid North America	82	789	1791	1791	1789	1789	1784	1784	21.81	21.84	21.84	21.82	21.82	21.76	21.76
4. Europe-Western North America	40	1360	1361	1361	1360	1360	1351	1351	34.02	34.03	34.03	34.02	34.02	33.79	33.79
5. Europe-Caribbean	31	736	735	735	735	735	729	729	23.73	23.72	23.72	23.68	23.68	23.53	23.53
6. Iberia-USA	32	616	616	616	616	616	615	615	19.28	19.28	19.28	19.24	19.24	19.19	19.19
7. Iberia-Canada	10	168	167	167	167	167	166	166	16.80	16.78	16.78	16.74	16.74	16.70	16.70
8. Iberia-Caribbean	20	405	405	405	406	406	404	404	20.22	20.22	20.22	20.24	20.24	20.16	20.16
9. North America-Africa	6	167	167	167	168	168	167	167	27.83	27.82	27.82	27.86	27.86	27.76	27.76
10. Europe-Iceland	19	108	108	108	106	106	106	107	5.63	5.65	5.75	5.63	5.63	5.63	5.63
11. Europe-Azores	16	79	79	79	79	79	79	79	4.93	4.93	4.93	4.93	4.93	4.90	4.90
12. US/Canada-Caribbean/S.America	180	1415	1415	1415	1414	1414	1413	1413	7.86	8.86	7.86	7.86	7.86	7.85	7.85
13. Mideast/Africa-Carib/S.America	1	16	16	16	15	15	16	16	15.21	15.21	15.21	15.05	15.05	15.18	15.18
ALL	751	13837	13836	13836	13824	13824	13780	13780	18.42	18.42	18.42	18.41	18.41	18.35	18.35

Note: Columns may not sum to given totals because of round-off.

Table B-6

2005 ESTIMATED PLANNED DAILY FLIGHT COST BY FLOW, JULY SAMPLE DAY

Origin-Destination Flow	Number of Flights	2005 Daily Costs (1979 $000) 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000
1. Scandinavia-North America	57	1518	1512	1512	1511	1511	1505	1505
2. Europe-Eastern North America	394	11268	11270	11270	11257	11257	11226	11226
3. Europe-Mid North America	152	4320	4322	4322	4319	4319	4307	4307
4. Europe-Western North America	94	3526	3529	3529	3526	3526	3502	3502
5. Europe-Caribbean	58	1850	1851	1851	1846	1846	1837	1837
6. Iberia-USA	50	1296	1296	1296	1294	1294	1288	1288
7. Iberia-Canada	14	272	272	272	272	272	271	271
8. Iberia-Caribbean	40	1154	1154	1154	1154	1154	1148	1148
9. North America-Africa	16	414	414	414	413	413	412	412
10. Europe-Iceland	21	131	131	131	131	131	131	131
11. Europe-Azores	20	111	111	111	111	111	110	110
12. US/Canada-Caribbean/S.America	304	3653	3653	3653	3653	3653	3640	3640
13. Mideast/Africa-Carib/S.America	4	114	114	114	114	114	113	113
ALL	1219	29567	29569	29569	29541	29541	29430	29430

Origin-Destination Flow	2005 Average Cost (1979 $000 per Flight) 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 1000	60 15 1000	60 10 1000
1. Scandinavia-North America	29.20	29.08	29.08	29.07	29.07	28.93	28.93
2. Europe-Eastern North America	28.60	28.60	28.60	28.57	28.57	28.49	28.49
3. Europe-Mid North America	28.42	28.44	28.44	28.41	28.41	28.34	28.34
4. Europe-Western North America	27.52	37.54	37.54	37.52	37.52	37.26	37.26
5. Europe-Caribbean	31.92	31.90	31.90	31.84	31.84	31.67	31.67
6. Iberia-USA	25.93	25.92	25.92	25.89	25.89	25.75	25.75
7. Iberia-Canada	19.50	19.49	19.49	19.44	19.44	19.37	19.37
8. Iberia-Caribbean	28.85	28.85	28.85	28.86	28.86	28.69	28.69
9. North America-Africa	25.86	25.85	25.85	25.85	25.85	25.74	25.74
10. Europe-Iceland	6.24	6.26	6.26	6.23	6.23	6.23	6.23
11. Europe-Azores	5.55	5.54	5.54	5.54	5.54	5.51	5.51
12. US/Canada-Caribbean/S.America	12.02	12.02	12.02	12.02	12.02	11.97	11.97
13. Mideast/Africa-Carib/S.America	28.52	28.52	28.52	28.51	28.31	28.35	28.35
ALL	24.26	24.26	24.26	24.23	24.23	24.14	24.14

Note: Columns may not sum to given totals because of round-off.

Table B-7

1979 ESTIMATED ACTUAL DAILY FLIGHT COST BY FLOW, JULY SAMPLE DAY

Origin-Destination Flow	Number of Flights	Daily Flight Cost (1979 $000): 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*
1. Scandinavia-North America	30	579	576	575	575	575	574	574	574
2. Europe-Eastern North America	252	5143	5143	5134	5126	5123	5111	5108	5120
3 Europe-Mid North America	73	1512	1511	1512	1507	1507	1504	1503	1505
4. Europe-Western North America	33	1004	1004	1004	1004	1003	999	998	1001
5. Europe-Caribbean	25	570	568	569	568	568	563	563	563
6. Iberia-USA	27	470	468	468	467	467	466	466	466
7. Iberia-Canada	6	99	99	99	99	99	98	98	99
8. Iberia-Caribbean	18	374	373	374	373	373	371	371	372
9. North America-Africa	4	96	96	96	96	95	95	95	95
10. Europe-Iceland	17	82	83	83	83	83	83	83	83
11. Europe-Azores	15	64	64	64	64	64	63	63	63
12. US/Canada-Caribbean/S.America	155	1150	1151	1144	1146	1140	1138	1138	1139
13. Mideast/Africa-Carib/S.America	1	16	16	16	15	15	16	16	16
ALL	656	11158	11150	11136	11120	11111	11081	11075	11096

Origin-Destination Flow	Average Daily Flight Cost (1979 $000 per Flight): 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*
1. Scandinavia-North America	19.31	19.20	19.18	19.17	19.16	19.13	19.12	19.14
2. Europe-Eastern North America	20.41	20.41	20.37	20.34	20.33	20.29	20.27	20.32
3 Europe-Mid North America	20.71	20.70	20.71	20.65	20.64	20.60	20.58	20.62
4. Europe-Western North America	30.44	30.42	30.41	30.41	30.38	30.25	30.25	30.33
5. Europe-Caribbean	22.78	22.75	22.76	22.71	22.71	22.52	22.52	22.53
6. Iberia-USA	17.41	17.36	17.37	17.31	17.31	17.28	17.26	17.26
7. Iberia-Canada	16.64	16.61	16.60	16.56	16.56	16.49	16.48	16.50
8. Iberia-Caribbean	20.73	20.71	20.72	20.71	20.71	20.62	20.62	20.64
9. North America-Africa	23.96	23.92	23.92	23.85	23.82	23.76	23.76	23.77
10. Europe-Iceland	4.86	4.88	4.88	4.86	4.86	4.86	4.86	4.88
11. Europe-Azores	4.23	4.23	4.22	4.22	4.22	4.20	4.19	4.20
12. US/Canada-Caribbean/S.America	7.41	7.42	7.38	7.39	7.36	7.34	7.34	7.35
13. Mideast/Africa-Carib/S.America	15.21	15.21	15.21	15.05	15.05	15.18	15.18	15.19
ALL	17.01	17.00	16.98	16.95	16.94	16.89	16.88	16.91

Note: Columns may not sum to given totals because of round-off.

Table 8-8

1984 ESTIMATED ACTUAL DAILY FLIGHT COST BY FLOW, JULY SAMPLE DAY

Origin-Destination Flow	Number of Flights	Daily Flight Cost (1979 $000) 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	Average Daily Flight Cost (1979 $000 per Flight) 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000
1. Scandinavia-North America	33	704	699	699	699	698	696	695	21.32	21.17	21.15	21.16	21.15	21.07	21.07
2. Europe-Eastern North America	281	6311	6309	6302	6292	6287	6269	6266	22.46	22.45	22.43	22.39	22.37	22.31	22.30
3. Europe-Mid North America	82	1796	1798	1795	1793	1791	1788	1787	21.90	21.92	21.90	21.85	21.84	21.80	21.79
4. Europe-Western North America	40	1364	1363	1362	1361	1361	1353	1352	34.08	34.06	34.05	34.04	34.03	33.82	33.80
5. Europe-Caribbean	31	737	737	737	736	736	730	730	23.79	23.77	23.77	23.74	23.72	23.56	23.55
6. Iberia-USA	32	620	619	619	617	616	615	615	19.38	19.34	19.32	19.27	19.26	19.22	19.22
7. Iberia-Canada	10	168	167	167	167	167	166	166	16.85	16.81	16.79	16.77	16.78	16.70	16.70
8. Iberia-Caribbean	20	405	404	404	406	406	404	404	20.27	20.25	20.25	20.26	20.26	20.17	20.17
9. North America-Africa	6	168	167	167	168	168	167	167	27.87	27.84	27.84	27.88	27.88	27.85	27.85
10. Europe-Iceland	19	108	108	108	107	107	107	107	5.69	5.65	5.65	5.63	5.63	5.63	5.63
11. Europe-Azores	16	79	79	79	79	79	79	79	4.94	4.93	4.93	4.93	4.93	4.90	4.90
12. US/Canada-Caribbean/S.America	180	1430	1428	1423	1421	1419	1415	1414	7.94	7.93	7.90	7.90	7.88	7.86	7.85
13. Mideast/Africa-Carib/S.America	1	16	16	16	15	15	16	16	15.21	15.21	15.21	15.05	15.05	15.18	15.18
ALL	751	13904	13893	13878	13860	13849	13804	13797	18.51	18.50	18.48	18.46	18.44	18.38	18.37

Note: Columns may not sum to given totals because of round-off.

Table B-9

2005 ESTIMATED ACTUAL DAILY FLIGHT COST BY FLOW, JULY SAMPLE DAY

		Daily Flight Cost (1979 $000)							Average Daily Flight Cost (1979 $000 per Flight)						
Origin-Destination Flow	Number of Flights	60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000
1. Scandinavia-North America	52	1526	1518	1517	1513	1512	1506	1506	29.34	29.19	29.16	29.11	29.09	28.95	28.95
2. Europe-Eastern North America	394	11323	11319	11307	11285	11277	11254	11244	28.74	28.73	28.70	28.64	28.62	28.56	28.54
3. Europe-Mid North America	152	4343	4338	4335	4326	4324	4314	4311	28.58	28.54	28.52	28.47	28.45	28.39	28.36
4. Europe-Western North America	94	3535	3535	3534	3530	3528	3508	3506	37.61	37.60	37.59	37.55	37.53	37.31	37.30
5. Europe-Caribbean	58	1863	1858	1857	1850	1849	1841	1839	32.11	32.04	32.01	31.90	31.90	31.74	31.71
6. Iberia-USA	50	1304	1300	1299	1296	1296	1290	1288	26.06	25.99	25.99	25.94	25.92	25.81	25.78
7. Iberia-Canada	14	273	273	272	272	272	271	271	19.55	19.53	19.51	19.47	19.46	19.41	19.40
8. Iberia-Caribbean	40	1159	1157	1157	1157	1156	1150	1150	28.97	28.91	28.91	28.91	28.88	28.74	28.74
9. North America-Africa	16	416	415	415	413	413	414	413	25.95	25.93	25.90	25.86	25.86	25.82	25.80
10. Europe-Iceland	21	131	131	131	131	131	131	131	6.24	6.26	6.26	6.23	6.23	6.23	6.23
11. Europe-Azores	20	111	111	111	111	111	110	110	5.55	5.55	5.55	5.55	5.55	5.51	5.51
12. US/Canada-Caribbean/S.America	304	3693	3700	3684	3680	3669	3652	3647	12.15	12.17	12.12	12.11	12.07	12.02	11.99
13. Mideast/Africa-Carib/S.America	4	114	114	114	114	114	113	113	28.58	28.58	28.58	28.55	28.55	28.35	28.35
ALL	1219	29790	29768	29734	29682	29653	29554	29530	24.44	24.42	24.39	24.35	24.33	24.24	24.22

Note: Columns may not sum to given totals because of round-off.

Table B-10

1979 ACTUAL DAILY FLIGHT COST RELATIVE TO 1979 60-120/15/2000 SYSTEM BY FLOW, JULY SAMPLE DAY

		Daily Flight Cost Reduction (1979 $000)							Daily Average Flight Cost Reduction (1979 $000 per Flight)						
Origin-Destination Flow	Number of Flights	60 NMI 15 Min 2000 Ft	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*	60 NMI 15 Min 2000 Ft	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*
1. Scandinavia-North America	30	3	4	4	4	5	5	5	0.11	0.13	0.14	0.15	0.18	0.19	0.17
2. Europe-Eastern North America	252	0	9	17	20	32	35	23	0.00	0.04	0.07	0.08	0.12	0.14	0.09
3. Europe-Mid North America	73	1	0	5	5	8	9	7	0.01	0.00	0.07	0.07	0.11	0.13	0.09
4. Europe-Western North America	33	0	0	0	1	5	6	3	0.02	0.03	0.03	0.06	0.19	0.19	0.11
5. Europe-Caribbean	25	2	1	2	2	7	7	7	0.03	0.02	0.07	0.07	0.26	0.26	0.25
6. Iberia-USA	27	2	2	3	3	4	4	4	0.05	0.04	0.10	0.10	0.13	0.15	0.15
7. Iberia-Canada	6	0	0	0	0	1	1	0	0.03	0.04	0.08	0.08	0.15	0.16	0.14
8. Iberia-Caribbean	18	1	0	1	1	3	3	2	0.02	0.01	0.02	0.02	0.11	0.11	0.09
9. North America-Africa	4	0	0	0	1	1	1	1	0.04	0.04	0.11	0.14	0.20	0.20	0.19
10. Europe-Iceland	17	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(0.02)	(0.02)	0.00	0.00	0.80	0.00	(0.02)
11. Europe-Azores	15	0	0	0	0	1	1	1	0.00	0.01	0.01	0.01	0.03	0.04	0.03
12. US/Canada-Caribbean/S. America	155	(1)	6	4	10	12	12	11	(0.01)	0.03	0.02	0.05	0.07	0.07	0.06
13. Mideast/Africa-Carib/S.America	1	0	0	1	1	0	0	0	0.00	0.00	0.16	0.16	0.03	0.03	0.02
ALL	656	8	22	36	47	78	83	63	0.01	0.03	0.06	0.07	0.12	0.13	0.10

( ) = addition

Note: Columns may not sum to given totals because of round-off.

Table B-11

1984 ACTUAL DAILY FLIGHT COST RELATIVE TO 1984 60-120/15/2000 SYSTEM BY FLOW, JULY SAMPLE DAY

Origin-Destination Flow	Number of Flights	Daily Flight Cost Reduction (1979 $000)						Daily Average Flight Cost Reduction (1979 $000 per Flight)					
		60 NMI 15 Min 2000 Ft	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 NMI 15 Min 2000 Ft	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000
1. Scandinavia-North America	33	5	5	5	6	8	9	0.15	0.17	0.16	0.17	0.25	0.25
2. Europe-Eastern North America	281	2	9	19	24	42	45	0.01	0.03	0.07	0.09	0.15	0.16
3. Europe-Mid North America	82	(2)	1	3	5	8	9	(0.02)	0.00	0.05	0.06	0.10	0.11
4. Europe-Western North America	40	1	2	3	3	11	12	0.02	0.03	0.04	0.05	0.26	0.28
5. Europe-Caribbean	31	0	0	1	1	7	7	0.02	0.02	0.05	0.07	0.23	0.24
6. Iberia - USA	32	1	1	3	4	5	5	0.04	0.06	0.11	0.12	0.16	0.16
7. Iberia-Canada	10	0	1	1	1	2	2	0.04	0.06	0.08	0.07	0.15	0.15
8. Iberia-Caribbean	20	1	1	(1)	(1)	1	1	0.02	0.02	0.01	0.01	0.10	0.10
9. North America-Africa	6	1	1	0	0	1	1	0.03	0.03	(0.01)	(0.01)	0.02	0.02
10. Europe-Iceland	19	0	0	1	1	1	1	0.04	0.04	0.06	0.06	0.06	0.06
11. Europe-Azores	16	0	0	0	0	0	0	0.01	0.01	0.01	0.01	0.04	0.04
12. US/Canada-Caribbean/S. America	180	2	7	9	11	15	16	0.01	0.04	0.04	0.06	0.08	0.09
13. Mideast/Africa-Carib/S. America	1	0	0	1	1	0	0	0.00	0.00	0.16	0.16	0.03	0.03
ALL	751	11	26	44	55	100	107	0.01	0.03	0.05	0.07	0.13	0.14

( ) = addition

Note: Columns may not sum to given totals because of round-off.

Table B-12

2005 ACTUAL DAILY FLIGHT COST RELATIVE TO 2005 60-120/15/2000 SYSTEM BY FLOW, JULY SAMPLE DAY

Origin-Destination Flow	Number of Flights	Daily Flight Cost Reduction (1979 $000)						Daily Average Flight Cost Reduction (1979 $000 per Flight)					
		60-NMI 15 Min 2000 Ft	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 NMI 15 Min 2000 Ft	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000
1. Scandinavia-North America	52	8	9	13	14	20	20	0.15	0.18	0.23	0.25	0.39	0.39
2. Europe-Eastern North America	394	4	16	38	46	69	79	0.01	0.04	0.10	0.12	0.18	0.20
3. Europe-Mid North America	152	5	8	17	19	29	32	0.04	0.06	0.11	0.13	0.19	0.22
4. Europe-Western North America	94	0	1	5	7	27	29	0.01	0.02	0.06	0.08	0.30	0.31
5. Europe-Caribbean	58	5	6	13	14	22	24	0.07	0.10	0.21	0.21	0.37	0.40
6. Iberia-USA	50	4	5	8	8	14	16	0.07	0.07	0.12	0.14	0.25	0.28
7. Iberia-Canada	14	0	1	1	1	2	2	0.02	0.04	0.08	0.09	0.14	0.15
8. Iberia-Caribbean	40	2	2	2	3	9	9	0.06	0.06	0.06	0.09	0.23	0.23
9. North America-Africa	16	1	1	3	3	2	3	0.02	0.05	0.09	0.09	0.13	0.15
10. Europe-Iceland	21	0	0	0	0	0	0	(0.02)	(0.02)	0.01	0.01	0.01	0.01
11. Europe-Azores	20	0	0	0	0	1	1	0.00	0.00	0.00	0.00	0.04	0.04
12. US/Canada-Caribbean/S. America	304	(7)	9	13	24	41	46	(0.02)	0.03	0.04	0.08	0.13	0.16
13. Mideast/Africa-Carib/S. America	4	0	0	0	0	1	1	0.00	0.00	0.03	0.03	0.23	0.23
ALL	1219	22	56	108	137	236	260	0.02	0.05	0.09	0.11	0.20	0.22

( ) = addition

Note: Columns may not sum to given totals because of round-off.

Table B-13

1979 ACTUAL DAILY FLIGHT COST RELATIVE TO IDEAL COST BY FLOW, JULY SAMPLE DAY

Origin-Destination Flow	Ideal Daily Cost	1979 Daily Costs (1979 $000) Daily Flight Cost Increase: 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*
1. Scandinavia-North America	564	15	12	11	11	11	10	10	10
2. Europe-Eastern North America	5070	73	73	64	56	53	41	38	50
3. Europe-Mid North America	1491	21	20	21	16	16	13	12	14
4. Europe-Western North America	993	11	11	11	11	10	6	5	8
5. Europe-Caribbean	558	12	10	11	10	10	5	5	5
6. Iberia-USA	464	6	4	4	3	3	2	2	2
7. Iberia-Canada	97	2	2	2	2	2	1	1	2
8. Iberia-Caribbean	371	3	2	3	2	2	0	0	1
9. North America-Africa	95	1	1	1	1	0	0	0	0
10. Europe-Iceland	81	1	2	2	2	2	2	2	2
11. Europe-Azores	63	1	1	1	1	1	0	0	0
12. US/Canada-Caribbean/S. America	1138	12	13	6	8	2	0	0	1
13. Mideast/Africa-Carib/S. America	16	0	0	0	(1)	(1)	0	0	0
All	11002	156	148	134	118	109	79	73	95

Origin-Destination Flow	Ideal Daily Cost	1979 Average Cost (1979 $000 per Flight) Daily Average Flight Cost Increase: 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*
1. Scandinavia-North America	18.81	0.50	0.39	0.37	0.36	0.35	0.32	0.31	0.33
2. Europe-Eastern North America	20.12	0.29	0.29	0.25	0.22	0.21	0.17	0.15	0.20
3. Europe-Mid North America	20.43	0.28	0.27	0.28	0.22	0.21	0.17	0.15	0.19
4. Europe-Western North America	30.10	0.34	0.32	0.31	0.31	0.28	0.15	0.15	0.23
5. Europe-Caribbean	22.33	0.45	0.42	0.43	0.38	0.38	0.19	0.19	0.20
6. Iberia-USA	17.17	0.24	0.19	0.20	0.14	0.14	0.11	0.09	0.09
7. Iberia-Canada	16.23	0.41	0.38	0.37	0.33	0.33	0.26	0.25	0.27
8. Iberia-Caribbean	20.61	0.12	0.10	0.11	0.10	0.10	0.01	0.01	0.03
9. North America-Africa	23.75	0.21	0.17	0.17	0.10	0.07	0.01	0.01	0.02
10. Europe-Iceland	4.85	0.01	0.03	0.03	0.01	0.01	0.01	0.01	0.03
11. Europe-Azores	4.19	0.04	0.04	0.03	0.03	0.03	0.01	0.00	0.01
12. US/Canada-Caribbean/S. America	7.34	0.07	0.08	0.04	0.05	0.02	0.00	0.00	0.01
13. Mideast/Africa-Carib/S. America	15.18	0.03	0.03	0.03	(0.13)	(0.13)	0.00	0.00	0.01
All	16.77	0.24	0.23	0.20	0.18	0.17	0.12	0.11	0.14

Note: Columns may not sum to given totals because of round-off.

Table B-14

1984 ACTUAL DAILY FLIGHT COST RELATIVE TO IDEAL COST BY FLOW, JULY SAMPLE DAY

	1984 Daily Costs (1979 $000)								1984 Average Cost (1979 $000 per Flight)							
		Daily Flight Cost Increase								Daily Average Flight Cost Increase						
Origin-Destination Flow	Ideal Daily Cost	60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	Ideal Daily Cost	60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000
1. Scandinavia-North America	684	20	15	15	15	14	12	11	20.72	0.60	0.45	0.43	0.44	0.43	0.35	0.35
2. Europe-Eastern North America	6219	92	90	83	73	68	50	47	22.13	0.33	0.32	0.30	0.26	0.24	0.18	0.17
3. Europe-Mid North America	1772	24	26	23	21	19	16	15	21.61	0.29	0.31	0.29	0.24	0.23	0.19	0.18
4. Europe-Western North America	1346	18	17	16	15	15	7	6	33.67	0.41	0.39	0.38	0.37	0.36	0.16	0.13
5. Europe-Caribbean	724	13	13	13	12	12	6	6	23.33	0.46	0.44	0.44	0.41	0.39	0.23	0.22
6. Iberia-USA	611	9	8	8	6	5	4	4	19.11	0.27	0.23	0.21	0.16	0.15	0.11	0.11
7. Iberia-Canada	164	4	4	3	3	3	2	2	16.37	0.48	0.44	0.42	0.40	0.41	0.33	0.33
8. Iberia-Caribbean	404	1	0	0	2	2	0	0	20.16	0.11	0.09	0.09	0.10	0.10	0.01	0.01
9. North America-Africa	166	2	1	1	2	2	1	1	27.69	0.18	0.15	0.15	0.19	0.19	0.16	0.16
10. Europe-Iceland	107	1	1	1	0	0	0	0	5.60	0.09	0.05	0.05	0.03	0.03	0.03	0.03
11. Europe-Azores	78	1	1	1	1	1	1	1	4.88	0.06	0.05	0.05	0.05	0.05	0.02	0.02
12. US/Canada-Caribbean/S. America	1414	16	14	9	7	5	1	0	7.85	0.09	0.08	0.05	0.05	0.03	0.01	0.00
13. Mideast/Africa-Carib/S. America	16	0	0	0	(1)	(1)	0	0	15.18	0.03	0.03	0.03	(0.13)	(0.13)	0.00	0.00
ALL	13702	202	191	176	158	147	102	95	18.25	0.27	0.25	0.23	0.21	0.20	0.14	0.13

Note: Columns may not sum to given totals because of round-off.

( ) = negative number

Table B-15

2005 ACTUAL DAILY FLIGHT COST RELATIVE TO IDEAL COST BY FLOW, JULY SAMPLE DAY

	2005 Daily Costs (1979 $000)								2005 Average Cost (1979 $000 per Flight)							
		Daily Flight Cost Increase								Daily Average Flight Cost Increase						
Origin-Destination Flow	Ideal Daily Cost	60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	Ideal Daily Cost	60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000
1. Scandinavia-North America	1484	42	34	33	29	28	22	22	28.54	0.80	0.65	0,62	0.57	0.55	0.41	0.41
2. Europe-Eastern North America	11158	165	161	149	127	119	96	86	28.32	0.42	0.41	0.38	0.32	0.30	0.24	0.22
3. Europe-Mid North America	4279	64	59	56	47	45	35	32	28.15	0.43	0.39	0.37	0.32	0.30	0.24	0.21
4. Europe-Western North America	3485	50	50	49	45	43	23	21	37.08	0.53	0.52	0.51	0.47	0.45	0.23	0.22
5. Europe-Caribbean	1822	41	36	35	28	27	19	17	31.43	0.68	0.61	0.58	0.47	0.47	0.31	0.28
6. Iberia-USA	1281	23	19	18	15	15	9	7	25.61	0.45	0.38	0.38	0.33	0.31	0.20	0.17
7. Iberia-Canada	265	8	8	7	7	7	6	6	18.89	0.66	0.64	0.62	0.58	0.57	0.52	0.51
8. Iberia-Caribbean	1145	14	12	12	12	11	5	5	28.62	0.35	0.29	0.29	0.29	0.26	0.12	0.12
9. North America-Africa	411	5	4	4	2	2	3	2	25.70	0.25	0.23	0.20	0.16	0.16	0.12	0.10
10. Europe-Iceland	130	1	1	1	1	1	1	1	6.20	0.04	0.06	0.06	0.03	0.03	0.03	0.03
11. Europe-Azores	109	2	2	2	2	2	1	1	5.48	0.07	0.07	0.07	0.07	0.07	0.03	0.03
12. US/Canada-Caribbean/S. America	3644	49	56	40	36	25	8	3	11.98	0.17	0.19	0.14	0.13	0.09	0.04	0.01
13. Mideast/Africa-Carib/S. America	113	1	1	1	1	1	0	0	28.35	0.23	0.23	0.23	0.20	0.20	0.00	0.00
ALL	29327	463	444	407	355	326	227	203	24.06	0.38	0.36	0.33	0.29	0.27	0.19	0.17

Note: Columns may not sum to given totals because of round-off.

( ) = negative number

Table B-16

SENSITIVITY ANALYSES OF FLIGHT COST USING 60/10/2000 SYSTEM, JULY 1979 SAMPLE DAY

Sensitivity Test Case	Step Climb Communication Delay Time (min)	Random Track Clearance Strategy	Daily Flight Cost (1979 $000)	Average Daily Flight Cost (1979 $000 per flight)
Standard	6	Tactical Control in New York, San Juan, Miami CTA/FIRs, strategic control in all other CTA/FIRs	11,174	17.03
Tactical Clearance	6	Tactical control in all CTA/FIRs	11,171	17.03
Communication Delay	1	Same as standard	11,174*	17.03*

*A $1000 decrease in fuel cost is counterbalanced by an equal increase in crew and maintenance cost. (Ref. B.7 above, p. 34)

Table 8-17

DAILY FLIGHT FLOW SUMMARY FOR 60-120/15/2000 SYSTEM, NOVEMBER SAMPLE DAY

Origin-Destination Flow	Number of Flights			Number of OTS Flights			Number of non-OTS Flights		
	1979	1984	2005	1979	1984	2005	1979	1984	2005
1. Scandinavia-North America	21	28	42	7	10	15	14	18	27
2. Europe-Eastern North America	180	205	291	154	173	247	26	32	44
3. Europe-Mid North America	23	24	38	11	12	24	12	12	14
4. Europe-Western North America	29	31	76	0	0	3	29	31	73
5. Europe-Caribbean	19	20	31	0	0	1	19	20	30
6. Iberia-USA	13	18	28	3	4	7	10	14	21
7. Iberia-Canada	3	3	6	0	0	2	3	3	4
8. Iberia-Caribbean	16	18	31	0	0	1	16	18	30
9. North America-Africa	4	6	14	0	0	0	4	6	14
10. Europe-Iceland	9	12	13	0	0	0	9	12	13
11. Europe-Azores	4	6	6	0	0	0	4	6	6
12. US/Canada-Caribbean/S. America	127	140	251	0	0	0	127	140	251
13. Mideast/Africa-Carib/S. America	1	1	3	0	0	0	1	1	3
ALL	449	512	830	175	199	309	274	313	521

Table B-18

ESTIMATED PLANNED DAILY FLIGHT COSTS BY FLOW FOR 60-120/15/2000 SYSTEM, NOVEMBER SAMPLE DAY

Origin-Destination Flow	Daily Flight Cost (1979 $000)			Daily Average Flight Cost (1979 $000 per flight)		
	1979	1984	2005	1979	1984	2005
1. Scandinavia-North America	404	571	1174	19.29	20.43	27.94
2. Europe-Eastern North America	4009	4802	8164	22.27	23.43	28.05
3. Europe-Mid North America	518	561	1131	22.53	23.38	29.77
4. Europe-Western North America	929	1024	2821	32.00	33.04	37.13
5. Europe-Caribbean	444	476	941	23.34	23.79	30.34
6. Iberia-USA	249	364	724	19.15	20.22	25.86
7. Iberia-Canada	34	39	108	11.26	12.89	18.00
8. Iberia-Caribbean	287	338	853	17.93	18.81	27.53
9. North America-Africa	94	135	321	23.41	22.58	22.89
10. Europe-Iceland	49	69	85	5.41	5.77	6.52
11. Europe-Azores	13	33	35	3.53	5.58	5.95
12. US/Canada-Caribbean/S. America	1112	1270	2996	8.75	9.07	11.94
13. Mideast/Africa-Carib/S. America	15	19	81	14.92	19.12	27.24
ALL	8157	9701	19434	18.17	18.95	23.41

Note: Columns may not sum to indicated totals because of round-off.

Table 8-19

ESTIMATED ACTUAL DAILY FLIGHT COSTS BY FLOW FOR 60-120/15/2000 SYSTEM, NOVEMBER SAMPLE DAY

Origin-Destination Flow	Daily Flight Cost (1979 $000)			Daily Average Flight Cost (1979 $000 per flight)		
	1979	1984	2005	1979	1984	2005
1. Scandinavia-North America	407	576	1180	19.38	20.55	28.11
2. Europe-Eastern North America	4033	4835	8210	22.41	23.59	28.22
3. Europe-Mid North America	521	565	1139	22.66	23.52	29.95
4. Europe-Western North America	930	1025	2828	32.06	33.09	37.22
5. Europe-Caribbean	445	477	943	23.40	33.83	30.41
6. Iberia-USA	251	364	727	19.31	20.22	25.96
7. Iberia-Canada	34	39	109	11.26	13.00	18.17
8. Iberia-Caribbean	289	340	856	18.05	18.90	27.61
9. North America-Africa	94	135	322	23.45	22.63	22.99
10. Europe-Iceland	49	70	86	5.47	5.21	6.59
11. Europe-Azores	13	33	35	3.53	5.58	5.95
12. US/Canada-Caribbean/S. America	1123	1282	3032	8.85	9.15	12.08
13. Mideast/Africa-Carib/S. America	15	19	81	15.01	19.12	27.34
ALL	8204	9760	19548	18.27	19.06	23.55

Note: Columns may not sum to indicated totals because of round-off.

APPENDIX C

FCM TRAFFIC OPERATIONS RESULTS--SUPPLEMENTAL INFORMATION

C.1 General

This appendix presents preliminary FCM results describing traffic loadings, oceanic entry operations, oceanic operations and oceanic exit operations in the NAT for the July sample day. The data presented are entirely FCM produced estimates and are not data reports of actual (real world) operations.

C.2 Traffic Loadings

The number of aircraft entering each NAT CTA/FIR in each hour of the July 1979 sample day under the present 60-120nmi/15min/2000 ft system operation is shown in Table C-1. The corresponding maximum instantaneous aircraft count (IAC) in each hour by CTA/FIR is shown in Table C-2. The Gander and Shanwick CTA/FIRs are the busiest areas and handle about the same daily number of aircraft, but the Gander CTA/FIR has a greater IAC than the Shanwick CTA/FIR because of the typically longer flight times that are experienced in the Gander CTA/FIR.

The distribution of the maximum IAC for the entire NAT in each year by system alternative is shown in Table C-3 for the July sample day. Note that IAC does not vary significantly by system but increases from 170 aircraft in 1979 to 230 aircraft in 2005. The present and future IACs by CTA/FIR are represented in Table C-4 using the 60-120 nmi/15 min/2000 ft system; the corresponding November IAC data is included for comparison.

C.3 Oceanic Entry Operations

The distribution of OTS flight level requests and clearances at oceanic entry by system are shown in Tables C-5 and C-6 for eastbound and westbound flights. More than 90 percent of the eastbound traffic requests entry at and between FL330 and FL370, while about 90 percent westbound traffic, because of heavier weight at oceanic entry, requests lower altitudes in the FL310 to FL350 range. Note that comparison with actual (real world) statistics for the July sample day indicate that the westbound aircraft weights in the FCM may be higher than normal and that a slightly higher percent of westbound traffic may typically request FL370 more frequently than indicated in Table C-6.

The entry flight level requests in Tables C-5 and C-6 show a sensitivity to changes in vertical flight level assignments as in the case where the composite altitudes are eliminated and in the case where the vertical separation minimum is reduced by one-half to 1000 ft. The 60 nmi/1000 ft systems show a significant redistribution of requests over the odd and even flight levels as opposed to the odd-only flight levels of the other systems. The requests for the altitudes above FL370 in the 60 nmi/1000 ft systems are affected by directionality of the hemispheric vertical separation rules which were assumed.

The distribution of the flight level clearances versus requests are also shown in Tables C-5 and C-6. The clearance data in Table C-5 for the case of the present 60-120 nmi/15 min/2000 ft system, for example, shows that 11.54 percent of the total eastbound OTS traffic receive FL350 clearances at entry from among the 17.58 percent that requested that flight level. The data in Tables C-5 and C-6 indicate that a greater proportion of westbound (77.05 percent) than eastbound (54.40 percent) flights in the present system receive their requested flight level, but that this difference between eastbound and westbound requested clearance satisfactions is less significant in the other system operations. A general increase in the proportion of requested clearance satisfactions is shown as separation minima are reduced with the greatest satisfaction proportion occurring in the 30 nmi/2000 ft system operation. Table C-7 shows the distribution of OTS flight level clearances for each direction. These clearances are regardless of requested flight levels; the figures represent all OTS aircraft cleared at each flight level no matter what the flight plans requested.

In regard to OTS packing at oceanic entry, Tables C-8 and C-9 show the preference and utilization distributions for the six most popular flight paths (as defined by an individual track/flight level combination) while Tables C-10 and C-11 show the planned and actual pairwise longitudinal separations (i.e., interarrival times) estimated by the FCM. These data indicate a general tendency for aircraft to spread out their preferences and reduce their competition for individual flight paths and time slots as more flight levels and tracks are made available with reduced separation minima. Note that the cases in Table C-11 where pairwise aircraft longitudinal separations are less than the normal longitudinal separation minimum are due to the application of the Mach number techniques to a slower following aircraft.

The impacts of changes in separation minima on OTS and non-OTS diversions are presented in Tables C-12, C-13 and C-14. As is expected, the severity of diversions decreases as separation minima are reduced. The diversions are least severe in the 30 nmi/2000 ft and 60 nmi/1000 ft systems and are almost equal in both these systems. In Table C-13, for example, the proportion of all aircraft cleared to within 60 nmi and 1000 ft of their requested flight path of oceanic entry is about 95 percent for both the 30 nmi/2000 ft and 60 nmi/1000 ft systems.

The severity of diversions estimated for each origin and destination flow are shown in Tables C-15, C-16 and C-17 by system for the July 1979 sample day. These data show percentages of aircraft cleared to within 60 nmi and 1000 ft of their request of entry and the results are similar to those given in the preceding paragraph.

The data items missing in Tables C-15, C-16 and C-17 (and in subsequent Tables C-21, C-22, C-29, C-30 and C-31) are due to improper constraints placed on the Iberia-USA and Iberia-Canada flows. These flights were inadvertently constrained by incorrect FCM input data to choose OTS flight plans. As previously noted in Appendix B, the flight count and cost data presented in this report have been manually adjusted to reflect the proper results. However, such adjustments in the traffic operations statistics are not possible. The data presented in other tables in this appendix include the effects of the inadvertent OTS constraint. But, since the Iberia-USA and Iberia-Canada flows are not a major portion of the NAT traffic, the data presented in the Appendix C tables should be reasonable representations of the operations.

C.4 Oceanic Operations

The percentage of flights that request one or more step climbs in the oceanic airspace is tabulated in Table C-18. A significant increase (15 percent overall) in step climb requests is apparent when the vertical separation minimum is reduced to 1000 ft and reflects the associated increase in the number of available flight levels. Differences between the step climb request percentages among the other systems (i.e., those with the 2000 ft minimum) are likely due to variations in the interactive effects between diversions and aircraft weights.

he percentage of individual step climb requests that are approved are shown in Table C-19 in which a double step climb profile would be counted as two requests. The approval percentage generally increases as separation minima are reduced, with the 30 nmi/2000 ft system showing about the same approval rate as the 60 nmi/1000 ft system.

The percent of westbound OTS flights that request step climbs, shown in Table C-18, may be higher than actual (real world) experience because of the aircraft weight differences described previously in this section. However, as shown in Table C-19, the proportion (55 percent) of westbound OTS step-climb approvals does not appear to be adversely affected in relation to those of the eastbound flights (43 percent) in the present 60-120 nmi/15 min/2000 ft operation. Also the increase in the proportion of westbound OTS step climb approvals is roughly similar to the increase in the eastbound approvals as separations are reduced (i.e., both eastbound and westbound approvals increase by about 16 percent relative to the present system with the introduction of the 60 nmi/15 min/2000 ft system and by about 30 percent relative to the present system with the introduction of the 60 nmi/10 min/1000 ft system.

Table C-20 shows the average time from the instant of a step climb request to the receipt of approval to climb (if such a clearance is issued). The time to approval reflects the time from the first instant of the request and could cover numerous position reports; the FCM rechecks a step climb request at successive positions along the route of flight if the approval was not granted initially. A 6 min communication time is assumed as part of the step climb clearance process. Table C-20 indicates a general reduction in the average step climb approval time as separation minima are reduced.

A measure of the overall efficiency of oceanic operations is shown in Tables C-21 and C-22 which present the time spent at flight levels below the requested flight level by origin-destination flow. Table C-21 shows the time spent at 1000 ft and 2000 ft below the requested flight level. The data shown in Table C-21 for the systems with a 2000 ft vertical separation minima are representative of the OTS situation. Hemispheric rules do not apply on the OTS and 1000 ft and 2000 ft altitude diversions are routine. Hemispheric vertical separation rules are routine on the non-OTS tracks where altitude diversions in steps of 4000 ft occur in the systems with a 2000 ft vertical separation minima. These effects are included in Table C-22 which shows the time spent at 3000 ft or more below the requested flight level. The results shown in both tables for the 60 nmi/1000 ft system show this system's ability to provide 1000 and 2000 ft diversions rather than larger ones.

C.5 Exit Operations

Data describing exit operations are shown in Tables C-23 through C-31, which are similar in format and content to the preceding tables.

Table C-1

NUMBER OF CTA/FIR HOURLY FLIGHT ENTRIES, JULY 1979

Hourly Period Start Time (GMT)	CTA/FIR						
	Reykjavik	Shanwick	Gander	Santa Maria	New York	San Juan (NAT)	Miami (NAT)
0000	7	4	21	1	8	5	0
0100	2	11	48	3	16	0	3
0200	1	20	30	7	7	2	0
0300	1	43	34	7	6	3	0
0400	3	37	25	2	6	2	1
0500	3	32	16	2	9	4	0
0600	1	18	5	3	3	2	2
0700	1	17	7	1	2	2	1
0800	3	6	3	0	4	0	0
0900	3	9	6	1	3	0	0
1000	1	16	5	5	0	0	0
1100	4	32	10	1	1	1	0
1200	6	25	16	5	7	0	2
1300	9	36	30	6	16	1	1
1400	6	32	30	5	18	5	4
1500	8	16	46	1	13	4	2
1600	5	11	26	2	14	3	6
1700	2	20	12	2	14	1	3
1800	3	10	12	2	10	1	2
1900	1	4	16	1	9	3	2
2000	1	2	6	1	6	3	3
2100	0	3	5	0	15	4	2
2200	2	3	5	2	14	5	4
2300	3	3	4	1	15	2	1
TOTAL	76	410	419	61	216	53	39

Table C-2

MAXIMUM INSTANTANEOUS AIRCRAFT COUNT BY HOUR FOR 60-120/15/2000 SYSTEM, JULY 1979

Hourly Period Start Time (GMT)	Max IAC During The Hourly Period							
	Reykjavik CTA/FIR	Shanwick CTA/FIR	Gander CTA/FIR	Santa Maria CTA/FIR	New York CTA/FIR	San Juan CTA/FIR	Miami CTA/FIR	NAT
0000	10	7	25	3	25	5	0	61
0100	11	12	65	4	24	4	3	118
0200	11	25	77	11	24	2	3	145
0300	11	49	76	16	23	3	0	152
0400	6	49	67	16	18	3	1	149
0500	5	44	53	10	15	7	1	126
0600	5	43	34	7	13	7	2	107
0700	6	26	19	4	9	4	2	68
0800	4	19	13	2	7	4	1	44
0900	7	15	11	2	8	1	0	37
1000	5	12	9	0	6	0	0	32
1100	6	37	14	6	1	1	0	63
1200	11	48	27	8	7	1	2	103
1300	17	56	48	9	18	1	2	143
1400	17	57	61	10	22	4	3	165
1500	19	52	76	10	26	6	4	170
1600	16	29	80	11	25	6	6	158
1700	12	26	70	7	21	6	7	135
1800	10	26	37	5	19	2	5	98
1900	8	18	29	4	17	4	2	68
2000	2	9	29	2	13	4	3	53
2100	2	5	22	2	18	6	3	47
2200	2	6	12	4	22	7	5	51
2300	4	4	11	4	28	6	3	54
Daily Max IAC	19	57	80	16	28	7	7	170

Table C-3

MAXIMUM INSTANTANEOUS AIRCRAFT COUNT BY SYSTEM, JULY SAMPLE DAY

NAT Daily Max IAC by System Operating Alternatives

Sample Day	60-120 NMI 15 Min 2000 Ft	60 NMI 15 Min 2000 Ft	60 NMI 10 Min 2000 Ft	30 NMI 10 Min 2000 Ft	30 NMI 5 Min 2000 Ft	60 NMI 15 Min 1000 Ft	60 NMI 10 Min 1000 Ft	60 NMI 10 Min 1000* Ft
July 1979	170	170	170	167	166	170	170	171
July 1984	180	181	181	176	175	179	179	*
July 2005	227	228	227	222	223	230	230	*

* Data not available.

Table C-4

MAXIMUM INSTANTANEOUS AIRCRAFT COUNT BY YEAR FOR 60-120/15/2000 SYSTEM

Sample Day	Daily Max IAC by CTA/FIR							
	Reykjavik CTA/FIR	Shanwick CTA/FIR	Gander CTA/FIR	Santa Maria CTA/FIR	New York CTA/FIR	San Juan CTA/FIR	Miami CTA/FIR	NAT
July 1979	1°	57	80	16	28	7	7	170
July 1984	18	61	80	18	33	8	7	180
July 2005	28	69	94	27	44	14	12	227
Nov 1979	15	50	59	19	30	7	6	142
Nov 1984	15	49	57	19	30	7	6	143
Nov 2005	23	56	74	33	50	11	10	204

Table C-5

1979 EASTBOUND OTS ENTRY FLIGHT LEVEL PREFERENCE AND CLEARANCE SUMMARY, JULY SAMPLE DAY

Eastbound Flight Level at Oceanic Entry	Percent of OTS Daily Flights Requesting Flight Level Indicated								Percent of OTS Flights Cleared at Their Requested Flight Level							
	60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*	60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*
≥400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
390	0	0	0	0	0	2.75	2.73	1.67	0	0	0	0	0	2.75	2.73	1.67
380	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
370	17.58	22.95	22.28	23.37	23.12	14.29	14.21	16.67	11.54	22.95	22.28	22.83	23.12	11.54	11.48	14.44
360	9.89	0	0	0	0	17.03	16.94	16.11	5.49	0	0	0	0	13.19	14.21	15.00
350	29.12	45.36	46.20	45.11	44.62	34.62	34.97	32.22	12.09	38.25	40.76	43.48	43.55	28.57	29.51	27.78
340	24.18	0	0	0	0	25.82	25.68	24.44	12.64	0	0	0	0	23.08	24.04	23.89
330	15.38	28.42	28.26	28.80	29.57	2.20	2.19	5.56	9.89	25.68	27.17	27.72	27.96	2.20	2.19	5.56
320	3.30	0	0	0	0	3.30	3.28	3.33	2.75	0	0	0	0	2.75	2.73	2.78
310	0.55	3.28	3.26	2.72	2.69	0	0	0	0	2.73	2.72	2.72	2.69	0	0	0
≤300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ALL	100	100	100	100	100	100	100	100	54.40	89.62	92.93	96.74	97.31	84.07	86.89	91.11

Note: Columns may not sum to given totals because of round-off.

Table C-6

1979 WESTBOUND OTS ENTRY FLIGHT LEVEL PREFERENCE AND CLEARANCE SUMMARY, JULY SAMPLE DAY

Westbound Flight Level at Oceanic Entry	Percent of OTS Daily Flights Requesting Flight Level Indicated								Percent of OTS Flights Cleared at Their Requested Flight Level							
	60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*	60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*
≥400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
390	4.92	4.89	4.89	4.35	4.35	0	0	0	4.92	4.89	4.89	4.35	4.35	0	0	0
380	0	0	0	0	0	4.95	4.95	4.92	0	0	0	0	0	4,95	4.95	4.92
370	1.64	1.63	1.63	2.17	2.17	2.20	2.20	2.19	1.64	1.63	1.63	2.17	2.17	2.20	2.20	2.19
360	0	0	0	0	0	10.99	10.99	12.02	0	0	0	0	0	10.99	10.99	12.02
350	31.15	31.52	31.52	30.98	30.98	16.48	16.48	15.85	25.68	30.98	31.52	29.89	30.43	16.48	16.48	15.85
340	1.09	0	0	0	0	24.73	24.73	19.13	0.55	0	0	0	0	22.53	23.08	17.49
330	36.07	36.41	36.41	41.30	41.30	22.53	22.53	26.23	24.59	31.52	33.70	40.22	40.22	19.78	20.88	23.50
320	3.83	0	0	0	0	12.09	12.09	13.66	2.19	0	0	0	0	12.09	12.09	13.66
310	20.22	24.46	24.46	20.11	20.11	4.95	4.95	4.92	16.94	23.37	23.91	19.57	19.57	4.95	4.95	4.92
≤300	1.09	1.09	1.09	1.09	1.09	1.10	1.10	1.10	0.55	1.09	0.54	1.09	1.09	1.10	0.55	1.10
ALL	100	100	100	100	100	100	100	100	77.05	93.48	96.20	97.28	97.83	95.05	96.15	95.63

Note: Columns may not sum to given totals because of round-off.

Table C-7

1979 EASTBOUND AND WESTBOUND OTS ENTRY FLIGHT LEVEL CLEARANCE SUMMARY, JULY SAMPLE DAY

PERCENT OF DAILY FLIGHTS CLEARED AS INDICATED AT OCEANIC ENTRY

Flight Level at Oceanic Entry	EASTBOUND 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*	WESTBOUND 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*
≥400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
390	0	0	0	0	0	4.40	4.37	3.89	4.92	4.89	4.89	4.35	4.35	0	0	0
380	0	0	0	0	0	0	0	0	0	0	0	0	0	4.95	4.95	4.92
370	15.38	24.04	24.46	23.37	23.66	14.84	14.21	15.56	2.73	1.63	1.63	2.72	2.72	2.20	2.20	2.19
360	13.19	0	0	0	0	17.03	18.58	17.78	2.19	0	0	0	0	10.99	10.99	12.02
350	17.58	39.34	41.30	44.02	44.09	30.22	31.14	28.33	28.96	34.24	33.70	30.43	30.98	18.68	17.58	16.39
340	17.03	0	0	0	0	24.73	25.14	24.44	3.83	0	0	0	0	24.73	24.73	20.22
330	18.13	30.05	28.80	28.80	28.49	5.49	3.28	6.67	26.78	32.07	33.70	40.76	40.22	19.78	20.88	24.04
320	10.44	0	0	0	0	2.75	2.73	2.78	4.37	0	0	0	0	12.64	12.64	14.21
310	4.40	4.37	3.26	3.80	3.76	0.55	0.55	0.56	21.31	24.46	24.46	20.11	20.11	4.95	4.95	4.92
≤300	3.85	2.19	2.17	0	0	0	0	0	4.91	2.72	1.63	1.63	1.63	1.10	1.10	1.10
ALL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Note: Columns may not sum to given totals because of round-off.

Table C-8

1979 OTS ENTRY TRACK/FLIGHT LEVEL
PREFERENCE SUMMARY, JULY SAMPLE DAY

Track/Flight Level at Entry	Percent of OTS Daily Flights Requesting Track/Flight Level Indicated: 60-120 NMI 15 Min 2000 Ft	60 X 2000	30 X 2000	60 X 1000
	Eastbound Flights			
1st Most Preferred	22.0	18.8	21.2	14.8
2nd Most Preferred	19.2	17.7	10.9	13.7
3rd Most Preferred	11.0	9.4	8.7	9.3
4th Most Preferred	5.5	7.7	7.1	7.7
5th Most Preferred	5.5	7.2	5.4	6.6
6th Most Preferred	4.9	5.5	4.9	4.9
	Westbound Flights			
1st Most Preferred	15.8	20.3	25.5	8.2
2nd Most Preferred	10.9	11.9	15.8	7.7
3rd Most Preferred	10.4	11.2	8.7	6.6
4th Most Preferred	7.1	6.3	4.3	5.5
5th Most Preferred	6.6	6.3	3.8	4.4
6th Most Preferred	4.9	6.3	3.8	3.8

Table C-9

1979 OTS ENTRY TRACK/FLIGHT LEVEL
CLEARANCE SUMMARY, JULY SAMPLE DAY

Track Flight Level at Entry	Percent of OTS Flights Cleared on Track/Flight Level Indicated							
	60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*
Eastbound Flights								
1st Most Preferred	9.9	10.0	12.2	10.9	14.5	9.9	9.8	10.6
2nd Most Preferred	8.2	8.9	9.9	9.2	9.7	8.8	9.8	8.3
3rd Most Preferred	8.2	8.3	7.7	8.7	8.1	8.2	9.3	7.8
4th Most Preferred	8.2	7.2	7.7	8.7	7.5	5.5	6.0	5.6
5th Most Preferred	6.6	7.2	7.2	6.5	7.5	5.5	5.5	5.6
6th Most Preferred	4.9	6.7	7.2	4.9	4.8	4.9	4.9	4.4
Westbound Flights								
1st Most Preferred	9.3	11.2	13.3	14.7	18.5	6.6	6.6	7.1
2nd Most Preferred	9.3	10.5	11.2	10.9	14.1	6.0	6.6	6.0
3rd Most Preferred	7.7	8.4	9.8	7.1	7.1	6.0	6.0	4.9
4th Most Preferred	6.6	6.3	7.0	5.4	4.9	5.5	5.5	4.9
5th Most Preferred	6.6	6.3	6.3	4.9	3.3	3.8	3.8	3.8
6th Most Preferred	6.0	6.3	6.3	3.3	3.3	3.8	3.8	3.8

Table C-10

1979 OTS PLANNED LONGITUDINAL ENTRY
SEPARATION SUMMARY, JULY SAMPLE DAY

Longitudinal Separation at Entry (Min)	Percent of OTS Daily Flight Requests at Oceanic Entry: 60-120 NMI X 2000 Ft	60 X 2000	30 X 2000	60 X 1000
Eastbound Requests				
0-10	40.6	35.6	29.7	36.9
10-15	12.1	13.1	11.0	10.1
15-20	9.1	8.8	11.0	6.0
20-25	4.8	6.9	5.8	4.0
25-30	3.6	5.0	5.8	6.0
>30	29.8	30.6	36.7	37.0
Westbound Requests				
0-10	29.5	25.9	35.6	15.5
10-15	10.1	10.6	11.6	7.4
15-20	5.7	5.3	7.5	7.4
20-25	8.2	7.9	5.5	5.9
25-30	5.7	5.3	3.4	7.4
>30	40.8	45.0	36.4	56.4

Table C-11

1979 OTS CLEARED LONGITUDINAL ENTRY SEPARATION
SUMMARY, JULY SAMPLE DAY

Longitudinal Separation at Entry (Min)	Percent of OTS Daily Flight Clearances at Oceanic Entry							
	60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*
Eastbound Clearances								
0-10	0	2.0	10.5	8.2	19.4	1.4	5.6	8.1
10-15	7.8	12.1	18.3	19.0	18.8	6.5	19.7	17.8
15-20	20.9	22.8	18.3	18.4	12.1	22.5	14.8	6.7
20-25	17.0	10.1	9.2	6.1	5.4	12.3	9.2	10.4
25-30	7.8	6.7	5.9	6.1	8.1	7.2	6.3	6.7
>30	46.5	46.3	37.8	42.2	36.2	50.1	44.4	50.3
Westbound Clearances								
0-10	1.4	0.7	6.8	7.3	18.7	0	3.1	3.1
10-15	7.5	4.2	12.9	12.4	15.1	0.8	4.7	5.5
15-20	15.0	9.8	7.5	10.9	10.1	10.9	8.7	10.2
20-25	10.2	14.0	11.6	12.4	6.5	11.6	7.1	8.6
25-30	12.2	8.4	6.1	5.8	2.9	6.2	7.1	4.7
>30	53.7	62.9	55.1	51.2	46.7	70.5	69.3	67.9

Table C-12

ENTRY DIVERSION DISTRIBUTION FOR OTS FLIGHTS, JULY 1979 SAMPLE DAY

	Percent Cleared							
Entry Clearance	60-120 NMI 15 Min 2000 Ft	60 NMI 15 Min 2000 Ft	60 NMI 10 Min 2000 Ft	30 NMI 10 Min 2000 Ft	30 NMI 5 Min 2000 Ft	60 NMI 15 Min 1000 Ft	60 NMI 10 Min 1000 Ft	60 NMI 10 Min 1000* Ft
Eastbound OTS								
At Track and Alt. Requested	52	60	69	77	87	68	74	81
At Track Requested	77	70	76	80	90	84	87	90
At Alt. Requested	54	90	93	97	97	84	87	91
At or within 60 NMI/1000 Ft	69	86	92	97	97	96	97	97
At or within 60 NMI/2000 Ft	90	95	97	100	100	99	100	100
At or within 120 NMI/2000 Ft	94	98	98	100	100	99	100	100
Westbound OTS								
At Track and Alt. Requested	74	73	84	77	87	85	87	90
At Track Requested	86	79	88	79	89	90	91	94
At Alt. Requested	77	93	96	97	98	95	96	96
At or within 60 NMI/1000 Ft	84	92	97	97	98	99	99	99
At or within 60 NMI/2000 Ft	93	98	100	100	100	100	100	100
At or within 120 NMI/2000 FT	98	99	100	100	100	100	100	100
Total OTS								
At Track and Alt. Requested	63	66	76	77	87	76	81	85
At Track Requested	81	75	82	79	89	87	89	92
At Alt. Requested	66	92	95	97	98	90	92	93
At or within 60 NMI/1000 Ft	76	89	94	97	98	97	98	98
At or within 60 NMI/2000 Ft	92	96	99	100	100	99	100	100
At or within 120 NMI/2000 Ft	96	99	99	100	100	100	100	100

Table C-13

ENTRY DIVERSION DISTRIBUTION. FOR NON-OTS FLIGHTS, JULY 1979 SAMPLE DAY

Entry Clearance	Percent Cleared: 60-120 NMI 15 Min 2000 Ft	60 NMI 15 Min 2000 Ft	60 NMI 10 Min 2000 Ft	30 NMI 10 Min 2000 Ft	30 NMI 5 Min 2000 Ft	60 NMI 15 Min 1000 Ft	60 NMI 10 Min 1000 Ft	60 NMI 10 Min 1000* Ft
Eastbound OTS								
At Track and Alt. Requested	84	87	79	90	94	89	92	89
At Track Requested	100	100	100	100	100	100	100	100
At Alt. Requested	84	87	89	90	94	89	92	89
At or within 60 NMI/1000 Ft	85	87	89	90	94	90	93	90
At or within 60 NMI/2000 Ft	86	88	89	90	95	98	99	99
At or within 120 NMI/2000 Ft	86	88	89	90	95	98	99	99
Westbound OTS								
At Track and Alt. Requested	81	88	90	91	93	88	91	89
At Track Requested	100	100	100	100	100	100	100	100
At Alt. Requested	81	88	90	91	93	88	91	89
At or within 60 NMI/1000 Ft	85	90	91	92	94	92	94	92
At or within 60 NMI/2000 Ft	87	92	92	93	94	98	99	99
At or within 120 NMI/2000 FT	87	92	92	93	94	98	99	99
Total OTS								
At Track and Alt. Requested	83	87	89	90	94	88	91	89
At Track Requested	100	100	100	100	100	100	100	100
At Alt. Requested	83	87	89	90	94	88	91	89
At or within 60 NMI/1000 Ft	85	89	90	91	94	91	93	91
At or within 60 NMI/2000 Ft	87	90	91	91	94	98	99	99
At or within 120 NMI/2000 Ft	87	90	91	91	94	98	99	99

Table C-14

ENTRY DIVERSION DISTRIBUTION FOR ALL (OTS AND NON-OTS) FLIGHTS, JULY 1979 SAMPLE DAY

	Percent Cleared							
Entry Clearance	60-120 NMI 15 Min 2000 Ft	60 NMI 15 Min 2000 Ft	60 NMI 10 Min 2000 Ft	30 NMI 10 Min 2000 Ft	30 NMI 5 Min 2000 Ft	60 NMI 15 Min 1000 Ft	60 NMI 10 Min 1000 Ft	60 NMI 10 Min 1000* Ft
Eastbound All								
At Track and Alt. Requested	68	73	78	83	91	78	83	85
At Track Requested	88	85	88	90	95	92	93	95
At Alt. Requested	69	88	91	93	96	86	89	90
At or within 60 NMI/1000 Ft	77	86	90	93	96	93	95	94
At or within 60 NMI/2000 Ft	88	91	93	95	98	98	99	99
At or within 120 NMI/2000 Ft	90	93	94	95	98	99	99	99
Westbound All								
At Track and Alt. Requested	78	80	87	84	90	86	89	89
At Track Requested	93	90	94	89	95	95	96	97
At Alt. Requested	79	91	93	94	95	92	93	92
At or within 60 NMI/1000 Ft	84	91	94	95	96	95	97	96
At or within 60 NMI/2000 Ft	90	95	96	96	97	99	100	99
At or within 120 NMI/2000 FT	93	95	96	96	97	99	100	99
Total All								
At Track and Alt. Requested	73	77	83	83	90	82	86	87
At Track Requested	91	87	91	90	95	93	95	96
At Alt. Requested	74	90	92	94	96	89	91	91
At or within 60 NMI/1000 Ft	81	89	92	94	96	94	96	95
At or within 60 NMI/2000 Ft	89	93	95	96	97	99	100	99
At or within 120 NMI/2000 Ft	91	94	95	96	97	99	100	99

Table C-15

60 NMI/1000 FT EASTBOUND ENTRY DIVERSIONS BY FLOW, JULY 1979 SAMPLE DAY

Origin-Destination Flow	Percent Cleared at or within 60 NMI/1000 Ft of Request							
	60-120 NMI 15 Min 2000 Ft	60 NMI 15 Min 2000 Ft	60 NMI 10 Min 2000 Ft	30 NMI 10 Min 2000 Ft	30 NMI 5 Min 2000 Ft	60 NMI 15 Min 1000 Ft	60 NMI 10 Min 1000 Ft	60 NMI 10 Min 1000± Ft
1. Scandinavia-North America	95	86	100	95	100	86	90	95
2. Europe-Eastern North America	65	85	92	96	96	93	96	95
3. Europe-Mid North America	75	81	83	97	97	94	97	92
4. Europe-Western North America	84	84	84	84	95	89	89	89
5. Europe-Caribbean	85	85	85	85	92	85	85	83
6. Iberia-USA †	†	†	†	†	†	†	†	†
7. Iberia-Canada †	†	†	†	†	†	†	†	†
8. Iberia-Caribbean	100	100	100	100	100	100	100	100
9. North America-Africa	100	100	100	100	100	100	100	100
10. Europe-Iceland	100	100	100	100	100	91	91	91
11. Europe-Azores	100	100	100	100	100	100	100	100
12. US/Canada-Caribbean/S. America	80	86	86	88	93	91	95	90
13. Mideast/Africa-Carib/S. America	100	100	100	100	100	100	100	100

† Not available (see text)

Table C-16

60 NMI/1000 FT WESTBOUND ENTRY DIVERSIONS BY FLOW, JULY 1979 SAMPLE DAY

Origin-Destination Flow	Percent Cleared at or within 60 NMI/1000 Ft of Request							
	60-120 NMI 15 Min 2000 Ft	60 NMI 15 Min 2000 Ft	60 NMI 10 Min 2000 Ft	30 NMI 10 Min 2000 Ft	30 NMI 5 Min 2000 Ft	60 NMI 15 Min 1000 Ft	60 NMI 10 Min 1000 Ft	60 NMI 10 Min 1000* Ft
1. Scandinavia-North America	88	100	96	100	100	100	100	100
2. Europe-Eastern North America	85	94	99	97	98	99	100	100
3. Europe-Mid North America	82	85	92	97	97	100	100	100
4. Europe-Western North America	79	86	86	93	100	85	85	85
5. Europe-Caribbean	92	92	100	100	100	100	100	100
6. Iberia-USA †	†	†	†	†	†	†	†	†
7. Iberia-Canada †	†	†	†	†	†	†	†	†
8. Iberia-Caribbean	90	90	90	90	90	100	100	100
9. North America-Africa	100	100	100	100	100	100	100	100
10. Europe-Iceland	92	83	83	83	83	100	100	100
11. Europe-Azores	90	90	100	100	100	90	100	100
12. US/Canada-Caribbean/S. America	80	89	88	89	92	87	91	86
13. Mideast/Africa-Carib/S. America	100	100	100	100	100	100	100	100

† Not available (see text)

Table C-17

60 NMI/1000 FT TOTAL (EB AND WB) ENTRY DIVERSIONS BY FLOW, JULY 1979 SAMPLE DAY

Origin-Destination Flow	Percent Cleared at or within 60 NMI/1000 Ft of Request: 60-120 NMI 15 Min 2000 Ft	60 NMI 15 Min 2000 Ft	60 NMI 10 Min 2000 Ft	30 NMI 10 Min 2000 Ft	30 NMI 5 Min 2000 Ft	60 NMI 15 Min 1000 Ft	60 NMI 10 Min 1000 Ft	60 NMI 10 Min 1000* Ft
1. Scandinavia-North America	91	93	98	98	100	93	95	98
2. Europe-Eastern North America	75	90	95	96	97	96	98	98
3. Europe-Mid North America	79	83	88	97	97	97	99	96
4. Europe-Western North America	82	85	85	88	97	88	88	88
5. Europe-Caribbean	88	88	92	92	96	92	92	92
6. Iberia-USA†	†	†	†	†	†	†	†	†
7. Iberia-Canada†	†	†	†	†	†	†	†	†
8. Iberia-Caribbean	95	95	95	95	95	100	100	100
9. North America-Africa	100	100	100	100	100	100	100	100
10. Europe-Iceland	96	91	91	91	91	96	96	96
11. Europe-Azores	93	93	100	100	100	93	100	100
12. US/Canada-Caribbean/S. America	80	88	87	88	92	89	93	88
13. Mideast/Africa-Carib/S. America	100	100	100	100	100	100	100	100

† Not available (see text)

Table C-18

1979 STEP CLIMB REQUEST SUMMARY, JULY SAMPLE DAY

Flight		Percent of Flights That Request at Least One Step Climb							
		60-120 NMI 15 Min 3000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*
OTS	Eastbound	58	68	69	70	71	88	89	83
	Westbound	84	82	85	88	90	95	95	92
	Total	71	75	77	79	80	91	92	88
Non-OTS	Eastbound	31	30	30	28	29	51	51	60
	Westbound	31	29	28	27	26	44	44	46
	Total	31	30	29	27	27	47	47	53
All	Eastbound	45	50	50	50	50	70	70	72
	Westbound	57	55	56	57	57	69	69	69
	Total	51	53	53	53	54	69	70	70

Table C-19

1979 STEP CLIMB APPROVAL SUMMARY, JULY SAMPLE DAY

Flight		Step Climbs Approved (Percent of Step Climb Requests)							
		60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*
OTS	Eastbound	25	40	56	68	80	52	60	66
	Westbound	55	72	79	76	81	78	85	83
	Total	43	59	70	73	81	67	75	76
Non-OTS	Eastbound	41	47	53	60	66	60	64	65
	Westbound	58	61	66	70	76	71	74	70
	Total	49	54	59	65	71	65	69	67
All	Eastbound	32	43	54	65	74	55	62	65
	Westbound	56	69	75	74	80	76	82	80
	Total	45	57	66	70	78	66	73	73

Table C-20

1979 STEP CLIMB DELAY TIME SUMMARY, JULY SAMPLE DAY

Flight		Average Time to Step Climb Approval (Min)							
		60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*
OTS	Eastbound	21.7	15.6	11.0	10.9	11.2	7.8	8.6	8.9
	Westbound	15.7	13.3	12.3	10.8	10.4	9.2	7.8	8.2
	Total	17.2	14.0	11.9	10.8	10.7	8.8	8.1	8.5
Non-OTS	Eastbound	13.8	14.1	12.3	11.6	9.0	14.1	12.6	11.8
	Westbound	20.7	17.4	16.9	9.6	7.8	12.8	9.1	10.8
	Total	17.6	15.9	14.6	10.6	8.4	13.4	10.9	11.4
All	Eastbound	17.4	14.9	11.5	11.2	10.4	10.5	10.3	10.2
	Westbound	17.3	14.5	13.5	10.5	9.7	10.2	8.1	8.9
	Total	17.4	14.6	12.8	10.7	10.0	10.3	9.0	9.4

Note: The data shown includes a 6 min communication delay time

Table C-22

1979 *OCEANIC FLIGHT TIME AT 3000 FT AND GREATER ALTITUDE DIVERSION, JULY SAMPLE DAY*

Origin-Destination Flow	Percent of Total Flight Time spent 3000 Ft and Greater Below Requested Altitude in Oceanic Airspace							
	60-120 NMI 15 Min 2000 Ft	60 NMI 15 Min 2000 Ft	60 NMI 10 Min 2000 Ft	30 NMI 10 Min 2000 Ft	30 NMI 5 Min 2000 Ft	60 NMI 15 Min 1000 Ft	60 NMI 10 Min 1000 Ft	60 NMI 10 Min 1000* Ft
1. Scandinavia-North America	6.55	3.84	0.00	0.87	0.00	2.71	1.47	1.39
2. Europe-Eastern North America	9.36	4.57	3.51	1.56	0.93	1.41	0.92	1.12
3. Europe-Mid North America	12.11	8.86	6.75	4.53	3.05	4.60	3.99	3.06
4. Europe-Western North America	19.01	18.72	16.73	16.95	12.11	10.21	10.23	11.05
5. Europe-Caribbean	10.36	8.99	8.50	3.23	2.29	5.88	5.84	3.75
6. Iberia-USA †	†	†	†	†	†	†	†	†
7. Iberia-Canada†	†	†	†	†	†	†	†	†
8. Iberia-Caribbean	15.59	13.58	12.69	9.53	8.63	0.00	0.00	0.00
9. North America-Africa	19.42	5.31	5.31	11.92	0.00	0.00	0.00	0.00
10. Europe-Iceland	0.00	4.92	4.92	4.88	4.88	0.00	0.00	0.00
11. Europe-Azores	6.41	6.40	0.00	0.00	0.00	0.00	0.00	0.00
12. [illegible]/Canada-Caribbean/S. America	22.44	15.37	15.4[illegible]	13.90	8.95	9.65	8.46	9.76
13. Mideast/Africa-Carib/S. America	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL	13.03	8.83	7.69	5.59	3.89	3.79	3.30	3.42

Note: Columns may not sum to given totals because of round-off.

† Not available (see text)

Table C-21

1979 OCEANIC FLIGHT TIME AT 1000 AND 2000 FT ALTITUDE DIVERSION, JULY SAMPLE DAY

Origin-Destination Flow	Percent of Total Flight Time Spent 1000 and 2000 Ft Below Requested Altitude in Oceanic Airspace							
	60-120 NMI 15 Min 2000 Ft	60 NMI 15 Min 2000 Ft	60 NMI 10 Min 2000 Ft	30 NMI 10 Min 2000 Ft	30 NMI 5 Min 2000 Ft	60 NMI 15 Min 1000 Ft	60 NMI 10 Min 1000 Ft	60 NMI 10 Min 1000* Ft
1. Scandinavia-North America	5.83	6.61	3.31	2.45	3.26	8.43	3.35	2.56
2. Europe-Eastern North America	20.95	14.83	11.98	12.37	10.38	15.89	12.21	12.57
3. Europe-Mid North America	14.34	12.23	11.33	10.90	6.66	20.12	15.90	14.06
4. Europe-Western North America	2.39	1.79	1.79	0.00	0.00	8.81	7.26	8.83
5. Europe-Caribbean	7.32	4.27	3.33	3.50	3.47	9.91	9.37	9.00
6. Iberia-USA†	†	†	†	†	†	†	†	†
7. Iberia-Canada†	†	†	†	†	†	†	†	†
8. Iberia-Caribbean	0.00	1.48	0.00	0.41	0.41	9.18	7.60	7.49
9. North America-Africa	0.00	0.00	0.00	0.00	0.00	4.94	4.94	12.91
10. Europe-Iceland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11. Europe-Azores	0.00	0.00	0.00	0.00	0.00	10.82	0.00	0.00
12. US/Canada-Caribbean/S. America	0.00	0.00	0.00	0.00	0.00	10.48	9.39	10.10
13. Mideast/Africa-Carib/S. America	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL	12.74	9.32	7.56	7.29	5.97	13.70	10.87	11.15

Note: Columns may not sum to given totals because of round-off.

† Not available (see text)

Table C-23

1979 EASTBOUND OTS EXIT FLIGHT LEVEL PREFERENCE AND CLEARANCE SUMMARY, JULY SAMPLE DAY

Percent of OTS Daily Flights Requesting Flight Level Indicated

Eastbound Flight Level at Oceanic Exit	60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*
≥400	0	0	0	0	0	0	0	0
390	0	0	0	0	0	24.73	24.59	12.22
380	3.30	0	0	0	0	0	0	0
370	40.66	69.95	70.65	71.20	70.97	39.01	39.34	51.11
360	29.67	0	0	0	0	17.58	17.49	18.33
350	13.74	23.50	22.83	23.37	23.12	13.19	13.11	10.56
340	8.79	0	0	0	0	3.30	3.28	3.89
330	3.85	6.56	6.52	5.43	5.91	2.20	2.19	3.89
320	0	0	0	0	0	0	0	0
310	0	0	0	0	0	0	0	0
≤300	0	0	0	0	0	0	0	0
ALL	100	100	100	100	100	100	100	100

Percent of OTS Flights Cleared at Their Requested Flight Level

Eastbound Flight Level at Oceanic Exit	60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*
≥400	0	0	0	0	0	0	0	0
390	0	0	0	0	0	16.48	16.94	11.11
380	0	0	0	0	0	0	0	0
370	23.63	42.62	50.00	54.89	61.83	20.33	24.59	31.67
360	14.84	0	0	0	0	9.89	10.93	12.78
350	7.14	10.93	14.13	16.85	18.82	8.24	9.29	8.89
340	6.04	0	0	0	0	2.20	2.19	3.33
330	2.75	5.46	5.43	5.43	5.38	0.55	1.09	3.33
320	0	0	0	0	0	0	0	0
310	0	0	0	0	0	0	0	0
≤300	0	0	0	0	0	0	0	0
ALL	54.40	59.02	69.57	77.17	86.02	57.69	65.03	71.11

Note: Columns may not sum to given totals because of round-off.

Table C-24

1979 WESTBOUND OTS EXIT FLIGHT LEVEL PREFERENCE AND CLEARANCE SUMMARY, JULY SAMPLE DAY

Westbound Flight Level at Oceanic Exit	Percent of OTS Daily Flights Requesting Flight Level Indicated								Percent of OTS Flights Cleared at Their Requested Flight Level							
	60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*	60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*
≥400	0.55	0	0	0	0	1.10	1.10	1.09	0	0	0	0	0	1.10	1.10	1.09
390	8.20	10.33	10.33	9.24	9.24	0	0	0	5.46	8.70	8.70	8.15	8.70	0	0	0
380	4.92	0	0	0	0	24.73	24.73	22.95	0	0	0	0	0	18.68	19.78	19.67
370	35.52	35.87	36.41	46.74	46.74	23.08	23.08	14.75	22.95	25.54	28.26	34.78	38.04	17.58	20.88	12.57
360	4.37	0	0	0	0	21.98	21.98	28.96	2.73	0	0	0	0	15.38	18.13	22.95
350	39.34	47.83	47.83	39.13	39.13	19.23	19.23	23.50	25.14	35.33	38.04	28.80	30.98	14.29	15.93	18.58
340	1.09	0	0	0	0	6.59	6.59	4.92	1.09	0	0	0	0	4.40	4.95	4.37
330	4.92	5.43	4.89	4.35	4.35	2.75	2.75	2.73	3.83	4.89	4.35	4.35	4.35	2.75	2.75	2.73
320	0	0	0	0	0	0.55	0.55	1.09	0	0	0	0	0	0.55	0.55	1.09
310	1.09	0.54	0.54	0.54	0.54	0	0	0	1.09	0.54	0.54	0.54	0.54	0	0	0
≤300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ALL	100	100	100	100	100	100	100	100	62.30	75.00	79.89	76.63	82.61	74.73	84.07	83.06

Note: Columns may not sum to given totals because of round-off.

Table C-25

1979 EASTBOUND AND WESTBOUND OTS EXIT FLIGHT LEVEL CLEARANCE SUMMARY, JULY SAMPLE DAY

PERCENT OF DAILY FLIGHTS CLEARED AS INDICATED AT OCEANIC EXIT

Flight Level at Oceanic Exit	EASTBOUND 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*	WESTBOUND 60-120 NMI 15 Min 2000 Ft	60 15 2000	60 10 2000	30 10 2000	30 5 2000	60 15 1000	60 10 1000	60 10 1000*
≥400	0	0	0	0	0	0	0	0	0	0	0	0	0	1.10	1.10	1.09
390	0	0	0	0	0	17.03	17.49	12.22	7.65	10.33	10.33	9.78	10.33	0	0	0
380	0	0	0	0	0	0	0	0	0	0	0	0	0	20.33	21.43	21.31
370	23.63	43.17	50.54	55.43	62.37	25.82	30.60	32.78	22.95	26.09	28.80	35.33	38.04	21.43	24.18	25.30
360	18.13	0	0	0	0	20.33	18.03	23.89	6.01	0	0	0	0	19.78	20.88	24.04
350	15.93	33.88	31.52	32.07	28.49	21.43	22.95	18.33	35.52	44.02	45.11	39.67	39.13	21.98	19.78	24.04
340	15.38	0	0	0	0	11.54	8.20	8.33	3.83	0	0	0	0	9.34	7.69	8.20
330	12.64	18.58	14.67	11.96	9.14	2.75	2.19	3.89	13.66	14.13	11.41	10.87	9.78	4.40	3.85	4.92
320	7.14	0	0	0	0	1.10	0.55	0.56	0.55	0	0	0	0	1.65	1.10	1.09
310	4.40	3.83	3.26	0.54	C	0	0	0	8.74	4.35	3.80	3.80	2.72	0	0	0
≤300	2.75	0.55	0	0	0	0	0	0	1.09	1.09	0.54	0.54	0	0	0	0
ALL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Note: Columns may not sum to given totals because of round-off.

Table C-26

EXIT DIVERSION DISTRIBUTION FOR OTS FLIGHTS, JULY 1979 SAMPLE DAY

	Percent Cleared							
Exit Clearance	60-120 NMI 15 Min 2000 Ft	60 NMI 15 Min 2000 Ft	60 NMI 10 Min 2000 Ft	30 NMI 10 Min 2000 Ft	30 NMI 5 Min 2000 Ft	60 NMI 15 Min 1000 Ft	60 NMI 10 Min 1000 Ft	60 NMI 10 Min 1000* Ft
Eastbound OTS								
At Track and Alt. Requested	41	43	55	62	76	48	58	66
At Track Requested	77	70	76	80	90	84	87	90
At Alt. Requested	54	59	70	77	86	58	65	71
At or within 60 NMI/1000 Ft	51	57	69	77	86	75	78	87
At or within 60 NMI/2000 Ft	77	90	95	98	100	93	96	97
At or within 120 NMI/2000 Ft	82	93	96	98	100	93	96	97
Westbound								
At Track and Alt. Requested	58	60	69	60	72	66	76	78
At Track Requested	86	79	88	79	89	90	91	94
At Alt. Requested	62	75	80	77	83	75	84	83
At or within 60 NMI/1000 Ft	60	74	80	77	83	88	93	93
At or within 60 NMI/2000 Ft	80	90	92	93	95	97	98	99
At or within 120 NMI/2000 FT	85	91	92	93	95	97	98	99
Total								
At Track and Alt. Requested	50	52	62	61	74	57	67	72
At Track Requested	81	75	82	79	89	87	89	92
At Alt. Requested	58	67	75	77	84	66	75	77
At or within 60 NMI/1000 Ft	56	66	74	77	84	82	85	90
At or within 60 NMI/2000 Ft	79	90	93	96	98	95	97	98
At or within 120 NMI/2000 Ft	83	92	94	96	98	95	97	98

Table C-27

EXIT DIVERSION DISTRIBUTION FOR NON-OTS FLIGHTS, JULY 1979 SAMPLE DAY

Exit Clearance	Percent Cleared							
	60-120 NMI 15 Min 2000 Ft	60 NMI 15 Min 2000 Ft	60 NMI 10 Min 2000 Ft	30 NMI 10 Min 2000 Ft	30 NMI 5 Min 2000 Ft	60 NMI 15 Min 1000 Ft	60 NMI 10 Min 1000 Ft	60 NMI 10 Min 1000* Ft
Eastbound Non-OTS								
At Track and Alt. Requested	76	82	84	86	89	78	80	79
At Track Requested	100	100	100	100	100	100	100	100
At Alt. Requested	76	82	84	86	89	78	80	79
At or within 60 NMI/1000 Ft	78	82	84	86	89	79	81	79
At or within 60 NMI/2000 Ft	78	84	85	87	90	89	90	92
At or within 120 NMI/2000 Ft	78	84	85	87	90	89	90	92
Westbound Non-OTS								
At Track and Alt. Requested	80	85	87	88	90	85	87	85
At Track Requested	100	100	100	100	100	100	100	100
At Alt. Requested	80	85	87	88	90	85	87	85
At or within 60 NMI/1000 Ft	80	85	87	88	90	85	87	86
At or within 60 NMI/2000 Ft	81	85	88	89	90	92	92	93
At or within 120 NMI/2000 FT	81	85	88	89	90	92	92	93
Total Non-OTS								
At Track and Alt. Requested	78	84	86	87	89	81	83	82
At Track Requested	100	100	100	100	100	100	100	100
At Alt. Requested	78	84	86	87	89	81	83	82
At or within 60 NMI/1000 Ft	79	84	86	87	89	82	84	83
At or within 60 NMI/2000 Ft	79	84	86	88	90	91	91	93
At or within 120 NMI/2000 Ft	79	84	86	88	90	91	91	93

AD-A123 831 OCEANIC AREA SYSTEM IMPROVEMENT STUDY (OASIS) VOLUME VII NORTH ATLANTIC R..(U) SRI INTERNATIONAL MENLO PARK CA G J COULURIS ET AL. SEP 81 OASIS-NAT-FCM 2/2

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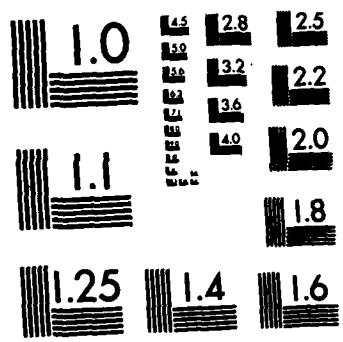

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Table C-28

EXIT DIVERSION DISTRIBUTION FOR ALL (OTS AND NON-OTS) FLIGHTS, JULY 1979 SAMPLE DAY

Exit Clearance	Percent Cleared							
	60-120 NMI 15 Min 2000 Ft	60 NMI 15 Min 2000 Ft	60 NMI 10 Min 2000 Ft	30 NMI 10 Min 2000 Ft	30 NMI 5 Min 2000 Ft	60 NMI 15 Min 1000 Ft	60 NMI 10 Min 1000 Ft	60 NMI 10 Min 1000* Ft
Eastbound All								
At Track and Alt. Requested	58	62	69	74	83	62	69	72
At Track Requested	88	84	88	90	95	92	93	95
At Alt. Requested	65	70	76	81	88	68	72	75
At or within 60 NMI/1000 Ft	64	69	76	81	88	77	80	83
At or within 60 NMI/2000 Ft	78	87	90	93	95	91	93	94
At or within 120 NMI/2000 Ft	80	89	91	93	95	91	93	94
Westbound All								
At Track and Alt. Requested	69	72	78	74	81	76	81	82
At Track Requested	93	90	94	89	95	95	96	97
At Alt. Requested	71	80	84	82	86	80	85	84
At or within 60 NMI/1000 Ft	70	79	84	82	86	87	90	89
At or within 60 NMI/2000 Ft	80	87	90	91	93	95	95	96
At or within 120 NMI/2000 FT	83	88	90	91	93	95	95	96
Total All								
At Track and Alt. Requested	64	67	74	74	82	69	75	77
At Track Requested	90	87	91	90	95	93	94	96
At Alt. Requested	68	75	80	82	87	74	79	80
At or within 60 NMI/1000 Ft	67	74	80	82	87	82	85	86
At or within 60 NMI/2000 Ft	79	87	90	92	94	93	94	95
At or within 120 NMI/2000 Ft	81	88	90	92	94	93	94	95

Table C-29

60 NMI/FT EASTBOUND EXIT DIVERSIONS BY FLOW, JULY 1979 SAMPLE DAY

Origin-Destination Flow	Percent Cleared at or within 60 NMI/1000 Ft of Request							
	60-120 NMI 15 Min 2000 Ft	60 NMI 15 Min 2000 Ft	60 NMI 10 Min 2000 Ft	30 NMI 10 Min 2000 Ft	30 NMI 5 Min 2000 Ft	60 NMI 15 Min 1000 Ft	60 NMI 10 Min 1000 Ft	60 NMI 10 Min 1000* Ft
1. Scandinavia-North America	71	76	86	90	100	81	86	90
2. Europe-Eastern North America	53	57	68	74	82	74	76	84
3. Europe-Mid North America	58	58	64	78	92	71	78	89
4. Europe-Western North America	74	79	79	79	79	79	79	79
5. Europe-Caribbean	73	75	82	92	85	77	77	91
6. Iberia-USA †	†	†	†	†	†	†	†	†
7. Iberia-Canada †	†	†	†	†	†	†	†	†
8. Iberia-Caribbean	100	100	100	100	100	100	100	100
9. North America-Africa	50	100	100	100	100	100	100	50
10. Europe-Iceland	50	100	100	100	100	91	91	91
11. Europe-Azores	100	100	100	100	100	100	100	100
12. US/Canada-Caribbean/S. America	71	80	81	80	88	73	78	74
13. Mideast/Africa-Carib/S. America	100	100	100	100	100	100	100	100

† Not available (see text)

Table C-30

60 NMI/1000 FT WESTBOUND EXIT DIVERSIONS BY FLOW, JULY 1979 SAMPLE DAY

Origin-Destination Flow	Percent Cleared at or within 60 NMI/1000 Ft of Request							
	60-120 NMI 15 Min 2000 Ft	60 NMI 15 Min 2000 Ft	60 NMI 10 Min 2000 Ft	30 NMI 10 Min 2000 Ft	30 NMI 5 Min 2000 Ft	60 NMI 15 Min 1000 Ft	60 NMI 10 Min 1000 Ft	60 NMI 10 Min 1000* Ft
1. Scandinavia-North America	79	92	100	100	96	100	100	100
2. Europe-Eastern North America	57	73	78	76	81	88	94	92
3. Europe-Mid North America	79	85	92	82	92	92	95	97
4. Europe-Western North America	86	79	86	86	93	92	92	92
5. Europe-Caribbean	85	92	92	100	100	92	92	85
6. Iberia-USA †	†	†	†	†	†	†	†	†
7. Iberia-Canada †	†	†	†	†	†	†	†	†
8. Iberia-Caribbean	90	90	90	90	90	100	100	100
9. North America-Africa	100	100	100	100	100	100	100	100
10. Europe-Iceland	92	83	83	83	83	100	100	100
11. Europe-Azores	90	90	100	100	100	90	100	100
12. US/Canada-Caribbean/S. America	68	78	80	82	84	71	74	73
13. Mideast/Africa-Carib/S. America	100	100	100	100	100	100	100	100

† Not available (see text)

Table C-31

60 NMI/1000 FT TOTAL (EB AND WB) EXIT DIVERSIONS BY FLOW, JULY 1979 SAMPLE DAY

Origin-Destination Flow	Percent Cleared at or within 60 NMI/1000 Ft of Request							
	60-120 NMI 15 Min 2000 Ft	60 NMI 15 Min 2000 Ft	60 NMI 10 Min 2000 Ft	30 NMI 10 Min 2000 Ft	30 NMI 5 Min 2000 Ft	60 NMI 15 Min 1000 Ft	60 NMI 10 Min 1000 Ft	60 NMI 10 Min 1000* Ft
1. Scandinavia-North America	76	84	93	96	98	91	93	96
2. Europe-Eastern North America	55	65	73	75	82	81	85	88
3. Europe-Mid North America	69	72	79	80	92	82	87	93
4. Europe-Western North America	79	79	82	82	85	84	84	84
5. Europe-Caribbean	79	84	88	96	92	85	85	88
6. Iberia-USA†	†	†	†	†	†	†	†	†
7. Iberia-Canada†	†	†	†	†	†	†	†	†
8. Iberia-Caribbean	95	95	95	95	95	100	100	100
9. North America-Africa	75	100	100	100	100	100	100	75
10. Europe-Iceland	96	91	91	91	91	96	96	96
11. Europe-Azores	93	93	100	100	100	93	100	100
12. US/Canada-Caribbean/S. America	70	79	80	81	86	73	76	73
13. Mideast/Africa-Carib/S. America	100	100	100	100	100	100	100	100

† Not available