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INTRODUCTION

The work for this project was carried out in three phases, as MS projects by two students, and as a postdoctoral project by a visiting scientist. The first phase was completed by Michael F. Boyer[1] in 1969-70, and consisted entirely of measurements between San Francisco and London over the great circle route. The second phase was carried out in 1971-72 by Jon A. Kirby, over routes from San Francisco to Washington, D. C., Tokyo, Buenos Aires, and Rio de Janeiro. The City-Pair code, which originated at Boeing Aircraft Co., was reprogrammed to run on the computers at the Lawrence Berkeley Laboratory by Douglas C. Wallace, and the code was revised further by Kalina Mamont-Cieśla, guest physicist, who is visiting the Lawrence Berkeley Laboratory from the Central Laboratory of Radiological Protection, Warsaw, Poland.

In the first phase, photographic emulsions and thermoluminescent dosimeters were mailed by conventional registered air mail from Berkeley via San Francisco to Professor Jack Fowler at Hammersmith Hospital near London, who returned them to us. These detectors accumulated approximately 2100 hours of flight time at altitudes above 30, 000 feet. In the second experimental phase, similar detectors were mailed round trip through diplomatic channels to Washington, D. C., and thence to Tokyo, Buenos Aires, and Rio de Janeiro for a total flight time above 30, 000 feet in excess of 2900 hours. The dates of the flights are listed in Tables Ia and II, and of solar proton events in Table Ib. The measured results were then compared to the results of the "Boeing Code" which was originally programmed by Stanley Curtis and was originally described in the Boeing report.[2] This program, called the Galactic Radiation Exposure Program (GREP), calculates the dose in tissue in millirads for the great circle flight path between two cities. The agreement is seen to be reasonably good.

It is concluded that both experiments and theory show that the total doses received at present day conventional jet aircraft altitudes are considerably higher than those encountered in supersonic flights at much higher altitudes, even though the dose rate is lower at these lower altitudes, when the longer time of exposure at the lower altitudes is taken into consideration.

The Experiments

The dosimetric measurements were made with thermoluminescent dosimeters (TLD's) and with emulsions of three types sealed in plastic packets. These packets were sent by air mail back and forth from Berkeley, California to the five cities on the dates shown in Tables Ia and II. A dose sufficiently above background for a satisfactory measurement was accumulated by the TLD's on one round trip and by the emulsions on three round trips. Although there were some small variations in the contents of certain packets, all were basically the same. Pieces of polyvinyl-chloride (0.6 mm thick) were cut to the size of a regular business envelope (10 cm $\times$ 23 cm). The packet was compartmentized and sealed with a radio-frequency plastic welder. Packets sent to London contained β-γ films, NTA films, 600μ emulsion, and CaF_2 thermoluminescent detectors (TLD). Packets sent to Washington, Tokyo, Rio de Janeiro, and Buenos Aires contained only β-γ emulsions and TLD's. Before sealing, each packet was flushed with dry nitrogen gas to reduce photographic fading of the latent image by decreasing the relative humidity and decreasing the atmospheric oxygen in contact with the emulsion.

Each packet contained four β-γ films. Two of these films were unexposed; the third film was pre-exposed to 20 mr and the fourth film was pre-exposed to 100 mr of radium γ-rays. In those packets that contained nuclear track emulsions (NTA), one NTA film was pre-exposed to 20 mrem and the other to 100 mrem of PuBe neutrons.

In evaluating the flight paths for the first part of this experiment from San Francisco to London, an air mail flight schedule was obtained from the Berkeley post office. When the total number of available flights is considered, it is reasonable to assume that at least 80% of the packets sent to London made the trip by the polar route, rather than landing in New York. Polar flights from San Francisco to London always go via Los Angeles. On the Los Angeles to London leg they have a flight profile approximately like that seen in Fig. 1. These flights usually go over the southern part of Hudson Bay, Baffin Island, and the southern third of Greenland. Each flight is flown over the predicted "least time" route based on the latest weather predictions. Some flights may go considerably south of Greenland, occasionally as far south as Atlanta, although this is rare. These variations probably don't have a large effect on the galactic cosmic ray dose since they take longer at a lower dose rate, which has a compensating effect on the integrated dose. The solar flare dose, if any, would be reduced by a larger factor at the lower magnetic latitudes. Since few solar flares occurred during this experiment, these relatively rare and self-compensating route variations have little effect on our results.

Calculations made with the GREP code[2] indicate that for the San Francisco to London route one should expect a total dose of about 5 mr/round trip. Since the lower limit of sensitivity for the film is approximately 10 mr, each packet to London was sent on about five round trips. Unfortunately, during this time there were no large flares and only one small flare. Three groups of packets completed five round trips to London. Six groups of packets completed round trips to Washington, Tokyo, and Buenos Aires. Five groups of packets completed round trips to Rio de Janeiro.

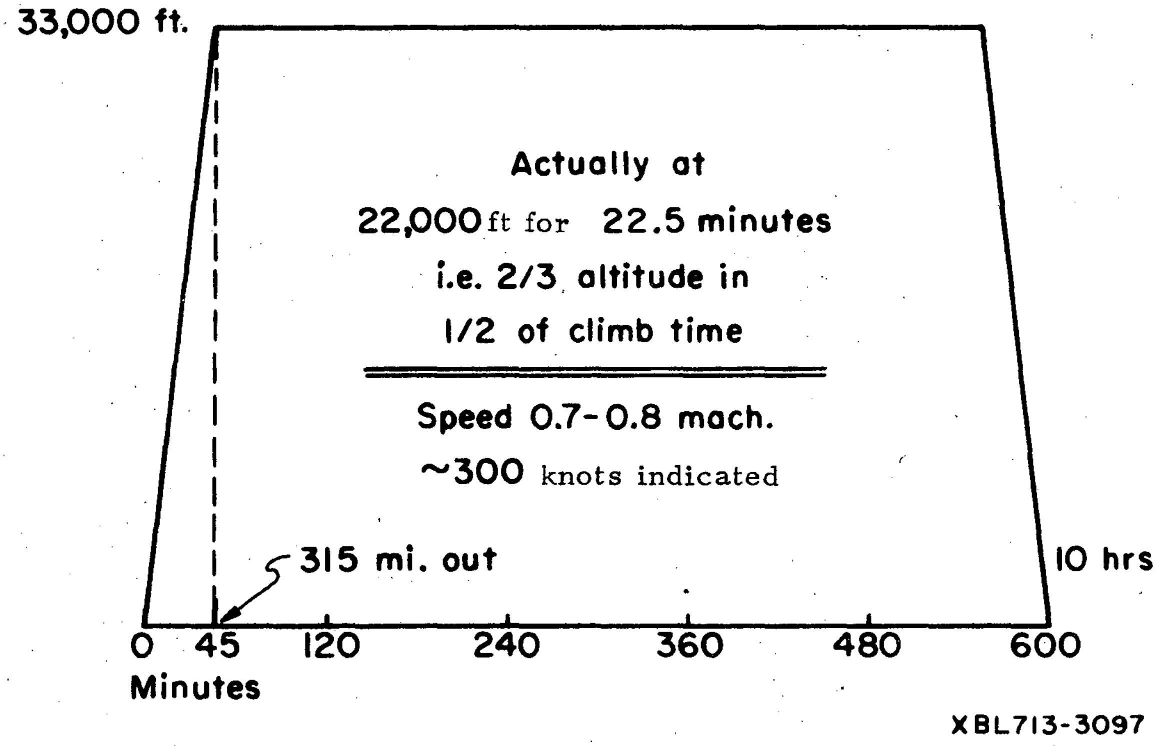

Fig. 1. Flight profile of a typical flight between Los Angeles and London from TWA.

One packet was lost on this route.

The packets sent to Washington, Tokyo, Rio de Janeiro, and Buenos Aires actually followed the following routes, according to the U. S. Postal Service and the U. S. Department of State. The return route was the reverse of the outbound route in each case. In the calculations, each leg of these routes was assumed to be a great circle path between the two points at its end. The Washington route was direct from San Francisco to Washington. The Tokyo route was also direct from San Francisco to Tokyo non stop. The Rio de Janeiro route was from San Francisco to New York; to Charleston, South Carolina; to Caracus, Venezuela; to Rio de Janeiro, Brazil. The Buenos Aires route on the other hand, was from San Francisco to Washington, D. C.; to New York; to Buenos Aires, Argentina. The dates of the flights are shown in Table Ia and the dates of solar proton events are shown in Table I b.

Background Radiation

Realizing that from the time the film is sealed until it is developed, it spends more time at sea level than at altitude, it is necessary to attempt to estimate the dose of ionizing radiation which is accumulated during the time not spent in the aircraft.

Duplicate dosimeters were stored in a low background cave at the Lawrence Berkeley Laboratory and in an unshielded area (Oakland) during the flight times. These dosimeters were processed with the dosimeters that had been mailed, and the background readings were subtracted appropriately.

Analysis of β - γ Film Data

In interpreting the data there were two experimental factors which need special mention. First, these films, all from the same emulsion number, were packaged, exposed, and developed in different groups; and secondly, the time which elapsed from loading to development in the different groups was different, even though the time which each group spent in the air was essentially the same. The total dose gathered on

Table Ia. The TLD's each flew on one trip between the following dates

	1971				1972	
	#1	#2	#3	#4	#5	#6
Washington	7/28-8/8	8/28-9/2	9/28-10/12	11/17-12/3	1/13-1/20*	4/6-4/14
Tokyo	7/28-8/6	8/27-9/9	9/28-10/6	11/17-12/9	1/13-1/24*	4/6-4/17
Buenos Aires	7/28-8/18	8/27-9/16	9/28-10/19	11/17-12/6	1/13-2/1*	4/6-4/26
Rio de Janeiro	7/28-8/30	8/27-9/23	9/28-10/28	11/17-12/13	1/13-2/8 *	4/6-5/1
TLD Dates Between Start and Reading					1/13-2/16*	4/5-5/5

The films each flew three trips as follows:

Set of Films		Trips
Washington	# A	1, 2, 3
	# B	4, 5, 6
Tokyo	# A	1, 2, 3
	# B	4, 5, 6
Buenos Aires	# A	1, 2, 3
	# B	4, 5, 6
Rio de Janeiro	# A	1, 3, 4
	# B	2, 3, 4
	# C	4, 5, 6

* There was solar activity during these flights, See Table Ib.

Table Ib. Dates of Solar Proton Events

Date	Strength (all events low energy)	Duration
September 1, 1971	small	short
October 3, 1971	medium	day
December 2, 1971	small	short
December 14-21, 1971 peak December 17	medium to large	7 days
January 11, 1972	small	day
January 15-16, 1972	small	2 days
January 19-25, 1972 peak January 20-21	medium	6 days
April 17-18, 1972	small	6 hours

the London trips made by these films represents about 2052 hours of exposure at altitudes above 30,000 feet, as calculated from the flight profile in Fig. 1. The total time spent above 30,000 feet on the Washington, Tokyo, Rio de Janeiro, and Buenos Aires flights was 2897 hours.

Fading

The question of the change of the latent image during the 8 to 16 weeks between loading and development is poorly understood. The controls which were kept in the shielded cave showed an apparent fading in the last two groups and an increase of background in the first group. Many possible explanations for this were examined and discarded. We are forced to attribute this inconsistency in the background film exposures to unexplained but occasionally observed variations in β-γ film dosimetry. The film was all from one emulsion number and all films were treated the same. The assumption was made in the case of each group that, for the time period from loading into the packets until development, all films in the group underwent the same fading and background change. Therefore, the figures in Table II represent the dose readings in roentgens minus the actual dose reading from the appropriate control film which was kept in the low background cave.

In groups 2 and 3 the fading of the control films was more that might be expected, even though they were sealed in nitrogen and kept in the cave, which has a very constant environment. In some low dose films the fading was as much as 60 percent. This proved to be especially annoying in the case of the last group, where the average readings were higher than in groups 1 and 2. (See Table II)

The experience which has been gained over many years in reading β- γ film indicates that the data are reasonable. It may not be possible to attach dosimetric significance to the measurements of any one film, but, in view of the large total number of hours which the film spent in the air, the average is probably significant.

Many possible explanations of the wide variation in measured doses were examined. It is quite possible that packages 9 and 13 may have

Table II. Results from the β-γ films making flight San Francisco-London in the packets.

Group	Pkg.	Rd. trips	Hrs. in air*	Total dose in milliroentgen gained					mr/round trip			Group Average
				Zero	Zero	20	100	Ave.	Min.	Max.	Ave.	
	1	6	108	23	26	30	6	21	1.0	5.0	3.5	
	2	5	90	16	19	57	23	29	3.2	11.4	5.8	
1 (9 Dec. 69 to 9 Apr. 70)	3	5	90	19	19	23	27	22	3.8	5.4	4.4	
	4	3	54	11	11	15	19	14	3.7	6.3	4.7	
	5	5	90	16	23	16	9	16	1.8	4.6	3.2	
	6	5	90	30	30	33	37	33	6.0	7.4	6.6	4.7
	9	5	90	228	228	62	202	180	12.4	45.6	36.0	
	10	5	90	24	31	20	21	24	4.0	6.2	4.8	
	11	5	90	24	31	18	24	24	3.6	6.2	4.8	
	12	5	90	28	28	17	33	26	3.4	6.6	5.2	
2 (10 Mar. 70 to 29 Mar. 70)	13	5	90	90	100	118	88	99	17.6	23.6	19.8	
	14	5	90	28	32	9	20	22	1.8	6.4	4.4	
	15	5	90	28	30	12	28	24	2.4	5.6	4.8	
	16	5	90	30	31	14	18	23	2.8	6.2	4.6	10.6
	20	5	90	37	47	89	90	66	7.4	18.0	13.2	
	21	5	90	64	92	104	97	89	12.8	20.8	17.8	
	22	5	90	107	121	149	164	135	21.4	32.8	27.0	
	23	5	90	30	44	96	69	60	6.0	19.2	12.0	
3 (13 Mar. 70 to 14 Jul. 70)	24	5	90	89	160	186	193	157	17.8	38.6	31.4	
	25	5	90	47	54	96	94	73	9.4	19.2	14.6	
	26	5	90	100	107	142	164	128	20.0	32.8	25.6	
	27	5	90	61	71	78	90	75	12.2	18.0	15.0	
	28	5	90	92	100	128	97	104	18.4	25.6	20.8	19.7
								Ave.	Ave.	Ave.	Ave.	
Total Averages								62.8	8.3	16.1	12.5	

*Approximately 18 hours in air at altitude per round trip been exposed to a source of radiation somewhere along their trips. To suggest that all of group 3 is higher from this type of cause seems very unreasonable. There is, however, experimental experience that for unknown reasons, probably connected with environmental conditions, as much as 50 mr per film might be due to activation of the silver grains by a so far unidentified process other than radiation. This phenomenon has been known to occur in the processing of large groups of films in which, for unknown reasons, most of the films which left the photoprocessing lab apparently gained an abnormally large amount of radiation, while the control films that did not leave the laboratory showed nothing abnormal.

Although no large solar flares occurred during the experiment, an attempt was made to correlate enhanced solar activity with those packets which showed a higher dose. This was only mildly successful. For example, June 13 and 14 were the most active days since the beginning of the year. There were large class X events. Packet 27 flew during this period and showed the highest dose of all packets for group 3. Packet 23 also flew during this time period and showed the lowest dose of group 3.

If the readings for the four days previous to the May 30, 1970 flare, made on the polar route to London, are averaged together using the amounts over the 4.0 mrad background, one gets an average of 1.93 mrad/round trip. We assume that half of this dose was accumulated during each flight direction, or that on a no-flare trip the extra amount of radiation from flying is about 1 mrad. There was thus an increase of about 50% per round trip due to this flare.

Analysis of TLD Data

The TLD's (thermoluminescent dosimeters) were CaF_2. Each reading is actually an average of three separate dosimeters contained in a small plastic disk. All readings and calibration of these dosimeters was done at the Lawrence Livermore Laboratory under the direction of D. E. Jones, R. E. McMillan, and G. L. Seibel, Hazards Control Group, and are listed in Table III.

Due to their greater sensitivity (down to 0.1 mrad) TLD dosimeters were sent on only one round trip before being read. Of special interest is the TLD sent on the 30th of May, 1970. It was in the air when the first proton event in 45 days occurred. Unfortunately, on this particular day a TLD was not sent via JFK airport, and so no comparison could be made between the polar and lower magnetic latitude routes. However, the measurement during the flare* was clearly above the other measurements. There was at most a 50% increase in dose for the flight during this class M flare.

Experimental Results

The experimental results from the first phase of the experiment are listed in Table II. The average additional dose from cosmic rays on flights to London from December, 1969 to July, 1970 was 12.5 ± 4 mrad/round trip with a lower limit of 8.3 mrad/trip and an upper limit of 16.1 mrad/round trip. The results from the second phase of the experiment, including both the beta-gamma films and the TLD dosimeters, are summarized in Tables III to VI.

Measured Cosmic Ray Neutron Spectrum

One of the 600μ emulsions was scanned for proton recoils, and these in turn converted to the neutron spectrum in Fig. 2.

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*A description of the flare of May 30, 1970, as given by ESSA, is as follows:

"The proton event was associated with an imp IN, a Class M flare at 30/0240Z, (IN-A size and intensity evaluation. In this case, area 2.1 — 5.1 sq. deg with normal intensity.) again in region 760. The 1-8 A x-ray burst associated with this flare had a peak flux of only 0.04 erg per sq cm per cm per sec, but a total duration of 6 hours. Protons were first detected by the ATS-1 satellite at about 30/0800 Z and were of the order of 350 and 16 particles per sq cm per sec in the 5-21 and 21-70 MeV channels respectively. Associated riometer absorption at 30 MHz was 1 Db or less."

Table III. CaF_2 TLD's (^{60}Co mrad)

Destination	#1	#2	#3	#4	#5	#6
Washington	8.23	6.25	9.74	12.76	5.77	1.31
	8.34	6.28	9.98	12.47	5.74	1.29
Average	8.29	6.27	9.86	12.62	5.76	1.30
Tokyo	7.45	8.38	10.26	14.20	6.80	2.28
	7.69	8.54	10.37	14.28	6.78	2.32
Average	7.57	8.46	10.32	14.24	6.79	2.30
Buenos Aires	8.18	7.41	11.77	15.01	7.82	2.79
	8.63	7.71	12.05	15.35	7.86	2.92
Average	8.41	7.56	11.91	15.18	7.84	2.86
Rio de Janeiro	lost	10.68	12.27	16.00	10.38	7.92
	lost	10.85	12.86	17.71	10.58	7.87
Average		10.77	12.57	16.86	10.48	7.90
Cave Control	2.28	2.11	2.71	2.37	2.07	0.25
	——	2.13	2.75	2.31	2.15	0.21
Average	2.28	2.12	2.73	2.34	2.11	0.26
Home Control (Oakland, Ca)	3.95	4.45	6.32	8.07	4.22	1.44
	——	4.52	7.53	7.15	lost	1.47
Average	3.95	4.49	6.93	7.61	4.22	1.46

Table IV. β- γ Films (^{226}Ra mr)

The doses shown are the excess dose above the pre-irradiated dose per individual film. Each film has been on three round trips. It should be noted that the averages were taken after excluding the 100 mr exposed films, which apparently had experienced fading.

		0	0	20	40	100	Average/trip**
Washington	#A	29	30	30	30	17	10.0
	#B	40		36	31	—	11.8
Tokyo	#A	30	29	26	30	13	9.8
	#B	41		38	32		12.3
Buenos Aires	#A	31	32	30	31	17	10.3
	#B	43		39	35		13.0
Rio de Janeiro	#A	39	36	31	30	8	11.3
	#B	36		30	26		10.2
	#C	54		50	40		16.0
Cave Control	#A	3.5	3.5	4.5	9	-13	1.7
	#B	4		2	0		0.7
	#C	12		13	0		2.8
Home Controls							
	#A (cold)	11.0	11.5	14.5	20.5	- 1	
	#A(shelf)	24.0	24.0	19.0	22.0	13	
Average		17.5	17.8	16.8	21.3	7	6.0
	#B(cold)	30		29	26		
	#B(shelf)	30		26	22		
Average		30		27.5	24		9.1

*Control for Rio de Janeiro flight #B

**The 100 mr column is not included in the average.

Table V(A). Average dose/trip

The doses shown are the average doses/trip above the background at Oakland, California. The values are secured, except as noted in the post note, by subtracting the Oakland, California values from the flight values shown in Table I.

	TLD's (in Rad)						
Destination	#1	#2	#3	#4	#5*	#6*	Net/Ave.
Washington	4.34	1.78	2.93	5.01	3.22 (7/34)	0.72 (8/30)	3.00
Tokyo	3.62	3.97	3.39	6.63	4.00 (11/34)	1.60 (11/30)	3.87
Buenos Aires	4.46	3.07	4.98	7.57	4.55 (19/34)	1.60 (20/30)	4.37
Rio de Janeiro	——	6.28	5.64	9.25	6.76 (26/34)	6.64 (25/30)	6.91

*These sets of TLD's were handled differently from the first four sets. These TLD's were kept in the cave except when in the mail. The TLD's were 34 (#5) and 30 (#6) days between preparation and reading. The numerator of the fraction in parentheses in the number of days it was out of the cave. The dose above background for these sets is found by:

Dose = reported exposed dose minus cave dose
minus (fraction) (home dose-cave dose)

This process takes into account the time the packets were in the cave.

Table V (B). Average dose/trip

	β- γ Films (mr)			
	#A	#B	#C	Net/Ave.
Washington	4.0	2.7		3.4
Tokyo	3.8	3.2		3.5
Buenos Aires	4.3	3.9		4.1
Rio de Janeiro*	2.2	7.2	6.9	5.4

*Trip # A: Since these three trips took 46 days longer than the others, 140/94 times the home control dose was used to find the exposure over background.

Trip # B: These three trips had their own cave control, so a factor of 0.7/1.7 times the home control dose was used to find the exposure over background.

Table VI. Experimental and calculated equivalent doses received per round trip in conventional jet aircraft during average solar conditions between San Francisco and several cities.

San Francisco to:	Calculated Solar Average Conditions: Charged Particles	Neutrons	Total	Experimental: β-γ Film	TLD
London*	5.58	1.64	7.22	8.5	2.00
Washington	2.39	0.68	3.06	3.4	3.00
Tokyo	2.48	0.83	3.31	3.5	3.87
Buenos Aires	6.98	1.74	8.72	4.1	4.37
Rio de Janeiro	5.10	1.30	6.40	5.4	6.91

*There was at most an increase of 50% during a class M solar flare which occurred on May 30, 1970, between San Francisco and London.

The proton recoil emulsion was read using the random-walk method. Using this method, 1150 proton recoil tracks were measured in the emulsion, which is approximately 2 cm $\times$ 2 cm $\times$ 600μ in size. These data were then introduced into a computer program which determines the track-length energy. The number of tracks per energy interval $\Delta N/(P.\Delta E)$ was then plotted versus energy. From this a smooth proton spectrum was drawn.

The two peaks at the low end of the proton spectrum are produced by systematic effects. They are caused by nitrogen in the emulsion (a nth, p reaction on nitrogen) and alphas from thorium and radium impurities.

Points from the smooth proton spectrum are then introduced into another program which determines the neutron spectrum. (See Fig. 2.) A second plot of this neutron spectrum was made with a linear scale. (See Fig. 3.) Then, using the relations shown below

Analytic expressions for dose equivalent vs neutron energy

Energy range (MeV)	$n\text{-}cm^{-2}\text{-}sec^{-1}$ equivalent to 1 $mrem\text{-}h^{-1}$
$<10^{-2}$	232
10^{-2} - 10^{0}	$7.20\ E^{-3/4}$
10^{0} - 10^{1}	7.20
$>10^{-1}$	$12.8\ E^{-1/4}$

An integral rem dose was calculated for each energy interval. This rem spectrum was then plotted with the linear neutron spectrum for comparison. (See Fig. 3.)

Calculations

The calculations[2] were made by a code GREP originally programmed at the Boeing Aircraft Company by Stanley Curtis (now at the Lawrence Berkeley Laboratory) and modified by Douglas Wallace and Kalina Mamont-Cieśla for this work. This code calculates tissue doses due to galactic

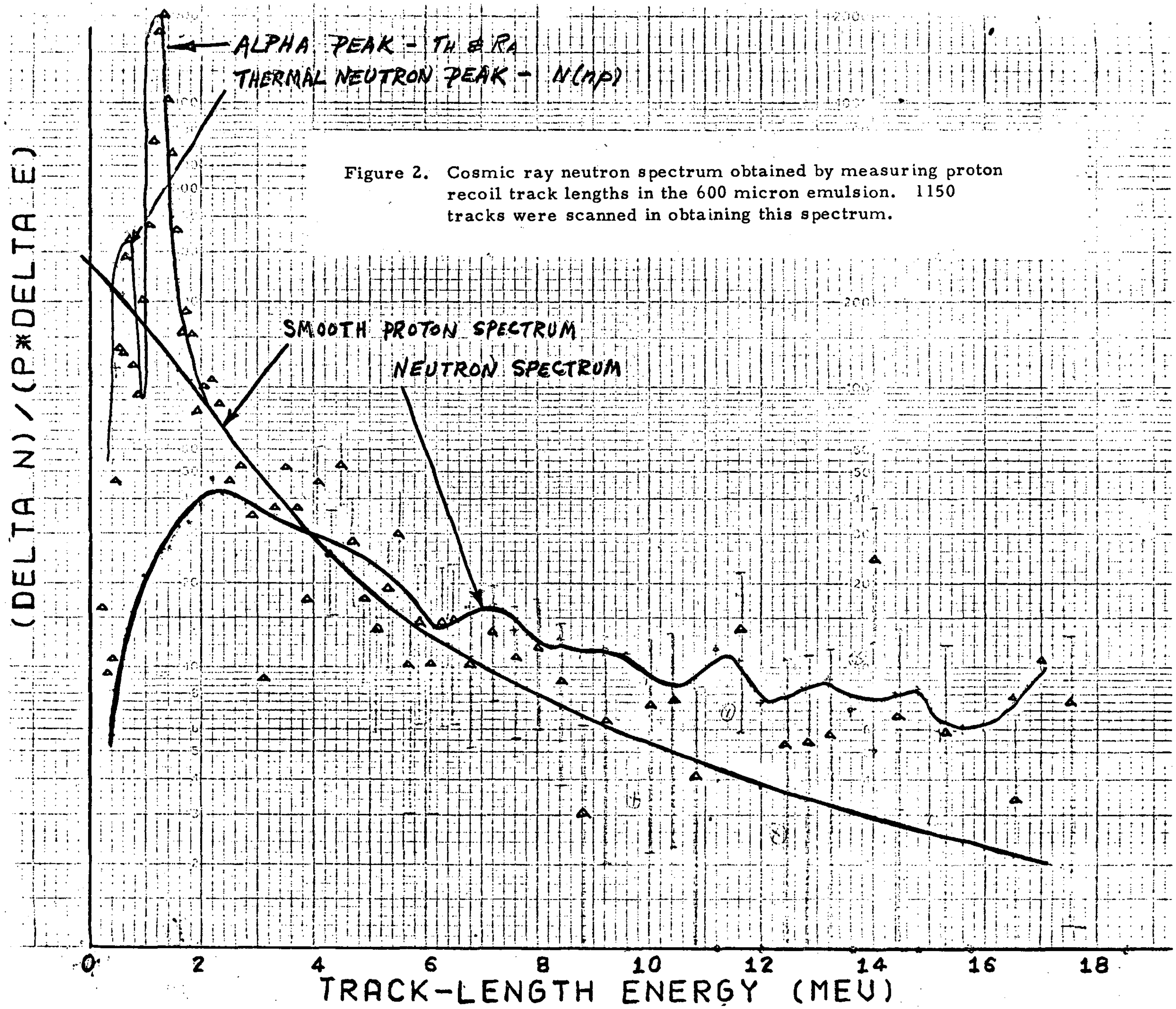

Figure 2. Cosmic ray neutron spectrum obtained by measuring proton recoil track lengths in the 600 micron emulsion. 1150 tracks were scanned in obtaining this spectrum.

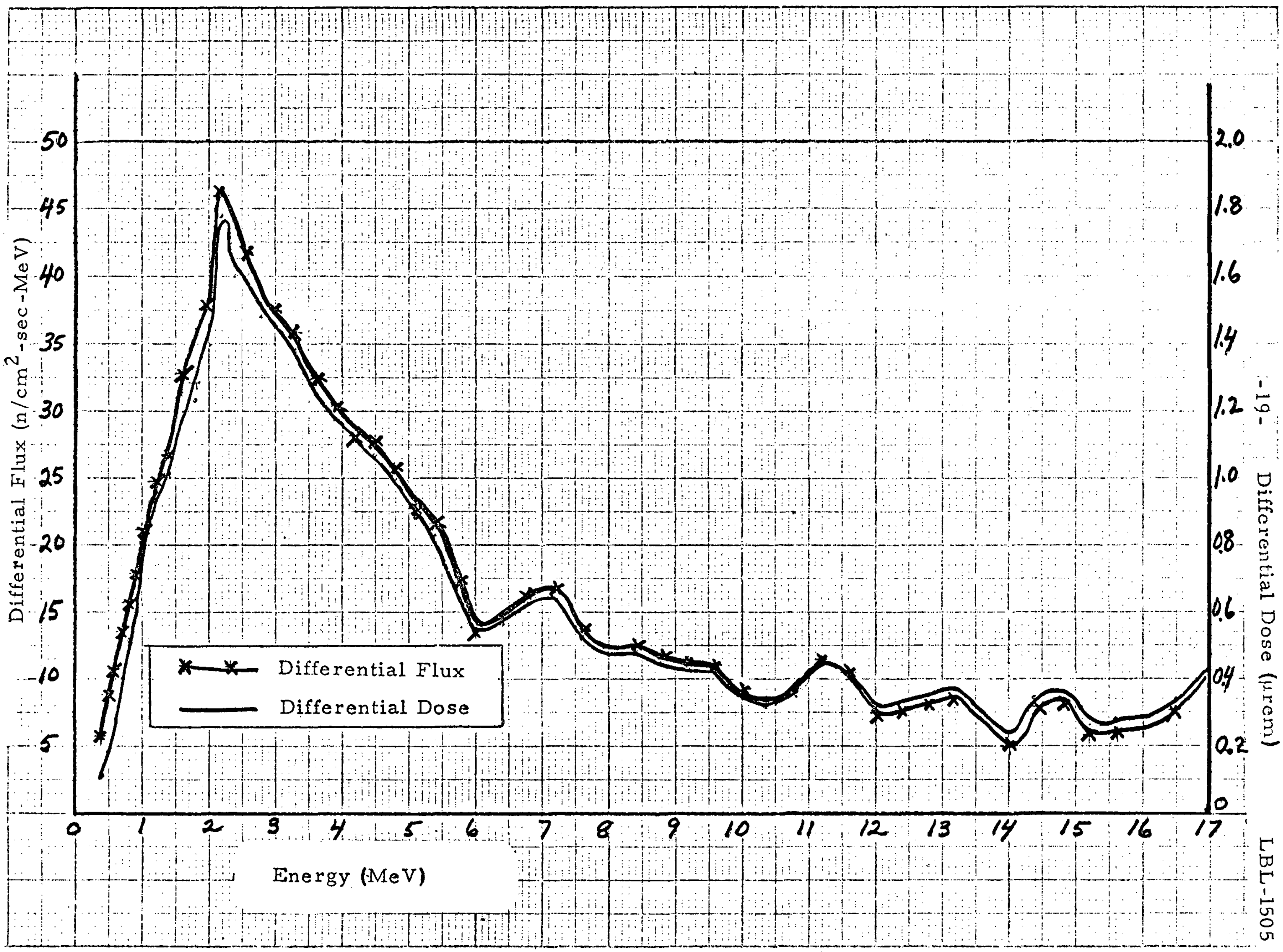
Differential Flux (n/cm2-sec-MeV)
Differential Dose (μrem)
Energy (MeV)
Differential Flux
Differential Dose
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
5
10
15
20
25
30
35
40
45
50
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

Figure 3

cosmic radiation during subsonic and supersonic flight for times of minimum solar activity and times of average solar activity.

In this calculation the input to the code, which is listed in the appendix, is the geographical coordinates of the cities, altitude-distance flight profiles, and block times. The program then changes the instantaneous geographic latitude and longitude of the plane to geomagnetic latitude and longitude and pressure altitude as it follows the aircraft on a great circle route. At 0.1 hour intervals, the ionization density, caused by charged particles in the atmosphere from basic cosmic ray data ion pairs formed in a cm^3 per sec of standard air, is converted to an equivalent tissue dose rate in mrads per hour with all the appropriate conditions taken into account. The ion pair data are entered in a table from which values are interpolated as needed. This dose rate is then integrated and accumulated over the entire flight.

Results

In particular, note in Table VII that the direct Los Angeles - Paris flight is 3.70 mrad/round trip for an SST under average solar conditions and that the same trip made by way of New York is 3.66 mrad/round trip. (1.28 + 2.38 = 3.66.) In general, while more southerly routes have lower hourly dose rates, the flight routes are longer and thus more time is spent in these lower dose rate regions (due to the larger area of the earth in the equatorial and temperate zones). Thus, there is a compensating effect which tends to make doses on polar flights almost the same as those on lower latitude flights.

There is a similar compensating effect of altitude which takes place as altitude is varied. Subsonic flight at 35,000 feet takes about three times as long as supersonic flight over the same route at 65,000 feet. Since the dose rate is about three times higher at 65,000 feet relative to 35,000 feet, these effects roughly cancel. As an example,

Table VII. Comparison of the subsonic and supersonic round trip doses computed by the GREP code. The dose is given in mrem obtained when flying between various city pairs under average solar conditions.

City Pair	Subsonic Flight - 35,000 ft. altitude	
	Block Time* (BT) hrs	mrad/round trip
Paris-Anchorage	9.45	4.07
Los Angeles-Paris	11.15	4.79
Anchorage-Hamburg	8.95	3.84
Chicago-Paris	8.35	3.56
New York-Paris	7.45	3.13
Montreal-Paris	7.05	2.94
New York-London	7.05	2.94
San Francisco-New York	5.45	2.07
Los Angeles-New York	5.25	1.92
Los Angeles-Washington	4.95	1.75
Los Angeles-Chicago	3.95	1.34
Sydney-Acapulco**	17.45	4.40

City Pair	Supersonic Flight 60-65,000 ft. altitude	
	Block Time (BT) hrs	mrad/round trip
Paris-Anchorage	3.25	3.16
Los Angeles-Paris	3.85	3.70
Anchorage-Hamburg	3.05	2.92
Chicago-Paris	2.85	2.64
New York-Paris	2.65	2.38
Montreal-Paris	2.45	2.17
New York-London	2.45	2.17
San Francisco-New York	2.05	1.44
Los Angeles-New York	1.95	1.28
Los Angeles-Washington	1.85	1.16
Los Angeles-Chicago	1.55	0.89
Sydney-Acapulco**	6.25	2.08

*Time in the air

**Two stopovers

note that the Los Angeles to Paris SST dose is 3.70 mrad and the subsonic dose is 4.79 mrad. In fact, the total doses for subsonic 35,000 feet flights are between 25 and 100% higher than for flights at 65,000 feet, the supersonic altitude range. These increased doses in subsonic flight will undoubtedly be experienced by far more people than will experience the reduced doses associated with supersonic flights.

References

1. Michael Boyer, A Measurement of Cosmic Radiation Dose: Jet Aircraft to Polar Route, San Francisco to London, August, 1970. (M.S. Thesis.) Lawrence Berkeley Laboratory report, UCRL-20052.
2. City Pair Dose Calculations, Boeing Document D6 A11467-1.

```
****
      C****
      C****
      C****
            PROGRAM ACRE(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT)
      C****
      C**** ACRE--AIR CRAFT RADIATION EXPOSURE
      C****
            DIMENSION ALTTAB(300),DTAB(300),LTAB(11),TALTAB(15),
           1LNTTAB(18),FTAB(18),IPTAB(11,15),SOLRAT(11,15), NFTAB(11,15),
           2LAMBDA(300),XI(300,3),          TALT(300), IDOSE(300,2),
           3XDOSE(300,4) ,  SPEED(3),NDOSE(300,2),XDOSEN(300,4),TDOSE(300,2),
           4ALAT(2), PRBNM(2,2),AIRPORT( 800,8) ,ALONG(2),TXDOSE(300,4)
            REAL LAT1,LAT2,LONG1,LONG2,LAT,LNTALT,IDOSE,IPAIRS,FLUXN,NDOSE,
           1LAMBDA,LONG
            INTEGER CDPRNM, IRPORT ( 800,8), DIFER
            EQUIVALENCE (IRPORT,AIRPORT)
      C****
      C**** READ IN FIXED DATA TABLES, THESE ARE THE SAME FOR ALL PROBLEMS.
      C**** IPTAB (11,15) ARRAY OF ION PAIRS/CM**3/SEC AS A FUNCTION OF GEOMAG-
      C**** NETIC LATITUDE AND AIR DEPTH
      C**** SOLRAT(11,15) ARRAY OF ADJUSTMENT RATIOS AS  A FUNCTION OF GEOMAG-
      C**** NETIC LATITUDE AND AIR DEPTH.THESE FACTORS CORRECT FROM SOLAR MINI-
      C**** MUM TO SOLAR AVERAGE CONDITIONS.
      C**** NFTAB (11,15) ARRAY OF NEUTRON FLUXES AS A  FUNCTION  OF GEOMAG-
      C**** NETIC LATITUDE AND AIR DEPTH
            READ   1000,((IPTAB(I,J),J=1,15),I=1,11)
  22        READ     1000,((SOLRAT(I,J),J=1,15),I=1,11)
  42        READ   1000,((NFTAB(I,J),J=1,15),I=1,11)
       1000 FORMAT (13F6.0,2X)
      C****
      C**** TALTAB(15) ARRAY OF AIR DEPTH VALUES (GM/CM**2)
      C**** LTAB  (11) ARRAY OF GEOMAGNETIC LATITUDES
      C**** LNTTAB(18) ARRAY OF LOGARITHMS OF THE MASS OF AIR OVERHEAD AT A-
      C**** GIVEN ALTITUDE IN FTAB
      C**** FTAB  (18) ARRAY OF ALTITUDES IN FEET
  62        READ   1010,(TALTAB(J),J=1,15)
  70        READ     1010, (LTAB(J),J=1,11)
  76        READ    1010, (LNTTAB(J),J=1,18)
 104        READ    1010, (FTAB(J),J=1,18)
       1010 FORMAT(8F10.0)
      C****
      C**** END OF FIXED DATA TABLES FOR COSMIC RAY FLUXES AND AIR PROPERTIES.
      C**** PRINT OUT THESE FIXED DATA TABLES.
 112        PRINT     1110, (TALTAB(J),J=1,15)
       1110 FORMAT(1H1,//,55X,34HAIR DEPTH TABLE (GM/CM**2) TALTAB.//
           2,24X,(15F7.0))
      C****
 120        PRINT    1090, ((LTAB(I) ,(IPTAB(I,J),J=1,15)),I=1,11)
       1090 FORMAT(//6X,*GEOMAGNETIC*,38X,46HION PAIR DATA (ION PAIRS / CM**3
           1/ SEC)  IPTAB,/
           2,6X,*LATITUDE*//
           3(6X,F5.0,13X,15F7.1//))
      C****
 144        PRINT    1111, (TALTAB(J),J=1,15)
       1111 FORMAT(1H1,//,55X,34HAIR DEPTH TABLE (GM/CM**2) TALTAB.//
           2,24X,(15F7.0))
```

APPENDIX

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****
        C****
 152          PRINT    1100, ((LTAB(I) ,(SOLRAT(I,J),J=1,15)),I=1,11)                     27
         1100 FORMAT(// ,6X,*GEOMAGNETIC*,18X,62HSOLAR AVERAGE ATMOSPHERIC CORRE          28
             2CTION FACTOR (GM/CM**2) SOLRAT./                                            29
             3,6X,*LATITUDE*//                                                            30
             4(6X,F5.0,13X,15F7.3/))                                                      31
 176          PRINT    1130, (LNTTAB(J),J=1,18)                                           32
         1130 FORMAT(//36X,*LOG OF AIR DEPTH VALUES  LNTTAB.*//(9F14.5/))                 33
        C****
 204          PRINT    1140, (FTAB(J),J=1,18)                                             34
         1140 FORMAT (//,36X,*ALTITUDE IN FEET  FTAB.*//(9F14.0/))                        35
        C****
 212          PRINT    1110, (TALTAB(J),J=1,15)                                           35A
        C****
 220          PRINT    1091, ((LTAB(I) ,(NFTAB(I,J),J=1,15)),I=1,11)                      35B
         1091 FORMAT(//6X,*GEOMAGNETIC*,38X,38HNEUTRON FLUX DATA (N/CM**2/SEC)            35C
             2NFTAB,/                                                                     35D
             3,6X,*LATITUDE*//                                                            35E
             4(6X,F5.0,13X,15F7.2/))                                                      35F
        C****
        C**** READ IN ALL AIRPORT DATA(4 ITEMS FOR EACH AIRPORT# CODE NAME,LAT,           36
        C**** LONG,FULL NAME) AND STORE IT IN MATRIX AIRPORT(K,M)                         36A
        C**** READ IN K=NUMBER OF AIRPORTS                                                36B
        C**** READ IN IND, THIS VARIABLE HAS A VALUE ZERO IF WE DO NOT WANT THE           36C
        C**** LIST OF AIRPORTS TO BE PRINTED AND  VALUE 1 IF WE DO                        36D
 244          READ     3010, K,IND                                                        37
         3010 FORMAT (2I5)                                                                37A
 254          IF (IND-1) 305,306,306                                                      38
 257      306 CONTINUE                                                               C306 38A
 257          WRITE (6,3005)                                                              39
         3005 FORMAT(1H1,//,35X,16HLIST OF AIRPORTS,///,4X,20HCODE NAME OF AIRPO          40
             2RT,5X,8HLATITUDE,5X,9HLONGITUDE,9X,7HAIRPORT,//)                            40A
 263      305 CONTINUE                                                                    41
        C**** THE GEOGRAPHIC LOCATION OF THE AIRPORTS IS ENTERED WITH THE WEATHER
        C**** STATION AIRPORT CODE OF THREE LETTERS IN THE FIRST THREE COLUMNS.
        C**** THE LATITUDE AND THE LONGITUDE EXPRESSED TO THE NEAREST DECIMAL HUNDREDTH
        C**** OF A DEGREE ARE ENTERED IN COLUMNS 11 - 20 AND 21 - 30 RESPECTIVELY. THIS
        C**** IS THEN FOLLOWED IN COLUMNS 31 - 80 BY THE NAME OF THE CITY AND THE
        C**** AIRPORT.
 263          DO 300 IK=1,K                                                          D 30042
 265          READ     3020, (AIRPORT (IK,IM),IM=1,8)                                     43
         3020 FORMAT ( A10, 2F10.2 , 5A10)                                                43A
 301          IF (IND-1) 300,310,310                                                      43B
 304      310 PRINT    3030,(AIRPORT(IK,IM),IM=1,8)                                       44
         3030 FORMAT( 11X,A6,13X,F7.2,7X,F7.2,8X,5A10)                                    44A
 321      300 CONTINUE                                                                    44B
        C****
        C****
        C**** INITIALIZE CONSTANTS                                                        45
 324        1 CONTINUE                                                               C 1  45A
 324          SNZT= SIN(11.5/57.2958)                                                     45B
 326          CNZT=COS(11.5/57.2958)                                                      45C
 331          XN = 1./14.1                                                                45D
 332          XK=.001924                                                                  46
        C**** RESET FLIGHT DOSAGE VALUES                                                  46A
 333          SOLMIN=0.                                                                   46B
```

```
****
      SOLAVE =0.                                                         46C
      IFLB=0                                                             46D
      SOLMINN = 0.                                                       46E
      SOLAVEN = 0.                                                       46F
C****
C**** RESET COUNTER OF READ IN CODE NAMES IN .IT WILL HAVE A VALUE 1 OR 2   47
      IN=0                                                               47A
C****READ IN MESSAGE ON THE FLIGHT                                       47E
      READ 1021,SPEED                                                    47F
 1021 FORMAT (3A10)                                                      47G
C**** CHECK TO SEE IF ALL PROBLEMS HAVE BEEN DONE. IF SO --EXIT. IF NOT   47H
C**** CONTINUE                                                           47I
C****
      IF (EOF,5) 999,2                                          B999/248
    2 CONTINUE                                                  C 2  48A
C**** READ IN  2 PROBLEM DATA CARDS  CDPRNM=CODE PROBLEM NAME AND FIND    49
C**** THEIR LAT, LONG AND FULL NAMES IN THE LIBRARY OF AIRPORTS          49A
  330 IN=IN+1                                                            50
      READ 3040, CDPRNM                                                  51
 3040 FORMAT (A6)                                                        52
C**** RESET INDEX LACK. LACK BECOMES 1 IF A PROBLEM CODE NAME HAS BEEN   52A
C**** FOUND IN THE LIBRARY OF AIRPORTS AND LEAVES ZERO IF NOT            52B
    3 LACK = 0                                                           52C
      DO 401  IK=1,K                                            D401 53
      IF (CDPRNM .NE. IRPORT(IK,1)) GO TO 401                            53A
      ALAT  (IN)= AIRPORT(IK,2)                                          53B
      ALONG (IN)= AIRPORT(IK,3)                                          53C
      PRBNM (IN,1)=AIRPORT(IK,4)                                         53D
      PRBNM (IN,2)=AIRPORT(IK,5)                                         53E
      LACK=1                                                             53F
      GO TO 340                                                 G340 53G
  401 CONTINUE                                                  C401 53H
C****
C****
  340 IF ( LACK-1 ) 402,345,345                                          54
  402 PRINT 1081, CDPRNM                                                 54A
 1081 FORMAT( 1H1,//,10X,A6, 37HIS MISSING IN THE LIBRARY OF AIRPORTS)   54B
      IF (IN-2) 403,404,1                                                54C
  403 READ 3040, CDPRNM                                                  54D
      IN = 3                                                             54E
  404 READ 1020, BLKTM,RTCLIMB,CRSALT,RTDSCNT, STARTRT, RTHRZTL,ENDRT     55
      IF ( IN .EQ. 3) GO TO 3                                            55A
      GO TO 1                                                            55B
  345 IF ( IN - 2 ) 330, 405, 1                                          55C
  405 PRINT 1080 ,   (PRBNM (1,J),J=1,2) ,(PRBNM(2,J),J=1,2),SPEED       55D
 1080 FORMAT(1H1,//     5A10,X, 2HTO, X,5A10,3A10,//)                    55E
C****
C****
      LAT1=ALAT(1)                                                       56
      LAT2=ALAT(2)                                                       56A
      LONG1=ALONG(1)                                                     56B
      LONG2=ALONG(2)                                                     56C
C****
C**** CALCULATE COURSE IN SPHERICAL GEOGRAPHIC GEOMETRY                   56D
      XLAT1=LAT1                                                         56E
      XLAT2= LAT2                                                        57
```

```
****
 507          LAT1=90.- LAT1                                                    57A
 510          LAT2 =90.-LAT2                                                    57B
 511          SNLAT1 = SIN(LAT1/57.2958)                                        57C
 515          CNLAT1=  COS(LAT1/57.2958)                                        57D
 521          SNLAT2 =SIN(LAT2/57.2958)                                         57E
 525          CNLAT2 = COS(LAT2/57.2958)                                        58
 531          CNLGDF = COS(ABS(LONG2- LONG1)/57.2958)                           58A
 537          COSA  =CNLAT1*CNLAT2+SNLAT1*SNLAT2*CNLGDF                         58B
 543          DIST = 3956.*ATAN(((1.-COSA  *COSA)  **.5)/COSA)                  58C
 556          SINC  =SNLAT2*(1.-CNLGDF*CNLGDF)**.5/((1.-COSA  *COSA)**.5)       58D
 570          COSC  =(CNLAT2-COSA  *CNLAT1)/((1.-COSA*COSA) **.5*SNLAT1)        58E
 577          CRSANG =57.2958*ATAN2(SINC  ,COSC  )                              59
        C****
 602          IF(LONG2-LONG1)12,53,53                                           59A
 605       12 CRSANG=360-CRSANG                                                 59B
 610       53 CONTINUE                                                          59C
        C**** GENERATE FLIGHT PROFILE ALTITUDE ARRAY ALTTAB(NDPS) AND DISTANCE  59D
        C**** ARRAY  DTAB(NDPS). NOTE  NDPS ≤ 300.                              59E
 610          READ    1020, BLKTM,RTCLIMB,CRSALT,RTDSCNT,STARTRT,RTHRZTL,ENDRT  60
         1020 FORMAT ( 7 F10.0)                                                 60A
        C****
        C**** BLKTM=THE BLOCK TIME IN THE AIR ON ONE WAY TRIP                   60B
        C**** RTCLIMB=RATE OF CLIMB IN FEET/MIN                                 60C
        C**** CRSALT=CRUISING ALTITUDE IN FEET                                  60D
        C**** RTDSCNT=RATE OF DESCENT IN FEET/MIN                               60E
        C**** STARTRT=CLIMBING GROUND SPEED IN MILES/HOUR                       61
        C**** RTHRZTL=CRUISING SPEED IN MILES/HOUR                              61A
        C**** ENDRT= DESCENDING GROUND SPEED IN MILES/HOUR                      61B
        C****
 632          RLDATA = BLKTM*10.                                                61C
 634          NDPS = IFIX(RLDATA+ 0.00001)                                      61D
 636      104 CONTINUE                                                          61E
 636          RLDATDS=RLDATA-CRSALT/RTDSCNT/6.                                  62
 641          LDATADS= IFIX(RLDATDS+.001)                                       62A
 643          ALTTAB(1)=6.*RTCLIMB                                              62B
 645          DTAB(1) =     STARTRT/10.                                         62C
        C****
 647          DO 2040 I=2,NDPS                                            D2040620
 651          IF((ALTTAB(I-1)+.01    )-CRSALT) 2010,2020,2020                   62E
 655     2010 IF (I-LDATADS)2025,2025,2030                                      63
 661     2025 ALTTAB(I)=6.*RTCLIMB + ALTTAB(I-1)                                63A
 664          DTAB(I) =     STARTRT/10.                                         63B
 666          GO TO 2040                                                  G204063C
 670     2030 ALTTAB(I)=ALTTAB(I-1)-6.*RTCLIMB                                  63D
 673          DTAB(I) =     ENDRT /10.                                          63E
 675          GO TO 2040                                                  G204064
 676     2020 IF (I-LDATADS) 2026,2026,2030                                     64A
 702     2026 ALTTAB(I)=CRSALT                                                  64B
 703          DTAB(I) =     RTHRZTL/10.                                         64C
 706     2040 CONTINUE                                                    C204064D
 711          ALTTAB(NDPS) =0.                                                  64E
        C****
 712          PDIST =0.                                                         65
 713          DO 10 M=1,NDPS                                              D 10 65A
 720          PDIST =PDIST+ DTAB(M)                                             65B
 721       10 CONTINUE                                                    C 10 65C
```

```
****
      C****
      C**** COMPARE THE GREAT CIRCLE DITANCE DIST WITH THE DISTANCE PDIST CAL-       66
      C**** CULATED AS A SUM OF GENERATED DISTANCES TRAVELLED PER 0.1 HOUR           66A
      C**** INCREMENT  AND CORRECT THE READ IN SCHEDULE VALUE OF BLKTM TO BLK        66B
      C**** IF NECESSARY.                                                            66C
 722          DIF = (DIST - PDIST ) /(RTHRZTL /10. )                                 66D
 726          IF (ABS(DIF) .LT. 1.) GO TO  102                                       66E
 731          DIFER = IFIX ( DIF )                                                   66F
 732          IF ( DIFER - 0 ) 101, 102, 103                                         66G
 735      101 NDPS = NDPS + DIFER                                                    67
 736          RLDATA = FLOAT ( NDPS )                                                67A
 737          GO TO 104                                                         G 10467B
 741      103 NDPS = NDPS - DIFER                                                    67C
 742          RLDATA = FLOAT ( NDPS)                                                 67D
 743          GO TO 104                                                              67E
 744      102 CONTINUE                                                               68
 744          PRINT 1180,     BLKTM,RTCLIMB,CRSALT,RTDSCNT,STARTRT,RTHRZTL,ENDRT     68A
         1180 FORMAT(1H0,47X,36HSCHEDULE BLOCK TIME ON ONE WAY(HRS)=,F10.1//         68B
             224HRATE OF CLIMB(FEET/MIN)=,F10.3,9X,24HCRUISING ALTITUDE(FEET)=,      68C
             3 F10.0, 4X,26HRATE OF DESCENT(FEET/MIN)=,F10.3//34HCLIMBING GROUN      68D
             4 SPEED(MILES/HOUR)=,F6.2,3X,27HCRUISING SPEED(MILES/HOUR)=,F7.2,4X     68E
             7::58+FG FG):.)I 1-OWNE  UP::E (O-N:UT:-QWZ: ≤*F8.)*TT)                 ')H
      C****
 766          PRINT 1150,     (ALTTAB(I),I=1,NDPS)                                   69
         1150 FORMAT (35X, 62HFLIGHT ALTITUDE AND DISTANCE PROFILE IN 1/10 HOUR      70
             1INCREMENTS.  // 4X,                                                    71
             2  8HALTITUDE //( 8F10.0 ))                                             72
 775          PRINT    1160, (DTAB(I),I=1,NDPS)                                      73
         1160 FORMAT (1H0, 3X, 8HDISTANCE/ / ( 8F10.2 )                              74
1004          BLK = RLDATA / 10.                                                     75
1006          PRINT  1170, PDIST , BLK                                               76
         1170 FORMAT (1H0, 3X, 30HTOTAL INPUT PROFILE DISTANCE = ,F10.2,             77
             12X,13HSTATUTE MILES // 4X, 19HFLIGHT PROFILE TIME,  10X, 1H=,F10.2     78
             2,2X,C 16HHOURS IN THE AIR   )                                          79
      C**** PRINT OUT GREAT CIRCLE PATH VALUES.                                      103
1016          PRINT  1050,    DIST,CRSANG,XLAT1,LONG1,XLAT2,LONG2                    104
         1050 FORMAT (1H1,2X,37HCOMPUTED GREAT CIRCLE LEG DISTANCE = ,F10.1,5X,      105
             127HTHE INITIAL COURSE ANGLE = ,F10.3//                                 106
             23X,21HLEG START LATITUDE = ,F7.2,5X,22HLEG START LONGITUDE = ,         107
             3F7.2//3X,18HLEG END LATITUDE = ,3X,                                    108
             4 F7.2,5X,19HLEG END LONGITUDE =,3X,F7.2 )                              109
      C****
1036          SUMX=0.0                                                               110
1037          DO 100 I = 1 , NDPS                                               D 100112
1041          IFLB = IFLB+1                                                          113
      C**** CALCULATE LAT.+LONG. OF FLIGHT PATH INCREMENTS IN GEOGRAPHIC COORDS      114
      C**** NOTE THAT THE MIDPOINT OF THE 0.1 HOUR INTERVAL IS USED TO COMPUTE       115
      C**** POSITION AND DOSE.                                                       116
1042          IF (IFLB .GT. 1) GO TO 15                                         B 15 117
1045          X= 0.5 *DTAB(IFLB)                                                     118
1047          GO TO 20                                                          G 20 119
1047       15 X= 0.5*(DTAB(IFLB)+DTAB(IFLB-1))                                       120
1053       20 CONTINUE                                                          C 20 121
1053          SUMX=SUMX+X                                                            122
      C**** THE RADIUS OF THE EARTH IS 3956 STATUTE MILES.                           122A
1055          COSL2  =COS(SUMX/3956.)*CNLAT1+SIN(SUMX/3956.)*SNLAT1*COSC             123
```

```
 ****
  1070        SINA  =SIN(SUMX/3956.)*SINC  /(1.-COSL2  *COSL2  )**.5                  124
  1103        COSNA  =(COS(SUMX/3956.)-CNLAT1*COSL2) /(SNLAT1*(1.-COSL2  *COSL2        125
             1)**.5)                                                                   126
        C**** DETERMINE DIRECTION OF TRAVEL IN ORDER TO GET NEW LONGITUDE.             127
  1120        IF  (LONG2 - LONG1) 30,35,35                                      B 303535
  1123     30 CONTINUE                                                          C 30 129
  1123        LONG = LONG1 - ATAN2(SINA  ,COSNA) *57.2958                              130
  1130        GO TO 40                                                          G 40 131
  1131     35 CONTINUE                                                          C 35 132
  1131        LONG = LONG1 + ATAN2(SINA  ,COSNA  )*57.2958                             133
  1136     40 CONTINUE                                                          C 40 134
  1136        LAT = ATAN2((1. - COSL2  *COSL2  )**.5,COSL2  )*57.2958                  135
  1147        LAT = 90. - LAT                                                          136
        C**** COMPUTE THE NEW PRESENT POSITION COURSE ANGLE. THE DESTINATION FOR      136A
        C**** EACH CALCUAATION IS STILL THE AIRPORT AT LAT2 AND LONG2 READ BY         136B
        C**** CARD NO. 86. THE CURRENT POSITION LATITUDES, LONGITUDES AND COURSE      136C
        C**** ANGLES ARE STORED IN THE XI(300,3) MATRIX.                              136D
  1151        LAT1 = LAT                                                              136E
  1151        LAT2 = LAT2                                                             136F
  1153        SNLAT11= SIN(LAT1/57.2958)                                              136G
  1156        CNLAT11= COS(LAT1/57.2958)                                              136H
  1162        SNLAT22=SIN(LAT2/57.2958)                                               136I
  1166        CNLAT22= COS(LAT2/57.2958)                                              136J
  1172        CNLGDFF= COS(ABS(LONG2- LONG)/57.2958)                                  136K
  1200        COSAA =CNLAT11*CNLAT22+SNLAT11*SNLAT22*CNLGDFF                          136L
  1204        DISTT= 3956.*ATAN(((1.-COSAA *COSAA) **.5)/COSAA)                       136M
  1217        SINCC=SNLAT22*(1.-CNLGDFF*CNLGDFF)**.5/((1.-COSAA*COSAA)**.5)           136N
  1231        COSCC=(CNLAT22-COSAA*CNLAT11)/((1.-COSAA*COSAA)**.5*SNLAT11)            136O
  1240        CRSANG =57.2958*ATAN2(SINCC ,COSCC )                                    136P
  1243        IF(LONG2-LONG)42,43,43                                                 136P1
  1246     42 CRSANG=360-CRSANG                                                      136P2
        C**** COMPUTE ABSOLUTE VALUE OF THE GEOMAGNETIC LATITUDE.  THIS ASSUMES       136Q
        C**** THE SOUTH MAGNETIC POLE IS LOCATED IN THE NORTHERN HEMISPHERE NEAR THE 137
        C**** NORTH GEOGRAPHIC POLE AT LATITUDE 78.5 NORTH AND LONGITUDE 68.9 WEST. 137A
        C**** THE SOUTHERN GEOMAGNETIC HEMISPHERS IS SYMMETRICAL TO THE NORTHERN GEO-138
        C**** MAGNETIC HEMISPHERE.                                                     139
  1251     43 Z = COS(LAT/57.2958)*SNZT*COS((LONG + 68.9)/57.2958) + SIN(LAT/          140
             1   57.2958)*CNZT                                                         141
  1272        LAMBDA(I) = 57.2958*ABS(ATAN(Z/(1. - Z*Z)**.5))                          142
  1305        XI(I,1) = LAT                                                            143
  1307        XI(I,2) = LONG                                                           144
  1310        XI(I,3)= CRSANG                                                         144A
        C**** CONVERT FLIGHT PATH ALTITUDE FOR THIS INCREMENT TO MASS OF AIR OVERHEAD.
  1312        IF (IFLB .GT. 1) GO TO 45                                         B 45 146
  1315        ALT = 0.5*ALTTAB(IFLB)                                                   147
  1317        GO TO 50                                                                 148
  1317     45 ALT = 0.5*(ALTTAB(IFLB) + ALTTAB(IFLB-1))                                149
  1323     50 CONTINUE                                                          C 50 150
  1323        LNTALT = TBLU1(ALT, FTAB, LNTTAB, 1, 18)                                 151
  1327        TALT(I) = EXP(LNTALT)                                                    152
        C**** LOOK UP THE NO. OF ION PAIRS FOR THIS GEOMAG. LAT. + ALTITUDE.           153
  1333        IPAIRS = TBLU2(LAMBDA(I),TALT(I),LTAB,TALTAB,IPTAB,1,1,11,15,11,15       154
             1)                                                                        155
        C**** LOOK UP THE NEUTRON FLUX     FOR THIS GEOMAG. LAT. + ALTITUDE.          155A
  1346        FLUXN  = TBLU2(LAMBDA(I),TALT(I),LTAB,TALTAB,NFTAB,1,1,11,15,11,15      155B
             1)                                                                       155C
```

```
****
      C**** CONVERT TO MILLIRADS/HOUR                                          156
      C**** IDOSE(NDPS,K) ARRAY OF INCREMENTAL  DOSE RATES FROM CHARGED PAR-   156A
      C**** TICLES AND GAMMA RAY                                               156B
      C**** NDOSE(NDPS,K) ARRAY OF INCREMENTAL DOSE RATES FROM NEUTRONS        156C
      C**** TDOSE(NDPS,K) ARRAY OF INCREMENTAL TOTAL DOSE RATES                156D
      C**** K=1 CORRESPONDS TO THE SOLAR MINIMUM CONDITION                     156E
      C**** K=2 CORRESPONDS TO THE SOLAR AVERAGE  CONDITION                    156F
 1364         IDOSE(I,1) = IPAIRS*XK                                           157
 1365         NDOSE (I,1) = FLUXN*XN                                           157A
 1367         TDOSE (I,1) = IDOSE (I,1) + NDOSE (I,1)                          157B
      C**** COMPUTE INCREMENT AND CUMULATIVE DOSE IN MILLIRADS IN ARRAYS-      158
      C**** XDOSE (NDPS,J) FOR CHARGED PARTICLES AND GAMMA RAYS                158A
      C**** XDOSEN(NDPS,J) FOR NEUTRONS                                        158B
      C**** TXDOSE(NDPS,J) FOR TOTAL                                           158C
      C**** J=1 CORRESPONDS TO INCREMENTAL DOSE FOR THE SOLAR MINIMUM CONDITION 158D
      C**** J=2 CORRESPONDS TO CUMULATIVE DOSE FOR THE SOLAR MINIM. CONDITION  158E
      C**** J=3 CORRESPONDS TO INCREMENTAL DOSE FOR THE SOLAR AVER. CONDITION  158F
      C**** J=4 CORRESPONDS TO CUMULATIVE DOSE FOR THE SOLAR AVER. CONDITION   158G
 1371         XDOSE(I,1) = IDOSE (I,1)*0.1                                     159
 1372         XDOSEN(I,1) = NDOSE(I,1) * 0.1                                   159A
 1374         TXDOSE(I,1) = XDOSE (I,1) + XDOSEN(I,1)                          159B
 1376         IF (I .GT.1) GO TO 80                                       B 80 160
 1402         XDOSE (I,2) = XDOSE(I,1)                                         161
 1403         XDOSEN(I,2) = XDOSEN(I,1)                                        161A
 1404         TXDOSE (I,2) = TXDOSE (I,1)                                      161B
 1406         GO TO 85                                                    G 85 162
 1407      80 CONTINUE                                                    C 80 163
 1411         XDOSE (I,2) = XDOSE (I,1) + XDOSE (I-1,2)                        164
 1412         XDOSEN(I,2) = XDOSEN(I,1) + XDOSEN(I-1,2)                        164A
 1415         TXDOSE(I,2) = XDOSEN(I,2) + XDOSE (I,2)                          164B
 1417      85 CONTINUE                                                    C 85 165
      C**** COMPUTE SOLAR AVERAGE MILLIRAD/HOUR DOSE                           166
 1417         RATIO=TBLU2(LAMBDA(I),TALT(I),LTAB,TALTAB,SOLRAT,1,1,11,15,11,15) 167
 1435         IDOSE(I,2) = IDOSE(I,1)*RATIO                                    168
 1436         NDOSE(I,2) = NDOSE(I,1)*RATIO                                    168A
 1440         TDOSE(I,2) = TDOSE(I,1)*RATIO                                    168B
      C**** COMPUTE INCREMENT AND CUMULATIVE DOSE IN MILLIRADS                 169
 1441         XDOSE (I,3) = IDOSE(I,2)*0.1                                     180
 1443         XDOSEN(I,3) = NDOSE(I,2)*0.1                                     180A
 1445         TXDOSE(I,3) = XDOSE (I,3) + XDOSEN(I,3)                          180B
 1447         IF (I.GT.1) GO TO 90                                        B 90 181
 1454         XDOSE (I,4) = XDOSE (I,3)                                        182
 1455         XDOSEN(I,4) = XDOSEN(I,3)                                        182A
 1457         TXDOSE (I,4) = XDOSE (I,4) + XDOSEN(I,4)                         182B
 1461         GO TO 95                                                    G 95 183
 1461      90 CONTINUE                                                    C 90 184
 1463         XDOSE(I,4) = XDOSE(I,3) + XDOSE(I-1,4)                           185
 1464         XDOSEN(I,4) = XDOSEN(I,3) + XDOSEN(I-1,4)                        185A
 1467         TXDOSE(I,4) = XDOSE (I,4) + XDOSEN(I,4)                          185B
 1471      95 CONTINUE                                                    C 95 186
 1471     100 CONTINUE                                                    C 100187
      C****
      C**** PRINT OUT LEG INCREMENT RESULTS                                    188
      C****
      C****
 1474         PRINT    1060, ((XI(I,1),XI(I,2),XI(I,3),LAMBDA(I),TALT(I),      189
```

```
****
            1IDOSE(I,1),IDOSE (I,2), NDOSE (I,1), NDOSE (I,2), TDOSE (I,1),        189A
            2TDOSE (I,2)),I=1, NDPS)                                               190
       1060  FORMAT (1H0,2X,4HLAT.,4X,5HLONG.,3X,6HCOURSE,3X,7HGEOMAG.,3X,        191
            16HATMOS.,3X, 27HCHARGED PARTICLES AND GAMMA,11X, 8HNEUTRONS,17X,     192
            215HTOTAL DOSE RATE,/,19X,5HANGLE,6X,4HLAT.,4X,5HDEPTH,7X,20HDOSE R    193
            3ATE (MREMS/HR),9X,20HDOSE RATE (MREMS/HR),9X,20HDOSE RATE (MREMS/HR   194
            4R),/,38X,6HGR/SQ.,3X, 10HSOLAR MIN.,5X,10HSOLAR AVG.,5X,10HSOLAR M    195
            5IN.,5X,                                                               195A
            6   10HSOLAR AVG.,4X,10HSOLAR MIN.,4X,10HSOLAR AVG.,/,40X,3HCM.,//     196
            7(1X,5(F7.2,2X),6(F8.6,7X)))                                           197
          C**** ACCUMULATE FLIGHT DOSE                                             198
          C**** SOLMIN,SOLMINN,SOLMINT - FLIGHT DOSE FROM CHARGED PARTICLES AND    198A
          C**** GAMMA RAYS , NEUTRONS , BOTH  FOR SOLAR MINIMUM CONDITIONS         198B
          C**** SOLAVE , SOLAVEN, SOLAVET - THE SAME FOR SOLAR AVERAGE CONDITIONS  198C
  1551         SOLMIN = SOLMIN + XDOSE (NDPS,2)                                    199
  1552         SOLAVE = SOLAVE + XDOSE ( NDPS,4)                                   200
  1554         SOLMINN= SOLMINN+ XDOSEN(NDPS,2)                                    200A
  1555         SOLAVEN= SOLAVEN+ XDOSEN( NDPS,4)                                   200B
  1557         SOLMINT = SOLMINN + SOLMIN                                          200C
  1560         SOLAVET = SOLAVEN + SOLAVE                                          200D
  1562      400 CONTINUE                                                         C 400201
          C**** CALCULATE THE AVERAGE DOSE PER FLIGHT PROFILE HOUR                 202
          C**** ADFHM, ADFHMN, ADFHMT - AVERAGE DOSE PER FLIGHT PROFILE HOUR FROM  202A
          C**** CHARGED PARTICLES AND GAMMA RAYS, NEUTRONS, BOTH  FOR SOLAR MINI-  202B
          C**** MUM CONDITIONS                                                     202C
          C**** ADFHA, ADFHAN, ADFHAT - THE SAME FOR SOLAR AVERAGE CONDITIONS      202D
  1564         ADFHM = SOLMIN/BLK                                                  203
  1565         ADFHA = SOLAVE/BLK                                                  204
  1567         ADFHMN = SOLMINN/BLK                                                204A
  1570         ADFHAN = SOLAVEN/BLK                                                204B
  1572         ADFHMT = ADFHM + ADFHMN                                             204C
  1573         ADFHAT = ADFHA + ADFHAN                                             204D
          C**** CALCULATE THE AVERAGE DOSE PER FLIGHT BLOCK TIME FOR 300 HRS.      205
          C**** ADBTM, ADBTMN, ADBTMT - AVERAGE DOSE PER BLOCK TIME HOUR FROM CHAR- 205A
          C**** GED PARTICLES AND GAMMA RAYS, NEUTRONS, BOTH  FOR SOLAR MINIMUM    205B
          C**** CONDITIONS                                                         205C
          C**** ADBTA, ADBTAN, ADBTAT - THE SAME FOR SOLAR AVERAGE CONDITIONS      205D
  1575         ADBTM = SOLMIN/(BLK   + 0.25)                                       206
  1577         ADBTA = SOLAVE/(BLK   + 0.25)                                       207
  1601         ADBTMN = SOLMINN/(BLK + 0.25)                                       208
  1602         ADBTAN = SOLAVEN/(BLK + 0.25)                                       209
  1604         ADBTMT = ADBTM + ADBTMN                                             210
  1605         ADBTAT = ADBTA + ADBTAN                                             211
          C****
  1610         PRINT  1070, SOLMIN,SOLMINN,SOLMINT, SOLAVE,SOLAVEN,SOLAVET,        212
            2ADFHM,ADFHMN,ADFHMT, ADFHA,ADFHAN,ADFHAT, ADBTM,ADBTMN,ADBTMT,        213
            3ADBTA,ADBTAN,ADBTAT                                                   214
       1070 FORMAT(1H1,//,49X,13HCHARGED PART.,5X,8HNEUTRONS,8X,5HTOTAL,/,        215
            249X,9HGAMMA RAY,//,                                                   215A
            3          1X,48HTOTAL FLIGHT DOSE FOR SOLAR MINIMUM CONDITIONS =, 3   215B
            AF13.5, 30H  MILLIREMS PER FLIGHT PROFILE  //  49H TOTAL FLIGHT DOS    216
            BE FOR SOLAR AVERAGE CONDITIONS = ,3F13.5,           30H  MILLIREM     217
            CS PER FLIGHT PROFILE  // 49H AVG. DOSE / FLIGHT PROFILE HOUR (SOLA    218
            DR MIN.)    = ,3F13.5, 20H  MILLIREMS PER HOUR // 49H AVG. DOSE / FL   219
            EIGHT PROFILE HOUR (SOLAR AVG.)   = ,3F13.5, 20H  MILLIREMS PER HOU    220
            FR // 49H AVG. DOSE / BLOCK TIME HOUR (SOLAR MINIMUM)    =,3F13.5,     221
```

```
****
          G31H  MILLIREMS / (BLOCK TIME) HOUR // 49H AVG. DOSE / BLOCK TIME H      222
          HOUR (SOLAR AVERAGE)     = ,3F13.5,32H  MILLIREMS / (BLOCK TIME) HOU      223
          IR,   //1X,   42HLEG BLOCK TIME = PROFILE TIME + 0.25 HOURS  )           224
      C****
      C**** SEE IF THERE IS ANOTHER PROBLEM. IF SO --PROCEED. IF NOT EXIT.         231
 1657       GO TO 1                                                          G 1  232
 1660   999 CALL EXIT                                                        E 999233
 1661       END                                                                   234
```

PROGRAM LENGTH INCLUDING I/O BUFFERS

40227

STATEMENT FUNCTION REFERENCES

LOCATION	GEN TAG	SYM TAG	REFERENCES

STATEMENT NUMBER REFERENCES

LOCATION	GEN TAG	SYM TAG	REFERENCES			
000325	L00137	1	000414	000450	000453	001660
000351	L00160	2	000453			
000360	L00164	3	000447			
000606	L00267	12	NONE			
001050	L00377	15	001044			
001054	L00400	20	001047			
001124	L00413	30	NONE			
001132	L00416	35	001123			
001137	L00420	40	001131			
001247	L00454	42	NONE			
001252	L00455	43	001246			
001320	L00474	45	001314			
001324	L00475	50	001317			
000611	L00270	53	000605			
001410	L00522	80	001400			
001420	L00525	85	001407			
001462	L00544	90	001452			
001472	L00547	95	001461			
001472	L00547	100	001461			
000735	L00337	101	NONE			
000745	L00345	102	000731	000733		
000741	L00342	103	000734			
000637	L00275	104	000740	000744		
000322	L00135	300	000304			
000264	L00117	305	000257			
000260	L00114	306	000256			
000305	L00130	310	000303			
000351	L00160	330	000453			
000401	L00202	340	000375			
000451	L00221	345	000402	000403		
001563	L00564	400	NONE			
000376	L00200	401	000364			
000404	L00203	402	NONE			
000415	L00207	403	NONE			

```
****
        C****
        C****
        C****
        C****
        C****
              FUNCTION TBLU2(X1,Y1,X,Y,F2,NDUM1,NDUM2,NX,NY,MX,MY)
        C****
        C**** LINEAR INTERPOLATION SUBROUTINE FOR 2 DIMENSIONAL NON-EQUALLY/
        C**** SPACED INTERVALS. USES BINARY SEARCH SUBROUTINE BAINS.
              DIMENSION         X(1),Y(1),F2(MX,MY)
        C**** OBTAIN NEAREST POINTS IN TABLE TO (X1,Y1).
              CALL BAINS(X,NX,X1,KX,K1X)                                 G
     21       CALL BAINS(Y,NY,Y1,KY,K1Y)                                 G
     31       TBLU2=            -0.
     32       IF(KX .EQ. 0)     GO TO 98                                 B 98
     37       IF(KY .EQ. 0)     GO TO 98                                 B 98
     40       IF(K1X .NE. 0)    GO TO 10                                 B 10
     41       FX1=              F2(KX,KY)
     45       IF(K1Y .EQ. 0)    GO TO 60                                 B 60
     47       FX2=              F2(KX,K1Y)
     52       GO TO 50
     53    10 CONTINUE                                                   C 10
     53       FX1=              F2(KX,KY)+(X1-X(KX))*(F2(K1X,KY)-F2(KX,KY))/
             $                  (X(K1X)-X(KX))
     74       IF(K1Y .EQ. 0)    GO TO 60                                 B 60
     75       FX2=              F2(KX,K1Y)+ (X1-X(KX))*(F2(K1X,K1Y)-F2(KX,K1Y))/
             $                  (X(K1X)-X(KX))
    116    50 CONTINUE                                                   C 50
    116       TBLU2=            FX1+(Y1-Y(KY))*(FX2-FX1)/(Y(K1Y)-Y(KY))
    126       RETURN                                                     R
    127    60 CONTINUE                                                   C 60
    127       TBLU2=            FX1
    131       RETURN                                                     R
    131    98 CONTINUE                                                   C 98
        C****
    131       PRINT 998,        X1,Y1
          998 FORMAT(*0$$$$$ ERROR EXIT FROM TBLU2, THE POINT (* F6.2, *,*,
             $   F6.2, *)*, 2X, *DOES NOT LIE WITHIN TABLE LIMITS*)
        C****
    146       RETURN                                                     R
    147       END                                                        E
```

SUBPROGRAM LENGTH

00226

STATEMENT FUNCTION REFERENCES

LOCATION	GEN TAG	SYM TAG	REFERENCES

STATEMENT NUMBER REFERENCES

LOCATION	GEN TAG	SYM TAG	REFERENCES
000054	L00037	10	000041

```
****
        C****
        C****
              FUNCTION TBLU1(X,XTAB,FTB,NDUM,NX)
        C****
        C**** LINEAR INTERPOLATION SUBROUTINE FOR 1-DIMENSIONAL NON-UNIFORM INTERVALS.
              DIMENSION XTAB(1),FTB(1)
        C**** OBTAIN VALUE CLOSEST TO X BY BINARY SEARCH.
              CALL BAINS(XTAB,NX,X,K,K1)                                  G
        C**** IF POINT OUTSDE TABLE, TAKE ERROR EXIT.
   12         TBLU1=           -0.
   13         IF(K .EQ. 0)     GO TO 99                                   B 99
   20         IF( K1 .NE. 0)   GO TO 10                                   B 10
        C**** POINT IS A TABLE VALUE.
   21         TBLU1=           FTB(K)
   22         RETURN                                                      R
   23      10 CONTINUE                                                    C 10
   23         TBLU1=           FTB(K)+(X-XTAB(K))*(FTB(K1)-FTB(K))/
             $                 (XTAB(K1)-XTAB(K))
   34         RETURN                                                      R
   34      99 CONTINUE                                                    C 99
        C****
   34         PRINT 999 ,      X
          999 FORMAT(*0$$$$ ERROR EXIT FROM TBLU1,  THE POINT X= *, F6.2,
             $   *DOES NOT LIE WITHIN TABLE LIMITS*)
        C****
   45         RETURN                                                      R
   47         END
```

SUBPROGRAM LENGTH

00105

STATEMENT FUNCTION REFERENCES

LOCATION	GEN TAG	SYM TAG	REFERENCES

STATEMENT NUMBER REFERENCES

LOCATION	GEN TAG	SYM TAG	REFERENCES
000024	L00022	10	000021
000035	L00024	99	000020
000056	C00004	999	000035

BLOCK NAMES AND LENGTHS

VARIABLE REFERENCES

LOCATION	GEN TAG	SYM TAG	REFERENCES			
000103	V00007	K	000010	000017	000024	
000104	V00010	K1	000011	000020	000025	
000102	V00006	TBLU1	000017	000022	000034	000046

START OF CONSTANTS-000052   TEMPS--000071   INDIRECTS-000101

```
****
        C****
        C****
              SUBROUTINE BAINS( SLIST, MM, Z, K ,K1)                        291
        C****
              DIMENSION SLIST(1)                                            292
        C**** SLIST=TABLE, WHICH MUST BE MONOTONICALLY INCREASING           293
        C**** OR MONOTONICALLY DECREASING                                   294
        C**** M= NUMBER OF ENTRIES IN SLIST                                 295
        C**** Z=VALUE TO BE FOUND IN TABLE                                  296
        C**** K=SUBSCRIPT OF VALUE IN TABLE NEAREST TO Z                    297
        C**** PROGRAM RETURNS K = 0 IF Z IF OFF TABLE.                      298
              M=MM                                                          299
   7          K1=             0                                             300
  10          L1=1                                                          301
  11          L2=M                                                          302
  12          K=1                                                           303
        C**** CHECK IF MONOTONICALLY DECREASING. IF SO, GO TO 50            304
  13          IF(SLIST(1) .GT. SLIST(2))  GO TO 50                    B 50 305
  17          IF(Z-SLIST(1)) 1,15,3                                   B 1,15,3
  21        3 K=M                                                           307
  22          IF(SLIST(M)-Z) 1,15,9                                   B 1,15,9
  25        9 K=M/2                                                         309
  26          IF(Z-SLIST(K)) 20, 15, 29                               B 201529
  31       20 L2=K                                                          312
  32          GO TO 23                                                G 23 313
  33       29 L1=K                                                          314
  34       23 IF(L2-L1-1) 1,14,25                                     B1,14,25
  37       25 M=L1+L2                                                       316
  41          GO TO 9                                                 G 9  317
  42       14 CONTINUE                                                C 14 318
  42          K=              L1                                            319
  43          IF(2.*Z .GT. (SLIST(L1) + SLIST(L2))) K=L2              B     320
  51          K1=             L2                                            321
  52          IF(K .EQ. L2)   K1=L1                                   B     322
  54          GO TO 15                                                G 15 323
  55        1 K = 0                                                         333
  56       15 RETURN                                                  R     334
        C**** PROCEDURE FOR MONOTONICALLY DECREASING SEQUENCE.              335
  57       50 CONTINUE                                                C 50 336
  57          IF(Z-SLIST(1))  55,15,1                                 B55,15,1
  61       55 CONTINUE                                                C 55 338
  61          K=              M                                             339
  62          IF(SLIST(M)-Z)  60,15,1                                 B701565
  65       60 CONTINUE                                                C60  341
  65          K=              M/2                                           342
  66          IF(Z-SLIST(K))  70,15,65                                B701565
  71       65 CONTINUE                                                C65  344
  71          L2=             K                                             345
  72          GO TO 80                                                G 80 346
  73       70 CONTINUE                                                C 70 347
  73          L1=K                                                          348
  74       80 CONTINUE                                                C80  349
  74          IF(L2-L1-1)     1,90,85                                 B1,90,85
  77       85 CONTINUE                                                C 85 351
  77          M=              L1+L2                                         352
 101          GO TO 60                                                G 60 353
```

AIR DEPTH TABLE (GM/CM**2) TALTAB.

ION PAIR DATA (ION PAIRS / CM**3 / SEC) IPTAB

GEOMAGNETIC LATITUDE	30	40	50	59	60	70	80	90	100	120	140	200	245	300	1034
88	445.0	430.0	414.0	401.5	399.0	383.0	366.0	349.0	332.0	298.0	266.0	181.0	136.0	95.0	11.4
81	445.0	430.0	414.0	401.5	399.0	383.0	366.0	349.0	332.0	298.0	266.0	181.0	136.0	95.0	11.4
65	444.0	430.0	414.0	401.5	399.0	383.0	368.0	349.0	332.0	298.0	266.0	181.0	136.0	95.0	11.3
56	411.8	404.3	394.4	384.0	382.0	369.0	354.8	339.4	325.0	292.3	261.5	181.0	136.0	95.0	11.2
53	325.0	333.0	340.0	335.8	335.0	330.0	312.5	308.0	300.0	285.0	264.0	181.0	134.0	95.0	11.1
50	300.0	305.0	310.0	306.0	305.0	300.0	290.0	285.0	280.0	255.0	230.0	173.0	126.0	95.0	11.0
40	185.0	195.0	208.0	208.0	208.0	208.0	208.0	208.0	208.0	195.0	185.0	135.0	103.0	75.0	10.6
30	127.6	137.0	145.0	149.0	150.2	153.8	155.8	156.0	154.6	149.7	142.2	111.3	87.0	66.6	10.4
20	85.0	92.0	98.0	99.0	100.0	102.0	105.0	107.0	110.0	108.0	105.0	80.0	77.0	60.0	10.0
10	70.0	75.0	82.0	84.0	85.0	89.0	93.6	95.0	100.0	98.0	95.0	60.0	68.8	50.0	10.0
0	66.3	73.8	80.0	83.5	84.8	88.5	91.1	92.6	93.5	93.4	90.5	75.0	62.3	48.0	10.0

AIR DEPTH TABLE (GM/CM**2) TALTAB.

SOLAR AVERAGE ATMOSPHERIC CORRECTION FACTOR (GM/CM**2) SOLRAT.

GEOMAGNETIC LATITUDE	30	40	50	59	60	70	80	90	100	120	140	200	245	300	1034
88	.750	.765	.780	.788	.790	.800	.810	.820	.830	.840	.850	.880	.895	.910	1.000
81	.751	.766	.782	.789	.790	.800	.810	.820	.830	.840	.850	.880	.895	.910	1.000
65	.755	.770	.785	.793	.794	.801	.811	.820	.830	.840	.851	.881	.896	.910	1.000
56	.774	.783	.795	.800	.801	.807	.816	.824	.832	.842	.852	.881	.897	.911	1.000
53	.786	.793	.803	.806	.807	.812	.820	.826	.834	.842	.853	.881	.897	.911	1.000
50	.801	.807	.815	.817	.817	.819	.826	.831	.838	.845	.855	.884	.898	.911	1.000
40	.897	.900	.904	.906	.906	.907	.910	.912	.914	.914	.916	.920	.926	.931	1.000
30	.936	.938	.941	.943	.943	.944	.946	.946	.948	.948	.949	.951	.951	.951	1.000
20	.959	.961	.962	.963	.963	.964	.966	.967	.968	.968	.968	.968	.968	.968	1.000
10	.969	.971	.972	.973	.973	.973	.975	.976	.976	.977	.978	.979	.979	.979	1.000
0	.974	.976	.977	.978	.978	.979	.980	.981	.982	.982	.983	.984	.984	.984	1.000

LOG OF AIR DEPTH VALUES LNTTAB.

6.94022	6.69827	6.44572	6.17794	5.89990	5.60212	5.29330	4.97673	4.67283
4.35157	4.03777	3.72810	3.41773	3.11352	2.81541	2.51770	2.21485	1.92279

ALTITUDE IN FEET FTAB.

0	6560	13100	19700	26200	32800	39400	45900	52500
59100	65600	72200	78700	85300	91900	98400	105000	112000

AIR DEPTH TABLE (GM/CM**2) TALTAB.

NEUTRON FLUX DATA (N/CM**2/SEC) NFTAB

GEOMAGNETIC LATITUDE	30	40	50	59	60	70	80	90	100	120	140	200	245	300	1034
88	5.66	4.65	4.06	3.68	3.63	3.30	3.04	2.79	2.54	2.28	2.03	1.44	1.10	.80	0.00
81	5.66	4.65	4.06	3.68	3.63	3.30	3.04	2.79	2.54	2.28	2.03	1.44	1.10	.80	0.00
65	5.66	4.65	4.06	3.68	3.63	3.30	3.04	2.79	2.54	2.28	2.03	1.44	1.10	.80	0.00
56	5.55	4.56	3.98	3.61	3.56	3.23	2.98	2.73	2.49	2.23	1.99	1.41	1.08	.78	0.00
53	5.38	4.42	3.86	3.50	3.45	3.13	2.89	2.65	2.41	2.17	1.93	1.37	1.05	.76	0.00
50	5.26	4.32	3.78	3.42	3.38	3.07	2.83	2.59	2.36	2.19	1.89	1.34	1.02	.74	0.00
40	4.02	3.30	2.88	2.61	2.58	2.34	2.16	1.98	1.80	1.62	1.44	1.02	.78	.57	0.00
30	2.66	2.19	1.91	1.73	1.71	1.55	1.43	1.31	1.19	1.07	.95	.68	.52	.38	0.00
20	1.92	1.58	1.38	1.25	1.23	1.12	1.03	.95	.86	.78	.69	.49	.37	.27	0.00
10	1.70	1.39	1.22	1.10	1.09	.99	.91	.84	.76	.68	.61	.43	.33	.24	0.00
0	1.53	1.26	1.10	.99	.98	.89	.82	.75	.69	.62	.55	.39	.30	.22	0.00

LIST OF AIRPORTS

CODE NAME OF AIRPORT	LATITUDE	LONGITUDE	AIRPORT
ABD	30.20	48.16	ABADAN, IRAN
ABQ	35.05	-106.40	ALBUQUERQUE, N. M., USA
ACA	16.51	-99.55	ACAPULCO, MEXICO
ACC	5.33	-.13	ACCRA, GHANA
ACE	28.57	-13.32	ARRECIFE, CANARY IS.
ADD	9.00	38.50	ADDIS ABEBA, ETHOPIA
ADL	-34.58	138.32	ADELAIDE, S. AUSTRALIA
AGA	30.26	-9.36	AGADIR, MOROCCO
AGP	34.43	-4.25	MALAGA, SPAIN
AGR	27.12	77.59	AGRA,INDIA
AJA	41.55	8.44	AJACCIO, CORSICA
AKL	-36.53	174.45	AUCKLAND, NEW ZEALAND
ALA	43.15	76.57	ALMA-ATA, USSR
ALG	36.42	3.08	ALGIERS, ALGERIA
AMA	35.13	-101.49	AMARILLO, TEXAS, USA
AMM	31.57	35.56	AMMAN, JORDAN
AMS	52.17	4.40	AMSTERDAM, NETHERLANDS
ANC	61.13	-149.53	ANCHORAGE, ALASKA, USA.
APW	-13.50	-171.44	APIA, W. SAMOA
ASU	-25.16	-57.40	ASUNCION, PARAGUAY
ATH	37.58	23.43	ATHENS, GREECE
ATL	33.45	-84.23	ATALANTA, GA., USA
AUH	23.37	58.35	ABU DAHABI, TRUCIAL OMAN (MUSCAT, MUSQAT)
AUS	30.16	-97.45	AUSTIN, TEX, USA
BAH	26.00	50.30	BAHRAIN IS., ARABIAN GULF
BAK	40.23	49.51	BAKU, USSR
BAL	39.11	-76.40	BALTIMORE, MD., USA
BCN	41.23	2.11	BARCELONA, SPAIN
BDA	32.20	-64.45	BERMUDA, ATLANTIC OCEAN
BDI	13.10	-59.32	BARBADOS, WEST INDIES
BEG	44.50	20.30	BELGRADE, YUGOSLAVIA
BER	52.31	13.24	BERLIN, GER. FED. REP.
BEY	33.49	35.30	BEIRUT, LEBANON
BGW	33.20	44.26	BAGHDAD, IRAQ
BHX	52.30	-1.50	BIRMINGHAM, ENGLAND
BHZ	-19.55	-43.56	BELO HORIZONTE, BRAZIL
BJD	47.30	19.05	BUDAPEST, HUNGARY
BMA	59.21	17.55	STOCKHOLM, SWEDEN-BROMMA ARPT
BNE	-27.27	153.11	BRISBANE-EAGLE FARM ARPT, QUEENS., AUSTRALIA
BOB	-16.30	-151.45	BORA-BORA, POLYNESIA
BOG	33.28	-95.13	BOGOTA, COLOMBIA
BOM	19.05	72.52	BOMBAY, INDIA-SANTA CRUZ ARPT
BOS	42.21	-71.04	BOSTON, MASS., USA
BPL	40.26	30.31	KIEV, USSR
BRH	50.54	4.30	BRUSSELS, BELGIUM
BRS	51.27	-2.35	BRISTOL, ENGLAND
BSL	47.33	7.25	BASEL, SWITZERLAND (BALE)
BTH	13.28	-16.39	BATHURST, GAMBIA
BTS	48.10	17.10	BRATISLAVA, CZECHOSLOVAKIA
BUE	-34.49	-58.32	BUENOS AIRES-EZEIZA AEROPUERTO, ARGENTINA
BUF	42.52	-76.43	BUFFALO, N.Y., USA
BUH	44.26	26.06	BUCHAREST, ROUMANIA
BUR	34.12	-118.18	BURBANK, CALIF., USA
BZV	-4.14	15.14	BRAZZAVILLE, CONGO REP.

CAI	30.08	31.24	CAIRO-INT. ARPT. ARAB REP. OF EGYPT
CAN	23.06	113.16	CANTON, CHINA (GUANGZHOO,ZHG)
CAS	33.39	-7.35	CASABLANCA, MOROCCO
CCU	44.50	-.34	CALCUTTA, INDIA
CHC	-43.42	172.38	CHRISTCHURCH, N.Z.
CIA	41.48	12.36	ROME-CIAMPINO ARPT, ITALY
CIT	34.08	-118.08	CALTECH
CMB	6.56	79.51	COLOMBO, CEYLON
CNS	-16.51	145.43	CAIRNS, QUEENS. AURTRALIA
COK	9.58	76.15	COCHIN, INDIA
CPH	55.40	12.35	COPENHAGEN
CPY	55.40	12.35	COPENHAGEN, DENMARK
CPT	-34.02	18.28	CAPETOWN-MALAN ARPT, REP. S. AFRICA
CSO	-34.52	-56.02	MONTEVIDEO-CARRASCO AEROPUERTO, URUGUAY
CUM	53.35	-64.27	CHURCHILL FALLS, NFLE., CANADA
CVG	39.06	84.31	CINCINNATI, OHIO, USA
CVQ	-24.53	113.40	CARNARVON, W. AUSTRALIA
DAC	23.43	90.25	DACCA, BANGLADESH
DAM	33.30	36.19	DAMASCUS-MEZZE ARPT, ARAB REP. OF SYRIA
DAR	12.23	130.44	DAR ES SALAAM, TANZANIA
DCA	42.19	-83.25	WASHINGTON DC-NATIONAL ARPT, USA
DEL	28.35	77.07	DELHI-PALAM INT. ARPT, INDIA
DEN	39.43	-105.01	DENVER, COLO., USA
DET	42.20	-83.03	DETROIT, MICH., USA
DHA	26.18	50.08	DHAHRAN, SAUDI ARABIA (AZ-ZAHRAN)
DKR	14.40	-17.26	DAKAR, SENEGAL
DLA	4.03	9.42	DOUALA, CAMEROON
DME	55.25	37.35	MOSCOW, USSR-DOMODEDOVO ARPT
DOH	25.17	51.32	DOHA (AD-DAWHAH) QATAR, ARABIA
DRW	-12.28	130.50	DARWIN, NT. AUSTRALIA.
DTT	42.13	-83.22	DETROIT-METROPOLITAN WAYNE CO. ARPT., MICH., USA
DTW	42.25	-83.01	DETROIT, MICH-METROPOLITAN APT
DUR	-19.55	30.56	DURBAN, REP OF S. AFRICA
DXB	25.18	55.18	DUBAI (DUBAYY), TRUCIAL OMAN
EBB	.19	32.25	KAMPALA, UGANDA (ENTEBBE)
ELD	61.14	-149.54	ELMENDORF, AFB, ALASKA, USA
ESB	39.56	32.52	ANKARA-ESENBOGA ARPT, TURKEY
EVN	40.10	44.31	EREVAN, ARMENIA, USSR (YEREVAN)
EZE	-34.49	-58.32	BUENOS AIRES-EZEIZA AEROPUERTO, ARGENTINA
FAI	64.51	-147.43	FAIRBANKS, ALASKA, USA.
FCO	41.46	12.13	ROME-LEONARDO DA VINCI DI FIUMICINO ARPT, ITALY
FIN	-6.35	147.50	FINSCHHAFEN, NEW GUINEA
FNC	32.38	-16.54	FUNCHAL, MADERIA IS.
FNG	39.00	125.47	PYONGYANG, N. KOREA
FRA	50.02	8.33	FRANKFURT, GERMAN FEDERAL REP.
KUL	3.09	101.43	KUALA LUMPUR, MALAYSIA
KWA	9.05	167.20	KWAJALEIN, MARSHALL IS.
KWI	29.30	47.45	KUWAIT, KUWAIT
LAD	-8.48	13.14	LUANDA, ANGOLA
LAP	24.10	-110.18	LAPAZ, MEXICO
LAS	36.11	-115.08	LAS VEGAS, NEV., USA
LAX	33.56	-118.24	LOS ANGELES-INTERNATIONAL ARPT, CALIF., USA
LBB	33.35	-101.51	LUBBOCK, TEXAS, USA
LBG	48.56	2.26	PARIS, FRANCE-LE BOURGET ARPT
LBZ	-29.55	30.56	DURBAN, REP. S. AFRICA
LGW	51.09	-.21	LONDON, ENGLAND-GATWICK ARPT
LHR	51.27	-.28	LONDON, ENGLAND-HEATHROW ARPT
LID	60.01	30.17	LENINGRAD, USSR (KOLOM'AGI APT)
LIH	21.59	-159.21	LIHUE, KAUAI HAWAII, USA
LIM	-12.03	-77.03	LIMA, PERU
LIN	45.27	9.16	MILAN, ITALY-FORLANINI-LINATE

LIS	38.43	-9.08	LISBON, PORTUGAL
LJU	46.03	14.31	LJUBLJANA, YUGOSLAVIA
LON	51.40	.15	LONDON
LOS	6.37	3.16	LAGOS-IKEJA ARPT, NIGERIA
LPA	28.06	15.24	LAS PALMAS, CANARY IS
LPB	-16.30	-68.09	LA PAZ, BOLIVIA
LPQ	19.52	102.08	LUANG PRABANG, LAOS
LUX	49.37	6.10	LUXEMBOURG, LUXEMBOURG (FINDEL)
MAA	11.00	78.15	MADRAS, INDIA
MAD	40.28	-3.34	MADRID, SPAIN (BARAJAS)
MBA	-4.03	39.40	MOMBASA, KENYA
MBJ	18.30	-77.55	MONTEGO BAY, JAMAICA
MCT	23.37	58.35	MUSCAT, OMAN (MASQAT)
MDL	22.00	96.05	MANDALAY, BURMA
MDY	28.13	-177.26	MIDWAY ISLAND, PACIFIC OCEAN
MEL	-37.49	144.58	MELBOURNE-TULLAMARINE ARPT, VIC., AUSTRALIA
MLW	6.18	-10.47	MONROVIA, LIBERIA
MMM	-77.50	166.25	MC MURDO, ANTARCTICA
MNL	14.34	121.01	MANILA-INT. ARPT, PHILIPPINES
MOW	55.45	37.42	MOSCOW
MSY	29.58	-90.07	NEW ORLEANS, LA., USA
MVD	-34.53	-56.11	MONTEVIDEO, URUGUAY
MWU	-22.16	166.27	NOUMEA, NEW CAL-MAGENTA ARPT
MXP	45.38	8.44	MILAN, ITALY-MALPENSA ARPT
MZT	23.13	-106.25	MAZATLAN, MEXICO
NAN	-17.48	177.25	NANDI, FIJI IS.
NAP	40.51	14.17	NAPLES, ITALY (NAPOLI)
NAS	25.05	-77.21	NASSAU, BAHAMAS
NAT	-5.47	-35.13	NATAL, BRAZIL
NBO	-1.17	36.49	NAIROBI, KENYA (ENTEBBE)
NCE	43.40	7.14	NICE, FRANCE (COTE D'AZUR)
NLK	-29.03	167.56	NORFOLK, IS. PACIFIC OCEAN
OAK	37.47	-122.13	OAKLAND, CALIF., USA
ODS	46.28	30.44	ODESSA, USSR
GHV	69.15	-53.33	GODHAVN, GREENLAND
GIG	-22.50	-43.15	RIO DE JANEIRO, BRAZIL (AEROPORTO DO GALEAO)
GUM	13.29	144.48	GUAM, MARIANAS (AGANA NAS)
GVA	46.13	6.09	GENEVA-MEYRIN
HAN	21.02	105.51	HANOI, N VIETNAM
HAV	23.08	-82.22	HAVANA, CUBA
HBA	-42.51	147.19	HOBART, TASMANIA
HEL	60.10	24.58	HELSINKI, FINLAND
HGS	8.30	-13.15	FREETOWN, SIERA LEONE
HIR	-9.27	159.57	HONIARA, GUADALCANAL, SOLOMON
HKG	22.20	114.12	HONG KONG, BR CROWN COLONY
HLZ	-37.47	175.17	HAMILTON, NEW ZEALAND
HNL	21.20	-157.55	HONOLULU, OAHU HAWAII, USA
HRK	50.00	36.15	KHARKOV, USSR
IAD	38.57	-77.27	WASHINGTON DC-DULLES INTERNATIONAL AIRPORT, USA
IAH	39.59	-95.27	HOUSTON (INTERCONTINENTAL APT) TEXAS, USA
IBZ	38.54	1.26	IBIZA, SPAIN
ICO	35.11	33.23	NICOSIA, CYPRUS
IEV	50.26	30.31	KIEV, USSR
IKT	52.16	104.20	IRKUTSK, USSR
IND	39.46	-86.09	INDIANAPOLIS, IND., USA
IPC	-27.08	-109.23	EASTER ISLAND, PACIFIC OCEAN
ISP	40.44	-73.13	ISLIP, N.Y., USA
IST	40.58	-8.49	ISTANBUL, TURKEY (HAVA ALANI)
ITO	19.43	-155.05	HILO, HAWAII, USA
IXM	9.56	78.08	MADURAI, INDIA
IYK	35.39	-117.49	INYOKERN, CALIF., USA
IZM	38.25	27.09	IZMIR, TURKEY

JBK	37.57	-122.28	BERKELEY, CALIF., USA
JED	24.38	46.43	RIYADH, SAUDI ARABIA, AR-RIYAD
JFK	40.38	-73.47	NEW YORK, NY-KENNEDY INT ARPT.
JKT	-6.10	106.48	DJAKARTA, JAVA, INDONESIA
JLT	50.26	30.31	KIEV, USSR-JULIANI ARPT,
JUN	58.20	-134.27	JUNEAU, ALASKA, USA
KBL	34.30	69.10	KABUL, AFGHANISTAN
KDH	31.32	65.30	KANDAHAR, AFGHANISTAN
KDI	-3.57	122.35	KENDARI, CELEBES, INDONESIA
KEF	64.02	-22.36	REYKJAVIK, ICE. KEFLAVIK ARPT.
KHI	24.51	67.02	KARACHI, W. PAKISTAN
KIE	-6.13	155.38	KIETA, BOUGAINVILLE SOLOMON IS
KIM	-28.43	24.46	KIMBERLEY, REP OF S AFRICA
KIN	18.00	-76.50	KINGSTON, JAMAICA
KNU	26.28	80.20	KANPUR, INDIA
KOA	21.24	-157.44	KONA, KAILUA, HAWAII, USA
KOI	58.59	-2.58	KIRKWALL, ORKNEY IS. SCOTLAND
KRK	50.03	19.58	KRAKOW, POLAND
KRN	67.51	20.16	KIRUNA, SWEDEN
KRT	15.36	32.32	KHARTOUM, SUDAN
KTM	17.42	85.20	KATMANDU, NEPAL
OGG	20.54	-156.26	KAHULUI, MAUI HAWAII, USA
OKA	26.22	127.45	OKINAWA, RYUKYU IS. (KADENA)
OKC	35.28	-97.32	OKLAHOMA CITY, OKLA., USA
OKD	43.30	141.21	SAPPORO, JAPAN (OKADAMA ARPT)
OMA	41.16	-95.57	OMAHA, NEB., USA
OME	64.30	-165.24	NOME, ALASKA, USA
OMS	55.00	73.24	OMSK, USSR
OPO	41.11	-8.36	OPORTO, PORTUGAL
ORD	41.59	-87.54	CHICAGO, ILL-OHARE ARPT, USA
ORY	48.45	2.24	PARIS, FRANCE-ORLY ARPT
OSA	34.47	135.26	OSAKA, JAPAN (KOKUSAI-KUKO)
OSL	59.55	10.45	OSLO, NORWAY
OTP	44.26	26.06	BUCHAREST, ROU-OTOPENI ARPT
OTZ	66.53	-162.39	KOTZEBUE, ALASKA, USA
OVB	55.02	82.55	NOVOSIBIRSK, USSR
PAP	18.32	-72.20	PORT AU PRINCE, HAITI
PAR	48.45	2.24	PARIS-ORLY ARPT, FRANCE
PDX	45.33	-122.36	PORTLAND, ORE., USA
PEK	38.47	116.23	PEKING, PEIPING, CHINA (NANYANGCHANG)
PER	-31.57	115.58	PERTH, W AUSTRALIA
PHL	39.53	-75.14	PHILADELPHIA, PA., USA
PHX	33.27	-112.05	PHOENIX, ARIZ., USA
PIK	55.30	-4.36	GLASGOW, SCOT-PRESTWICK ARPT
PLZ	-33.58	25.40	PORT ELIZABETH, REP. S. AFRICA
PNI	6.58	158.13	PONAPE, CAROLINES, PAC. OCEAN
POM	-9.30	147.10	PORT MORESBY, PAPUA, N GUINEA
PON	6.58	158.13	PONAPE, CAROLINES
POS	10.39	-61.31	PORT OF SPAIN, TRINIDAD
PPG	-14.16	-170.42	PAGO PAGO, SAMOA
PPT	-17.32	-149.34	PAPEETE, TAHITI, FR POLYNESIA
PRG	50.05	14.26	PRAGUE, CZECHOSLOVAKIA
PSA	43.43	10.23	PISA, ITALY
RAB	-4.13	152.11	RABAUL, NEW BRITAIN, N. GUINEA
RAK	31.49	-8.00	MARRAKECH, MOROCCO
RAR	-31.14	-159.46	RAROTONGA, COOK IS. S PACIFIC
RBA	34.02	-6.51	RABAT, MOROCCO
RFK	64.02	-22.36	REYKJAVIK, ICELAND
RGN	16.47	96.10	RANGOON, BURMA
RIO	-22.55	-43.10	RIO DE JANERIO, BRAZIL (SANTOS DUMONT ARPT)
RML	6.56	79.51	COLOMBO, CEYLON-RATMALANA
RND	-26.08	28.14	JOHANNESBURG, R S AFRICA (JAN SMUTS)

RNO	39.31	-119.48	RENO, NEV., USA
ROM	41.46	12.13	ROME, ITALY
SAF	35.42	-106.57	SANTA FE, N.M., USA
SAN	32.43	-117.09	SAN DIEGO, CALIF., USA
SAO	23.32	-46.37	SAO PAULO, BRAZIL
SAY	-17.50	31.03	SALISBURY, RHODESIA
SCL	-33.30	-70.40	SANTIAGO, CHILE
SDU	-22.55	-43.10	RIO DE JANERIO, BRAZIL (SANTOS DUMONT ARPT)
SEA	47.27	-122.18	SEATTLE-TACOMA INT. ARPT, WASHINGTON, USA
SEL	37.32	126.56	SEOUL, REP OF KOREA
SEZ	-4.35	55.40	SEYCHELLES IS., INDIAN OCEAN
SFJ	67.00	-50.59	SONDRE STROMFJORD, GREENLAND
SFO	37.37	-122.23	SAN FRANCISCO, CALIF., USA
SGN	10.49	106.40	SAIGON, S VIETNAM (TAN SON NHUT)
SHA	31.12	121.23	SHANGHAI, CHINA
SIN	1.21	103.54	SINGAPORE, SINGAPORE (PAYA-LEBAR)
SJU	18.28	-66.07	SAN JUAN, PUERTO RICO
SKD	39.40	66.58	SAMARKAND, USSR
SLC	40.46	-111.53	SALT LAKE CITY, UTAH, USA
SNN	52.30	-9.53	SHANNON, IRELAND (LIMERICK)
SOF	42.40	23.18	SOFIA, BULGARIA (SOFIYA)
SPK	43.03	141.21	SAPPORO, JAPAN
SPN	15.10	145.45	SAIPAN, MARIANA IS
STO	59.37	17.55	STOCKHOLM, SWEDEN (ARLANDA)
STT	18.21	-64.59	ST. THOMAS (HARRY TRUMAN APT) VIRGIN IS. USA
SVO	55.45	37.35	MOSCOW, US (MOSKVA-SHEREMETYEVO ARPT) USSR
SVQ	37.23	5.59	SEVILLE, SPAIN
SYD	-33.52	151.13	SYDNEY-KINGSFORD SMITH ARPT, NEW SOUTH WALES, AUS.
SZG	47.48	13.02	SALZBURG, AUSTRIA
TAB	11.15	-60.40	TOBAGO, TRINIDAD AND TOBAGO
TAS	41.20	69.18	TASHKENT, USSR
THF	52.29	13.25	BERLIN-TEMPLEHOF (ZENTRALFLUGHAFEN) GER. FED. REP.
THH	-21.17	-175.08	TONGA, TONGATAPU (FUAAMOTU ARPT) NEW HEBRIDES
THR	35.40	51.26	TEHERAN, IRAN (TEHRAN)
TIJ	32.32	-117.01	TIJUANA, MEXICO
TIP	32.58	13.12	TRIPOLI, ARAB REP. OF LIBYA
TKE	39.20	-120.11	TRUCKEE, CALIFORNIA, USA
TKK	7.23	151.43	TRUK, CAROLINES, PAC. OCEAN
TLS	43.36	1.26	TOULOUSE, FRANCE
TLV	32.07	34.45	TEL AVIV, ISRAEL
TNN	23.00	120.11	TAINAN, REP OF CHINA (TAIWAN)
TNR	-18.55	47.31	TANANARIVE, MALAGASY REP. (ANTANANARIVO)
TOM	16.46	3.01	TOMBOUCTOU, MALI
TPE	25.03	121.30	TAIPEI, REP. OF CHINA (TAIWAN)
TPJ	18.00	-76.50	KINGSTON, JAMAICA-TINSON PEN
TRN	45.03	7.40	TURIN, ITALY (TORINO)
TRR	8.34	81.14	TRINCOMALEE, CEYLON
TRV	8.28	76.57	TRIVANDRUM, INDIA
TRW	1.25	173.00	TARAWA, GILBERT IS., PACIFIC OCEAN
TRZ	17.43	83.19	TRICHINOPOLY, INDIA (TIRUCHCHIR)
TUM	30.10	-85.41	PANAMA CITY, PAN-TOCUMEN ARPT
TUN	36.48	10.11	TUNIS, TUNISIA
TUS	32.13	-110.58	TUCSON, ARIZ., USA
TVL	38.54	-120.00	LAKE TAHOE, CALIF., USA (SO. LAKE TAHOE ARPT)
TWF	42.34	-114.28	TWIN FALLS, IDAHO, USA
TYO	35.33	139.46	TOKYO -KOKUSAI-KUKO ARPT, JAPAN
TZA	17.30	-88.12	BELIZE, BR. HONDURAS-MUN ARPT (BELICE)
ULN	47.55	106.53	ULAN BATOR, MONGOLIA (ULAANBAATAR)
UMR	-31.31	137.10	WOOMERA, S. AUSTRALIA
VCL	48.45	2.10	PARIS-VILLACOUBLAY AERODROME, FRANCE
VCP	23.00	47.08	SAO PAULO, BRAZIL-VIRACOPOS AEROPORTO
VIE	48.13	16.20	VIENNA, AUSTRIA (WIEN, VIENNE)

VKO	55.37	37.17	MOSCOW-VNUKOVO ARPT, USSR
VLC	39.28	.22	VALENCIA, SPAIN (VALENCE)
VPS	30.29	86.30	EGLIN A.F. BASE.FLA.,USA
VTE	17.58	102.36	VIENTIANE, LAOS
WAK	19.17	166.37	WAKE AIRPORT, WAKE ISLAND, PACIFIC OCEAN
WAL	47.28	-115.56	WALLACE, IDAHO, USA
WAR	52.15	21.00	WARSZAWA (WARSAW)
WAW	32.15	21.00	WARSAW, POLAND (WARSZAWA)
WKE	19.17	166.36	WAKE ISLAND, PACIFIC OCEAN
WLG	-41.18	174.46	WELLINGTON, N.Z.
WLS	-13.18	-173.10	WALLIS ILES, S. PACIFIC OCEAN
YAP	9.34	138.09	YAP, CAROLINES, PAC. OCEAN
YDA	64.04	-139.25	DAWSON CITY, Y.T. CANADA
YDQ	55.46	-120.14	DAWSON CREEK, B.C. CANADA
YOW	45.25	-75.42	OTTAWA, ONTARIO, CANADA
YEG	53.33	-113.28	EDMONTON-INTERNATIONAL ARPT, CANADA
YFB	63.44	-68.28	FROBISHER BAY, N.W.T. CANADA
YFO	54.46	-101.53	FLIN FLON, MAN. CANADA
YJT	48.33	-58.35	STEPHENVILLE, NFLD. CANADA
YQB	46.47	-71.23	QUEBEC, QUE. CANADA
YUL	45.28	-73.45	MONTREAL, QUE., CANADA
YVR	49.11	-123.10	VANCOUVER-INTERNATIONAL ARPT, B.C., CANADA
YWG	49.53	-97.09	WINNIPEG, MAN., CANADA
YXD	53.33	-113.28	EDMONTON, ALTA., CANADA
YXU	42.59	-81.14	LONDON, ONT., CANADA
YYJ	48.25	-123.22	VICTORIA, B.C., CANADA
YYZ	43.41	-79.38	TORONTO-INT. ARPT, QUE., CANADA
YZF	62.27	-114.21	YELLOWKNIFE, N.W.T., CANADA
ZAG	45.48	15.58	ZAGREB, YUGOSLAVIA
ZAM	6.54	122.05	ZAMBOANGA, PHILIPPINE IS
ZNZ	6.10	39.11	ZANZIBAR, TANZANIA
ZRH	47.27	8.33	ZURICH-KLOTEN FLUGHAFEN, SWITZERLAND
ABD	30.20	48.16	ABADAN, IRAN
AUH	23.37	58.35	ABU DAHABI, TRUCIAL OMAN (MUSCAT, MUSQAT)
ACA	16.51	-99.55	ACAPULCO, MEXICO
ACC	5.33	-.13	ACCRA, GHANA
ADD	9.00	38.50	ADDIS ABEBA, ETHOPIA
ADL	-34.58	138.32	ADELAIDE, S. AUSTRALIA
AGA	30.26	-9.36	AGADIR, MOROCCO
AGR	27.12	77.59	AGRA,INDIA
AJA	41.55	8.44	AJACCIO, CORSICA
ABQ	35.05	-106.40	ALBUQUERQUE, N. M., USA
ALG	36.42	3.08	ALGIERS, ALGERIA
ALA	43.15	76.57	ALMA-ATA, USSR
AMA	35.13	-101.49	AMARILLO, TEXAS, USA
AMM	31.57	35.56	AMMAN, JORDAN
AMS	52.17	4.40	AMSTERDAM, NETHERLANDS
ANC	61.13	-149.53	ANCHORAGE, ALASKA, USA.
ESB	39.56	32.52	ANKARA-ESENBOGA ARPT, TURKEY
APW	-13.50	-171.44	APIA, W. SAMOA
ACE	28.57	-13.32	ARRECIFE, CANARY IS.
ASU	-25.16	-57.40	ASUNCION, PARAGUAY
ATH	37.58	23.43	ATHENS, GREECE
ATL	33.45	-84.23	ATLANTA, GA, USA
AKL	-36.53	174.45	AUCKLAND, NEW ZEALAND
AUS	30.16	-97.45	AUSTIN, TEX, USA
BGW	33.20	44.26	BAGHDAD, IRAQ
BAH	26.00	50.30	BAHRAIN IS., ARABIAN GULF
BAK	40.23	49.51	BAKU, USSR
BAL	39.11	-76.40	BALTIMORE, MD., USA
BDI	13.10	-59.32	BARBADOS, WEST INDIES
BCN	41.23	2.11	BARCELONA, SPAIN

BSL	47.33	7.25	BASEL, SWITZERLAND (BALE)
BTH	13.28	-16.39	BATHURST, GAMBIA
BEY	33.49	35.30	BEIRUT, LEBANON
BEG	44.50	20.30	BELGRADE, YUGOSLAVIA
TZA	17.30	-88.12	BELIZE, BR. HONDURAS-MUN ARPT (BELICE)
BHZ	-19.55	-43.56	BELO HORIZONTE, BRAZIL
JBK	37.57	-122.28	BERKELEY, CALIF., USA
BER	52.31	13.24	BERLIN, GER. FED. REP.
THF	52.29	13.25	BERLIN-TEMPLEHOF (ZENTRALFLUGHAFEN) GER. FED. REP.
BDA	32.20	-64.45	BERMUDA, ATLANTIC OCEAN
BHX	52.30	-1.50	BIRMINGHAM, ENGLAND
BOG	33.28	-95.13	BOGOTA, COLOMBIA
BOM	19.05	72.52	BOMBAY, INDIA-SANTA CRUZ ARPT
BOB	-16.30	-151.45	BORA-BORA, POLYNESIA
BOS	42.21	-71.04	BOSTON, MASS., USA
BTS	48.10	17.10	BRATISLAVA, CZECHOSLOVAKIA
BZV	-4.14	15.14	BRAZZAVILLE, CONGO REP.
BNE	-27.27	153.11	BRISBANE-EAGLE FARM ARPT, QUEENS., AUSTRALIA
BRS	51.27	-2.35	BRISTOL, ENGLAND
BRH	50.54	4.30	BRUSSELS, BELGIUM
BUH	44.26	26.06	BUCHAREST, ROUMANIA
OTP	44.26	26.06	BUCHAREST, ROU-OTOPENI ARPT
BUD	47.30	19.05	BUDAPEST, HUNGARY
BUE	-34.49	-58.32	BUENOS AIRES-EZEIZA AEROPUERTO, ARGENTINA
EZE	-34.49	-58.32	BUENOS AIRES-EZEIZA AEROPUERTO, ARGENTINA
BUF	42.52	-76.43	BUFFALO, N.Y., USA
BUR	34.12	-118.18	BURBANK, CALIF., USA
CNS	-16.51	145.43	CAIRNS, QUEENS. AURTRALIA
CAI	30.08	31.24	CAIRO-INT. ARPT. ARAB REP. OF EGYPT
CCU	44.50	-.34	CALCUTTA, INDIA
CIT	34.08	-118.08	CALTECH
CAN	23.06	113.16	CANTON, CHINA (GUANGZHOO,ZHG)
CPT	-34.02	18.28	CAPETOWN-MALAN ARPT, REP. S. AFRICA
CVQ	-24.53	113.40	CARNARVON, W. AUSTRALIA
CAS	33.39	-7.35	CASABLANCA, MOROCCO
ORD	41.59	-87.54	CHICAGO, ILL-OHARE ARPT, USA
CHC	-43.42	172.38	CHRISTCHURCH, N.Z.
CUM	53.35	-64.27	CHURCHILL FALLS, NFLE., CANADA
CVG	39.06	84.31	CINCINNATI, OHIO, USA
COK	9.58	76.15	COCHIN, INDIA
CMB	6.56	79.51	COLOMBO, CEYLON
RML	6.56	79.51	COLOMBO, CEYLON-RATMALANA
CPH	55.40	12.35	COPENHAGEN
CPY	55.40	12.35	COPENHAGEN, DENMARK
DAC	23.42	90.22	DACCA, BANGLADESH
DKR	14.40	-17.26	DAKAR, SENEGAL
DAM	33.30	36.19	DAMASCUS-MEZZE ARPT, ARAB REP. OF SYRIA
DAR	12.23	130.44	DAR ES SALAAM, TANZANIA
DRW	-12.28	130.50	DARWIN, NT. AUSTRALIA.
YDA	64.04	-139.25	DAWSON CITY, Y.T. CANADA
YDQ	55.46	-120.14	DAWSON CREEK, B.C. CANADA
DEL	28.35	77.07	DELHI-PALAM INT. ARPT, INDIA
DEN	39.43	-105.01	DENVER, COLO., USA
DTT	42.13	-83.22	DETROIT-METROPOLITAN WAYNE CO. ARPT., MICH., USA
DTW	42.25	-83.01	DETROIT, MICH-METROPOLITAN APT
DET	42.20	-83.03	DETROIT, MICH., USA
DHA	26.18	50.08	DHAHRAN, SAUDI ARABIA (AZ-ZAHRAN)
JKT	-6.10	106.48	DJAKARTA, JAVA, INDONESIA
DOH	25.17	51.32	DOHA (AD-DAWHAH) QATAR, ARABIA
DLA	4.03	9.42	DOUALA, CAMEROON
DXB	25.18	55.18	DUBAI (DUBAYY), TRUCIAL OMAN
DUR	-19.55	30.56	DURBAN, REP OF S. AFRICA

LBZ	-29.55	30.56	DURBAN, REP. S. AFRICA
IPC	-27.08	-109.23	EASTER ISLAND, PACIFIC OCEAN
YXD	53.33	-113.28	EDMONTON, ALTA., CANADA
YEG	53.33	-113.28	EDMONTON-INTERNATIONAL ARPT, CANADA
VPS	30.29	86.30	EGLIN A.F. BASE.FLA.,USA
ELD	61.14	-149.54	ELMENDORF, AFB, ALASKA, USA
EVN	40.10	44.31	EREVAN, ARMENIA, USSR (YEREVAN)
FAI	64.51	-147.43	FAIRBANKS, ALASKA, USA
FIN	-6.35	147.50	FINSCHHAFEN, NEW GUINEA
YFO	54.46	-101.53	FLIN FLON, MAN. CANADA
FRA	50.02	8.33	FRANKFURT, GERMAN FEDERAL REP.
HGS	8.30	-13.15	FREETOWN, SIERA LEONE
YFB	63.44	-68.28	FROBISHER BAY, N.W.T. CANADA
FNC	32.38	-16.54	FUNCHAL, MADERIA IS.
GVA	46.13	6.09	GENEVA-MEYRIN
PIK	55.30	-4.36	GLASGOW, SCOT-PRESTWICK ARPT
GHV	69.15	-53.33	GODHAVN, GREENLAND
GUM	13.29	144.48	GUAM, MARIANAS (AGANA NAS)
HLZ	-37.47	175.17	HAMILTON, NEW ZEALAND
HAN	21.02	105.51	HANOI, N VIETNAM
HAV	23.08	-82.22	HAVANA, CUBA
HEL	60.10	24.58	HELSINKI, FINLAND
ITO	19.43	-155.05	HILO, HAWAII, USA
HBA	-42.51	147.19	HOBART, TASMANIA
HKG	22.20	114.12	HONG KONG, BR CROWN COLONY
HIR	-9.27	159.57	HONIARA, GUADALCANAL, SOLOMON
HNL	21.20	-157.55	HONOLULU, OAHU HAWAII, USA
IAH	39.59	-95.27	HOUSTON (INTERCONTINENTAL APT) TEXAS, USA
IBZ	38.54	1.26	IBIZA, SPAIN
IND	39.46	-86.09	INDIANAPOLIS, IND., USA
IYK	35.39	-117.49	INYOKERN, CALIF., USA
IKT	52.16	104.20	IRKUTSK, USSR
ISP	40.44	-73.13	ISLIP, N.Y., USA
IST	40.58	-8.49	ISTANBUL, TURKEY (HAVA ALANI)
IZM	38.25	27.09	IZMIR, TURKEY
RND	-26.08	28.14	JOHANNESBURG, R S AFRICA (JAN SMUTS)
JUN	58.20	-134.27	JUNEAU, ALASKA, USA
KBL	34.30	69.10	KABUL, AFGHANISTAN
OGG	20.54	-156.26	KAHULUI, MAUI HAWAII, USA
EBB	.19	32.25	KAMPALA, UGANDA (ENTEBBE)
KDH	31.32	65.30	KANDAHAR, AFGHANISTAN
KNU	26.28	80.20	KANPUR, INDIA
KHI	24.52	67.03	KARACHI, W PAKISTAN
KTM	17.42	85.20	KATMANDU, NEPAL
KDI	-3.57	122.35	KENDARI, CELEBES, INDONESIA
HRK	50.00	36.15	KHARKOV, USSR
KRT	15.36	32.32	KHARTOUM, SUDAN
KIF	-6.13	155.38	KIETA, BOUGAINVILLE SOLOMON IS
JLT	50.26	30.31	KIEV, USSR-JULIANI ARPT,
KIM	-28.43	24.46	KIMBERLEY, REP OF S AFRICA
KIN	18.00	-76.50	KINGSTON, JAMAICA
TPJ	18.00	-76.50	KINGSTON, JAMAICA-TINSON PEN
KOI	58.59	-2.58	KIRKWALL, ORKNEY IS. SCOTLAND
KRN	67.51	20.16	KIRUNA, SWEDEN
KOA	21.24	-157.44	KONA, KAILUA, HAWAII, USA
OTZ	66.53	-162.39	KOTZEBUE, ALASKA, USA
KRK	50.03	19.58	KRAKOW, POLAND
KUL	3.09	101.43	KUALA LUMPUR, MALAYSIA
KWI	29.30	47.45	KUWAIT, KUWAIT
KWA	9.05	167.20	KWAJALEIN, MARSHALL IS.

LOS	6.37	3.16	LAGOS-IKEJA ARPT, NIGERIA
TVL	38.54	-120.00	LAKE TAHOE, CALIF., USA (SO. LAKE TAHOE ARPT)
LPB	-16.30	-68.09	LA PAZ, BOLIVIA
LAP	24.10	-110.18	LAPAZ, MEXICO
LPA	28.06	15.24	LAS PALMAS, CANARY IS
LAS	36.11	-115.08	LAS VEGAS, NEV., USA
LID	60.01	30.17	LENINGRAD, USSR (KOLOM'AGI APT)
LIH	21.59	-159.21	LIHUE, KAUAI HAWAII, USA
LIM	-12.03	-77.03	LIMA, PERU
LIS	38.43	-9.08	LISBON, PORTUGAL
LJU	46.03	14.31	LJUBLJANA, YUGOSLAVIA
LON	51.40	.15	LONDON
LGW	51.09	-.21	LONDON, ENGLAND-GATWICK ARPT
LHR	51.27	-.28	LONDON, ENGLAND-HEATHROW ARPT
YXU	42.59	-81.14	LONDON, ONT., CANADA
LAX	33.56	-118.24	LOS ANGELES-INTERNATIONAL ARPT, CALIF., USA
LAD	-8.48	13.14	LUANDA, ANGOLA
LPQ	19.52	102.08	LUANG PRABANG, LAOS
LBB	33.35	-101.51	LUBBOCK, TEXAS, USA
LUX	49.37	6.10	LUXEMBOURG, LUXEMBOURG (FINDEL)
MAA	11.00	78.15	MADRAS, INDIA
MAD	40.28	-3.34	MADRID, SPAIN (BARAJAS)
IXM	9.56	78.08	MADURAI, INDIA
AGP	34.43	-4.25	MALAGA, SPAIN
MDL	22.00	96.05	MANDALAY, BURMA
MNL	14.34	121.01	MANILA-INT. ARPT, PHILIPPINES
RAK	31.49	-8.00	MARRAKECH, MOROCCO
MZT	23.13	-106.25	MAZATLAN, MEXICO
MMM	-77.50	166.25	MC MURDO, ANTARCTICA
MEL	-37.49	144.58	MELBOURNE-TULLAMARINE ARPT, VIC., AUSTRALIA
MDY	28.13	-177.26	MIDWAY ISLAND, PACIFIC OCEAN
LIN	45.27	9.16	MILAN, ITALY-FORLANINI-LINATE
MXP	45.38	8.44	MILAN, ITALY-MALPENSA ARPT
MBA	-4.03	39.40	MOMBASA, KENYA
MLW	6.18	-10.47	MONROVIA, LIBERIA
MBJ	18.30	-77.55	MONTEGO BAY, JAMAICA
CSO	-34.52	-56.02	MONTEVIDEO-CARRASCO AEROPUERTO, URUGUAY
MVD	-34.53	-56.11	MONTEVIDEO, URUGUAY
YUL	45.28	-73.45	MONTREAL, QUE., CANADA
MOW	55.45	37.42	MOSCOW
DME	55.25	37.35	MOSCOW, USSR-DOMODEDOVO ARPT
SVO	55.45	37.35	MOSCOW, US (MOSKVA-SHEREMETYEVO ARPT) USSR
VKO	55.37	37.17	MOSCOW-VNUKOVO ARPT, USSR
MCT	23.37	58.35	MUSCAT, OMAN (MASQAT)
NBO	-1.17	36.49	NAIROBI, KENYA (ENTEBBE)
NAN	-17.48	177.25	NANDI, FIJI IS.
NAP	40.51	14.17	NAPLES, ITALY (NAPOLI)
NAS	25.05	-77.21	NASSAU, BAHAMAS
NAT	-5.47	-35.13	NATAL, BRAZIL
MSY	29.58	-90.07	NEW ORLEANS, LA., USA
JFK	40.38	-73.47	NEW YORK, NY-KENNEDY INT ARPT.
NCE	43.40	7.14	NICE, FRANCE (COTE D'AZUR)
NIC	35.11	33.23	NICOSIA, CYPRUS
OME	64.30	-165.24	NOME, ALASKA, USA
NLK	-29.03	167.56	NORFOLK, IS. PACIFIC OCEAN
MWU	-22.16	166.27	NOUMEA, NEW CAL-MAGENTA ARPT
OVB	55.02	82.55	NOVOSIBIRSK, USSR
OAK	37.47	-122.13	OAKLAND, CALIF., USA
ODS	46.28	30.44	ODESSA, USSR
OKA	26.22	127.45	OKINAWA, RYUKYU IS. (KADENA)
OKC	35.28	-97.32	OKLAHOMA CITY, OKLA., USA
OMA	41.16	-95.57	OMAHA, NEB., USA

OMS	55.00	73.22	OMSK, USSR
OPO	41.11	-8.36	OPORTO, PORTUGAL
OSA	34.47	135.26	OSAKA, JAPAN (KOKUSAI-KUKO)
FBU	29.55	10.45	OSLO, NORWAY-FORNEBU ARPT
OSL	59.55	10.45	OSLO, NORWAY
YOW	45.25	-75.42	OTTAWA, ONTARIO, CANADA
PPG	-14.16	-170.42	PAGO PAGO, SAMOA
TUM	30.10	-85.41	PANAMA CITY, PAN-TOCUMEN ARPT
PPT	-17.32	-149.34	PAPEETE, TAHITI, FR POLYNESIA
LBG	48.56	2.26	PARIS, FRANCE-LE BOURGET ARPT
ORY	48.45	2.24	PARIS, FRANCE-ORLY ARPT
PAR	48.45	2.24	PARIS-ORLY ARPT, FRANCE
VCL	48.45	2.10	PARIS-VILLACOUBLAY AERODROME, FRANCE
PEK	38.47	116.23	PEKING, PEIPING, CHINA (NANYANGCHANG)
PER	-31.57	115.58	PERTH, W AUSTRALIA
PHL	39.53	-75.14	PHILADELPHIA, PA., USA
PHX	33.27	-112.05	PHOENIX, ARIZ., USA
PSA	43.43	10.23	PISA, ITALY
PON	6.58	158.13	PONAPE, CAROLINES
PNI	6.58	158.13	PONAPE, CAROLINES, PAC. OCEAN
PAP	18.32	-72.20	PORT AU PRINCE, HAITI
PLZ	-33.58	25.40	PORT ELIZABETH, REP. S. AFRICA
POM	-9.30	147.10	PORT MORESBY, PAPUA, N GUINEA
POS	10.39	-61.31	PORT OF SPAIN, TRINIDAD
PDX	45.33	-122.36	PORTLAND, ORE., USA
PRG	50.05	14.26	PRAGUE, CZECHOSLOVAKIA
FNG	39.00	125.47	PYONGYANG, N. KOREA
YQB	46.47	-71.23	QUEBEC, QUE. CANADA
RBA	34.02	-6.51	RABAT, MOROCCO
RAB	-4.13	152.11	RABAUL, NEW BRITAIN, N. GUINEA
RGN	16.47	96.10	RANGOON, BURMA
RAR	-31.14	-159.46	RAROTONGA, COOK IS. S PACIFIC
RNO	39.31	-119.48	RENO, NEV., USA
KEF	64.02	-22.36	REYKJAVIK, ICE. KEFLAVIK ARPT.
RFK	64.02	-22.36	REYKJAVIK, ICELAND
GIG	-22.50	-43.15	RIO DE JANEIRO, BRAZIL (AEROPORTO DO GALEAO)
RIO	-22.55	-43.10	RIO DE JANERIO, BRAZIL (SANTOS DUMONT ARPT)
SDU	-22.55	-43.10	RIO DE JANERIO, BRAZIL (SANTOS DUMONT ARPT)
JED	24.38	46.43	RIYADH, SAUDI ARABIA, AR-RIYAD
CIA	41.48	12.36	ROME-CIAMPINO ARPT, ITALY
ROM	41.46	12.13	ROME, ITALY
FCO	41.46	12.13	ROME-LEONARDO DA VINCI DI FIUMICINO ARPT, ITALY
SGN	10.49	106.40	SAIGON, S VIETNAM (TAN SON NHUT)
SPN	15.10	145.45	SAIPAN, MARIANA IS
SAY	-17.50	31.03	SALISBURY, RHODESIA
SLC	40.46	-111.53	SALT LAKE CITY, UTAH, USA
SZG	47.48	13.02	SALZBURG, AUSTRIA
SKD	39.40	66.58	SAMARKAND, USSR
SAN	32.43	-117.09	SAN DIEGO, CALIF., USA
SFO	37.37	-122.23	SAN FRANCISCO, CALIF., USA
SJU	18.28	-66.07	SAN JUAN, PUERTO RICO
SAF	35.42	-106.57	SANTA FE, N.M., USA
SCL	-33.30	-70.40	SANTIAGO, CHILE
SAO	23.32	-46.37	SAO PAULO, BRAZIL
VCP	23.00	47.08	SAO PAULO, BRAZIL-VIRACOPOS AEROPORTO
OKD	43.30	141.21	SAPPORO, JAPAN (OKADAMA ARPT)
SPK	43.03	141.21	SAPPORO, JAPAN
SEA	47.27	-122.18	SEATTLE-TACOMA INT. ARPT, WASHINGTON, USA
SEL	37.32	126.56	SEOUL, REP OF KOREA
SVQ	37.23	5.59	SEVILLE, SPAIN
SEZ	-4.35	55.40	SEYCHELLES IS., INDIAN OCEAN
SHA	31.12	121.23	SHANGHAI, CHINA

SNN	52.30	-9.53	SHANNON, IRELAND (LIMERICK)
SIN	1.21	103.54	SINGAPORE, SINGAPORE (PAYA-LEBAR)
SOF	42.40	23.18	SOFIA, BULGARIA (SOFIYA)
SFJ	67.00	-50.59	SONDRE STROMFJORD, GREENLAND
YJT	48.33	-58.35	STEPHENVILLE, NFLD. CANADA
STO	59.37	17.55	STOCKHOLM, SWEDEN (ARLANDA)
BMA	59.21	17.55	STOCKHOLM, SWEDEN-BROMMA ARPT
STT	18.21	-64.59	ST. THOMAS (HARRY TRUMAN APT) VIRGIN IS. USA
SYD	-33.52	151.13	SYDNEY-KINGSFORD SMITH ARPT, NEW SOUTH WALES, AUS.
TNN	23.00	120.11	TAINAN, REP OF CHINA (TAIWAN)
TPE	25.03	121.30	TAIPEI, REP. OF CHINA (TAIWAN)
TNR	-18.55	47.31	TANANARIVE, MALAGASY REP. (ANTANANARIVO)
TRW	1.25	173.00	TARAWA, GILBERT IS., PACIFIC OCEAN
TAS	41.20	69.18	TASHKENT, USSR
THR	35.40	51.26	TEHERAN, IRAN (TEHRAN)
TLV	32.07	34.45	TEL AVIV, ISRAEL
TIJ	32.32	-117.01	TIJUANA, MEXICO
TAB	11.15	-60.40	TOBAGO, TRINIDAD AND TOBAGO
TYO	35.33	139.46	TOKYO -KOKUSAI-KUKO ARPT, JAPAN
TOM	16.46	3.01	TOMBOUCTOU, MALI
THH	-21.17	-175.08	TONGA, TONGATAPU (FUAAMOTU ARPT) NEW HEBRIDES
YYZ	43.41	-79.38	TORONTO-INT. ARPT, QUE., CANADA
TLS	43.36	1.26	TOULOUSE, FRANCE
TRZ	17.43	83.19	TRICHINOPOLY, INDIA (TIRUCHCHIR)
TRR	8.34	81.14	TRINCOMALEE, CEYLON
TIP	32.58	13.12	TRIPOLI, ARAB REP. OF LIBYA
TRV	8.28	76.57	TRIVANDRUM, INDIA
TKE	39.20	-120.11	TRUCKEE, CALIFORNIA, USA
TKK	7.23	151.43	TRUK, CAROLINES, PAC. OCEAN
TUS	32.13	-110.58	TUCSON, ARIZ., USA
TUN	36.48	10.11	TUNIS, TUNISIA
TRN	45.03	7.40	TURIN, ITALY (TORINO)
TWF	42.34	-114.28	TWIN FALLS, IDAHO, USA
ULN	47.55	106.53	ULAN BATOR, MONGOLIA (ULAANBAATAR)
VLC	39.28	.22	VALENCIA, SPAIN (VALENCE)
YVR	49.11	-123.10	VANCOUVER-INTERNATIONAL ARPT, B.C., CANADA
YYJ	48.25	-123.22	VICTORIA, B.C., CANADA
VIE	48.13	16.20	VIENNA, AUSTRIA (WIEN, VIENNE)
VTE	17.58	102.36	VIENTIANE, LAOS
WAK	19.17	166.37	WAKE AIRPORT, WAKE ISLAND, PACIFIC OCEAN
WKE	19.17	166.36	WAKE ISLAND, PACIFIC OCEAN
WAL	47.28	-115.56	WALLACE, IDAHO, USA
WLS	-13.18	-173.10	WALLIS ILES, S. PACIFIC OCEAN
WAW	32.15	21.00	WARSAW, POLAND (WARSZAWA)
WAR	52.15	21.00	WARSZAWA (WARSAW)
IAD	38.57	-77.27	WASHINGTON DC-DULLES INTERNATIONAL AIRPORT, USA
DCA	42.19	-83.25	WASHINGTON DC-NATIONAL ARPT, USA
WLG	-41.18	174.46	WELLINGTON, N.Z.
YWG	49.53	-97.09	WINNIPEG, MAN., CANADA
UMR	-31.31	137.10	WOOMERA, S. AUSTRALIA
YAP	9.34	138.09	YAP, CAROLINES, PAC. OCEAN
YZF	62.27	-114.21	YELLOWKNIFE, N.W.T., CANADA
ZAG	45.48	15.58	ZAGREB, YUGOSLAVIA
ZAM	6.54	122.05	ZAMBOANGA, PHILIPPINE IS
ZNZ	6.10	39.11	ZANZIBAR, TANZANIA
ZRH	47.27	8.33	ZURICH-KLOTEN FLUGHAFEN, SWITZERLAND

NEW YORK TO PARIS AT MACH 1.2

SCHEDULE BLOCK TIME ON ONE WAY(HRS)= 4.7

RATE OF CLIMB(FEET/MIN)= 3333.333 CRUISING ALTITUDE(FEET)= 40000 RATE OF DESCENT(FEET/MIN)= 3333.333

CLIMBING GROUN SPEED(MILES/HOUR)=570.00 CRUISING SPEED(MILES/HOUR)= 792.00 DESCENDING GROUND SPEED(MILES/HOUR)=570.00

FLIGHT ALTITUDE AND DISTANCE PROFILE IN 1/10 HOUR INCREMENTS.

ALTITUDE

20000	40000	40000	40000	40000	40000	40000	40000
40000	40000	40000	40000	40000	40000	40000	40000
40000	40000	40000	40000	40000	40000	40000	40000
40000	40000	40000	40000	40000	40000	40000	40000
40000	40000	40000	40000	40000	40000	40000	40000
40000	40000	40000	40000	40000	20000	0	

DISTANCE

57.00	57.00	79.20	79.20	79.20	79.20	79.20	79.20
79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20
79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20
79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20
79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20
79.20	79.20	79.20	79.20	79.20	57.00	57.00	

TOTAL INPUT PROFILE DISTANCE = 3633.60 STATUTE MILES

FLIGHT PROFILE TIME = 4.70 HOURS IN THE AIR

COMPUTED GREAT CIRCLE LEG DISTANCE = 3622.6 THE INITIAL COURSE ANGLE = 53.877

LEG START LATITUDE = 40.63 LEG START LONGITUDE = -73.77

LEG END LATITUDE = 48.72 LEG END LONGITUDE = 2.38

LAT.	LONG.	COURSE ANGLE	GEOMAG. LAT.	ATMOS. DEPTH GR/SQ. CM.	CHARGED PARTICLES AND GAMMA DOSE RATE (MREMS/HR)		NEUTRONS DOSE RATE (MREMS/HR)		TOTAL DOSE RATE DOSE RATE (MREMS/HR)	
					SOLAR MIN.	SOLAR AVG.	SOLAR MIN.	SOLAR AVG.	SOLAR MIN.	SOLAR AVG.
40.87	-73.33	60.03	52.33	710.12	.092562	.088927	.023644	.022716	.116206	.111642
41.35	-72.44	60.05	52.83	307.49	.181132	.165176	.053269	.048576	.234401	.213752
41.92	-71.36	60.08	53.40	193.27	.366089	.321369	.102022	.089560	.468111	.410928
42.56	-70.07	60.10	54.06	193.27	.365971	.321256	.102675	.090130	.468646	.411386
43.19	-68.76	60.11	54.69	193.27	.365858	.321148	.103305	.090681	.469163	.411829
43.80	-67.43	60.12	55.30	193.27	.365748	.321044	.103913	.091212	.469661	.412255
44.40	-66.06	60.12	55.88	193.27	.365643	.320943	.104496	.091722	.470139	.412665
44.98	-64.67	60.11	56.44	193.27	.365669	.320963	.104723	.091920	.470392	.412882
45.54	-63.25	60.09	56.97	193.27	.365726	.321011	.104854	.092034	.470580	.413044
46.09	-61.80	60.05	57.48	193.27	.365781	.321056	.104977	.092141	.470758	.413197
46.62	-60.33	60.01	57.95	193.27	.365832	.321099	.105094	.092243	.470926	.413342
47.12	-58.82	59.95	58.39	193.27	.365880	.321139	.105202	.092338	.471082	.413477
47.61	-57.29	59.87	58.81	193.27	.365924	.321176	.105303	.092426	.471228	.413602
48.08	-55.73	59.78	59.18	193.27	.365965	.321210	.105396	.092507	.471361	.413717
48.52	-54.14	59.67	59.53	193.27	.366002	.321241	.105480	.092580	.471483	.413821
48.95	-52.52	59.53	59.83	193.27	.366035	.321269	.105556	.092646	.471591	.413915
49.35	-50.88	59.37	60.11	193.27	.366065	.321293	.105622	.092704	.471687	.413997
49.72	-49.21	59.19	60.34	193.27	.366090	.321314	.105679	.092754	.471769	.414068
50.07	-47.51	58.97	60.53	193.27	.366111	.321332	.105727	.092795	.471837	.414127
50.40	-45.80	58.73	60.69	193.27	.366127	.321345	.105764	.092828	.471892	.414174
50.70	-44.05	58.44	60.80	193.27	.366140	.321356	.105792	.092852	.471932	.414208
50.98	-42.29	58.12	60.87	193.27	.366147	.321362	.105810	.092868	.471958	.414230
51.23	-40.51	57.76	60.90	193.27	.366151	.321365	.105818	.092875	.471969	.414240
51.45	-38.70	57.35	60.89	193.27	.366150	.321364	.105816	.092873	.471965	.414237
51.64	-36.89	56.89	60.84	193.27	.366144	.321360	.105803	.092862	.471947	.414222
51.80	-35.05	56.38	60.75	193.27	.366134	.321351	.105781	.092842	.471915	.414194
51.94	-33.21	55.80	60.62	193.27	.366120	.321340	.105748	.092814	.471868	.414153
52.05	-31.35	55.15	60.45	193.27	.366102	.321324	.105706	.092777	.471807	.414101
52.12	-29.49	54.42	60.24	193.27	.366079	.321305	.105654	.092732	.471733	.414037
52.17	-27.62	53.61	59.98	193.27	.366052	.321282	.105593	.092678	.471644	.413961
52.19	-25.75	52.69	59.70	193.27	.366021	.321256	.105522	.092617	.471543	.413873
52.18	-23.88	51.66	59.37	193.27	.365986	.321227	.105442	.092547	.471428	.413774
52.14	-22.01	50.51	59.01	193.27	.365947	.321195	.105354	.092470	.471301	.413665
52.07	-20.15	49.21	58.62	193.27	.365904	.321159	.105258	.092386	.471162	.413545
51.97	-18.29	47.74	58.19	193.27	.365858	.321121	.105153	.092295	.471011	.413416
51.84	-16.45	46.07	57.73	193.27	.365809	.321079	.105041	.092197	.470850	.413276
51.68	-14.61	44.17	57.25	193.27	.365756	.321035	.104921	.092092	.470677	.413128
51.50	-12.79	42.00	56.73	193.27	.365700	.320989	.104794	.091982	.470494	.412970
51.29	-10.98	39.51	56.18	193.27	.365642	.320940	.104661	.091865	.470302	.412805
51.04	-9.19	36.63	55.61	193.27	.365691	.320989	.104230	.091489	.469921	.412478
50.78	-7.42	33.29	55.02	193.27	.365798	.321091	.103635	.090969	.469433	.412060
50.48	-5.68	29.40	54.40	193.27	.365910	.321198	.103016	.090428	.468926	.411626
50.16	-3.95	24.87	53.76	193.27	.366025	.321308	.102376	.089868	.468401	.411176
49.82	-2.25	19.57	53.09	193.27	.366144	.321422	.101714	.089290	.467858	.410711
49.45	-.57	13.41	52.41	193.27	.362042	.318026	.101186	.088885	.463228	.406911
49.11	.85	7.37	51.81	307.49	.181131	.165175	.052793	.048143	.233925	.213318
48.81	2.02	1.80	51.29	710.12	.092525	.088891	.023428	.022508	.115953	.111399

	CHARGED PART. GAMMA RAY	NEUTRONS	TOTAL	
TOTAL FLIGHT DOSE FOR SOLAR MINIMUM CONDITIONS =	1.62793	.46587	2.09381	MILLIREMS PER FLIGHT PROFILE
TOTAL FLIGHT DOSE FOR SOLAR AVERAGE CONDITIONS =	1.43168	.40967	1.84135	MILLIREMS PER FLIGHT PROFILE
AVG. DOSE / FLIGHT PROFILE HOUR (SOLAR MIN.) =	.34637	.09912	.44549	MILLIRADS PER HOUR
AVG. DOSE / FLIGHT PROFILE HOUR (SOLAR AVG.) =	.30461	.08716	.39178	MILLIREMS PER HOUR
AVG. DOSE / BLOCK TIME HOUR (SOLAR MINIMUM) =	.32888	.09412	.42299	MILLIREMS / (BLOCK TIME) HOUR
AVG. DOSE / BLOCK TIME HOUR (SOLAR AVERAGE) =	.28923	.08276	.37199	MILLIREMS / (BLOCK TIME) HOUR.

LEG BLOCK TIME = PROFILE TIME + 0.25 HOURS

LOS ANGELES TO PARIS SUBSONIC FLIGHT (0.75 MACH)

SCHEDULE BLOCK TIME ON ONE WAY(HRS)= 11.6

RATE OF CLIMB(FEET/MIN)= 2000.000 CRUISING ALTITUDE(FEET)= 36000 RATE OF DESCENT(FEET/MIN)= 2000.000

CLIMBING GROUN SPEED(MILES/HOUR)=413.00 CRUISING SPEED(MILES/HOUR)= 495.80 DESCENDING GROUND SPEED(MILES/HOUR)=413.00

FLIGHT ALTITUDE AND DISTANCE PROFILE IN 1/10 HOUR INCREMENTS.

ALTITUDE

12000	24000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
24000	12000	0					

DISTANCE

41.30	41.30	41.30	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
41.30	41.30	41.30					

TOTAL INPUT PROFILE DISTANCE = 5652.02 STATUTE MILES

FLIGHT PROFILE TIME = 11.50 HOURS IN THE AIR

COMPUTED GREAT CIRCLE LEG DISTANCE = 5648.9 THE INITIAL COURSE ANGLE = 35.038

LEG START LATITUDE = 34.00 LEG START LONGITUDE = -118.15

LEG END LATITUDE = 48.72 LEG END LONGITUDE = 2.38

LAT.	LONG.	COURSE ANGLE	GEOMAG. LAT.	ATMOS. DEPTH GR/SQ. CM.	CHARGED PARTICLES AND GAMMA DOSE RATE (MREMS/HR)		NEUTRONS DOSE RATE (MREMS/HR)		TOTAL DOSE RATE DOSE RATE (MREMS/HR)	
					SOLAR MIN.	SOLAR AVG.	SOLAR MIN.	SOLAR AVG.	SOLAR MIN.	SOLAR AVG.
34.24	-117.94	39.20	41.26	827.93	.056611	.055474	.011776	.011539	.068387	.067014
34.73	-117.52	39.31	41.81	516.42	.112710	.106939	.030042	.028504	.142752	.135443
35.22	-117.10	39.42	42.35	307.49	.152000	.140911	.042821	.039697	.194821	.180608
35.75	-116.63	39.55	42.95	233.31	.229444	.210069	.065202	.059696	.294646	.269765
36.33	-116.10	39.69	43.61	233.31	.232827	.212709	.066411	.060673	.299239	.273382
36.91	-115.57	39.83	44.26	233.31	.236203	.215330	.067618	.061642	.303821	.276972
37.49	-115.03	39.98	44.91	233.31	.239571	.217931	.068821	.062605	.308392	.280536
38.06	-114.49	40.13	45.56	233.31	.242930	.220512	.070022	.063560	.312952	.284073
38.63	-113.93	40.29	46.21	233.31	.246281	.223074	.071220	.064509	.317500	.287582
39.20	-113.37	40.45	46.85	233.31	.249622	.225616	.072414	.065450	.322036	.291065
39.77	-112.79	40.61	47.50	233.31	.252954	.228137	.073605	.066383	.326558	.294520
40.33	-112.21	40.77	48.14	233.31	.256275	.230638	.074792	.067310	.331067	.297948
40.89	-111.62	40.94	48.78	233.31	.259586	.233118	.075975	.068228	.335561	.301347
41.44	-111.01	41.11	49.42	233.31	.262886	.235577	.077155	.069140	.340041	.304717
42.00	-110.40	41.29	50.05	233.31	.266172	.238048	.078270	.070000	.344443	.308048
42.55	-109.78	41.47	50.69	233.31	.269420	.240867	.078720	.070377	.348140	.311243
43.09	-109.14	41.65	51.32	233.31	.272656	.243672	.079167	.070751	.351823	.314423
43.64	-108.49	41.83	51.94	233.31	.275878	.246464	.079612	.071124	.355490	.317588
44.17	-107.84	42.02	52.57	233.31	.279086	.249242	.080056	.071495	.359142	.320736
44.71	-107.17	42.20	53.19	233.31	.281479	.251317	.080509	.071882	.361988	.323199
45.24	-106.48	42.40	53.81	233.31	.282067	.251842	.080986	.072308	.363053	.324150
45.77	-105.79	42.59	54.43	233.31	.282652	.252365	.081461	.072732	.364113	.325097
46.29	-105.08	42.79	55.04	233.31	.283234	.252884	.081933	.073154	.365167	.326038
46.81	-104.35	42.98	55.65	233.31	.283813	.253401	.082403	.073573	.366215	.326974
47.32	-103.62	43.18	56.25	233.31	.284146	.253693	.082718	.073853	.366865	.327546
47.83	-102.87	43.38	56.86	233.31	.284146	.253679	.082826	.073945	.366972	.327623
48.34	-102.10	43.59	57.45	233.31	.284146	.253665	.082932	.074035	.367078	.327700
48.83	-101.32	43.79	58.05	233.31	.284146	.253651	.083037	.074126	.367184	.327776
49.33	-100.52	44.00	58.63	233.31	.284146	.253637	.083142	.074215	.367288	.327852
49.82	-99.71	44.20	59.22	233.31	.284146	.253623	.083246	.074304	.367392	.327927
50.30	-98.88	44.41	59.80	233.31	.284146	.253610	.083349	.074392	.367495	.328002
50.77	-98.04	44.62	60.37	233.31	.284146	.253596	.083451	.074479	.367597	.328075
51.24	-97.17	44.83	60.94	233.31	.284146	.253583	.083552	.074565	.367698	.328148
51.71	-96.29	45.03	61.50	233.31	.284146	.253570	.083652	.074650	.367798	.328220
52.16	-95.39	45.24	62.05	233.31	.284146	.253557	.083750	.074734	.367896	.328292
52.61	-94.47	45.45	62.60	233.31	.284146	.253544	.083848	.074818	.367994	.328362
53.05	-93.54	45.65	63.14	233.31	.284146	.253532	.083944	.074900	.368090	.328431
53.49	-92.58	45.85	63.67	233.31	.284146	.253519	.084038	.074980	.368185	.328500
53.92	-91.61	46.06	64.19	233.31	.284146	.253507	.084132	.075060	.368278	.328567
54.33	-90.61	46.25	64.71	233.31	.284146	.253495	.084223	.075138	.368369	.328633
54.75	-89.60	46.45	65.21	233.31	.284146	.253484	.084276	.075182	.368422	.328666
55.15	-88.56	46.64	65.70	233.31	.284146	.253476	.084276	.075179	.368422	.328655
55.54	-87.50	46.83	66.19	233.31	.284146	.253467	.084276	.075177	.368422	.328644
55.92	-86.42	47.02	66.66	233.31	.284146	.253459	.084276	.075174	.368422	.328633
56.30	-85.32	47.20	67.12	233.31	.284146	.253450	.084276	.075172	.368422	.328622
56.66	-84.20	47.37	67.57	233.31	.284146	.253443	.084276	.075169	.368422	.328612
57.02	-83.06	47.54	68.01	233.31	.284146	.253435	.084276	.075167	.368422	.328602
57.36	-81.90	47.70	68.43	233.31	.284146	.253427	.084276	.075165	.368422	.328592
57.69	-80.71	47.85	68.83	233.31	.284146	.253420	.084276	.075163	.368422	.328583
58.01	-79.50	48.00	69.22	233.31	.284146	.253413	.084276	.075161	.368422	.328574
58.32	-78.28	48.14	69.59	233.31	.284146	.253407	.084276	.075159	.368422	.328565

58.62	-77.03	48.27	69.94	233.31	.284146	.253400	.084276	.075157	.368422	.328557
58.90	-75.76	48.39	70.28	233.31	.284146	.253394	.084276	.075155	.368422	.328549
59.18	-74.46	48.50	70.59	233.31	.284146	.253389	.084276	.075153	.368422	.328542
59.44	-73.15	48.60	70.89	233.31	.284146	.253384	.084276	.075152	.368422	.328535
59.68	-71.82	48.68	71.16	233.31	.284146	.253379	.084276	.075150	.368422	.328529
59.91	-70.47	48.76	71.41	233.31	.284146	.253374	.084276	.075149	.368422	.328523
60.13	-69.10	48.82	71.63	233.31	.284146	.253370	.084276	.075148	.368422	.328518
60.34	-67.71	48.86	71.83	233.31	.284146	.253367	.084276	.075147	.368422	.328514
60.53	-66.31	48.90	72.01	233.31	.284146	.253364	.084276	.075146	.368422	.328510
60.70	-64.89	48.91	72.16	233.31	.284146	.253361	.084276	.075145	.368422	.328506
60.86	-63.46	48.91	72.28	233.31	.284146	.253359	.084276	.075144	.368422	.328503
61.00	-62.01	48.90	72.37	233.31	.284146	.253357	.084276	.075144	.368422	.328501
61.13	-60.55	48.86	72.44	233.31	.284146	.253356	.084276	.075144	.368422	.328500
61.24	-59.08	48.81	72.47	233.31	.284146	.253355	.084276	.075143	.368422	.328499
61.34	-57.59	48.74	72.48	233.31	.284146	.253355	.084276	.075143	.368422	.328499
61.42	-56.10	48.65	72.46	233.31	.284146	.253356	.084276	.075143	.368422	.328499
61.48	-54.61	48.54	72.42	233.31	.284146	.253356	.084276	.075144	.368422	.328500
61.53	-53.11	48.41	72.34	233.31	.284146	.253358	.084276	.075144	.368422	.328502
61.56	-51.60	48.26	72.24	233.31	.284146	.253360	.084276	.075145	.368422	.328504
61.58	-50.09	48.09	72.11	233.31	.284146	.253362	.084276	.075145	.368422	.328507
61.57	-48.58	47.90	71.95	233.31	.284146	.253365	.084276	.075146	.368422	.328511
61.55	-47.08	47.68	71.76	233.31	.284146	.253368	.084276	.075147	.368422	.328515
61.52	-45.57	47.44	71.56	233.31	.284146	.253372	.084276	.075148	.368422	.328520
61.47	-44.07	47.18	71.32	233.31	.284146	.253376	.084276	.075149	.368422	.328525
61.40	-42.58	46.89	71.07	233.31	.284146	.253380	.084276	.075151	.368422	.328531
61.31	-41.09	46.59	70.79	233.31	.284146	.253385	.084276	.075152	.368422	.328538
61.21	-39.61	46.25	70.48	233.31	.284146	.253391	.084276	.075154	.368422	.328545
61.10	-38.14	45.89	70.16	233.31	.284146	.253396	.084276	.075156	.368422	.328552
60.96	-36.68	45.51	69.82	233.31	.284146	.253403	.084276	.075157	.368422	.328560
60.81	-35.24	45.10	69.46	233.31	.284146	.253409	.084276	.075159	.368422	.328568
60.65	-33.81	44.67	69.08	233.31	.284146	.253416	.084276	.075161	.368422	.328577
60.47	-32.40	44.21	68.69	233.31	.284146	.253423	.084276	.075163	.368422	.328586
60.28	-31.00	43.72	68.28	233.31	.284146	.253430	.084276	.075165	.368422	.328595
60.07	-29.61	43.21	67.85	233.31	.284146	.253437	.084276	.075168	.368422	.328605
59.85	-28.25	42.67	67.41	233.31	.284146	.253445	.084276	.075170	.368422	.328615
59.61	-26.91	42.10	66.96	233.31	.284146	.253453	.084276	.075172	.368422	.328626
59.36	-25.58	41.50	66.50	233.31	.284146	.253462	.084276	.075175	.368422	.328636
59.10	-24.27	40.87	66.02	233.31	.284146	.253470	.084276	.075177	.368422	.328647
58.82	-22.99	40.21	65.53	233.31	.284146	.253479	.084276	.075180	.368422	.328659
58.53	-21.72	39.52	65.03	233.31	.284146	.253488	.084276	.075183	.368422	.328670
58.23	-20.48	38.79	64.53	233.31	.284146	.253499	.084191	.075111	.368337	.328610
57.92	-19.26	38.03	64.01	233.31	.284146	.253511	.084099	.075032	.368245	.328543
57.59	-18.06	37.23	63.48	233.31	.284146	.253524	.084005	.074952	.368151	.328476
57.26	-16.88	36.39	62.95	233.31	.284146	.253536	.083910	.074871	.368056	.328407
56.91	-15.72	35.51	62.40	233.31	.284146	.253549	.083814	.074788	.367950	.328337
56.56	-14.58	34.58	61.86	233.31	.284146	.253562	.083716	.074705	.367852	.328267
56.19	-13.47	33.60	61.30	233.31	.284146	.253575	.083617	.074620	.367763	.328195
55.81	-12.38	32.56	60.74	233.31	.284146	.253588	.083516	.074535	.367663	.328123
55.42	-11.30	31.47	60.17	233.31	.284146	.253601	.083415	.074448	.367561	.328049
55.03	-10.25	30.31	59.59	233.31	.284146	.253615	.083313	.074361	.367459	.327975
54.62	-9.22	29.08	59.01	233.31	.284146	.253628	.083210	.074273	.367356	.327901
54.21	-8.21	27.77	58.43	233.31	.284146	.253642	.083105	.074184	.367252	.327825
53.79	-7.22	26.37	57.84	233.31	.284146	.253656	.083000	.074094	.367146	.327750
53.36	-6.26	24.86	57.24	233.31	.284146	.253669	.082895	.074003	.367041	.327673
52.92	-5.31	23.24	56.64	233.31	.284146	.253683	.082788	.073912	.366934	.327596
52.48	-4.37	21.50	56.04	233.31	.284146	.253698	.082681	.073821	.366827	.327518
52.03	-3.46	19.60	55.43	233.31	.283609	.253219	.082238	.073425	.365847	.326645
51.57	-2.57	17.53	54.82	233.31	.283030	.252702	.081767	.073005	.364797	.325707
51.10	-1.69	15.27	54.21	233.31	.282447	.252181	.081294	.072583	.363740	.324764
50.63	-.83	12.77	53.59	233.31	.281860	.251658	.080818	.072158	.362679	.323816
50.16	.01	10.02	52.97	233.31	.281156	.251033	.080342	.071734	.361498	.322767
49.71	.76	7.23	52.40	307.49	.181132	.165176	.053070	.048395	.234202	.213571

49.31	1.44	4.44	51.88	516.42	.135164	.126681	.037635	.035273	.172799	.161954
48.90	2.10	1.38	51.36	827.93	.066601	.064937	.014915	.014542	.081516	.079479

	CHARGED PART. GAMMA RAY	NEUTRONS	TOTAL	
TOTAL FLIGHT DOSE FOR SOLAR MINIMUM CONDITIONS =	3.11855	.91522	4.03377	MILLIREMS PER FLIGHT PROFILE
TOTAL FLIGHT DOSE FOR SOLAR AVERAGE CONDITIONS =	2.78923	.81844	3.60767	MILLIREMS PER FLIGHT PROFILE
AVG. DOSE / FLIGHT PROFILE HOUR (SOLAR MIN.) =	.27118	.07958	.35076	MILLIRADS PER HOUR
AVG. DOSE / FLIGHT PROFILE HOUR (SOLAR AVG.) =	.24254	.07117	.31371	MILLIREMS PER HOUR
AVG. DOSE / BLOCK TIME HOUR (SOLAR MINIMUM) =	.26541	.07789	.34330	MILLIREMS / (BLOCK TIME) HOUR
AVG. DOSE / BLOCK TIME HOUR (SOLAR AVERAGE) =	.23738	.06965	.30704	MILLIREMS / (BLOCK TIME) HOUR.

LEG BLOCK TIME = PROFILE TIME + 0.25 HOURS

LONDON TO LOS ANGELES AT MACH 1.2

SCHEDULE BLOCK TIME ON ONE WAY(HRS)= 7.3

RATE OF CLIMB(FEET/MIN)= 3333.333 CRUISING ALTITUDE(FEET)= 40000 RATE OF DESCENT(FEET/MIN)= 3333.333

CLIMBING GROUN SPEED(MILES/HOUR)=570.00 CRUISING SPEED(MILES/HOUR)= 792.00 DESCENDING GROUND SPEED(MILES/HOUR)=570.00

FLIGHT ALTITUDE AND DISTANCE PROFILE IN 1/10 HOUR INCREMENTS.

ALTITUDE

20000	40000	40000	40000	40000	40000	40000	40000
40000	40000	40000	40000	40000	40000	40000	40000
40000	40000	40000	40000	40000	40000	40000	40000
40000	40000	40000	40000	40000	40000	40000	40000
40000	40000	40000	40000	40000	40000	40000	40000
40000	40000	40000	40000	40000	40000	40000	40000
40000	40000	40000	40000	40000	40000	40000	40000
40000	40000	40000	40000	40000	40000	40000	40000
40000	40000	40000	40000	20000	0		

DISTANCE

57.00	57.00	79.20	79.20	79.20	79.20	79.20	79.20
79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20
79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20
79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20
79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20
79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20
79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20
79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20
79.20	79.20	79.20	79.20	57.00	57.00		

TOTAL INPUT PROFILE DISTANCE = 5455.20 STATUTE MILES

FLIGHT PROFILE TIME = 7.00 HOURS IN THE AIR

COMPUTED GREAT CIRCLE LEG DISTANCE = 5450.5 THE INITIAL COURSE ANGLE = 311.947

LEG START LATITUDE = 51.40 LEG START LONGITUDE = .15

LEG END LATITUDE = 34.00 LEG END LONGITUDE = -118.15

LAT.	LONG.	COURSE ANGLE	GEOMAG. LAT.	ATMOS. DEPTH GR/SQ. CM.	CHARGED PARTICLES AND GAMMA DOSE RATE (MREMS/HR) SOLAR MIN.	SOLAR AVG.	NEUTRONS DOSE RATE (MREMS/HR) SOLAR MIN.	SOLAR AVG.	TOTAL DOSE RATE DOSE RATE (MREMS/HR) SOLAR MIN.	SOLAR AVG.
51.67	-.35	312.78	54.48	710.12	.092639	.089001	.024094	.023148	.116733	.112148
52.22	-1.35	312.20	55.20	307.49	.181134	.165177	.054379	.049589	.235513	.214766
52.86	-2.59	311.50	56.05	193.27	.365627	.320927	.104627	.091836	.470253	.412763
53.58	-4.08	310.69	57.02	193.27	.365732	.321015	.104866	.092045	.470598	.413060
54.29	-5.61	309.87	57.99	193.27	.365836	.321102	.105103	.092251	.470940	.413354
54.97	-7.20	309.05	58.95	193.27	.365940	.321189	.105338	.092456	.471278	.413645
55.64	-8.84	308.23	59.89	193.27	.366042	.321274	.105569	.092658	.471611	.413932
56.28	-10.54	307.41	60.82	193.27	.366142	.321358	.105798	.092857	.471940	.414215
56.90	-12.30	306.59	61.74	193.27	.366241	.321440	.106023	.093053	.472264	.414494
57.49	-14.11	305.78	62.64	193.27	.366338	.321522	.106244	.093246	.472582	.414768
58.05	-15.98	304.98	63.52	193.27	.366434	.321601	.106460	.093435	.472894	.415036
58.59	-17.91	304.18	64.39	193.27	.366527	.321679	.106672	.093620	.473199	.415299
59.10	-19.90	303.40	65.23	193.27	.366593	.321729	.106823	.093750	.473416	.415479
59.57	-21.95	302.62	66.05	193.27	.366593	.321710	.106823	.093744	.473416	.415455
60.02	-24.05	301.86	66.84	193.27	.366593	.321692	.106823	.093739	.473416	.415431
60.42	-26.21	301.12	67.60	193.27	.366593	.321675	.106823	.093734	.473416	.415409
60.80	-28.42	300.39	68.34	193.27	.366593	.321658	.106823	.093729	.473416	.415387
61.13	-30.68	299.68	69.03	193.27	.366593	.321642	.106823	.093724	.473416	.415366
61.43	-32.99	298.99	69.69	193.27	.366593	.321627	.106823	.093720	.473416	.415347
61.69	-35.33	298.31	70.30	193.27	.366593	.321613	.106823	.093716	.473416	.415329
61.90	-37.72	297.66	70.87	193.27	.366593	.321600	.106823	.093712	.473416	.415312
62.08	-40.13	297.02	71.39	193.27	.366593	.321588	.106823	.093708	.473416	.415297
62.21	-42.57	296.39	71.85	193.27	.366593	.321578	.106823	.093705	.473416	.415283
62.30	-45.03	295.78	72.25	193.27	.366593	.321569	.106823	.093703	.473416	.415271
62.35	-47.49	295.19	72.58	193.27	.366593	.321561	.106823	.093700	.473416	.415261
62.35	-49.97	294.60	72.85	193.27	.366593	.321555	.106823	.093699	.473416	.415253
62.31	-52.43	294.01	73.04	193.27	.366593	.321550	.106823	.093697	.473416	.415248
62.22	-54.89	293.43	73.17	193.27	.366593	.321547	.106823	.093697	.473416	.415244
62.09	-57.33	292.85	73.21	193.27	.366593	.321546	.106823	.093696	.473416	.415243
61.92	-59.75	292.25	73.18	193.27	.366593	.321547	.106823	.093696	.473416	.415243
61.71	-62.14	291.64	73.08	193.27	.366593	.321549	.106823	.093697	.473416	.415247
61.45	-64.49	291.01	72.90	193.27	.366593	.321554	.106823	.093698	.473416	.415252
61.16	-66.80	290.35	72.65	193.27	.366593	.321559	.106823	.093700	.473416	.415259
60.83	-69.06	289.64	72.33	193.27	.366593	.321567	.106823	.093702	.473416	.415269
60.46	-71.28	288.89	71.94	193.27	.366593	.321575	.106823	.093705	.473416	.415280
60.05	-73.44	288.08	71.50	193.27	.366593	.321586	.106823	.093708	.473416	.415293
59.61	-75.55	287.20	70.99	193.27	.366593	.321597	.106823	.093711	.473416	.415308
59.14	-77.60	286.23	70.44	193.27	.366593	.321610	.106823	.093715	.473416	.415325
58.64	-79.59	285.17	69.83	193.27	.366593	.321624	.106823	.093719	.473416	.415343
58.10	-81.53	283.98	69.19	193.27	.366593	.321639	.106823	.093723	.473416	.415362
57.54	-83.41	282.67	68.50	193.27	.366593	.321654	.106823	.093728	.473416	.415382
56.95	-85.22	281.20	67.78	193.27	.366593	.321671	.106823	.093733	.473416	.415403
56.33	-86.99	279.55	67.02	193.27	.366593	.321688	.106823	.093738	.473416	.415426
55.69	-88.69	277.69	66.23	193.27	.366593	.321706	.106823	.093743	.473416	.415449
55.03	-90.34	275.61	65.42	193.27	.366593	.321725	.106823	.093748	.473416	.415473
54.35	-91.93	273.27	64.58	193.27	.366548	.321697	.106720	.093662	.473268	.415359
53.64	-93.47	270.63	63.72	193.27	.366455	.321619	.106509	.093478	.472965	.415097
52.92	-94.96	267.66	62.84	193.27	.366360	.321540	.106294	.093290	.472654	.414830
52.18	-96.40	264.34	61.95	193.27	.366264	.321459	.106074	.093098	.472338	.414557
51.42	-97.79	260.64	61.03	193.27	.366165	.321377	.105850	.092903	.472015	.414280
50.65	-99.14	256.55	60.11	193.27	.366065	.321293	.105622	.092704	.471697	.413998

49.86	-100.44	252.06	59.17	193.27	.365963	.321208	.105392	.092503	.471355	.413711
49.06	-101.70	247.20	58.21	193.27	.365860	.321122	.105158	.092299	.471018	.413421
48.24	-102.92	242.03	57.25	193.27	.365756	.321035	.104921	.092093	.470677	.413128
47.41	-104.10	236.62	56.27	193.27	.365651	.320948	.104682	.091884	.470333	.412831
46.57	-105.24	231.09	55.29	193.27	.365750	.321045	.103904	.091204	.469654	.412249
45.72	-106.35	225.55	54.30	193.27	.365928	.321215	.102913	.090338	.468841	.411553
44.86	-107.43	220.12	53.29	193.27	.366108	.321387	.101914	.089465	.468022	.410852
43.98	-108.47	214.91	52.29	193.27	.361169	.317303	.101095	.088816	.462264	.406119
43.10	-109.49	210.00	51.27	193.27	.354067	.311409	.100348	.088258	.454415	.399668
42.21	-110.47	205.45	50.25	193.27	.346922	.305466	.099597	.087696	.446519	.393162
41.31	-111.43	201.28	49.23	193.27	.339380	.299927	.097575	.086232	.436956	.386159
40.41	-112.36	197.49	48.19	193.27	.331684	.294453	.095128	.084450	.426812	.378903
39.50	-113.26	194.07	47.16	193.27	.323952	.288891	.092669	.082640	.416621	.371531
38.58	-114.15	191.00	46.12	193.27	.316186	.283243	.090200	.080802	.406386	.364045
37.65	-115.01	188.25	45.07	193.27	.308390	.277509	.087720	.078937	.396110	.356446
36.72	-115.84	185.78	44.02	193.27	.300564	.271691	.085232	.077044	.385796	.348735
35.78	-116.66	183.57	42.97	193.27	.292712	.265788	.082735	.075125	.375447	.340913
34.97	-117.35	181.85	42.06	307.49	.150901	.139978	.042477	.039402	.193377	.179380
34.29	-117.92	180.52	41.30	710.12	.077338	.074894	.018531	.017946	.095869	.092840

	CHARGED PART. GAMMA RAY	NEUTRONS	TOTAL	
TOTAL FLIGHT DOSE FOR SOLAR MINIMUM CONDITIONS =	2.42943	.70196	3.13139	MILLIREMS PER FLIGHT PROFILE
TOTAL FLIGHT DOSE FOR SOLAR AVERAGE CONDITIONS =	2.13881	.61791	2.75672	MILLIREMS PER FLIGHT PROFILE
AVG. DOSE / FLIGHT PROFILE HOUR (SOLAR MIN.) =	.34706	.10028	.44734	MILLIRADS PER HOUR
AVG. DOSE / FLIGHT PROFILE HOUR (SOLAR AVG.) =	.30554	.08827	.39382	MILLIREMS PER HOUR
AVG. DOSE / BLOCK TIME HOUR (SOLAR MINIMUM) =	.33509	.09682	.43192	MILLIREMS / (BLOCK TIME) HOUR
AVG. DOSE / BLOCK TIME HOUR (SOLAR AVERAGE) =	.29501	.08523	.38024	MILLIREMS / (BLOCK TIME) HOUR.

LEG BLOCK TIME = PROFILE TIME + 0.25 HOURS

LOS ANGELES TO NEW YORK SUBSONIC FLIGHT (0.75 MACH)

SCHEDULE BLOCK TIME ON ONE WAY(HRS)= 5.1

RATE OF CLIMB(FEET/MIN)= 2000.000 CRUISING ALTITUDE(FEET)= 36000 RATE OF DESCENT(FEET/MIN)= 2000.000

CLIMBING GROUN SPEED(MILES/HOUR)=413.00 CRUISING SPEED(MILES/HOUR)= 495.80 DESCENDING GROUND SPEED(MILES/HOUR)=413.00

FLIGHT ALTITUDE AND DISTANCE PROFILE IN 1/10 HOUR INCREMENTS.

ALTITUDE

12000	24000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
24000	12000	0					

DISTANCE

41.30	41.30	41.30	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
41.30	41.30	41.30					

TOTAL INPUT PROFILE DISTANCE = 2478.90 STATUTE MILES

FLIGHT PROFILE TIME = 5.10 HOURS IN THE AIR

COMPUTED GREAT CIRCLE LEG DISTANCE = 2453.1 THE INITIAL COURSE ANGLE = 65.982

LEG START LATITUDE = 34.00 LEG START LONGITUDE = -118.15

LEG END LATITUDE = 40.63 LEG END LONGITUDE = -73.77

LAT.	LONG.	COURSE ANGLE	GEOMAG. LAT.	ATMOS. DEPTH GR/SQ. CM.	CHARGED PARTICLES AND GAMMA DOSE RATE (MREMS/HR) SOLAR MIN.	CHARGED PARTICLES AND GAMMA DOSE RATE (MREMS/HR) SOLAR AVG.	NEUTRONS DOSE RATE (MREMS/HR) SOLAR MIN.	NEUTRONS DOSE RATE (MREMS/HR) SOLAR AVG.	TOTAL DOSE RATE DOSE RATE (MREMS/HR) SOLAR MIN.	TOTAL DOSE RATE DOSE RATE (MREMS/HR) SOLAR AVG.
34.12	-117.82	99.29	41.16	827.93	.056497	.055366	.011742	.011507	.068238	.066872
34.36	-117.16	99.56	41.50	516.42	.111878	.106197	.029784	.028271	.141661	.134469
34.60	-116.49	99.83	41.84	307.49	.150056	.139260	.042212	.039175	.192258	.178435
34.95	-115.75	100.14	42.21	233.31	.225611	.207063	.063832	.058584	.289444	.265647
35.13	-114.94	100.49	42.61	233.31	.227674	.208683	.064569	.059183	.292243	.267866
35.40	-114.13	100.86	43.00	233.31	.229707	.210275	.065296	.059772	.295003	.270047
35.66	-113.31	101.23	43.39	233.31	.231709	.211838	.066011	.060350	.297720	.272188
35.92	-112.48	101.62	43.77	233.31	.233679	.213372	.066716	.060918	.300395	.274290
36.17	-111.65	102.03	44.15	233.31	.235618	.214876	.067409	.061475	.303026	.276351
36.41	-110.81	102.45	44.52	233.31	.237523	.216351	.068090	.062020	.305613	.278371
36.65	-109.97	102.89	44.88	233.31	.239394	.217795	.068758	.062555	.308153	.280349
36.89	-109.12	103.35	45.23	233.31	.241231	.219208	.069415	.063078	.310646	.282286
37.12	-108.27	103.83	45.58	233.31	.243032	.220590	.070058	.063589	.313090	.284179
37.34	-107.41	104.33	45.92	233.31	.244796	.221940	.070689	.064089	.315485	.286029
37.55	-106.55	104.85	46.25	233.31	.246523	.223259	.071306	.064577	.317829	.287836
37.76	-105.68	105.40	46.58	233.31	.248211	.224544	.071910	.065053	.320121	.289597
37.97	-104.81	105.98	46.90	233.31	.249860	.225796	.072499	.065517	.322359	.291313
38.16	-103.93	106.59	47.21	233.31	.251469	.227015	.073074	.065968	.324543	.292983
38.35	-103.05	107.23	47.51	233.31	.253037	.228200	.073634	.066407	.326671	.294606
38.54	-102.16	107.90	47.81	233.31	.254563	.229350	.074180	.066833	.328742	.296183
38.71	-101.27	108.61	48.09	233.31	.256045	.230465	.074710	.067246	.330755	.297711
38.88	-100.38	109.37	48.37	233.31	.257484	.231545	.075224	.067646	.332708	.299191
39.05	-99.48	110.16	48.64	233.31	.258878	.232589	.075722	.068032	.334600	.300621
39.20	-98.57	111.01	48.90	233.31	.260227	.233597	.076204	.068406	.336431	.302002
39.35	-97.67	111.92	49.15	233.31	.261529	.234567	.076669	.068765	.338198	.303333
39.49	-96.75	112.88	49.40	233.31	.262783	.235501	.077118	.069111	.339901	.304612
39.63	-95.84	113.91	49.63	233.31	.263989	.236396	.077549	.069443	.341538	.305840
39.75	-94.92	115.01	49.85	233.31	.265146	.237254	.077962	.069761	.343108	.307015
39.87	-94.00	116.18	50.07	233.31	.266249	.238115	.078281	.070009	.344530	.308124
39.993	-93.07	117.45	50.27	233.31	.267296	.239023	.078426	.070131	.345722	.309154
40.09	-92.15	118.81	50.47	233.31	.268292	.239887	.078563	.070246	.346855	.310133
40.19	-91.22	120.28	50.65	233.31	.269235	.240706	.078694	.070355	.347929	.311061
40.28	-90.28	121.86	50.82	233.31	.270126	.241478	.078817	.070458	.348943	.311936
40.37	-89.35	123.57	50.99	233.31	.270963	.242204	.078933	.070555	.349895	.312759
40.44	-88.41	125.43	51.14	233.31	.271745	.242883	.079041	.070646	.350786	.313529
40.51	-87.47	127.44	51.28	233.31	.272473	.243514	.079142	.070730	.351615	.314244
40.57	-86.53	129.62	51.41	233.31	.273146	.244097	.079234	.070808	.352380	.314905
40.62	-85.59	131.99	51.53	233.31	.273762	.244631	.079320	.070879	.353082	.315510
40.67	-84.64	134.57	51.64	233.31	.274322	.245116	.079397	.070944	.353719	.316060
40.70	-83.70	137.36	51.74	233.31	.274824	.245551	.079467	.071002	.354291	.316553
40.73	-82.75	140.39	51.83	233.31	.275269	.245937	.079528	.071054	.354797	.316990
40.76	-81.80	143.66	51.90	233.31	.275656	.246272	.079582	.071098	.355238	.317370
40.77	-80.85	147.19	51.96	233.31	.275985	.246557	.079627	.071136	.355612	.317693
40.78	-79.91	150.97	52.02	233.31	.276255	.246791	.079664	.071168	.355919	.317958
40.78	-78.96	154.99	52.06	233.31	.276466	.246973	.079693	.071192	.356160	.318165
40.77	-78.01	159.24	52.09	233.31	.276618	.247105	.079714	.071210	.356333	.318315
40.75	-77.06	163.69	52.11	233.31	.276711	.247186	.079727	.071220	.356439	.318406
40.72	-76.11	168.30	52.11	233.31	.276745	.247215	.079732	.071224	.356477	.318439
40.70	-75.25	172.60	52.11	307.49	.181132	.165175	.052933	.048270	.234065	.213446
40.66	-74.46	176.55	52.10	516.42	.135168	.126685	.037707	.035341	.172875	.162026
40.63	-73.67	180.49	52.08	827.93	.066634	.064969	.015010	.014635	.081644	.079604

	CHARGED PART. GAMMA RAY	NEUTRONS	TOTAL	
TOTAL FLIGHT DOSE FOR SOLAR MINIMUM CONDITIONS =	1.23432	.35626	1.59058	MILLIREMS PER FLIGHT PROFILE
TOTAL FLIGHT DOSE FOR SOLAR AVERAGE CONDITIONS =	1.11310	.32116	1.43426	MILLIREMS PER FLIGHT PROFILE
AVG. DOSE / FLIGHT PROFILE HOUR (SOLAR MIN.) =	.24202	.06985	.31188	MILLIRADS PER HOUR
AVG. DOSE / FLIGHT PROFILE HOUR (SOLAR AVG.) =	.21825	.06297	.28123	MILLIREMS PER HOUR
AVG. DOSE / BLOCK TIME HOUR (SOLAR MINIMUM) =	.23071	.06659	.29730	MILLIREMS / (BLOCK TIME) HOUR
AVG. DOSE / BLOCK TIME HOUR (SOLAR AVERAGE) =	.20806	.06003	.26809	MILLIREMS / (BLOCK TIME) HOUR.

LEG BLOCK TIME = PROFILE TIME + 0.25 HOURS

LOS ANGELES TO NEW YORK AT 1.4 MACH

SCHEDULE BLOCK TIME ON ONE WAY(HRS)= 5.8

RATE OF CLIMB(FEET/MIN)= 3333.333 CRUISING ALTITUDE(FEET)= 40000 RATE OF DESCENT(FEET/MIN)= 3333.333

CLIMBING GROUN SPEED(MILES/HOUR)=665.00 CRUISING SPEED(MILES/HOUR)= 924.00 DESCENDING GROUND SPEED(MILES/HOUR)=665.00

FLIGHT ALTITUDE AND DISTANCE PROFILE IN 1/10 HOUR INCREMENTS.

ALTITUDE

20000	40000	40000	40000	40000	40000	40000	40000
40000	40000	40000	40000	40000	40000	40000	40000
40000	40000	40000	40000	40000	40000	40000	40000
40000	40000	20000	0				

DISTANCE

66.50	66.50	92.40	92.40	92.40	92.40	92.40	92.40
92.40	92.40	92.40	92.40	92.40	92.40	92.40	92.40
92.40	92.40	92.40	92.40	92.40	92.40	92.40	92.40
92.40	92.40	66.50	66.50				

TOTAL INPUT PROFILE DISTANCE = 2483.60 STATUTE MILES

FLIGHT PROFILE TIME = 2.80 HOURS IN THE AIR

COMPUTED GREAT CIRCLE LEG DISTANCE = 2453.1 THE INITIAL COURSE ANGLE = 65.982

LEG START LATITUDE = 34.00 LEG START LONGITUDE = -118.15

LEG END LATITUDE = 40.63 LEG END LONGITUDE = -73.77

LAT.	LONG.	COURSE ANGLE	GEOMAG. LAT.	ATMOS. DEPTH GR/SQ. CM.	CHARGED PARTICLES AND GAMMA DOSE RATE (MREMS/HR) SOLAR MIN.	CHARGED PARTICLES AND GAMMA DOSE RATE (MREMS/HR) SOLAR AVG.	NEUTRONS DOSE RATE (MREMS/HR) SOLAR MIN.	NEUTRONS DOSE RATE (MREMS/HR) SOLAR AVG.	TOTAL DOSE RATE DOSE RATE (MREMS/HR) SOLAR MIN.	TOTAL DOSE RATE DOSE RATE (MREMS/HR) SOLAR AVG.
34.19	-117.62	99.37	41.26	710.12	.077268	.074830	.018510	.017926	.095779	.092756
34.58	-116.55	99.81	41.81	307.49	.149946	.139167	.042178	.039146	.192124	.178313
35.02	-115.25	100.36	42.46	193.27	.288884	.262887	.081518	.074182	.370402	.337069
35.52	-113.73	101.04	43.19	193.27	.294343	.267019	.083254	.075525	.377597	.342545
36.00	-112.20	101.76	43.90	193.27	.299647	.271004	.084940	.076821	.384587	.347825
36.46	-110.64	102.54	44.59	193.27	.304788	.274839	.086575	.078068	.391363	.352907
36.90	-109.06	103.38	45.26	193.27	.309757	.278520	.088155	.079265	.397912	.357785
37.32	-107.47	104.30	45.90	193.27	.314548	.282043	.089679	.080412	.404226	.362455
37.72	-105.86	105.29	46.52	193.27	.319151	.285407	.091142	.081506	.410293	.366313
38.10	-104.23	106.38	47.11	193.27	.323558	.288607	.092544	.082547	.416102	.371154
38.45	-102.58	107.57	47.67	193.27	.327761	.291639	.093880	.083534	.421641	.375173
38.78	-100.92	108.90	48.20	193.27	.331751	.294501	.095149	.084465	.426900	.378966
39.09	-99.25	110.37	48.71	193.27	.335519	.297189	.096347	.085340	.431866	.382529
39.37	-97.56	112.02	49.18	193.27	.339057	.299699	.097473	.086158	.436530	.385857
39.62	-95.86	113.88	49.62	193.27	.342358	.302028	.098522	.086916	.440879	.388945
39.86	-94.14	115.99	50.03	193.27	.345395	.304194	.099437	.087576	.444832	.391770
40.06	-92.42	118.40	50.41	193.27	.348022	.306382	.099713	.087783	.447735	.394164
40.24	-90.68	121.17	50.75	193.27	.350402	.308363	.099963	.087970	.450366	.396333
40.40	-88.94	124.36	51.05	193.27	.352531	.310133	.100187	.088138	.452718	.398270
40.53	-87.19	128.07	51.32	193.27	.354401	.311687	.100383	.088285	.454784	.399971
40.63	-85.43	132.39	51.55	193.27	.356007	.313020	.100552	.088411	.456559	.401431
40.71	-83.67	137.43	51.74	193.27	.357344	.314131	.100693	.088516	.458037	.402647
40.75	-81.91	143.28	51.89	193.27	.358408	.315014	.100805	.088600	.459213	.403613
40.78	-80.14	150.01	52.01	193.27	.359197	.315668	.100887	.088661	.460084	.404329
40.77	-78.37	157.59	52.08	193.27	.359706	.316090	.100941	.088701	.460647	.404792
40.74	-76.61	165.88	52.11	193.27	.359935	.316280	.100965	.088719	.460900	.404999
40.69	-75.09	173.38	52.11	307.49	.181132	.165175	.052932	.048270	.234054	.213445
40.63	-73.82	179.74	52.08	710.12	.092553	.088918	.023592	.022666	.116145	.111584

		CHARGED PART. GAMMA RAY	NEUTRONS	TOTAL	
TOTAL FLIGHT DOSE FOR SOLAR MINIMUM CONDITIONS	=	.85334	.24209	1.09543	MILLIREMS PER FLIGHT PROFILE
TOTAL FLIGHT DOSE FOR SOLAR AVERAGE CONDITIONS	=	.75944	.21541	.97485	MILLIREMS PER FLIGHT PROFILE
AVG. DOSE / FLIGHT PROFILE HOUR (SOLAR MIN.)	=	.30476	.08646	.39122	MILLIRADS PER HOUR
AVG. DOSE / FLIGHT PROFILE HOUR (SOLAR AVG.)	=	.27123	.07693	.34816	MILLIREMS PER HOUR
AVG. DOSE / BLOCK TIME HOUR (SOLAR MINIMUM)	=	.27978	.07937	.35916	MILLIREMS / (BLOCK TIME) HOUR
AVG. DOSE / BLOCK TIME HOUR (SOLAR AVERAGE)	=	.24900	.07063	.31962	MILLIREMS / (BLOCK TIME) HOUR.

LEG BLOCK TIME = PROFILE TIME + 0.25 HOURS

WASHINGTON TO MOSCOW SUBSONIC FLIGHT (0.75 MACH)

SCHEDULE BLOCK TIME ON ONE WAY(HRS)= 10.0

RATE OF CLIMB(FEET/MIN)= 2000.000 CRUISING ALTITUDE(FEET)= 36000 RATE OF DESCENT(FEET/MIN)= 2000.000

CLIMBING GROUN SPEED(MILES/HOUR)=413.00 CRUISING SPEED(MILES/HOUR)= 495.80 DESCENDING GROUND SPEED(MILES/HOUR)=413.00

FLIGHT ALTITUDE AND DISTANCE PROFILE IN 1/10 HOUR INCREMENTS.

ALTITUDE

12000	24000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	24000	12000	0				

DISTANCE

41.30	41.30	41.30	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	49.58	49.58	49.58	49.58	49.58	49.58	49.58
49.58	41.30	41.30	41.30				

TOTAL INPUT PROFILE DISTANCE = 4908.32 STATUTE MILES

FLIGHT PROFILE TIME = 10.00 HOURS IN THE AIR

COMPUTED GREAT CIRCLE LEG DISTANCE = 4884.0 THE INITIAL COURSE ANGLE = 33.163

LEG START LATITUDE = 38.55 LEG START LONGITUDE = -77.00

LEG END LATITUDE = 55.45 LEG END LONGITUDE = 37.42

LAT.	LONG.	COURSE ANGLE	GEOMAG. LAT.	ATMOS. DEPTH GR/SQ. CM.	CHARGED PARTICLES AND GAMMA DOSE RATE (MREMS/HR) SOLAR MIN.	SOLAR AVG.	NEUTRONS DOSE RATE (MREMS/HR) SOLAR MIN.	SOLAR AVG.	TOTAL DOSE RATE DOSE RATE (MREMS/HR) SOLAR MIN.	SOLAR AVG.
38.80	-76.79	36.57	50.17	827.93	.066546	.064883	.014757	.014388	.081303	.079272
39.30	-76.37	36.60	50.68	516.42	.135141	.126660	.037235	.034898	.172376	.161558
39.80	-75.94	36.64	51.19	307.49	.181131	.165175	.052504	.047879	.233635	.213054
40.34	-75.45	36.69	51.75	233.31	.274888	.245606	.079475	.071009	.354363	.316615
40.94	-74.92	36.75	52.36	233.31	.278002	.248303	.079906	.071370	.357908	.319673
41.53	-74.38	36.81	52.96	233.31	.281100	.250984	.080334	.071727	.361434	.322711
42.11	-73.82	36.87	53.56	233.31	.281831	.251631	.080794	.072137	.362625	.323768
42.70	-73.26	36.94	54.16	233.31	.282397	.252137	.081254	.072547	.363651	.324684
43.28	-72.69	37.00	54.75	233.31	.282960	.252639	.081710	.072955	.364670	.325594
43.86	-72.10	37.08	55.34	233.31	.283518	.253138	.082164	.073359	.365682	.326498
44.44	-71.51	37.15	55.92	233.31	.284073	.253633	.082614	.073761	.366687	.327395
45.01	-70.90	37.23	56.50	233.31	.284146	.253687	.082763	.073891	.366909	.327578
45.58	-70.28	37.31	57.08	233.31	.284146	.253673	.082865	.073978	.367011	.327652
46.15	-69.64	37.40	57.65	233.31	.284146	.253660	.082966	.074065	.367112	.327725
46.71	-69.00	37.48	58.21	233.31	.284146	.253647	.083067	.074151	.367213	.327798
47.27	-68.34	37.57	58.77	233.31	.284146	.253634	.083166	.074236	.367312	.327969
47.83	-67.66	37.66	59.32	233.31	.284146	.253621	.083265	.074320	.367411	.327941
48.38	-66.97	37.76	59.87	233.31	.284146	.253608	.083362	.074403	.367508	.328011
48.92	-66.27	37.85	60.41	233.31	.284146	.253595	.083458	.074485	.367604	.328080
49.47	-65.55	37.95	60.94	233.31	.284146	.253583	.083553	.074566	.367699	.328149
50.01	-64.81	38.05	61.47	233.31	.284146	.253571	.083646	.074646	.367793	.328216
50.54	-64.06	38.15	61.98	233.31	.284146	.253559	.083739	.074724	.367885	.328283
51.07	-63.29	38.25	62.49	233.31	.284146	.253547	.083829	.074802	.367975	.328349
51.59	-62.51	38.35	62.99	233.31	.284146	.253535	.083918	.074878	.368054	.328413
52.11	-61.70	38.45	63.48	233.31	.284146	.253524	.084006	.074953	.368152	.328476
52.62	-60.88	38.55	63.97	233.31	.284146	.253512	.084092	.075026	.368238	.328538
53.13	-60.03	38.66	64.44	233.31	.284146	.253501	.084175	.075097	.368322	.328599
53.63	-59.17	38.76	64.90	233.31	.284146	.253491	.084257	.075167	.368404	.328658
54.12	-58.29	38.86	65.35	233.31	.284146	.253482	.084276	.075181	.368422	.328663
54.61	-57.38	38.96	65.78	233.31	.284146	.253474	.084276	.075179	.368422	.328653
55.09	-56.45	39.06	66.21	233.31	.284146	.253467	.084276	.075176	.368422	.328643
55.56	-55.50	39.15	66.62	233.31	.284146	.253459	.084276	.075174	.368422	.328634
56.03	-54.53	39.24	67.01	233.31	.284146	.253452	.084276	.075172	.368422	.328625
56.49	-53.54	39.33	67.39	233.31	.284146	.253446	.084276	.075170	.368422	.328616
56.94	-52.52	39.42	67.76	233.31	.284146	.253439	.084276	.075168	.368422	.328607
57.38	-51.47	39.50	68.11	233.31	.284146	.253433	.084276	.075166	.368422	.328599
57.81	-50.40	39.58	68.44	233.31	.284146	.253427	.084276	.075165	.368422	.328592
58.23	-49.31	39.65	68.75	233.31	.284146	.253422	.084276	.075163	.368422	.328585
58.65	-48.19	39.71	69.05	233.31	.284146	.253416	.084276	.075161	.368422	.328578
59.05	-47.04	39.77	69.32	233.31	.284146	.253411	.084276	.075160	.368422	.328571
59.44	-45.86	39.82	69.57	233.31	.284146	.253407	.084276	.075159	.368422	.328566
59.83	-44.66	39.86	69.81	233.31	.284146	.253403	.084276	.075157	.368422	.328560
60.20	-43.43	39.89	70.02	233.31	.284146	.253399	.084276	.075156	.368422	.328555
60.56	-42.17	39.91	70.20	233.31	.284146	.253396	.084276	.075155	.368422	.328551
60.91	-40.89	39.92	70.37	233.31	.284146	.253393	.084276	.075155	.368422	.328547
61.24	-39.57	39.91	70.51	233.31	.284146	.253390	.084276	.075154	.368422	.328544
61.56	-38.23	39.89	70.62	233.31	.284146	.253388	.084276	.075153	.368422	.328541
61.87	-36.86	39.86	70.71	233.31	.284146	.253387	.084276	.075153	.368422	.328539
62.17	-35.47	39.81	70.78	233.31	.284146	.253386	.084276	.075152	.368422	.328538
62.45	-34.05	39.74	70.81	233.31	.284146	.253385	.084276	.075152	.368422	.328537
62.71	-32.60	39.65	70.83	233.31	.284146	.253385	.084276	.075152	.368422	.328537

62.96	-31.12	39.54	70.81	233.31	.284146	.253385	.084276	.075152	.368422	.328537
63.20	-29.63	39.42	70.78	233.31	.284146	.253386	.084276	.075152	.368422	.328538
63.42	-28.10	39.27	70.71	233.31	.284146	.253387	.084276	.075153	.368422	.328539
63.62	-26.56	39.09	70.62	233.31	.284146	.253388	.084276	.075153	.368422	.328541
63.80	-24.99	38.89	70.51	233.31	.284146	.253390	.084276	.075154	.368422	.328544
63.97	-23.41	38.67	70.37	233.31	.284146	.253393	.084276	.075154	.368422	.328547
64.12	-21.80	38.42	70.20	233.31	.284146	.253396	.084276	.075155	.368422	.328551
64.26	-20.18	38.14	70.02	233.31	.284146	.253399	.084276	.075156	.368422	.328555
64.37	-18.54	37.83	69.81	233.31	.284146	.253403	.084276	.075157	.368422	.328560
64.47	-16.90	37.49	69.58	233.31	.284146	.253407	.084276	.075159	.368422	.328566
64.55	-15.24	37.12	69.32	233.31	.284146	.253411	.084276	.075160	.368422	.328571
64.61	-13.57	36.71	69.05	233.31	.284146	.253416	.084276	.075161	.368422	.328578
64.65	-11.90	36.28	68.75	233.31	.284146	.253421	.084276	.075163	.368422	.328584
64.67	-10.22	35.81	68.44	233.31	.284146	.253427	.084276	.075165	.368422	.328592
64.67	-8.54	35.30	68.11	233.31	.284146	.253433	.084276	.075166	.368422	.328599
64.65	-6.87	34.76	67.76	233.31	.284146	.253439	.084276	.075168	.368422	.328607
64.62	-5.19	34.19	67.40	233.31	.284146	.253446	.084276	.075170	.368422	.328616
64.56	-3.52	33.58	67.02	233.31	.284146	.253452	.084276	.075172	.368422	.328625
64.49	-1.86	32.93	66.62	233.31	.284146	.253459	.084276	.075174	.368422	.328634
64.40	-.21	32.25	66.21	233.31	.284146	.253467	.084276	.075176	.368422	.328643
64.29	1.43	31.54	65.79	233.31	.284146	.253474	.084276	.075179	.368422	.328653
64.16	3.05	30.79	65.35	233.31	.284146	.253482	.084276	.075181	.368422	.328663
64.01	4.66	30.00	64.90	233.31	.284146	.253490	.084258	.075168	.368404	.328658
63.85	6.25	29.19	64.44	233.31	.284146	.253501	.084176	.075098	.368322	.328599
63.67	7.83	28.33	63.97	233.31	.284146	.253512	.084092	.075026	.368238	.328539
63.47	9.38	27.45	63.49	233.31	.284146	.253523	.084007	.074953	.368153	.328477
63.26	10.91	26.53	63.00	233.31	.284146	.253535	.083919	.074879	.368065	.328413
63.03	12.41	25.58	62.50	233.31	.284146	.253547	.083830	.074802	.367976	.328349
62.78	13.89	24.60	61.99	233.31	.284146	.253559	.083739	.074725	.367886	.328284
62.52	15.35	23.58	61.47	233.31	.284146	.253571	.083647	.074646	.367793	.328217
62.24	16.78	22.54	60.95	233.31	.284146	.253583	.083554	.074567	.367700	.328149
61.95	18.18	21.47	60.41	233.31	.284146	.253595	.083459	.074486	.367605	.328081
61.65	19.55	20.37	59.87	233.31	.284146	.253608	.083363	.074404	.367509	.328012
61.33	20.90	19.25	59.33	233.31	.284146	.253621	.083266	.074320	.367412	.327941
61.00	22.22	18.09	58.77	233.31	.284146	.253634	.083167	.074236	.367313	.327870
60.65	23.52	16.91	58.22	233.31	.284146	.253647	.083068	.074151	.367214	.327798
60.30	24.78	15.71	57.65	233.31	.284146	.253660	.082967	.074066	.367113	.327726
59.93	26.02	14.48	57.08	233.31	.284146	.253673	.082866	.073979	.367012	.327652
59.55	27.23	13.22	56.51	233.31	.284146	.253687	.082763	.073892	.366910	.327578
59.16	28.41	11.94	55.93	233.31	.284078	.253638	.082618	.073765	.366696	.327402
58.76	29.57	10.63	55.34	233.31	.283523	.253142	.082168	.073363	.365691	.326506
58.35	30.69	9.30	54.76	233.31	.282965	.252644	.081714	.072958	.364679	.325602
57.92	31.80	7.94	54.16	233.31	.282402	.252141	.081258	.072551	.363660	.324692
57.49	32.87	6.56	53.57	233.31	.281836	.251636	.080798	.072140	.362634	.323776
57.06	33.92	5.15	52.97	233.31	.281127	.251008	.080338	.071731	.361465	.322738
56.61	34.95	3.72	52.36	233.31	.278030	.248327	.079910	.071373	.357939	.319700
56.19	35.87	2.38	51.81	307.49	.181131	.165175	.052792	.048142	.233924	.213317
55.81	36.69	1.14	51.30	516.42	.135153	.126671	.037441	.035091	.172594	.161762
55.41	37.49	359.89	50.79	827.93	.066575	.064911	.014839	.014469	.081414	.079380

00000600070

	CHARGED PART. GAMMA RAY	NEUTRONS	TOTAL	
TOTAL FLIGHT DOSE FOR SOLAR MINIMUM CONDITIONS =	2.74359	.80593	3.54952	MILLIREMS PER FLIGHT PROFILE
TOTAL FLIGHT DOSE FOR SOLAR AVERAGE CONDITIONS =	2.45099	.71987	3.17086	MILLIREMS PER FLIGHT PROFILE
AVG. DOSE / FLIGHT PROFILE HOUR (SOLAR MIN.) =	.27436	.08059	.35495	MILLIRADS PER HOUR
AVG. DOSE / FLIGHT PROFILE HOUR (SOLAR AVG.) =	.24510	.07199	.31709	MILLIREMS PER HOUR
AVG. DOSE / BLOCK TIME HOUR (SOLAR MINIMUM) =	.26767	.07863	.34630	MILLIREMS / (BLOCK TIME) HOUR
AVG. DOSE / BLOCK TIME HOUR (SOLAR AVERAGE) =	.23912	.07023	.30935	MILLIREMS / (BLOCK TIME) HOUR.

LEG BLOCK TIME = PROFILE TIME + 0.25 HOURS

NEW YORK TO RIO DE JANEIRO SUBSONIC FLIGHT (0.83 MACH)

SCHEDULE BLOCK TIME ON ONE WAY(HRS)= 8.8

RATE OF CLIMB(FEET/MIN)= 2000.000 CRUISING ALTITUDE(FEET)= 36000 RATE OF DESCENT(FEET/MIN)= 2000.000

CLIMBING GROUN SPEED(MILES/HOUR)=457.00 CRUISING SPEED(MILES/HOUR)= 548.60 DESCENDING GROUND SPEED(MILES/HOUR)=457.00

FLIGHT ALTITUDE AND DISTANCE PROFILE IN 1/10 HOUR INCREMENTS.

ALTITUDE

12000	24000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	36000	36000	36000
36000	36000	36000	36000	36000	24000	12000	0

DISTANCE

45.70	45.70	45.70	54.86	54.86	54.86	54.86	54.86
54.86	54.86	54.86	54.86	54.86	54.86	54.86	54.86
54.86	54.86	54.86	54.86	54.86	54.86	54.86	54.86
54.86	54.86	54.86	54.86	54.86	54.86	54.86	54.86
54.86	54.86	54.86	54.86	54.86	54.86	54.86	54.86
54.86	54.86	54.86	54.86	54.86	54.86	54.86	54.86
54.86	54.86	54.86	54.86	54.86	54.86	54.86	54.86
54.86	54.86	54.86	54.86	54.86	54.86	54.86	54.86
54.86	54.86	54.86	54.86	54.86	54.86	54.86	54.86
54.86	54.86	54.86	54.86	54.86	54.86	54.86	54.86
54.86	54.86	54.86	54.86	54.86	45.70	45.70	45.70

TOTAL INPUT PROFILE DISTANCE = 4772.72 STATUTE MILES

FLIGHT PROFILE TIME = 8.80 HOURS IN THE AIR

COMPUTED GREAT CIRCLE LEG DISTANCE = 4773.2 THE INITIAL COURSE ANGLE = 148.800

LEG START LATITUDE = 40.63 LEG START LONGITUDE = -73.77

LEG END LATITUDE = -22.00 LEG END LONGITUDE = -42.30

LAT.	LONG.	COURSE ANGLE	GEOMAG. LAT.	ATMOS. DEPTH GR/SQ. CM.	CHARGED PARTICLES AND GAMMA DOSE RATE (MREMS/HR) SOLAR MIN.	CHARGED PARTICLES AND GAMMA DOSE RATE (MREMS/HR) SOLAR AVG.	NEUTRONS DOSE RATE (MREMS/HR) SOLAR MIN.	NEUTRONS DOSE RATE (MREMS/HR) SOLAR AVG.	TOTAL DOSE RATE DOSE RATE (MREMS/HR) SOLAR MIN.	TOTAL DOSE RATE DOSE RATE (MREMS/HR) SOLAR AVG.
40.35	-73.55	150.40	51.80	827.93	.066621	.064957	.014974	.014599	.081595	.079556
39.78	-73.10	150.86	51.24	516.42	.135152	.126670	.037422	.035073	.172574	.161743
39.21	-72.66	151.32	50.68	307.49	.181131	.165175	.052264	.047660	.233395	.212835
38.58	-72.19	151.81	50.06	233.31	.266202	.238074	.078275	.070004	.344477	.308078
37.89	-71.68	152.33	49.38	233.31	.262679	.235424	.077081	.069083	.339760	.304506
37.20	-71.19	152.84	48.69	233.31	.259137	.232782	.075814	.068104	.334951	.300886
36.51	-70.70	153.34	48.00	233.31	.255578	.230114	.074542	.067116	.330120	.297229
35.82	-70.22	153.83	47.31	233.31	.252003	.227419	.073265	.066117	.325268	.293536
35.12	-69.75	154.31	46.62	233.31	.248413	.224698	.071982	.065110	.320395	.289807
34.42	-69.29	154.78	45.92	233.31	.244809	.221951	.070694	.064093	.315503	.286043
33.72	-68.83	155.24	45.22	233.31	.241192	.219178	.069401	.063067	.310593	.282245
33.02	-68.38	155.69	44.52	233.31	.237562	.216381	.068103	.062031	.305665	.278412
32.32	-67.94	156.13	43.82	233.31	.233920	.213558	.066802	.060987	.300721	.274545
31.62	-67.51	156.56	43.11	233.31	.230266	.210711	.065496	.059934	.295761	.270645
30.91	-67.08	156.98	42.40	233.31	.226600	.207840	.064186	.058872	.290786	.266712
30.20	-66.66	157.39	41.69	233.31	.222925	.204945	.062872	.057801	.285797	.262746
29.50	-66.24	157.80	40.98	233.31	.219239	.202026	.061555	.056722	.280794	.258748
28.79	-65.84	158.19	40.27	233.31	.215544	.199084	.060234	.055634	.275778	.254718
28.08	-65.43	158.58	39.55	233.31	.212607	.196796	.058846	.054470	.271453	.251266
27.36	-65.03	158.96	38.83	233.31	.210121	.194896	.057417	.053257	.267539	.248152
26.65	-64.64	159.34	38.11	233.31	.207631	.192982	.055985	.052035	.263616	.245017
25.94	-64.25	159.71	37.39	233.31	.205135	.191055	.054550	.050806	.259684	.241860
25.22	-63.87	160.07	36.67	233.31	.202633	.189114	.053112	.049568	.255745	.238682
24.51	-63.49	160.42	35.95	233.31	.200127	.187160	.051671	.048322	.251798	.235482
23.79	-63.11	160.77	35.22	233.31	.197617	.185192	.050227	.047069	.247843	.232261
23.07	-62.74	161.11	34.50	233.31	.195101	.183211	.048781	.045808	.243882	.229019
22.35	-62.37	161.44	33.77	233.31	.192582	.181217	.047332	.044539	.239914	.225756
21.63	-62.01	161.77	33.04	233.31	.190058	.179211	.045881	.043262	.235939	.222473
20.91	-61.65	162.10	32.31	233.31	.187531	.177191	.044427	.041978	.231958	.219169
20.19	-61.29	162.41	31.58	233.31	.184999	.175158	.042972	.040686	.227971	.215844
19.47	-60.94	162.73	30.85	233.31	.182465	.173113	.041514	.039387	.223979	.212500
18.75	-60.59	163.04	30.11	233.31	.179926	.171055	.040055	.038080	.219981	.209135
18.02	-60.24	163.34	29.38	233.31	.177679	.169159	.039122	.037246	.216801	.206406
17.30	-59.90	163.64	28.65	233.31	.175483	.167288	.038286	.036498	.213769	.203786
16.57	-59.56	163.94	27.91	233.31	.173285	.165409	.037449	.035747	.210734	.201157
15.85	-59.22	164.23	27.17	233.31	.171084	.163523	.036612	.034993	.207696	.198516
15.12	-58.88	164.52	26.44	233.31	.168881	.161629	.035773	.034237	.204654	.195865
14.40	-58.55	164.81	25.70	233.31	.166676	.159727	.034933	.033477	.201609	.193204
13.67	-58.22	165.09	24.96	233.31	.164468	.157818	.034093	.032715	.198561	.190533
12.95	-57.89	165.37	24.22	233.31	.162258	.155902	.033252	.031949	.195510	.187851
12.22	-57.56	165.64	23.48	233.31	.160047	.153978	.032410	.031181	.192457	.185160
11.49	-57.23	165.92	22.74	233.31	.157833	.152048	.031567	.030410	.189401	.182458
10.76	-56.91	166.19	22.00	233.31	.155618	.150110	.030724	.029637	.186342	.179746
10.03	-56.59	166.46	21.26	233.31	.153401	.148165	.029880	.028860	.183282	.177025
9.31	-56.27	166.73	20.51	233.31	.151183	.146213	.029036	.028081	.180218	.174294
8.58	-55.95	166.99	19.77	233.31	.149151	.144415	.028378	.027477	.177528	.171892
7.85	-55.63	167.26	19.03	233.31	.147539	.142976	.028139	.027269	.175679	.170245
7.12	-55.31	167.52	18.28	233.31	.145927	.141533	.027901	.027061	.173828	.168594
6.39	-54.99	167.78	17.54	233.31	.144314	.140086	.027662	.026852	.171976	.166938
5.66	-54.68	168.04	16.79	233.31	.142700	.138636	.027424	.026643	.170123	.165279
4.93	-54.36	168.30	16.05	233.31	.141084	.137183	.027185	.026433	.168269	.163616

4.20	-54.05	168.56	15.30	233.31	.139469	.135726	.026946	.026223	.166414	.161949
3.47	-53.73	168.82	14.56	233.31	.137852	.134266	.026707	.026012	.164559	.160278
2.74	-53.42	169.08	13.81	233.31	.136235	.132802	.026467	.025801	.162702	.158603
2.01	-53.11	169.34	13.06	233.31	.134616	.131336	.026228	.025589	.160845	.156925
1.28	-52.79	169.60	12.32	233.31	.132998	.129866	.025989	.025377	.158987	.155242
.55	-52.48	169.86	11.57	233.31	.131378	.128393	.025749	.025164	.157128	.153557
-.18	-52.17	170.12	10.82	233.31	.129759	.126916	.025510	.024951	.155268	.151867
-.91	-51.86	170.38	10.08	233.31	.128138	.125437	.025270	.024737	.153408	.150174
-1.65	-51.54	170.64	9.33	233.31	.127856	.125214	.025090	.024572	.152946	.149786
-2.38	-51.23	170.91	8.58	233.31	.127724	.125133	.024917	.024412	.152641	.149544
-3.11	-50.92	171.18	7.83	233.31	.127592	.125051	.024744	.024252	.152336	.149303
-3.84	-50.60	171.45	7.08	233.31	.127460	.124969	.024571	.024091	.152031	.149060
-4.57	-50.29	171.72	6.33	233.31	.127328	.124887	.024398	.023931	.151726	.148818
-5.30	-49.98	171.99	5.59	233.31	.127196	.124805	.024225	.023770	.151421	.148575
-6.03	-49.66	172.27	4.84	233.31	.127064	.124723	.024052	.023609	.151116	.148332
-6.76	-49.34	172.55	4.09	233.31	.126931	.124641	.023879	.023448	.150810	.148089
-7.49	-49.03	172.84	3.34	233.31	.126799	.124559	.023706	.023287	.150505	.147846
-8.22	-48.71	173.13	2.59	233.31	.126667	.124476	.023533	.023126	.150200	.147602
-8.94	-48.39	173.42	1.84	233.31	.126535	.124394	.023359	.022964	.149894	.147358
-9.67	-48.07	173.72	1.09	233.31	.126403	.124311	.023186	.022803	.149589	.147114
-10.40	-47.75	174.02	.34	233.31	.126270	.124229	.023013	.022641	.149283	.146869
-11.13	-47.42	174.33	.41	233.31	.126282	.124236	.023028	.022655	.149311	.146891
-11.86	-47.10	174.65	1.16	233.31	.126414	.124319	.023202	.022817	.149616	.147136
-12.58	-46.77	174.97	1.91	233.31	.126547	.124401	.023375	.022979	.149921	.147380
-13.31	-46.44	175.30	2.66	233.31	.126679	.124484	.023548	.023140	.150227	.147624
-14.04	-46.11	175.63	3.40	233.31	.126811	.124566	.023721	.023301	.150532	.147867
-14.76	-45.78	175.98	4.15	233.31	.126943	.124648	.023894	.023462	.150838	.148111
-15.49	-45.44	176.33	4.90	233.31	.127075	.124731	.024068	.023623	.151143	.148354
-16.22	-45.10	176.69	5.65	233.31	.127207	.124813	.024241	.023784	.151448	.148597
-16.94	-44.76	177.06	6.40	233.31	.127340	.124895	.024414	.023945	.151753	.148840
-17.66	-44.42	177.44	7.15	233.31	.127472	.124976	.024587	.024106	.152058	.149082
-18.39	-44.08	177.84	7.90	233.31	.127604	.125058	.024760	.024266	.152364	.149324
-19.11	-43.73	178.24	8.65	233.31	.127736	.125140	.024933	.024426	.152669	.149566
-19.83	-43.38	178.66	9.39	233.31	.127868	.125221	.025106	.024586	.152974	.149807
-20.49	-43.05	179.05	10.08	307.49	.095566	.093571	.016864	.016512	.112430	.110083
-21.09	-42.75	179.42	10.70	516.42	.074462	.073318	.012108	.011922	.086570	.085241
-21.69	-42.45	179.80	11.33	827.93	.041563	.041301	.004858	.004827	.046421	.046128

	CHARGED PART. GAMMA RAY	NEUTRONS	TOTAL	
TOTAL FLIGHT DOSE FOR SOLAR MINIMUM CONDITIONS =	1.43420	.33158	1.76578	MILLIREMS PER FLIGHT PROFILE
TOTAL FLIGHT DOSE FOR SOLAR AVERAGE CONDITIONS =	1.36099	.31292	1.67391	MILLIREMS PER FLIGHT PROFILE
AVG. DOSE / FLIGHT PROFILE HOUR (SOLAR MIN.) =	.16298	.03768	.20066	MILLIRADS PER HOUR
AVG. DOSE / FLIGHT PROFILE HOUR (SOLAR AVG.) =	.15466	.03556	.19022	MILLIREMS PER HOUR
AVG. DOSE / BLOCK TIME HOUR (SOLAR MINIMUM) =	.15847	.03664	.19511	MILLIREMS / (BLOCK TIME) HOUR
AVG. DOSE / BLOCK TIME HOUR (SOLAR AVERAGE) =	.15039	.03458	.18496	MILLIREMS / (BLOCK TIME) HOUR.

LEG BLOCK TIME = PROFILE TIME + 0.25 HOURS