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OCEANIC AREA SYSTEM IMPROVEMENT STUDY (OASIS)

Volume VIII: Central East Pacific Region Flight Cost Model Results

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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 the CEP 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

Volume IX
Flight Cost Model Description

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

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 the 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 Atlantic 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.

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GLOSSARY OF ACRONYMS

ACC	Area control center
ATA	Air Transport Association of America
ATC	Air traffic control
ATS	Air traffic services
CEP	Central East Pacific
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
nmi	Nautical miles
OASIS	Oceanic Area System Improvement Study
O-D	Origin/destination
ORS	Organized route system
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 Central East Pacific (CEP) 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 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 50 nmi 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 50nmi/10min/2000ft 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 CEP upper airspace including air carrier and military 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 a proposed future aircraft, a B747 stretch (ST). Flight performance characteristics for certain other aircraft, including air carrier and military, were not provided and fuel and time costs for these aircraft were not estimated by the FCM; B707 flight performance characteristics were used to simulate the flight profile for one non-costed air carrier aircraft (a B720) so as to include its contribution to system traffic. Flight profiles for the military 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 the B720 and military aircraft) and therefore are very slight underestimates of the air carrier direct operating flight expenses for fuel, crew and maintenance. All air carrier flights were costed in the 1984 and 2005 simulation runs. The traffic distribution is shown in Table 1.

Table 1

CEP TRAFFIC COMPOSITION, JULY SAMPLE DAY

	Traffic Loading		
	1979	1984	2005
Total Number of Flights	177	230	479
Air Carrier	89%	91%	96%
Military	11%	9%	4%
Number of Air Carrier Flights	157	210	459
Costed Air Carrier	99%	100%	100%
Number of Costed Air Carrier Flights	156	210	459
Wide Body Costed Air Carrier	81%	95%	100%

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.

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 mode simulates an operational situation in which flights are not constrained by Organized Route System (ORS) 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 flights are assumed to fly step-climb profiles (not cruise-climb) subject to 1000 ft 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 2000 ft 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.

To summarize, 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 CEP 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

Table 2

FCM DAILY FLIGHT COSTS, JULY SAMPLE DAY

Year	Ideal Flight Operating Mode	Daily Cost by System Operating Alternative†							
		100-50 NMI 15 Min 2000 Ft	50 NMI 15 Min 2000 Ft	50 NMI 10 Min 2000 Ft	25 NMI 10 Min 2000 Ft	25 NMI 5 Min 2000 Ft	50 NMI 15 Min 1000 Ft	50 NMI 10 Min 1000 Ft	50 NMI 10 Min 1000 Ft*
		Daily Flight Cost (1979 $000)							
1979	Ideal	2784	2784	2784	2784	2784	2784	2784	2784
	Planned	2805	2806	2806	2808	2808	2796	2796	2799
	Actual	2816	2816	2814	2817	2816	2807	2806	2808
1984	Ideal	4133	4133	4133	4133	4133	4133	4133	4133
	Planned	4165	4166	4166	4165	4165	4151	4151	4158
	Actual	4183	4182	4177	4175	4173	4163	4162	4169
2005	Ideal	11055	11055	11055	11055	11055	11055	11055	11055
	Planned	11144	11145	11145	11142	11142	11102	11102	11122
	Actual	11209	11201	11190	11180	11172	11135	11130	11155
		Daily Average Flight Cost (1979 $000 per Flight)							
1979	Ideal	17.85	17.85	17.85	17.85	17.85	17.85	17.85	17.85
	Planned	17.98	17.99	17.99	18.00	18.00	17.92	17.92	17.94
	Actual	18.05	18.05	18.04	18.06	18.05	17.99	17.99	18.00
1984	Ideal	19.68	19.68	19.68	19.68	19.68	19.68	19.68	19.68
	Planned	19.83	19.84	19.84	19.83	19.83	19.77	19.77	19.80
	Actual	19.92	19.91	19.89	19.88	19.87	19.82	19.82	19.85
2005	Ideal	24.08	24.08	24.08	24.08	24.08	24.08	24.08	24.08
	Planned	24.28	24.28	24.28	24.27	24.27	24.19	24.19	24.23
	Actual	24.42	24.40	24.38	24.36	24.34	24.26	24.25	24.30

*1000 ft vertical separation in CEP oceanic airspace only; 2000 ft elsewhere.
†Constant 1979 $ U.S. excluding inflation and discount rate.

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: all dollar amounts in the text of this report are in 1979 US dollars.

The ideal flight mode results show that the theoretical minimum daily flight cost regardless of system operating alternative is US $2.8 million in 1979 and increases to $4.1 million in 1984 and 11.1 million in 2005. The increase is due to the 194 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 81 to 100 percent over the 1979 to 2005 time period and causes the ideal average flight cost to increase from US $17.85 to $24.08 (thousands) per flight over the same period.

The planned flight mode requires aircraft to fly the established tracks of the ORS in the heavily-traveled airspace between Hawaii and the West Coast of the US, and random routes 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. The planned costs are also affected by aircraft operator flight planning techniques and practices (including anticipation of step-climbs, diversions and delays) and the survey 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, ORS 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 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 theoretically 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 the 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 50nmi/10min/2000ft system in 1984 show that the estimated planned cost difference accounts for 75 percent (US $33 thousand) of the difference between ideal and actual daily costs ($44 thousand). Note that the lowest cost penalties in each year are 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 ORS would require revolutionary advances in ATC automation. Planned cost penalties also may be reduced by some amount through improvements in planning procedures, meteorological forecasting, 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 presumably 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

Table 3

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

Year	Flight Operating Mode	Relative Daily Cost by System Operating Alternative							
		100-50 NMI 15 Min 2000 Ft	50 NMI 15 min 2000 Ft	50 NMI 10 Min 2000 Ft	25 NMI 10 Min 2000 Ft	25 NMI 5 Min 2000 Ft	50 NMI 15 Min 1000 Ft	50 NMI 10 Min 1000 Ft	50 NMI 10 Min 1000 Ft*
		Daily Flight Cost Difference Relative to Free Search Mode in Year Indicated (1979 $000)†							
1979	Planned	21	22	22	24	24	12	12	15
	Actual	32	32	30	33	32	23	22	24
1984	Planned	32	33	33	32	32	18	18	25
	Actual	50	49	44	42	40	30	29	36
2005	Planned	89	90	90	87	87	47	47	67
	Actual	154	146	135	125	118	80	75	100
		Daily Average Flight Cost Difference Relative to Free Search Mode in Year Indicated (1979 $000 per Flight)†							
1979	Planned	0.13	0.14	0.14	0.15	0.15	0.07	0.07	0.09
	Actual	0.20	0.20	0.19	0.21	0.20	0.14	0.14	0.15
1984	Planned	0.15	0.16	0.16	0.15	0.15	0.09	0.09	0.12
	Actual	0.24	0.23	0.21	0.20	0.19	0.14	0.14	0.17
2005	Planned	0.20	0.20	0.20	0.19	0.19	0.11	0.11	0.15
	Actual	0.34	0.32	0.30	0.28	0.26	0.18	0.17	0.22

*1000 ft vertical separation in CEP oceanic airspace only; 2000 ft elsewhere.
†Constant 1979 $ U.S. excluding inflation and discount rate.

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 also 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 50-100nmi/15min/2000ft system and each of the other seven system alternatives for the July sample day. The planned flight cost reductions for each of the seven alternatives are calculated relative to the current system planned cost; the actual cost reductions are similarly calculated.

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 some slight increase from implementation of the 50nmi lateral spacing, due primarily to loss of even flight levels on the previously composite tracks. For example, aircraft that could previously have flown at FL360 may have been forced down to FL350, which could be slightly more costly. A similar increase in planned costs is seen in the 25nmi lateral separation scenario, which, in the heavily ORS-concentrated earlier years, is attributable to the loss of track-direction pairings. All but two tracks are unidirectional, and insertion of new tracks requires half of the unidirectional tracks to change direction. Thus, some preferred routings would no longer be available. (Note that approximately half of the preferred routings would be lost regardless of which way the tracks are set up (i.e., east, west, east..., or west, east, west...). Many aircraft are then forced to fly as much as 25nmi away from previously preferred tracks which may have happened to be nearly optimal Great Circle routes. The decreased lateral spacing does pay off in terms of reduced conflict and diversion, resulting in $8 thousand and $29 thousand daily actual cost savings in 1984 and 2005, respectively. Further relaxation of constraints by reducing longitudinal separation to 5 minutes in the 25nmi system produces even greater savings.

The most dramatic reductions in planned and actual costs derive from halving the vertical separation minimum to 1000 ft. When the 50nmi system with 10 min. longitudinal separation is reduced to 1000 ft. in the CEP oceanic area alone, savings over the baseline increase in 2005 from $19 thousand to $54 thousand. When the 1000 ft. separation

Table 4

FCM DAILY COSTS RELATIVE TO 50-100/15/2000 SYSTEM, JULY SAMPLE DAY

Year	Flight Operating Mode	Relative Daily Cost by System Operating Alternative						
		50 NMI 15 Min 2000 Ft	50 NMI 10 Min 2000 Ft	25 NMI 10 Min 2000 Ft	25 NMI 5 Min 2000 Ft	50 NMI 15 Min 1000 Ft	50 NMI 10 Min 1000 Ft	50 NMI 10 Min 1000 Ft*
		Daily Flight Cost Difference Relative to 50-100/15/2000 System in Year Indicated (1979 $000)†						
1979	Planned	(1)	(1)	(3)	(3)	9	9	6
	Actual	-	2	(1)	-	9	10	8
1984	Planned	(1)	(1)	-	-	14	14	7
	Actual	1	6	8	10	20	21	14
2005	Planned	(1)	(1)	2	2	42	42	22
	Actual	8	19	29	37	74	79	54
		Daily Average Flight Cost Difference Relative to 50-100/15/2000 System in Year Indicated (1979 $000)†						
1979	Planned	(0.01)	(0.01)	(0.02)	(0.02)	0.06	0.06	0.04
	Actual	-	0.01	(0.01)	-	0.06	0.06	0.05
1984	Planned	(0.01)	(0.01)	-	-	0.06	0.06	0.03
	Actual	0.01	0.03	0.04	0.05	0.10	0.10	0.07
2005	Planned	-	-	0.01	0.01	0.09	0.09	0.05
	Actual	0.02	0.04	0.06	0.08	0.16	0.17	0.12

*1000 ft vertical separation in CEP oceanic airspace only; 2000 ft elsewhere.
†Constant 1979 $ U.S. excluding inflation and discount rate.
( ) indicates greater relative cost.

criterion is applied to CEP flights in domestic airspace and CTA/FIRs other than just Oakland and Honolulu (e.g., Tokyo, Anchorage and Tahiti), the savings in 2005 increase to $79 thousand daily.

In general, the actual daily cost savings achievable by halving vertical separations throughout are greater than twice those achievable by halving lateral separaions. In all cases where lateral and vertical separations are fixed, some cost savings are obtained by longitudinal minimum reduction. However, the relative impacts of longitudinal reductions are less as lateral and vertical minima are reduced. For example, a reduction of 5 min in the longitudinal minima produces 138, 9 and 7 percent greater reductions in daily flight cost in the 50nmi/x/2000ft, 25nmi/x/2000ft, and 50nmi/x/1000ft systems in 2005, respectively.

3.5 Seasonal Cost Variations

The FCM was applied to a November sample day for the years in 1979, 1984 and 2005 using the present 50-100nmi/15min/2000ft as a basis for comparing cost magnitudes by year with those of the July sample day. The number of costed flights in the November sample day for 1979 is 87 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 92 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 primarily to the slight difference in fleet composition and to a lesser degree to differences in weather patterns; widebody aircraft comprise 85 percent of the November sample day costed traffic as opposed to 81 percent in July. In 1984 and 2005 the higher average flight costs in July arise from more significant congestion penalties.

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 other related operational data are presented in Appendix C.

Table 5

FCM COST COMPARISONS FOR NOVEMBER AND JULY SAMPLE DAY
BASED ON 50-100/15/2000 SYSTEM OPERATION

Sample Day		Number Of Costed Flights	Daily Flight Cost (1979 $000)	Daily Average Flight Cost (1979 $000 Per Flight)
July	1979	156	2784	17.85
November	1979	135	2564	18.99
July	1984	210	4183	19.92
November	1984	183	3531	19.29
July	2005	459	11209	24.42
November	2005	390	9123	23.39

Appendix A

FCM INPUT DATA - SUPPLEMENTAL INFORMATION

Appendix A presents in part the CEP traffic loading, cost rates and ORS description data that were used for inputs into the FCM. Tables A-1 and A-2 present the current and forecasted traffic distributions by aircraft type and origin-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 29 origin airports for February, 1979; these prices were inflated by an additional 29% in the FCM applications to represent mid-1979 fuel costs.

The ORS alignment currently in operation, used in both the July and November 50-100nmi/15min/2000ft systems, is shown in Figure A-1. The corresponding ORS alignments assumed for the system alternatives are shown in Figures A-2 through A-4. The assigned directions of flight by altitude shown for each track in Figures A-1 through A-4 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

AIRCRAFT TYPE	1978 JULY	1978 NOVEMBER	1984 JULY	1984 NOVEMBER	1995 JULY	1995 NOVEMBER	2005 JULY	2005 NOVEMBER
B707	6	3	0	2	0	0	0	0
B727	0	1	0	0	0	0	0	0
B747	74	64	90	75	137	110	179	141
DC10	41	40	73	66	95	82	107	95
DC8	24	16	10	9	0	0	0	0
L1011	0	0	18	16	38	33	50	45
MILITARY	20	27	20	27	20	27	20	27
B747SP	11	11	19	15	36	32	52	44
B747ST	0	0	0	0	27	24	71	65
NOCO*	1	0	0	0	0	0	0	0
TOTAL ALL	177	162	230	210	353	308	479	417
TOTAL COSTED+	156	135	210	183	333	281	459	390

* Non-costed aircarrier (B720)

\+ Excludes NOCO, and Military Aircraft

TABLE A - 2
DISTRIBUTION OF COSTED FLIGHTS BY ORIGIN-DESTINATION FLOW

	JULY				NOVEMBER			
	1979	1984	1985	2005	1979	1984	1995	2005
Hawaii - California	95	103	120	144	73	87	107	131
Hawaii - Pacific NW	16	25	44	58	13	26	41	59
Hawaii - Other No. America	10	26	64	110	12	27	56	89
Hawaii - Alaska	1	2	4	8	0	0	1	4
Alaska - West Coast	1	2	2	2	0	0	0	0
Far East - No. America	27	40	80	112	32	37	69	99
Oceania - No. America	6	12	18	24	5	6	7	8
TOTAL	156	210	333	459	135	183	281	390

TABLE A - 3
ESTIMATED FUEL PRICE BY ORIGIN AIRPORT, FEBRUARY, 1979

AKL	69.87	Auckland, New Zealand
ANC	71.03	Anchorage, Alaska, U.S.A.
BOS	71.03	Boston, Massachussets, U.S.A.
DEN	71.03	Denver, Colorado, U.S.A.
DFW	71.03	Dallas/Ft. Worth, Texas, U.S.A.
EWR	71.03	New York, NY-Newark Arpt., U.S.A.
HKG	67.04	Hong Kong, Hong Kong
HNL	71.03	Honolulu, Oahu, Hawaii, U.S.A.
IAD	71.03	Washington, D.C., U.S.A.
IAH	71.03	Houston, Texas, U.S.A.
ITO	71.03	Hilo, Hawaii, U.S.A.
JFK	71.03	New York, New York, U.S.A.
MIA	71.03	Miami, Florida, U.S.A.
NRT	75.89	Tokyo, Japan (Narita Arpt.)
ORD	71.03	Chicago, Illinois, U.S.A.
PDX	71.03	Portland, Oregon, U.S.A.
PHL	71.03	Philadelphia, Pennsylvania, U.S.A.
PHX	71.03	Phoenix, Arizona, U.S.A.
PPT	71.21	Papeete, Soc. Is.,Fr. Polynesia (Tahiti)
SAN	71.03	San Diego, California, U.S.A.
SEA	71.03	Seattle, Washington, U.S.A.
SEL	67.47	Seoul, South Korea
SFO	71.03	San Francisco, California, U.S.A.
SYD	69.87	Sydney, N.S.W., Australia
TPE	67.04	Taipei, Taiwan
YMX	64.32	Montreal, Canada
YVR	66.51	Vancouver, Canada
YYC	66.51	Calgary, Canada
YYZ	59.09	Toronto, Canada

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*

*30% greater than B747 based on passenger seat growth.

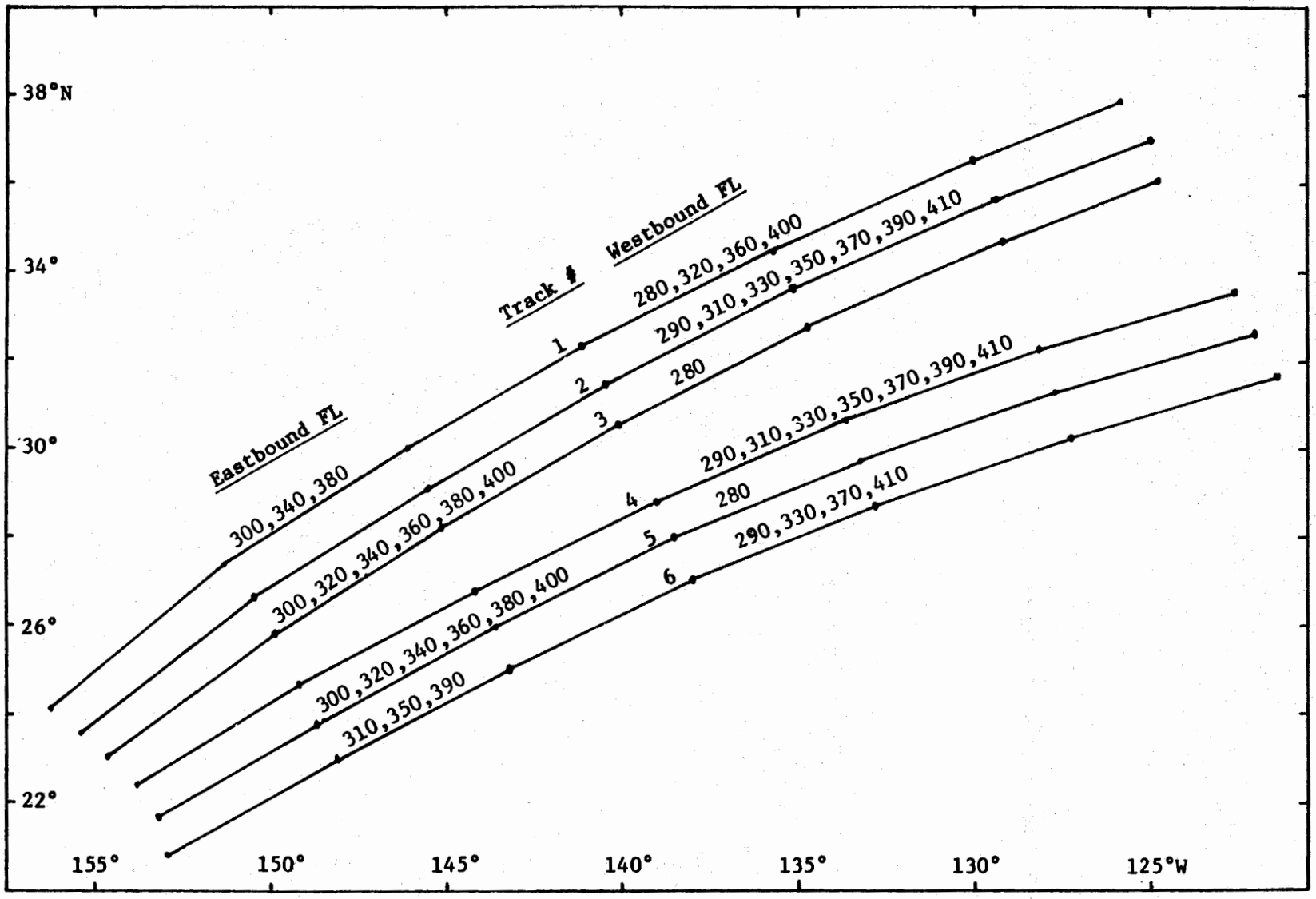

Figure A-1. 50-100 NMI /2000 FT ORS Layout

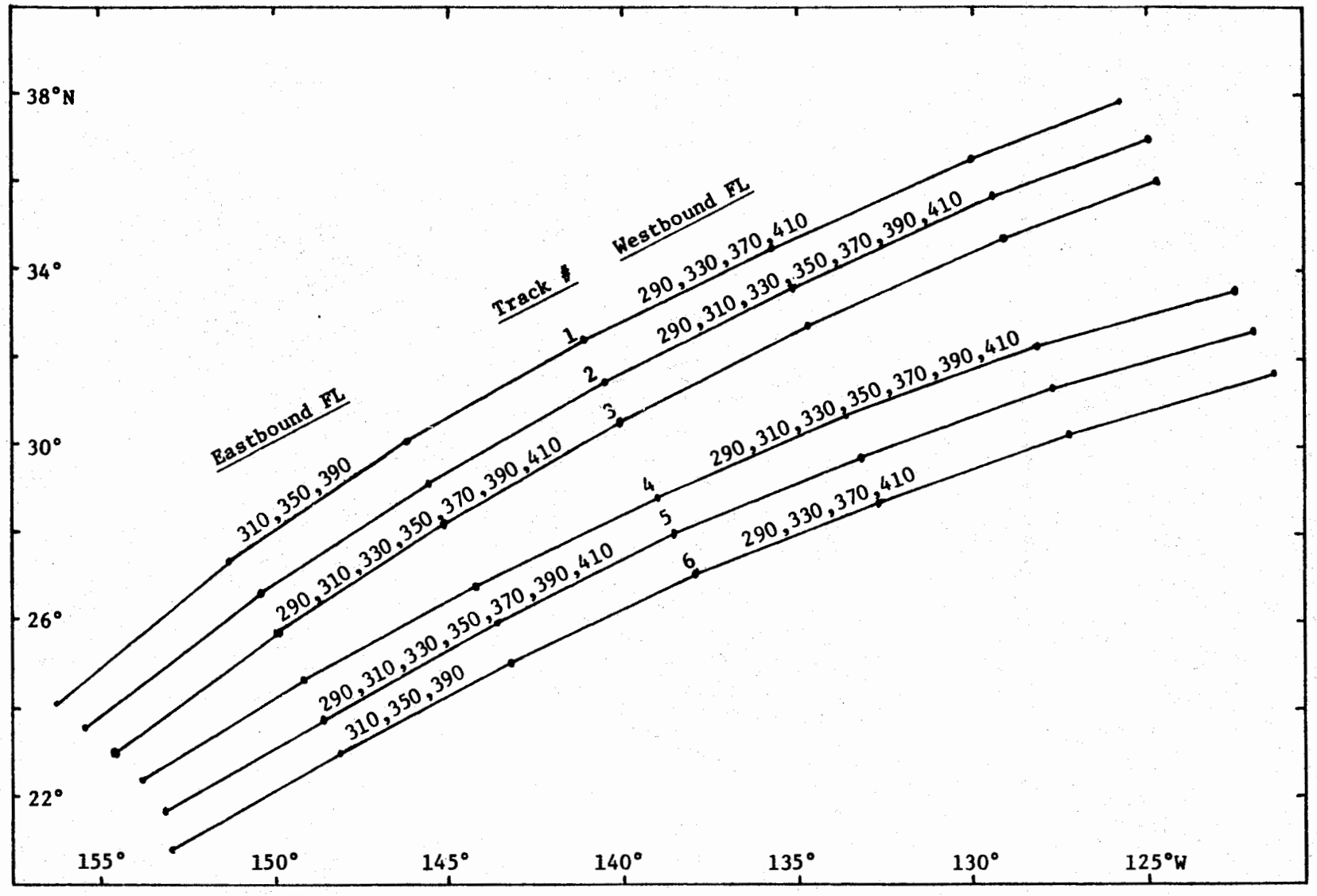

Figure A-2. 50 NMI/2000 ft ORS layout

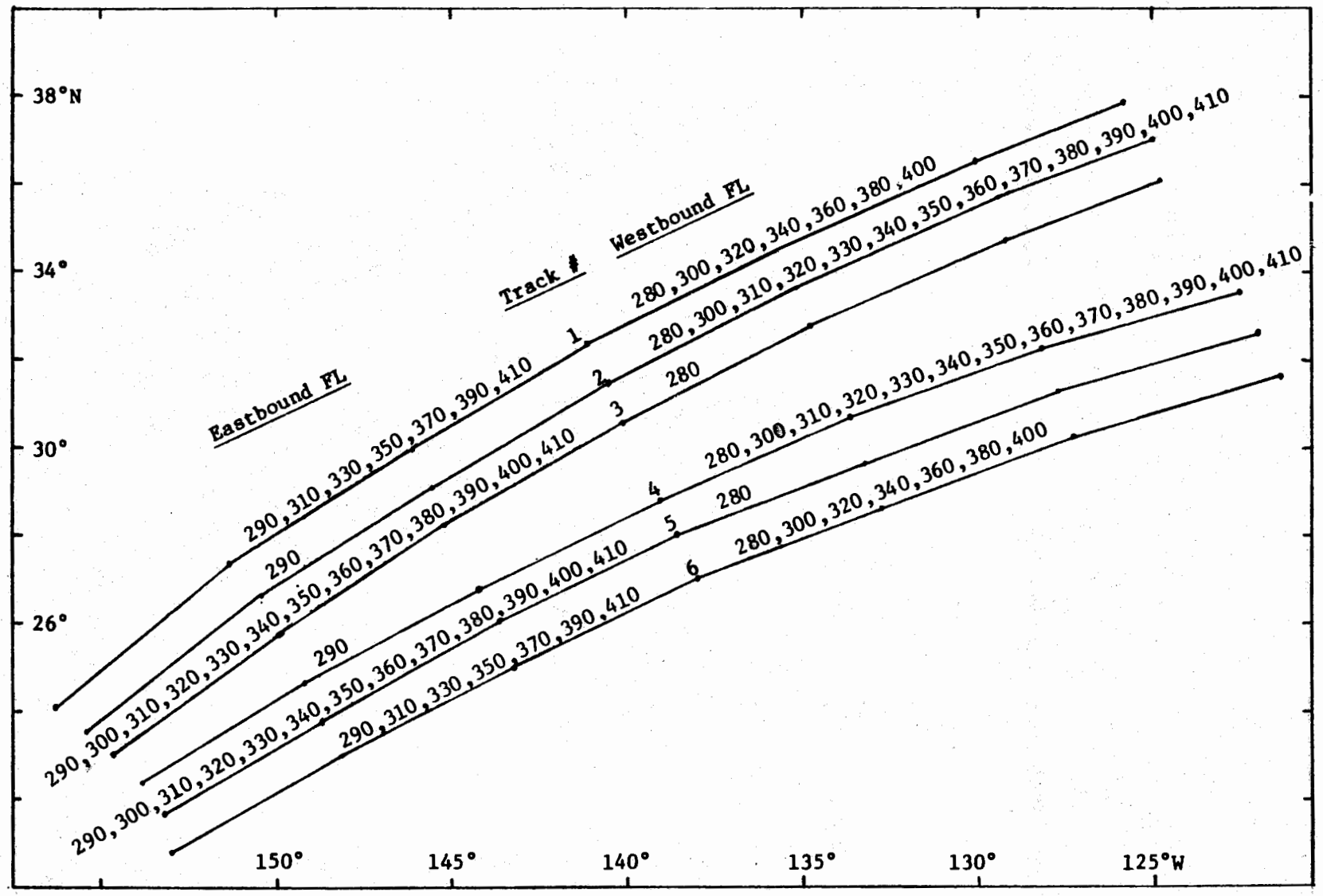

Figure A-3. 50NMI/1000 ft ORS layout

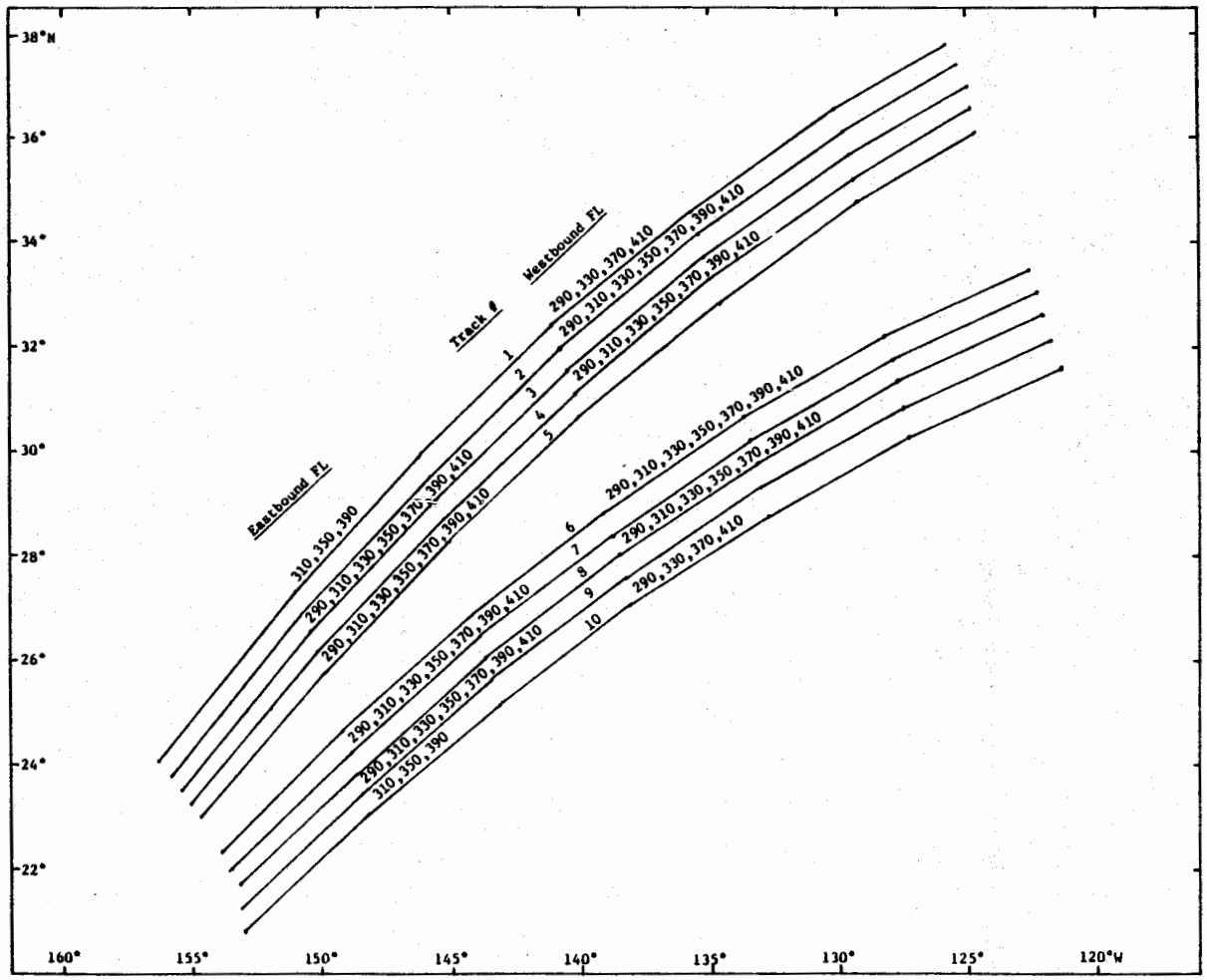

Figure A-4 25 nmi/2000 ft ORS Layout

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 (50-100nmi/15min/2000ft minimum separations), and FCM actual flight costs relative to ideal costs for the CEP for the July sample day. The data presented are estimates produced by the FCM simulation and are not data reports of real-world operations.

Note: The operating system alternative denoted by 50nmi/10min/1000* ft simulates halving the vertical separation minimum to 1000 ft in the CEP Oceanic area alone, and leaving it at 2000 ft in domestic airspace and in the other Oceanic CTA/FIR's (e.g., Anchorage, Tokyo, Tahiti) which became indirectly involved in the study.

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 Table B-1. The number of ORS and non-ORS flights in each origin-destination flow remained constant in each year for all operating system alternatives.

In the July simulations, individual fights which showed a preference for ORS paths were constrained to the tracks, so that in the FCM they would be accorded track separation criteria. In the November simulations, all aircraft flying between origin- destination pairs that showed a tendency to fly the tracks were constrained to fly the tracks. This may have resulted in a very small overstatement of estimated costs in the November runs.

B.3 Planned Flight Costs--July Sample Day

Tables B-2, B-3, and B-4 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 preferred flight plans. ORS constraints are imposed on flight plans, and aircraft may not plan to cross tracks above FL290 or below FL400. Planes are free to choose step climbs, with the only constraint being that they must be planned at position fixes (generally 5 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, with exceptions as noted in Section 3.4. In general, a greater reduction in costs is realized from decreasing vertical separations to 1000 ft than from reducing lateral separation to 25nmi from the 50nmi/2000ft case. As can be seen by comparing Tables B-2 through B-4, 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 due to a larger average aircraft size.

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-5, B-6, and B-7 respectively. These tables are analogous to the previous three tables, except the costs shown in these tables include the costs of diverting from the flight plan to resolve conflicts with other aircraft in order to insure adequate separation 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-8 shows the actual daily flight costs for each of the alternative systems relative to the 50-100/15/2000 system for the sample July day. These costs are provided for each flow on a total and per flight basis. Analogous costs are provided in Tables B-9 and B-10 for 1984 and 2005, respectively. These cost results indicate the benefit of using an alternative system instead of maintaining the current 50-100/15/2000 system.

One would expect the benefit of the 50/10/2000 system to be at least as great as the 50/15/2000 system, the benefit of the 25/5/2000 system to be at least as great as the 25/10/2000 system, the benefit of the 50/10/1000 system to be at least as great as the 50/15/1000 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 the individual flows.

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

The FCM was used to estimate the costs of operating in an unconstrained or ideal flight mode by planning flights using the 50nmi/1000ft system network with no track system constraints. In Table B-11, difference 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 prsented in Tables B-12 and B-13 for 1984 and 2005, respectively. These differences reflect the potential for most 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 produce cost results closer to those in the ideal flight mode case. It may be seen that aircraft in the Alaska flow groups have actual costs slightly lower than the "ideal". These figures represent in each case one or two flights and the differences are statistically insignificant, attributable to slight differences in methods of weather calculation between one FCM module and another. While the Flight Planning Model (FPM) uses dynamic programming to determine optimal aircraft paths (thus working backward from estimated arrival times), the Flight Tracking Model uses the flight plan produced by the FPM to track the aircraft forward (from scheduled departure times).

B.7 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-14, B-15 and B-16. An FCM analysis of the ideal flight costs for the November sample day was not performed.

TABLE B - 1

DAILY FLIGHTS FLOW SUMMARY FOR EACH SYSTEM, JULY SAMPLE DAY

	Origin-Destination Flow	Number of Flights			Number of ORS Flights			Number of Non-ORS Flights		
		1979	1984	2005	1979	1984	2005	1979	1984	2005
1.	Hawaii - California	95	103	145	94	102	144	1	1	1
2.	Hawaii - Pacific N.W.	16	25	58	0	0	0	16	25	58
3.	Hawaii - Alaska	1	2	8	0	0	0	1	2	8
4.	Hawaii - Other No. America	10	26	110	5	15	68	5	11	42
5.	Alaska - West Coast	1	2	2	0	0	0	1	2	2
6.	Far East - No. America	27	40	112	0	0	0	27	40	112
7.	Oceania - No. America	6	12	24	0	3	7	6	9	17
	ALL	156	210	459	99	120	219	57	90	240

TABLE B - 2
1979 ESTIMATED PLANNED DAILY FLIGHT COST BY FLOW, JULY SAMPLE DAY

ORIGIN-DESTINATION FLOW	1979 Daily Flights Costs (1979 $000)								1979 Average Flight Cost (1979 $000 Per Flight)							
	50-100NMI 15 Min. 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*	50-100NMI 15 Min. 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
1. Hawaii - California	1263	1264	1264	1269	1269	1260	1260	1261	13.30	13.30	13.30	13.35	13.35	13.27	13.27	13.27
2. Hawaii - Pacific N.W.	231	231	231	229	229	230	230	230	14.42	14.42	14.42	14.32	14.32	14.38	14.38	14.38
3. Hawaii - Alaska	13	13	13	13	13	13	13	13	12.96	12.96	12.96	12.96	12.96	12.97	12.97	12.97
4. Hawaii - Other No. America	233	233	233	233	233	233	233	233	23.35	23.34	23.34	23.30	23.30	23.26	23.26	23.29
5. Alaska - West Coast	8	8	8	8	8	8	8	8	7.69	7.69	7.69	7.67	7.67	7.69	7.69	7.69
6. Far East - No. America	906	906	906	905	905	901	901	903	33.57	33.57	33.57	33.53	33.53	33.38	33.38	33.47
7. Oceania - No. America	151	151	151	151	151	151	151	152	25.23	25.23	25.23	25.23	25.23	25.22	25.22	25.23
ALL	2805	2806	2806	2808	2808	2796	2796	2799	17.98	17.99	17.99	18.00	18.00	17.92	17.92	17.94

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

TABLE B - 3

1984 ESTIMATED PLANNED DAILY FLIGHTS COST BY FLOW, JULY SAMPLE DAY

ORIGIN-DESTINATION FLOW	1984 Daily Flights Costs (1979 $000)								1984 Average Flight Cost (1979 $000 Per Flight)							
	50-100NMI 15 Min. 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*	50-100NMI 15 Min. 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
1. Hawaii - California	1401	1402	1402	1406	1406	1398	1398	1398	13.60	13.61	13.61	13.65	13.65	13.57	13.57	13.57
2. Hawaii - Pacific N.W.	344	344	344	342	342	344	344	344	13.77	13.77	13.77	13.68	13.68	13.76	13.76	13.76
3. Hawaii - Alaska	27	27	27	27	27	27	27	27	13.56	13.56	13.56	13.56	13.56	13.55	13.55	13.55
4. Hawaii - Other No. America	574	574	574	573	573	573	573	575	22.08	22.07	22.07	22.04	22.04	22.05	22.05	22.07
5. Alaska - West Coast	29	29	29	29	29	29	29	29	14.50	14.50	14.50	14.48	14.48	14.42	14.42	14.43
6. Far East - No. America	1430	1430	1430	1429	1429	1421	1421	1426	35.74	35.74	35.74	35.72	35.72	35.53	35.53	35.65
7. Oceania - No. America	360	360	360	360	360	359	359	360	30.02	30.01	30.01	30.03	30.03	29.95	29.95	30.01
ALL	4165	4166	4166	4165	4165	4151	4151	4158	19.83	19.84	19.84	19.83	19.83	19.27	19.27	19.80

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

TABLE B - 4

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

ORIGIN-DESTINATION FLOW	2005 Daily Flight Costs (1979 $000)								2005 Average Flight Cost (1979 $000 Per Flight)							
	50-100NMI 15 Min. 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*	50-100NMI 15 Min. 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
1. Hawaii - California	2039	2040	2040	2052	2052	2034	2034	2033	14.06	14.07	14.07	14.15	14.15	14.03	14.03	14.03
2. Hawaii - Pacific N.W.	917	917	917	911	911	915	915	915	15.80	15.80	15.80	15.71	15.71	15.78	15.78	15.78
3. Hawaii - Alaska	114	114	114	114	114	114	114	114	14.26	14.26	14.26	14.26	14.26	14.20	14.20	14.20
4. Hawaii - Other No. America	2931	2931	2931	2926	2926	2922	2922	2927	26.65	26.65	26.65	26.60	26.60	26.57	26.57	26.61
5. Alaska - West Coast	29	29	29	29	29	29	29	29	14.50	14.50	14.50	14.48	14.48	14.42	14.42	14.43
6. Far East - No. America	4302	4302	4302	4298	4298	4278	4278	4292	38.41	38.41	38.41	38.38	38.38	38.20	38.20	38.32
7. Oceania - No. America	812	812	812	812	812	810	810	811	33.83	33.82	33.82	33.81	33.81	33.73	33.73	33.80
ALL	11144	11145	11145	11142	11142	11102	11102	11122	24.28	24.28	24.28	24.27	24.27	24.19	24.19	24.23

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

TABLE B - 5
1979 ESTIMATED ACTUAL DAILY FLIGHT COST BY FLOW, JULY SAMPLE DAY

ORIGIN-DESTINATION FLOW	Number of Flights	1979 Daily Flight Costs (1979 $000)								1979 Average Daily Flight Cost (1979 $000 Per Flight)							
		50-100NMI 15 Min. 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*	50-100NMI 15 Min. 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
Hawaii - California	95	1268	1268	1268	1272	1272	1267	1266	1266	13.35	13.35	13.34	13.39	13.38	13.34	13.32	13.32
Hawaii - Pacific N.W.	16	233	233	232	231	231	232	232	232	14.58	14.55	14.52	14.42	14.41	14.50	14.48	14.48
Hawaii - Alaska	1	13	13	13	13	13	13	13	13	12.96	12.96	12.96	12.96	12.96	12.98	12.98	12.98
Hawaii - Other No. America	10	234	234	234	234	234	233	233	234	23.36	23.39	23.39	23.36	23.36	23.34	23.34	23.36
Alaska - West Coast	1	8	8	8	8	8	8	8	8	7.70	7.70	7.70	7.67	7.67	7.69	7.69	7.69
Far East - No. America	27	908	908	907	907	906	902	902	905	33.63	33.63	33.61	33.57	33.55	33.42	33.41	33.49
Oceania - No. America	6	152	152	152	152	152	152	152	152	25.36	25.34	25.34	25.34	25.34	25.33	25.33	25.34
ALL	156	2816	2816	2814	2817	2816	2807	2806	2808	18.05	18.05	18.04	18.06	18.05	17.99	17.99	18.00

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

TABLE B - 6
1984 ESTIMATED ACTUAL DAILY FLIGHT COST BY FLOW, JULY SAMPLE DAY

ORIGIN-DESTINATION FLOW	Number of Flights	1984 Daily Flight Costs (1979 $000)								1984 Average Daily Flight Cost (1979 $000 Per Flight)							
		50-100NMI 15 Min. 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*	50-100NMI 15 Min. 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
Hawaii - California	103	1408	1408	1406	1410	1410	1404	1403	1403	13.66	13.67	13.66	13.69	13.68	13.64	13.63	13.63
Hawaii - Pacific N.W.	25	349	348	347	344	343	345	344	346	13.95	13.91	13.87	13.76	13.74	13.79	13.77	13.83
Hawaii - Alaska	2	27	27	27	27	27	27	27	27	13.55	13.55	13.58	13.55	13.55	13.54	13.54	13.54
Hawaii - Other No. America	26	575	575	575	574	574	575	575	576	22.15	22.16	22.15	22.09	22.08	22.08	22.08	22.11
Alaska - West Coast	2	29	29	29	29	29	29	29	29	14.58	14.58	14.58	14.56	14.56	14.49	14.49	14.50
Far East - No. America	40	1433	1434	1432	1430	1429	1423	1424	1427	35.83	35.83	35.80	35.76	35.74	35.58	35.57	35.68
Oceania - No. America	12	362	361	361	361	361	360	360	361	30.17	30.08	30.08	30.10	30.10	30.02	30.02	30.08
ALL	210	4183	4182	4177	4175	4173	4163	4162	4169	19.92	19.91	19.89	19.88	19.87	19.82	19.82	19.85

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

TABLE B - 7
2005 ESTIMATED ACTUAL DAILY FLIGHT COST BY FLOW, JULY SAMPLE DAY

ORIGIN-DESTINATION FLOW	Number of Flights	2005 Daily Flight Costs (1979 $000)									2005 Average Daily Flight Cost (1979 $000 Flight)							
		50-100NMI 15 Min. 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*	50-100NMI 15 Min. 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
Hawaii - California	145	2051	2052	2049	2059	2058	2046	2043	2043	14.15	14.16	14.13	14.20	14.19	14.11	14.09	14.09
Hawaii - Pacific N.W.	58	932	928	926	920	918	920	919	921	16.07	16.00	15.96	15.87	15.83	15.85	15.84	15.90
Hawaii - Alaska	8	115	115	115	114	114	114	114	114	14.36	14.36	14.33	14.29	14.29	14.22	14.22	14.22
Hawaii - Other No. America	110	2950	2949	2945	2936	2935	2930	2929	2935	28.82	26.81	26.78	26.69	26.67	26.64	26.63	26.68
Alaska - West Coast	2	29	29	29	29	29	29	29	29	14.58	14.58	14.58	14.56	14.56	14.49	14.49	14.50
Far East - No. America	112	4316	4315	4313	4308	4305	4285	4285	4298	38.54	38.54	38.52	38.46	38.44	38.26	38.26	38.38
Oceania - No. America	24	816	813	813	814	813	811	811	813	34.00	33.90	33.90	33.91	33.90	33.82	33.82	33.89
ALL	459	11209	11201	11190	11180	11172	11135	11130	11155	24.42	24.40	24.38	24.36	24.34	24.26	24.25	24.30

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

TABLE B - 8

1979 ACTUAL DAILY FLIGHT COST RELATIVE TO 1979 50-100/15/2000 SYSTEM BY FLOW, JULY SAMPLE DAY

ORIGIN-DESTINATION FLOW	Number of Flights	1979 Daily Flight Cost Reduction (1979 $000)							1979 Daily Average Flight Cost Reduction (1979 $000 Per Flight)						
		50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
Hawaii - California	95	0	0	(4)	(4)	1	2	2	0.00	0.01	(0.04)	(0.03)	0.01	0.03	0.03
Hawaii - Pacific N.W.	16	0	1	2	2	1	1	1	0.03	0.06	0.16	0.17	0.08	0.10	0.10
Hawaii - Alaska	1	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	(0.02)	(0.02)	(0.02)
Hawaii - Other No. America	10	0	0	0	0	1	1	0	(0.03)	(0.03)	0.00	0.00	0.02	0.02	0.00
Alaska - West Coast	1	0	0	0	0	0	0	0	0.00	0.00	0.03	0.03	0.01	0.01	0.01
Far East - No. America	27	0	1	1	2	6	6	3	0.00	0.02	0.06	0.08	0.21	0.22	0.14
Oceania - No. America	6	0	0	0	0	0	0	0	0.02	0.02	0.02	0.02	0.03	0.03	0.02
ALL	156	0	2	(1)	0	9	10	8	0.00	0.01	(0.01)	0.00	0.06	0.06	0.05

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

() = Addition

TABLE B - 9

1984 ACTUAL DAILY FLIGHT COST RELATIVE TO 1984 50-100/15/2000 SYSTEM BY FLOW, JULY SAMPLE DAY

ORIGIN-DESTINATION FLOW	Number of Flights	1984 Daily Flight Cost Reduction (1979 $000)							1984 Daily Average Flight Cost Reduction (1979 $000 Per Flight)						
		50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
Hawaii - California	103	0	2	(2)	(2)	4	5	5	(0.01)	0.00	(0.03)	(0.02)	0.02	0.03	0.04
Hawaii - Pacific N.W.	25	1	2	5	6	4	5	3	0.04	0.08	0.19	0.21	0.16	0.18	0.12
Hawaii - Alaska	2	0	0	0	0	0	0	0	0.00	(0.03)	0.00	0.00	0.01	0.01	0.01
Hawaii - Other No. America	26	0	0	1	1	0	0	(1)	(0.01)	0.00	0.06	0.07	0.07	0.07	0.04
Alaska - West Coast	2	0	0	0	0	0	0	0	0.00	0.00	0.02	0.02	0.09	0.09	0.08
Far East - No. America	40	(1)	1	3	4	10	11	6	0.00	0.02	0.07	0.09	0.25	0.26	0.15
Oceania - No. America	12	1	1	1	1	2	2	1	0.09	0.09	0.07	0.07	0.15	0.15	0.09
ALL	210	1	6	8	10	20	21	14	0.01	0.03	0.04	0.05	0.10	0.10	0.07

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

() = Addition

TABLE B - 10

2005 ACTUAL DAILY FLIGHT COST RELATIVE TO 2005 50-100/15/2000 SYSTEM BY FLOW, JULY SAMPLE DAY

ORIGIN-DESTINATION FLOW	Number of Flights	2005 Daily Flight Cost Reduction (1979 $000)							2005 Daily Average Flight Cost Reduction (1979 $000 Per Flight						
		50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
Hawaii - California	145	(1)	2	(8)	(7)	5	8	8	(0.01)	0.02	(0.05)	(0.04)	0.04	0.06	0.06
Hawaii - Pacific N.W.	58	4	6	12	14	12	13	11	0.07	0.11	0.20	0.24	0.22	0.23	0.17
Hawaii - Alaska	8	0	0	1	1	1	1	1	0.00	0.03	0.07	0.07	0.14	0.14	0.14
Hawaii - Other No. America	110	1	5	14	15	20	21	15	0.01	0.04	0.13	0.15	0.18	0.19	0.14
Alaska - West Coast	2	0	0	0	0	0	0	0	0.00	0.00	0.02	0.02	0.09	0.09	0.08
Far East - No. America	112	1	3	8	11	31	31	18	0.00	0.02	0.08	0.10	0.28	0.28	0.16
Oceania - No. America	24	3	3	2	3	5	5	3	0.10	0.10	0.09	0.10	0.18	0.18	0.11
ALL	459	8	19	29	37	74	79	54	0.02	0.04	0.06	0.08	0.16	0.17	0.12

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

() = Addition

TABLE B - 11

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

ORIGIN-DESTINATION FLOW	1979 Daily Flight Costs (1979 $000)										1979 Average Flight Cost (1979 $000 Per Flight)							
			Daily Flight Cost Increase								Daily Average Flight Cost Increase							
	Ideal Daily Cost	50-100NMI 15 Min. 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*	Ideal Average Cost	50-100NMI 15 Min. 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
Hawaii - California	1251	17	17	17	21	21	16	15	15	13.17	0.18	0.18	0.17	0.22	0.21	0.17	0.15	0.15
Hawaii - Pacific N.W.	228	5	5	4	3	3	4	4	4	14.25	0.33	0.30	0.27	0.17	0.16	0.25	0.23	0.23
Hawaii - Alaska	13	0	0	0	0	0	0	0	0	12.97	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	0.01	0.01	0.01
Hawaii - Other No. AM	232	2	2	2	2	2	1	1	2	23.15	0.21	0.24	0.24	0.21	0.21	0.19	0.19	0.21
Alaska - West Coast	8	0	0	0	0	0	0	0	0	7.69	0.01	0.01	0.01	(0.02)	(0.02)	0.00	0.00	0.00
Far East - No. AM	901	7	7	6	6	5	1	1	4	33.38	0.25	0.25	0.23	0.19	0.17	0.04	0.03	0.11
Oceania - No. AM	151	1	1	1	1	1	1	1	1	25.22	0.14	0.12	0.12	0.12	0.12	0.11	0.11	0.12
ALL	2784	32	32	30	33	32	23	22	24	17.85	0.20	0.20	0.19	0.21	0.20	0.14	0.14	0.15

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

() = Negative Number

TABLE B - 12

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

		1984 Daily Flight Costs (1979 $000) Daily Flight Cost Increase									1984 Average Flight Cost (1979 $000 Per Flight) Daily Average Flight Cost Increase								
ORIGIN-DESTINATION FLOW	Ideal Daily Cost	50-100NMI 15 Min. 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*	Ideal Average Cost	50-100NMI 15 Min. 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
Hawaii - California	1387	21	21	19	23	23	17	16	16	13.47	0.19	0.20	0.19	0.22	0.21	0.17	0.16	0.16
Hawaii - Pacific N.W.	340	9	8	7	4	3	5	4	6	13.61	0.34	0.30	0.26	0.15	0.13	0.18	0.16	0.22
Hawaii - Alaska	27	0	0	0	0	0	0	0	0	13.55	0.00	0.00	0.03	0.00	0.00	(0.01)	(0.01)	(0.01)
Hawaii - Other No. AM	570	5	5	5	4	4	5	5	6	21.91	0.24	0.25	0.24	0.18	0.17	0.17	0.17	0.20
Alaska - West Coast	29	0	0	0	0	0	0	0	0	14.42	0.16	0.16	0.16	0.14	0.14	0.07	0.07	0.08
Far East - No. AM	1421	12	13	11	9	8	2	3	6	35.53	0.30	0.30	0.27	0.23	0.21	0.05	0.04	0.15
Oceania - No. AM	359	3	2	2	2	2	1	1	2	29.94	0.23	0.14	0.16	0.16	0.16	0.08	0.08	0.14
ALL	4133	50	49	44	42	40	30	29	36	19.68	0.24	0.23	0.21	0.20	0.19	0.14	0.14	0.17

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

() = Negative Number

TABLE B - 13

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

ORIGIN-DESTINATION FLOW	2005 Daily Flight Costs (1979 $000)		Daily Flight Cost Increase							2005 Average Flight Cost (1979 $000 Per Flight)		Daily Average Flight Cost Increase						
	Ideal Daily Cost	50-100NMI 15 Min. 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*	Ideal Average Cost	50-100NMI 15 Min. 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
Hawaii - California	2015	36	37	34	44	43	31	28	28	13.89	0.26	0.27	0.24	0.31	0.30	0.22	0.20	0.20
Hawaii - Pacific N.W.	903	29	25	23	17	15	17	16	18	15.57	0.50	0.43	0.39	0.30	0.26	0.28	0.27	0.33
Hawaii - Alaska	114	1	1	1	0	0	0	0	0	14.20	0.16	0.16	0.13	0.09	0.09	0.02	0.02	0.02
Hawaii - Other No. AM	2907	43	42	38	29	28	23	22	28	26.43	0.39	0.38	0.35	0.26	0.24	0.21	0.20	0.25
Alaska - West Coast	29	0	0	0	0	0	0	0	0	14.42	0.16	0.16	0.16	0.14	0.14	0.07	0.07	0.08
Far East - No. AM	4278	38	37	35	30	27	7	7	20	38.20	0.34	0.34	0.32	0.26	0.24	0.06	0.06	0.18
Oceania - No. AM	809	7	4	4	5	4	2	2	4	33.71	0.29	0.19	0.19	0.20	0.19	0.11	0.11	0.18
ALL	11055	154	146	135	125	118	80	75	100	24.08	0.34	0.32	0.30	0.28	0.26	0.18	0.17	0.22

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

() = Negative Number

Table B-14

DAILY FLIGHTS FLOW SUMMARY FOR 50-100/15/2000 SYSTEM,
NOVEMBER SAMPLE DAY

Origin-Destination Flow	Number of Flights			Number of ORS Flights			Number of Non-ORS Flights		
	1979	1984	2005	1979	1984	2005	1979	1984	2005
1. Hawaii - California	73	87	131	73	87	131	0	0	0
2. Hawaii - Pacific N.W.	13	26	59	0	0	0	13	26	59
3. Hawaii - Alaska	0	0	4	0	0	0	0	0	4
4. Hawaii - Other No. America	12	27	89	8	17	63	4	10	26
5. Alaska - West Coast	0	0	0	0	0	0	0	0	0
6. Far East - No. America	32	37	99	0	0	0	32	37	99
7. Oceania - No. America	5	6	8	0	1	2	5	5	6
All	135	183	390	81	105	196	54	78	194

Table B-15

ESTIMATED PLANNED DAILY FLIGHT COSTS BY FLOW FOR 50-100/15/2000 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.	Hawaii - California	950	1134	1741	13.01	13.03	13.29
2.	Hawaii - Pacific N.W.	182	351	858	13.98	13.50	14.55
3.	Hawaii - Alaska	0	0	72	0.0	0.0	17.93
4.	Hawaii - Other No. America	275	634	2449	22.91	23.48	27.52
5.	Alaska - West Coast	0	0	0	0.0	0.0	0.0
6.	Far East - No. America	1035	1232	3692	32.36	33.30	37.30
7.	Oceania - No. America	112	170	271	22.48	28.26	33.93
	All	2554	3520	9084	18.92	19.24	23.29

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

Table B-16

ESTIMATED ACTUAL DAILY FLIGHT COSTS BY FLOW FOR 50-100/15/2000 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.	Hawaii - California	954	1139	1750	13.07	13.09	13.35
2.	Hawaii - Pacific N.W.	183	352	864	14.11	13.54	14.65
3.	Hawaii - Alaska	0	0	72	0.0	0.0	17.97
4.	Hawaii - Other No. America	276	636	2462	23.00	23.55	27.67
5.	Alaska - West Coast	0	0	0	0.0	0.0	0.0
6.	Far East - No. America	1038	1235	3704	32.44	33.36	37.42
7.	Oceania - No. America	112	170	271	22.48	28.25	33.95
	All	2564	3531	9123	18.99	19.29	23.39

Note: Columns may not sum to given 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 CEP 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 CEP CTA/FIR in each hour of the July 1979 sample day under the present 50-100nmi/15min/2000ft 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 distribution of the maximum IAC for the entire CEP in each year by system alternative is shown in Table C-3 for the July sample day. The present and future IAC's by CTA/FIR are represented in Table C-4 using the 50-100nmi/15min/2000ft system; the corresponding November IAC data are included for comparison.

C.3 Oceanic Entry Operations

The distribution of ORS flight level requests and clearances at oceanic entry by system are shown in Tables C-5, C-6, and C-7 for eastbound and westbound flights.

Distribution of CEP aircraft by flight level at oceanic entry, particularly for westbound traffic on the ORS, was not as expected. A flaw in the Flight Planning Model prevented aircraft leaving from coastal airports from climbing immediately to desired altitudes under a limited set of conditions. Because non-track routes were modeled as having hemispheric flight level rules, the aircraft ascended to a hemispheric flight level on the route from the airport to the tracks. However, the model logic prevented the planes from climbing to desired track altitude until the second network node encountered after completing the initial ascent. As a result, planes desiring FL370 entered the ocean at FL350, and aircraft desiring FL330 entered at FL310 instead. These aircraft climbed to their preferred altitudes at the first oceanic reporting point (5 degrees longitudinally west of oceanic entry).

The costs of the uncorrected error were somewhat mitigated by the Flight Tracking Model's resolution of the conflict on the now-congested lower flight levels by clearing planes on flight levels (e.g., FL330) that they would have originally chosen. Overall effects of the problem on total cost figures were small because fewer than 20% of all flights were affected, and these flew at slightly suboptimal flight levels for less than 15% of their flying time. For this 3% of total flight time, approximately 5% more fuel would be burned than normally, resulting in a system-wide discrepancy of less than 1/5 of 1% of total costs.

In addition, military (non-costed) flights were included in the flight level distribution, further biasing it downward.

The entry flight level requests in the three tables 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 50nmi/1000ft 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 distributions for flight level clearances versus requests, as well as for all flight level clearances, are also shown in Tables C-5, C-6, and C-7.

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 Table 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.

The impacts of changes in separation minima on ORS and non-ORS 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 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 percentage of aircraft cleared to within 50nmi and 1000ft of their entry requests, and the results are similar to the preceding group of tables.

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. An increase 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. The 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.

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 re-checks 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.

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 and 2000 ft below the requested flight level, while C-22 shows the time spent at 3000 ft or more below the requested flight level.

C.5 Exit Operations

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

TABLE C-1

NUMBER OF CTA/FIR HOURLY FLIGHT ENTRIES, JULY 1979

HOURLY PERIOD START TIME (GMT)	CTA/FIR		
	Oakland	Honolulu	Anchorage
00 00	9	11	0
01 00	9	7	0
02 00	12	6	2
03 00	7	4	0
04 00	9	4	2
05 00	7	5	0
06 00	5	4	1
07 00	4	6	0
08 00	1	5	0
09 00	5	7	0
10 00	5	5	0
11 00	5	5	2
12 00	2	2	2
13 00	3	0	3
14 00	3	0	5
15 00	4	0	1
16 00	12	0	2
17 00	11	3	1
18 00	7	8	2
19 00	9	15	0
20 00	6	10	1
21 00	16	7	1
22 00	11	9	2
23 00	7	14	0
TOTAL	169	137	27

TABLE C-2

MAXIMUM INSTANTANEOUS AIRCRAFT COUNT BY HOUR
FOR 50-100/15/2000 SYSTEM, JULY 1979

HOURLY PERIOD START TIME (GMT)	Max. IAC During The Hourly Period			
	Oakland CTA/FIR	Honolulu CTA/FIR	Anchorage CTA/FIR	CEP
00 00	17	28	0	42
01 00	19	26	0	42
02 00	21	16	2	36
03 00	22	10	2	33
04 00	22	10	2	29
05 00	17	10	2	29
06 00	12	12	2	25
07 00	12	10	1	21
08 00	8	11	0	18
09 00	6	15	0	20
10 00	11	13	0	23
11 00	12	13	2	23
12 00	11	7	4	20
13 00	6	7	5	17
14 00	6	2	8	14
15 00	7	0	8	14
16 00	15	0	6	18
17 00	21	3	3	26
18 00	21	11	4	31
19 00	18	23	3	40
20 00	16	26	1	40
21 00	21	26	2	43
22 00	26	19	4	46
23 00	22	25	8	43
DAILY MAX IAC	26	28	8	46

TABLE C-3

MAXIMUM INSTANTANEOUS AIRCRAFT COUNT BY SYSTEM,
JULY SAMPLE DAY

	CEP Daily Max IAC By System Operating Alternatives							
SAMPLE DAY	50-100 NMI 15 Min 2000 Ft	50 NMI 15 Min 2000 Ft	50 NMI 10 Min 2000 Ft	25 NMI 10 Min 2000 Ft	25 NMI 5 Min 2000 Ft	50 NMI 15 Min 1000 Ft	50 NMI 10 Min 1000 Ft	50 NMI 10 Min 1000 Ft*
JULY 1979	46	46	46	46	46	46	46	46
JULY 1984	59	59	59	59	59	59	59	58
JULY 2005	108	107	107	109	109	109	109	109

TABLE C-4

MAXIMUM INSTANTANEOUS AIRCRAFT COUNT BY YEAR
FOR 50-100/15/2000 SYSTEM

	Daily Max IAC By CTA/FIR			
SAMPLE DAY	Oakland CTA/FIR	Honolulu CTA/FIR	Anchorage CTA/FIR	CEP
JULY 1979	26	28	8	46
JULY 1984	35	36	12	59
JULY 2005	62	69	17	108
NOV 1979	24	24	5	46
NOV 1984	28	25	6	50
NOV 2005	54	42	11	99

Table C-5

1979 EASTBOUND ORS ENTRY FLIGHT LEVEL PREFERENCE AND CLEARANCE SUMMARY

JULY SAMPLE DAY

Eastbound Flight Level at Oceanic Entry	Percent of ORS Daily Flights Requesting Flight Level Indicated								Percent of ORS Flights Cleared at Their Requested Flight Level							
	50-100 NMI 15 Min 2000 Ft	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*	50-100NMI 15Min 2000Ft	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 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	5.66	5.66	5.66	0	0	0	0	0	5.66	5.66	5.66
380	28.85	0	0	0	0	0	0	0	26.92	0	0	0	0	0	0	0
370	0	54.72	54.72	61.54	61.54	26.42	26.42	26.42	0	45.28	47.17	59.62	59.62	22.64	24.53	24.53
360	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
350	5.77	5.66	5.66	0	0	58.49	58.49	58.49	3.85	3.77	3.77	0	0	47.17	52.83	52.83
340	61.54	0	0	0	0	0	0	0	46.15	0	0	0	0	0	0	0
330	0	37.74	37.74	38.46	38.46	7.55	7.55	7.55	0	35.85	35.85	36.54	38.46	7.55	7.55	7.55
320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
310	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
≤ 300	3.85	1.89	1.89	0	0	1.89	1.89	1.89	3.85	1.89	1.89	0	0	1.89	1.89	1.89
ALL	100	100	100	100	100	100	100	100	80.77	86.79	88.68	96.15	98.08	84.91	92.45	92.45

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

Table C-6

1979 WESTBOUND ORS ENTRY FLIGHT LEVEL PREFERENCE AND CLEARANCE SUMMARY

JULY SAMPLE DAY

Westbound Flight Level at Oceanic Entry	Percent of ORS Daily Flights Requesting Flight Level Indicated								Percent of ORS Flights Cleared at Their Requested Flight Level							
	50-100 NMI 15 Min 2000 Ft	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*	50-100 NMI 15Min. 2000Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
≥ 400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
390	6.45	6.45	6.45	3.28	3.28	0	0	0	6.45	6.45	6.45	3.28	3.28	0	0	0
380	0	0	0	0	0	6.35	6.35	6.35	0	0	0	0	0	6.35	6.35	6.35
370	0	0	0	16.39	16.39	0	0	0	0	0	0	16.39	16.39	0	0	0
360	0	0	0	0	0	23.81	23.81	23.81	0	0	0	0	0	22.22	22.22	22.22
350	46.77	46.77	46.77	32.79	32.79	1.59	1.59	1.59	40.32	40.32	41.94	29.51	29.51	1.59	1.59	1.59
340	0	0	0	0	0	41.27	41.27	41.27	0	0	0	0	0	36.51	38.10	38.10
330	0	0	0	21.31	21.31	0	0	0	0	0	0	21.31	21.31	0	0	0
320	6.45	0	0	0	0	25.40	25.40	25.40	6.45	0	0	0	0	22.22	22.22	22.22
310	27.42	27.42	27.42	26.23	26.23	0	0	0	20.97	20.97	22.58	21.31	22.95	0	0	0
≤ 300	12.90	19.35	19.35	0	0	1.59	1.59	1.59	9.68	16.13	16.13	0	0	1.59	1.59	1.59
ALL	100	100	100	100	100	100	100	100	83.87	83.87	87.10	91.80	93.44	90.48	92.06	92.06

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

Table C- 7

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

PERCENT OF DAILY FLIGHTS CLEARED AS INDICATED AT OCEANIC ENTRY

	EASTBOUND								WESTBOUND							
Flight Level at Oceanic Entry	50-100 NMI 15 Min 2000 Ft	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*	50-100NMI 15Min 2000Ft	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
≥ 400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
390	0	3.77	1.89	1.92	1.92	5.66	5.66	5.66	6.45	6.45	6.45	3.28	3.28	0	0	0
380	28.85	0	0	0	0	3.77	1.89	1.89	0	0	0	0	0	6.35	6.35	6.35
370	0	47.17	49.06	59.62	59.62	22.64	24.53	24.53	6.45	6.45	4.84	19.67	19.67	1.59	1.59	1.59
360	9.62	0	0	0	0	11.32	5.66	5.66	0	0	0	0	0	22.22	22.22	22.22
350	11.54	11.32	11.32	1.92	0	47.17	52.83	52.83	40.32	40.32	41.94	29.51	29.51	4.76	3.17	3.17
340	46.15	0	0	0	0	0	0	0	0	0	0	0	0	39.68	41.27	41.27
330	0	35.85	35.85	36.54	38.46	7.55	7.55	7.55	6.45	6.45	4.84	26.23	24.59	1.59	1.59	1.59
320	0	0	0	0	0	0	0	0	6.45	0	0	0	0	22.22	22.22	22.22
310	0	0	0	0	0	0	0	0	24.19	24.19	25.81	21.31	22.95	0	0	0
≤ 300	3.85	1.89	1.89	0	0	1.89	1.89	1.89	9.68	16.13	16.13	0	0	1.59	1.59	1.59
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 ORS ENTRY TRACK/FLIGHT LEVEL
PREFERENCE SUMMARY, JULY SAMPLE DAY

Percent of OFS Daily Flights Requesting
Track/Flight Level Indicated

Track/Flight Level At Entry	50-100 MNI 15 Min. 2000 Ft.	50 X 2000	25 X 2000	50 X 1000
	EASTBOUND FLIGHTS			
1st Most Preferred	40.4	28.3	26.9	37.7
2nd Most Preferred	21.2	26.4	26.9	20.8
3rd Most Preferred	19.2	20.8	19.2	13.2
4th Most Preferred	9.6	17.0	17.3	7.5
5th Most Preferred	5.8	5.7	7.7	5.7
6th Most Preferred	3.8	1.9	1.9	5.7
	WESTBOUND FLIGHTS			
1st Most Preferred	30.6	30.6	29.5	38.1
2nd Most Preferred	25.8	25.8	26.2	17.5
3rd Most Preferred	16.1	19.4	21.3	14.3
4th Most Preferred	12.9	16.1	16.4	9.5
5th Most Preferred	6.5	3.2	3.3	6.3
6th Most Preferred	3.2	3.2	1.6	3.2

TABLE C-9

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

Percent of ORS Flights Cleared On
Track/Flight Level Indicated

TRACK FLIGHT LEVEL AT ENTRY	50-100 MNI 15 Min 2000 Ft	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
			EASTBOUND FLIGHTS					
1st Most Preferred	26.9	26.4	26.4	26.9	26.9	24.5	32.1	32.1
2nd Most Preferred	17.3	20.8	22.6	23.1	25.0	17.0	18.9	18.9
3rd Most Preferred	15.4	20.8	20.8	19.2	19.2	11.3	13.2	13.2
4th Most Preferred	11.5	15.1	15.1	15.4	17.3	9.4	7.5	7.5
5th Most Preferred	11.5	3.8	3.8	7.7	7.7	7.5	5.7	5.7
6th Most Preferred	5.8	3.8	3.8	1.9	1.9	5.7	5.7	5.7
			WESTBOUND FLIGHTS					
1st Most Preferred	25.8	25.8	27.4	26.2	26.2	27.0	30.2	30.2
2nd Most Preferred	19.4	19.4	21.0	21.3	23.0	14.3	14.3	14.3
3rd Most Preferred	14.5	16.1	16.1	18.0	18.0	12.7	12.7	12.7
4th Most Preferred	9.7	14.5	14.5	14.8	16.4	9.5	9.5	9.5
5th Most Preferred	6.5	6.5	4.8	4.9	3.3	6.3	6.3	6.3
6th Most Preferred	6.5	4.8	4.8	3.3	3.3	6.3	4.8	4.8

TABLE C-10

1979 ORS PLANNED LONGITUDINAL ENTRY
SEPARATION SUMMARY, JULY SAMPLE DAY

Percent of ORS Daily Flight
Requests at Oceanic Entry

Longitudinal Separation At Entry (Min.)	50-100 NMI X 2000 Ft.	50 X 2000	25 X 2000	50 X 1000
	EASTBOUND REQUESTS			
0-10	20.5	20.0	18.5	17.6
11-15	15.4	7.5	7.9	17.6
16-20	2.6	2.5	2.6	2.9
21-25	7.7	7.5	7.9	8.8
26-30	2.6	2.5	2.6	2.9
>31	51.3	60.0	60.6	50.0
	WESTBOUND REQUESTS			
0-10	12.8	12.8	12.4	18.6
11-15	8.5	8.5	8.3	4.7
16-20	2.1	2.1	2.1	2.3
21-25	4.3	4.3	4.2	2.3
26-30	6.4	6.4	6.2	7.0
>31	65.9	65.9	66.6	65.1

TABLE C-11

1979 ORS CLEARED LONGITUDINAL ENTRY SEPARATION SUMMARY, JULY SAMPLE DAY

Percent of ORS Daily Flight Clearances at Oceanic Entry

LONGITUDINAL SEPARATION AT ENTRY (MIN)	50-100 NMI 15 Min 2000 Ft	50 15 2000	50 10 2000	25 10 2000	50 5 2000	50 15 1000	50 10 1000	50 10 1000*
				EASTBOUND CLEARANCES				
0-10	9.4	2.9	2.9	8.4	16.2	3.6	6.6	6.6
11-15	3.1	8.6	5.7	8.3	5.4	7.1	16.7	16.7
16-20	3.1	5.7	8.6	8.3	5.4	7.1	6.7	6.7
21-25	9.4	8.6	8.6	8.3	8.1	10.7	10.0	10.0
26-30	3.1	2.9	2.9	2.8	2.7	3.6	3.3	3.3
>31	71.9	71.5	71.4	64.0	62.1	67.9	56.6	56.6
				WESTBOUND CLEARANCES				
0-10	2.4	2.4	2.4	9.1	10.8	5.2	7.7	7.7
11-15	4.8	4.8	9.8	9.1	8.7	2.6	5.1	5.1
16-20	2.4	2.4	2.4	2.3	2.2	5.3	5.1	5.1
21-25	2.4	2.4	2.4	2.3	2.2	5.3	2.6	2.6
26-30	7.1	7.1	7.3	6.8	6.5	7.9	7.7	7.7
>31	81.0	81.0	75.6	70.3	69.4	73.6	71.9	71.9

TABLE C - 12

ENTRY DIVERSION DISTRIBUTION FOR ORS FLIGHTS, JULY 1979 SAMPLE DAY

	Percent Cleared							
	50-100 NMI 15 Min 2000 Ft	50 NMI 15 Min 2000 Ft	50 NMI 10 Min 2000 Ft	25 NMI 10 Min 2000 Ft	25 NMI 5 Min 2000 Ft	50 NMI 15 Min 1000 Ft	50 NMI 10 Min 1000 Ft	50 NMI 10 Min 1000* Ft
EASTBOUND ORS								
AT TRACK AND ALT. REQUESTED	77	87	89	90	94	79	91	91
AT TRACK REQUESTED	87	96	98	94	96	92	96	96
AT ALT. REQUESTED	81	87	89	96	98	85	92	92
AT OR WITHIN 50 NMI/1000 FT	85	87	89	96	98	98	98	98
AT OR WITHIN 50 NMI/2000 FT	94	98	100	100	100	98	98	98
AT OR WITHIN 100 NMI/2000 FT	98	100	100	100	100	100	100	100
WESTBOUND ORS								
AT TRACK AND ALT. REQUESTED	84	84	87	87	90	84	87	87
AT TRACK REQUESTED	100	100	100	95	97	94	95	95
AT ALT. REQUESTED	84	84	87	92	93	90	92	92
AT OR WITHIN 50 NMI/1000 FT	84	84	87	92	93	90	92	92
AT OR WITHIN 50 NMI/2000 FT	100	100	100	100	100	94	95	95
AT OR WITHIN 100 NMI/2000 FT	100	100	100	100	100	100	100	100
TOTAL ORS								
AT TRACK AND ALT. REQUESTED	81	85	88	89	92	82	89	89
AT TRACK REQUESTED	94	98	99	95	96	93	96	96
AT ALT. REQUESTED	82	85	88	94	96	88	92	92
AT OR WITHIN 50 NMI/1000 FT	84	85	88	94	96	94	95	95
AT OR WITHIN 50 NMI/2000 FT	97	99	100	100	100	96	97	97
AT OR WITHIN 100 NMI/2000 FT	99	100	100	100	100	100	100	100

TABLE C - 13

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

	Percent Cleared							
	50-100 NMI 15 Min 2000 Ft	50 NMI 15 Min 2000 Ft	50 NMI 10 Min 2000 Ft	25 NMI 10 Min 2000 Ft	25 NMI 5 Min 2000 Ft	50 NMI 15 Min 1000 Ft	50 NMI 10 Min 1000 Ft	50 NMI 10 Min 1000* Ft
EASTBOUND NON-ORS								
AT TRACK AND ALT. REQUESTED	85	94	97	97	100	85	91	91
AT TRACK REQUESTED	100	100	100	100	100	100	100	100
AT ALT. REQUESTED	85	94	97	97	100	85	91	91
AT OR WITHIN 50 NMI/1000 FT	85	94	97	97	100	85	91	91
AT OR WITHIN 50 NMI/2000 FT	85	94	97	97	100	97	100	100
AT OR WITHIN 100 NMI/2000 FT	85	94	97	97	100	97	100	100
WESTBOUND NON-ORS								
AT TRACK AND ALT. REQUESTED	90	90	97	100	100	96	100	100
AT TRACK REQUESTED	100	100	100	100	100	100	100	100
AT ALT. REQUESTED	90	90	97	100	100	96	100	100
AT OR WITHIN 50 NMI/1000 FT	90	90	97	100	100	100	100	100
AT OR WITHIN 50 NMI/2000 FT	93	93	97	100	100	100	100	100
AT OR WITHIN 100 NMI/2000 FT	93	93	97	100	100	100	100	100
TOTAL NON-ORS								
AT TRACK AND ALT. REQUESTED	87	92	97	98	100	90	95	95
AT TRACK REQUESTED	100	100	100	100	100	100	100	100
AT ALT. REQUESTED	87	92	97	98	100	90	95	95
AT OR WITHIN 50 NMI/1000 FT	87	92	97	98	100	92	95	95
AT OR WITHIN 50 NMI/2000 FT	89	94	97	98	100	98	100	100
AT OR WITHIN 100 NMI/2000 FT	89	94	97	98	100	98	100	100

TABLE C - 14

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

	Percent Cleared							
	50-100 NMI 15 Min 2000 Ft	50 NMI 15 Min 2000 Ft	50 NMI 10 Min 2000 Ft	25 NMI 10 Min 2000 Ft	25 NMI 5 Min 2000 Ft	50 NMI 15 Min 1000 Ft	50 NMI 10 Min 1000 Ft	50 NMI 10 Min 1000* Ft
EASTBOUND ALL								
AT TRACK AND ALT. REQUESTED	80	90	92	93	97	81	91	91
AT TRACK REQUESTED	92	98	99	97	98	95	98	98
AT ALT. REQUESTED	83	90	92	97	99	85	92	92
AT OR WITHIN 50 NMI/1000 FT	85	90	92	97	99	93	95	95
AT OR WITHIN 50 NMI/2000 FT	91	97	99	99	100	98	99	99
AT OR WITHIN 100 NMI/2000 FT	93	98	99	99	100	99	100	100
WESTBOUND ALL								
AT TRACK AND ALT. REQUESTED	86	86	90	91	93	88	91	91
AT TRACK REQUESTED	100	100	100	97	98	96	97	97
AT ALT. REQUESTED	86	86	90	95	96	92	95	95
AT OR WITHIN 50 NMI/1000 FT	86	86	90	95	96	93	95	95
AT OR WITHIN 50 NMI/2000 FT	98	98	99	100	100	96	97	97
AT OR WITHIN 100 NMI/2000 FT	98	98	99	100	100	100	100	100
TOTAL ALL								
AT TRACK AND ALT. REQUESTED	83	88	91	92	95	85	91	91
AT TRACK REQUESTED	96	99	99	97	98	95	97	97
AT ALT. REQUESTED	84	88	91	95	97	89	93	93
AT OR WITHIN 50 NMI/1000 FT	85	88	91	95	97	93	95	95
AT OR WITHIN 50 NMI/2000 FT	94	97	99	99	100	97	98	98
AT OR WITHIN 100 NMI/2000 FT	95	98	99	99	100	99	100	100

TABLE C - 15
50 NMI/1000 FT EASTBOUND ENTRY DIVERSIONS BY FLOW, JULY 1979 SAMPLE DAY

ORIGIN-DESTINATION FLOW	Percent Cleared At Or Within 50NMI/1000 FT Of Request							
	50-100NMI 15 Min. 2000 Ft.	50 NMI 15 Min. 2000 Ft.	50 NMI 10 Min. 2000 Ft.	25 NMI 10 Min. 2000 Ft.	25 NMI 5 Min. 2000 Ft.	50 NMI 15 Min. 1000 Ft.	50 NMI 10 Min. 1000 Ft.	50 NMI 10 Min. 1000* Ft.
Hawaii - California	83	85	88	96	98	98	98	98
Hawaii - Pacific N.W.	88	100	100	100	100	63	75	75
Hawaii - Alaska	100	100	100	100	100	100	100	100
Hawaii - Other No. America	100	100	100	100	100	100	100	100
Alaska - West Coast	100	100	100	100	100	100	100	100
Far East - No. America	84	89	95	95	100	89	95	95
Oceania - No. America	75	100	100	100	100	100	100	100

TABLE C - 16
50 NMI/1000 FT WESTBOUND ENTRY DIVERSIONS BY FLOW, JULY 1979 SAMPLE DAY

ORIGIN-DESTINATION FLOW	Percent Cleared At Or Within 50NMI/1000 FT Of Request							
	50-100NMI 15 Min. 2000 Ft.	50 NMI 15 Min. 2000 Ft.	50 NMI 10 Min. 2000 Ft.	25 NMI 10 Min. 2000 Ft.	25 NMI 5 Min. 2000 Ft.	50 NMI 15 Min. 1000 Ft.	50 NMI 10 Min. 1000 Ft.	50 NMI 10 Min. 1000* Ft.
Hawaii - California	83	83	86	92	93	90	92	92
Hawaii - Pacific N.W.	75	75	88	100	100	100	100	100
Hawaii - Alaska	100	100	100	100	100	100	100	100
Hawaii - Other No. America	100	100	100	100	100	100	100	100
Alaska - West Coast	100	100	100	100	100	100	100	100
Far East - No. America	91	91	100	100	100	100	100	100
Oceania - No. America	100	100	100	100	100	100	100	100

TABLE C - 17
50 NMI/1000 FT TOTAL (EB AND WB) ENTRY DIVERSIONS BY FLOW, JULY 1979 SAMPLE DAY

ORIGIN-DESTINATION FLOW	Percent Cleared At Or Within 50NMI/1000 FT Of Request							
	50-100NMI 15 Min. 2000 Ft.	50 NMI 15 Min. 2000 Ft.	50 NMI 10 Min. 2000 Ft.	25 NMI 10 Min. 2000 Ft.	25 NMI 5 Min. 2000 Ft.	50 NMI 15 Min. 1000 Ft.	50 NMI 10 Min. 1000 Ft.	50 NMI 10 Min. 1000* Ft.
Hawaii - California	83	84	87	93	95	93	94	94
Hawaii - Pacific N.W.	81	88	94	100	100	81	88	88
Hawaii - Alaska	100	100	100	100	100	100	100	100
Hawaii - Other No. America	100	100	100	100	100	100	100	100
Alaska - West Coast	100	100	100	100	100	100	100	100
Far East - No. America	87	90	97	97	100	93	97	97
Oceania - No. America	83	100	100	100	100	100	100	100

TABLE C-18

1979 STEP CLIMB REQUEST SUMMARY, JULY SAMPLE DAY

Percent of Flights that Request
at Least One Step Climb

FLIGHT		50-100 NMI 15 Min 2000 Ft	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
ORS	EASTBOUND	81	60	60	60	60	94	94	94
	WESTBOUND	63	63	63	56	56	76	76	76
	TOTAL	71	62	62	58	58	84	84	84
NON-ORS	EASTBOUND	26	24	24	26	26	30	33	33
	WESTBOUND	21	21	21	20	20	64	64	68
	TOTAL	24	23	23	23	23	46	48	49
All	EASTBOUND	59	47	47	47	47	70	71	71
	WESTBOUND	49	49	49	44	44	73	73	74
	TOTAL	54	48	48	45	45	71	72	72

TABLE C-19

1979 STEP CLIMB APPROVAL SUMMARY, JULY SAMPLE DAY

Step Climbs Approved

(Percent of Step Climb Requests)

FLIGHT		50-100 NMI 15 Min 2000 Ft.	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
ORS	EASTBOUND	67	72	80	88	91	79	84	83
	WESTBOUND	58	62	68	63	75	77	83	83
	TOTAL	62	66	73	76	83	78	83	83
NON-ORS	EASTBOUND	58	50	50	63	83	50	50	45
	WESTBOUND	58	58	70	67	80	81	81	87
	TOTAL	58	55	61	65	81	73	74	76
ALL	EASTBOUND	65	69	77	85	90	76	80	79
	WESTBOUND	58	61	68	63	75	78	82	84
	TOTAL	61	64	72	74	83	77	81	81

Table C-20

1979 STEP CLIMB DELAY TIME SUMMARY

JULY SAMPLE DAY

AVERAGE TIME TO STEP CLIMB APPROVAL (MIN.)

Flight		50-100 NMI 15 Min 2000 Ft	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
ORS	Eastbound	6.7	10.2	9.9	6.0	6.0	9.8	9.9	9.9
	Westbound	6.0	6.0	6.7	13.2	8.1	8.9	8.7	8.7
	TOTAL	6.4	7.9	8.1	9.0	6.9	9.4	9.3	9.3
NON-ORS	Eastbound	28.6	12.6	6.0	6.0	6.0	12.2	6.0	6.0
	Westbound	14.7	10.7	10.7	6.0	6.0	7.3	7.3	7.2
	TOTAL	21.6	11.5	9.0	6.0	6.0	8.2	7.1	7.0
All	Eastbound	9.6	10.5	9.6	6.0	6.0	9.9	9.7	9.7
	Westbound	7.2	6.6	7.2	11.8	7.7	8.5	8.3	8.3
	TOTAL	8.5	8.3	8.2	8.5	6.8	9.1	8.9	8.9

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

Table C-21

1979 OCEANIC FLIGHT TIME AT 1000 and 2000 FEET ALTITUDE DIVERSION

JULY SAMPLE DAY

PERCENT OF TOTAL FLIGHT TIME SPENT 1000 and 2000 FT.

BELOW REQUESTED ALTITUDE IN OCEANIC AIRSPACE

Origin-Destination Flow	50-100 NMI 15 Min 2000 Ft	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
Hawaii-California	13.74	14.97	10.77	6.80	5.90	16.61	13.08	13.24
Hawaii-Pacific N.W.	0.00	0.00	0.00	0.00	0.00	19.33	18.44	18.44
Hawaii-Alaska	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hawaii-Other No. Amer.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alaska-West Coast	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Far East-No. America	4.00	4.00	0.00	0.00	0.00	3.59	4.19	4.10
Oceania-No. America	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL	9.84	10.69	7.38	4.67	4.05	14.16	11.69	12.46

Table C- 22

1979 OCEANIC FLIGHT TIME AT 3000 FT. AND GREATER ALTITUDE DIVERSION

JULY SAMPLE DAY

PERCENT OF TOTAL FLIGHT TIME SPENT 3000 FT. AND GREATER

BELOW REQUESTED ALTITUDE IN OCEANIC AIRSPACE

Origin-Destination Flow	50-100 NMI 15 Min 2000 Ft	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
Hawaii-California	10.46	9.18	7.40	6.72	4.19	0.83	0.82	0.82
Hawaii-Pacific N.W.	22.64	21.55	15.48	11.61	4.68	7.55	6.52	6.52
Hawaii-Alaska	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hawaii - Other No. Amer	0.00	0.00	0.00	0.00	0.00	3.50	3.50	3.50
Alaska - West Coast	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Far East-No. America	13.12	10.85	7.71	4.28	0.00	1.87	0.00	0.00
Oceania - No. America	11.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL	11.41	10.12	7.81	6.49	3.44	1.94	1.62	1.55

Table C-23

1979 EASTBOUND ORS EXIT FLIGHT LEVEL PREFERENCE AND CLEARANCE SUMMARY

JULY SAMPLE DAY

Eastbound Flight Level at Oceanic Exit	Percent of ORS Daily Flights Requesting Flight Level Indicated								Percent of ORS Flights Cleared at Their Requested Flight Level							
	50-100 NMI 15 Min 2000 Ft	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*	50-100NMI 15 Min 2000ft	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
≥ 400	15.38	7.55	5.66	5.77	5.77	9.43	9.43	9.44	9.62	5.66	5.66	5.77	5.77	7.55	7.55	5.66
390	11.54	16.98	18.87	19.23	19.23	16.98	16.98	16.98	3.85	15.09	18.87	19.23	17.31	15.09	16.98	16.98
380	53.85	0	0	0	0	16.98	16.98	16.98	44.23	0	0	0	0	13.21	13.21	13.21
370	0	64.15	64.15	65.38	65.38	45.28	45.28	45.28	0	43.40	49.06	55.77	57.69	35.85	39.62	39.62
360	9.62	0	0	0	0	0	0	0	7.69	0	0	0	0	0	0	0
350	0	11.32	11.32	9.62	9.62	7.55	7.55	7.55	0	5.66	5.66	3.85	3.85	5.66	5.66	5.66
340	9.62	0	0	0	0	3.77	3.77	3.77	3.85	0	0	0	0	0	0	0
330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
310	0	0	0	0	0	0	0	0	0	0	0	0	0	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	69.23	69.81	79.25	84.62	84.62	77.36	83.02	81.13

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

Table C - 24

1979 WESTBOUND ORS EXIT FLIGHT LEVEL PREFERENCE AND CLEARANCE SUMMARY

JULY SAMPLE DAY

Westbound Flight Level at Oceanic Exit	Percent of ORS Daily Flights Requesting Flight Level Indicated								Percent of ORS Flights Cleared at their Requested Flight Level							
	50-100 NMI 15 Min 2000 Ft	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*	50-100NMI 15Min 2000Ft	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
≥400	0	0	0	3.28	3.28	3.17	3.17	3.17	0	0	0	3.28	3.28	3.17	3.17	3.17
390	16.13	16.13	16.13	9.84	9.84	9.52	9.52	9.52	9.68	9.68	11.29	4.92	6.56	9.52	9.52	9.52
380	0	0	0	0	0	3.17	3.17	3.17	0	0	0	0	0	3.17	3.17	3.17
370	41.94	48.39	48.39	50.82	50.82	9.52	9.52	9.52	25.81	32.26	35.48	40.98	44.26	6.35	6.35	6.35
360	6.45	0	0	0	0	57.14	57.14	57.14	6.45	0	0	0	0	49.21	50.79	50.79
350	20.97	20.97	20.97	18.03	18.03	0	0	0	12.90	12.90	12.90	13.11	14.75	0	0	0
340	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
330	6.45	6.45	6.45	11.48	11.48	9.52	9.52	9.52	0	0	0	1.64	1.64	0	0	0
320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
310	8.06	8.06	8.06	6.56	6.56	7.94	7.94	7.94	8.06	8.06	8.06	6.56	6.56	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	62.90	62.90	67.74	70.49	77.05	71.43	73.02	73.02

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

Table C-25

1979 EASTBOUND AND WESTBOUND ORS EXIT FLIGHT LEVEL PREFERENCE AND CLEARANCE SUMMARY
JULY SAMPLE DAY

PERCENT OF DAILY FLIGHTS CLEARED AS INDICATED AT OCEANIC EXIT

	EASTBOUND								WESTBOUND							
Flight Level at Oceanic Exit	50-100 NMI 15 Min 2000 Ft	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*	50-100NMI 15Min 2000Ft	50 15 2000	50 10 2000	25 10 2000	25 5 2000	50 15 1000	50 10 1000	50 10 1000*
≥ 400	11.54	5.66	5.66	5.77	5.77	7.55	7.55	7.55	0	0	0	3.28	3.28	3.17	3.17	3.17
390	3.85	18.87	18.87	19.23	19.23	20.75	22.64	22.64	14.52	14.52	16.13	6.56	8.20	9.52	9.52	9.52
380	51.92	0	0	0	0	15.09	15.09	15.09	0	0	0	0	0	7.94	7.94	7.94
370	0	50.94	54.72	61.54	65.38	39.62	39.62	39.62	32.26	38.71	41.94	54.10	54.10	6.35	6.35	6.35
360	15.38	0	0	0	0	9.43	7.55	7.55	6.45	0	0	0	0	52.38	53.97	53.97
350	7.69	18.87	16.98	13.46	9.62	7.55	7.55	7.55	30.65	30.65	27.42	19.67	22.95	4.76	3.17	3.17
340	9.62	0	0	0	0	0	0	0	0	0	0	0	0	7.94	7.94	7.94
330	0	5.66	3.77	0	0	0	0	0	6.45	6.45	4.84	8.20	4.92	0	0	0
320	0	0	0	0	0	0	0	0	0	0	0	0	0	7.94	7.94	7.94
310	0	0	0	0	0	0	0	0	9.68	9.68	9.68	8.20	6.56	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	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 ORS FLIGHTS, JULY 1979 SAMPLE DAY

	Percent Cleared							
	50-100 NMI 15 Min 2000 Ft	50 NMI 15 Min 2000 Ft	50 NMI 10 Min 2000 Ft	25 NMI 10 Min 2000 Ft	25 NMI 5 Min 2000 Ft	50 NMI 15 Min 1000 Ft	50 NMI 10 Min 1000 Ft	50 NMI 10 Min 1000* Ft
EASTBOUND ORS								
AT TRACK AND ALT. REQUESTED	67	68	77	79	81	72	79	79
AT TRACK REQUESTED	87	96	98	94	96	92	96	96
AT ALT. REQUESTED	69	70	79	85	85	77	83	81
AT OR WITHIN 50 NMI/1000 FT	67	70	79	85	85	87	87	87
AT OR WITHIN 50 NMI/2000 FT	77	92	96	100	100	91	91	91
AT OR WITHIN 100 NMI/2000 FT	81	94	96	100	100	92	92	92
WESTBOUND ORS								
AT TRACK AND ALT. REQUESTED	63	63	68	66	74	67	70	70
AT TRACK REQUESTED	100	100	100	95	97	94	95	95
AT ALT. REQUESTED	63	63	68	70	77	71	73	73
AT OR WITHIN 50 NMI/1000 FT	63	63	68	70	77	86	87	87
AT OR WITHIN 50 NMI/2000 FT	82	82	85	80	85	89	90	90
AT OR WITHIN 100 NMI/2000 FT	82	82	85	80	85	95	95	95
TOTAL ORS								
AT TRACK AND ALT. REQUESTED	65	65	72	72	77	69	74	74
AT TRACK REQUESTED	94	98	99	95	96	93	96	96
AT ALT. REQUESTED	66	66	73	77	81	74	78	77
AT OR WITHIN 50 NMI/1000 FT	65	66	73	77	81	86	87	87
AT OR WITHIN 50 NMI/2000 FT	80	87	90	89	92	90	91	91
AT OR WITHIN 100 NMI/2000 FT	82	88	90	89	92	94	94	94

TABLE C - 27

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

	Percent Cleared							
	50-100 NMI 15 Min 2000 Ft	50 NMI 15 Min 2000 Ft	50 NMI 10 Min 2000 Ft	25 NMI 10 Min 2000 Ft	25 NMI 5 Min 2000 Ft	50 NMI 15 Min 1000 Ft	50 NMI 10 Min 1000 Ft	50 NMI 10 Min 1000* Ft
EASTBOUND NON-ORS								
AT TRACK AND ALT. REQUESTED	79	79	79	82	88	79	79	76
AT TRACK REQUESTED	100	100	100	100	100	100	100	100
AT ALT. REQUESTED	79	79	79	82	88	79	79	76
AT OR WITHIN 50 NMI/1000 FT	79	79	79	82	88	79	79	76
AT OR WITHIN 50 NMI/2000 FT	79	79	79	82	88	88	88	88
AT OR WITHIN 100 NMI/2000 FT	79	79	79	82	88	88	88	88
WESTBOUND NON-ORS								
AT TRACK AND ALT. REQUESTED	83	86	93	90	97	89	89	89
AT TRACK REQUESTED	100	100	100	100	100	100	100	100
AT ALT. REQUESTED	83	86	93	90	97	89	89	89
AT OR WITHIN 50 NMI/1000 FT	83	86	93	90	97	89	89	89
AT OR WITHIN 50 NMI/2000 FT	86	90	93	90	97	93	93	93
AT OR WITHIN 100 NMI/2000 FT	86	90	93	90	97	93	93	93
TOTAL NON-ORS								
AT TRACK AND ALT. REQUESTED	81	82	85	86	92	84	84	82
AT TRACK REQUESTED	100	100	100	100	100	100	100	100
AT ALT. REQUESTED	81	82	85	86	92	84	84	82
AT OR WITHIN 50 NMI/1000 FT	81	82	85	86	92	84	84	82
AT OR WITHIN 50 NMI/2000 FT	83	84	85	86	92	90	90	90
AT OR WITHIN 100 NMI/2000 FT	83	84	85	86	92	90	90	90

TABLE C - 28

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

	Percent Cleared							
	50-100 NMI 15 Min 2000 Ft	50 NMI 15 Min 2000 Ft	50 NMI 10 Min 2000 Ft	25 NMI 10 Min 2000 Ft	25 NMI 5 Min 2000 Ft	50 NMI 15 Min 1000 Ft	50 NMI 10 Min 1000 Ft	50 NMI 10 Min 1000* Ft
EASTBOUND ALL								
AT TRACK AND ALT. REQUESTED	72	72	78	80	84	74	79	78
AT TRACK REQUESTED	92	98	99	97	98	95	98	98
AT ALT. REQUESTED	73	73	79	84	86	78	81	79
AT OR WITHIN 50 NMI/1000 FT	72	73	79	84	86	84	84	83
AT OR WITHIN 50 NMI/2000 FT	78	87	90	93	95	90	90	90
AT OR WITHIN 100 NMI/2000 FT	80	88	90	93	95	91	91	91
WESTBOUND ALL								
AT TRACK AND ALT. REQUESTED	69	70	76	74	81	74	76	76
AT TRACK REQUESTED	100	100	100	97	98	96	97	97
AT ALT. REQUESTED	69	70	76	77	84	77	78	78
AT OR WITHIN 50 NMI/1000 FT	69	70	76	77	84	87	88	88
AT OR WITHIN 50 NMI/2000 FT	84	85	88	84	89	90	91	91
AT OR WITHIN 100 NMI/2000 FT	84	85	88	84	89	95	95	95
TOTAL ALL								
AT TRACK AND ALT. REQUESTED	71	71	77	77	82	74	77	77
AT TRACK REQUESTED	96	99	99	97	98	95	97	97
AT ALT. REQUESTED	71	72	77	80	85	77	80	79
AT OR WITHIN 50NMI/1000 FT	71	72	77	80	85	85	86	85
AT OR WITHIN 50NMI/2000 FT	81	86	89	88	92	90	90	90
AT OR WITHIN 100NMI/2000 FT	82	86	89	88	92	93	93	93

TABLE C - 29
50 NMI/1000 FT EASTBOUND EXIT DIVERSIONS BY FLOW, JULY 1979 SAMPLE DAY

ORIGIN-DESTINATION FLOW	Percent Cleared At Or Within 50NMI/1000 FT Of Request							
	50-100NMI 15 Min. 2000 Ft.	50 NMI 15 Min. 2000 Ft.	50 NMI 10 Min. 2000 Ft.	25 NMI 10 Min. 2000 Ft.	25 NMI 5 Min. 2000 Ft.	50 NMI 15 Min. 1000 Ft.	50 NMI 10 Min. 1000 Ft.	50 NMI 10 Min. 1000* Ft.
Hawaii - California	65	67	77	83	83	85	85	85
Hawaii - Pacific N.W.	88	75	75	75	88	75	75	75
Hawaii - Alaska	100	100	100	100	100	0	0	0
Hawaii - Other No. America	100	100	100	100	100	100	100	100
Alaska - West Coast	100	100	100	100	100	100	100	100
Far East - No. America	74	74	74	79	84	79	79	74
Oceania - No. America	75	100	100	100	100	100	100	100

TABLE C - 30
50 NMI/1000 FT WESTBOUND EXIT DIVERSIONS BY FLOW, JULY 1979 SAMPLE DAY

ORIGIN-DESTINATION FLOW	Percent Cleared At Or Within 50NMI/1000 FT Of Request							
	50-100NMI 15 Min. 2000 Ft.	50 NMI 15 Min. 2000 Ft.	50 NMI 10 Min. 2000 Ft.	25 NMI 10 Min. 2000 Ft.	25 NMI 5 Min. 2000 Ft.	50 NMI 15 Min. 1000 Ft.	50 NMI 10 Min. 1000 Ft.	50 NMI 10 Min. 1000* Ft.
Hawaii - California	61	59	64	68	75	85	86	86
Hawaii - Pacific N.W.	50	75	88	75	100	75	75	75
Hawaii - Alaska	100	100	100	100	100	100	100	100
Hawaii - Other No. America	100	100	100	100	100	100	100	100
Alaska - West Coast	100	100	100	100	100	100	100	50
Far East - No. America	91	91	100	100	100	91	91	100
Oceania - No. America	100	100	100	100	100	100	100	100

TABLE C - 31
50 NMI/1000 FT TOTAL (EB AND WB) EXIT DIVERSIONS BY FLOW, JULY 1979 SAMPLE DAY

ORIGIN-DESTINATION FLOW	Percent Cleared At Or Within 50NMI/1000 FT Of Request							
	50-100NMI 15 Min. 2000 Ft.	50 NMI 15 Min. 2000 Ft.	50 NMI 10 Min. 2000 Ft.	25 NMI 10 Min. 2000 Ft.	25 NMI 5 Min. 2000 Ft.	50 NMI 15 Min. 1000 Ft.	50 NMI 10 Min. 1000 Ft.	50 NMI 10 Min. 1000* Ft.
Hawaii - California	63	63	70	75	79	85	86	86
Hawaii - Pacific N.W.	69	75	81	75	94	75	75	75
Hawaii - Alaska	100	100	100	100	100	50	50	50
Hawaii - Other No. America	100	100	100	100	100	100	100	100
Alaska - West Coast	100	100	100	100	100	100	100	67
Far East - No. America	80	80	83	87	90	83	83	83
Oceania - No. America	83	100	100	100	100	100	100	100