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PROJECTS SOLRAD and TIMATION

Space Radiation Exposure

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March 1974

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Foreword

At the request of the Spacecraft Technology Center, Naval Research Laboratory, a special orbital radiation study was conducted for the SOLRAD and TIMATION projects in order to evaluate mission-encountered energetic particle fluxes.

Magnetic field calculations were performed with a current field model, extrapolated to the tentative spacecraft launch epoch with linear time terms.

Orbital flux integrations for circular flight paths were performed with the latest proton and electron environment models, using new improved computational methods.

Temporal variations in the ambient electron environment were considered and partially accounted for.

Finally, estimates of average energetic solar proton fluxes are given for a one year mission duration at selected integral energies ranging from E > 10 to E > 100 Mev; the predicted annual fluence related to the period of maximum solar activity during the next solar cycle.

The results are presented in graphical and tabular form; they are analyzed, explained, and discussed.

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Introduction

The objective of the present study is to evaluate the charged particle fluxes to be encountered by spacecrafts in circular orbits with inclinations of 125 and 65 degrees, and altitudes of 13890 and 1111 kilometers, respectively. For these conditions, two nominal trajectories were generated, corresponding to missions SOLRAD and TIMATION.

An additionally requested circular SOLRAD orbit at $i = 23^{o}$ and $h = 65000$ n.m. was not considered in this study because it lies entirely outside the trapped particle radiation belts. A spacecraft in that trajectory is exposed only to the unattenuated interplanetary energetic solar proton fluxes, discussed in a separate section.

At this point, we wish to insert some general comments concerning orbits and geomagnetic geometry. Circular flightpaths with small inclinations ($i < 45^{o}$) and low altitudes ($h \leq 1000$ km) lie almost entirely within the region of magnetic dipole space that is called the "inner zone" ($1.0 < L < 2.8$), in contrast to high inclination ($i > 55^{o}$) flightpaths at similar altitudes, which traverse the entire terrestrial radiation belt twice during each revolution, moving alternately through regions of low L values (i.e. the inner zone) and regions of high L values (i.e. the "outer zone": $2.8 < L < 12.$*). However, when orbit altitude is increased,

*The upper boundary of the "outer zone" in the current electron models has been placed at about L = 12 e.r., as against L = 6.5 e.r. in the older models.

the above flightpaths attain minimal L values that are correspondingly higher; eventually, when $h \gtrsim 13000$ km, these trajectories never enter the inner zone region of L-space. This happens in the case of the TIMATION orbit, which moves in the L-domain bounded by L(min) = 3.14 and L(max)$^{+}$ = 12.52 (see Table 2). The SOLRAD orbit, on the other hand, executes the described transverse motion, visiting L values as low as L = 1.09 and as high as L = 29.08^{+} (see Table 2).

This grouping of trajectories according to L ranges or zones is important in radiation studies because each zone requires special treatment. Thus, with regards to the inner zone, which is visited by the first kind of orbit for varying intervals of time, special considerations are necessary on account of the substantial "Starfish"** residuals (Teague and Stassinopoulos, 1972) that still populated this region in 1967, the epoch of the corresponding environment model.

The outer zone, while it is visited by high inclination or high altitude orbits only, also warrants special consideration because these trajectories may pass through regions of space within the magnetosphere that are accessible to subrelativistic cosmic ray fluxes of solar origin.

+This value is not the true upper boundary of the orbit because calculations and storage of B and L are suspended by an (lat, long, alt)-sensitive exclusion test.

**"Starfish" is the high altitude nuclear explosion over Johnston Island in the Pacific in July 1962, which injected about 10^{29} energetic artificial electrons into the inner zone region of the Van Allen belts.

A detailed discussion of this matter is given in the section on "Energetic Solar Proton Fluxes".

Another important feature of the outer zone electron environment is the strong local time dependence of the ambient fluxes. The LT variations for high energy electrons (1-3 Mev) at about $5 < L < 6$ exceed one order of magnitude. These variations are due to the distortion of the magnetosphere caused by the solar wind (compression at local noon, elongation at local midnight).

Theoretically, the new outer zone model, to be discussed in a subsequent paragraph, recognized this dependence and accounted for it by incorporating an analytic function for its calculation. However, the version distributed in card deck form for practical application purposes provides fluxes which are averaged over local time. The reason behind this simplication is that most users employ the model in orbit-or time-integration processes to missions which have durations of 6 months or more and the local time effects would be averaged out anyway. Hence, in order to save time, core, and effort, a local time averaged value, which is nearly equivalent to the fluxes at the dawn meridian, was inserted into the model in place of the analytic function.

In regards to the TIMATION orbit, it should be noted that although the specified inclination of the proposed trajectory was 125 degrees prograde, which is identical to 55 degrees <u>retrograde</u>, the trajectory used in the study was generated for 55 degrees prograde inclination. In terms of orbital flux integrations, this is an "equivalent" trajectory in the sense that the results produced by it are about equal to those produced by a trajectory with opposite tilt (55^{o} prograde vs. 55^{o} retrograde), if the duration of flight time is adequately long (about 30 revolutions) and provided the orbit periods are comparatively small ($\tau \leq 2.5$ hours) and are not an exact divisor of 24 (hours in a day).

Of course, this happens because the same limited volume of space is being sampled by both prograde and retrograde trajectories; when the sampling density is then sufficiently increased, by extending the flight duration considered in the calculations, the statistical treatment of the data (averaging process) produces the almost identical results.

Orbital flux integrations were performed with UNIFLUX, a "Unified Orbital Flux Integration and Analysis System" by Stassinopoulos and Gregory (1972).

Two new environmental models were used in the calculations: the AE5 by Teague and Vette (1972) for the inner zone electrons, and the AE4 by Singley and Vette (1971) for the outer zone electrons. Some observations on these models are in order.

Both are static models describing the environment as it existed back in October, 1967, at about solar maximum conditions. In constructing the models, it was possible to infer a change of the average quiet-time electron flux levels as a function of the solar cycle. However, a complete temporal description of the solar cycle dependence is not available at this time. Besides, for the regions of space visited by the orbits considered in this study, there occur no appreciable changes in the time averaged fluxes.

Additional static versions of the AE5-AE4 models for the 1964 (1974) solar minimum epoch have just been released and will be incorporated into UNIFLUX for future applications.

In the meantime, electron fluxes calculated for the years 1973-76 (next solar min) with the currently in use solar max models, are inevitably overestimates. To partially compensate for this error, the uncertainty factor attached to the electron results will have to be adjusted. This is done in Appendix A, where a reduced uncertainty factor is given, to be used with the presented fluxes.

In contrast to the electrons, no special considerations are required for the proton results obtained from standard models long in use. Although they also describe a static environment, this is a valid representation for these particles because experimental measurements have shown that no significant changes with time have occurred in the proton population. With the exception of the fringe areas of the proton belt, that is at very low altitudes and at the outer edges of the trapping region, the possible error introduced by the static approximation lies well within the uncertainty factor attached to the models. Consequently, the proton data may be applied to any epoch without the need for an updating process.

We wish to emphasize that our calculations are only approximations although they are based on the best available data; as always, we strongly recommend that all persons receiving parts of this report be advised about the uncertainty in the data, as discussed in Appendix A.

Appendix A also contains pertinent information on units, field models, trajectory generation and conversion, etc.

Finally, an explanation regarding the attribute "standard" frequently used in the reformatted OFI (Orbital Flux Integration) Study Reports. The term is applied as a modifier to parameters, constants, or variables in order to indicate or refer to some specific value of these quantities that has been used without change over extended periods of time. Although override possibilities do exist in the UNIFLUX system, a routinely submitted production run will, by default option, always use these "standard" values. The term is also used in reference to established forms, style, processes, or procedures, as for example, "standard tables", "standard plots", "standard production runs", etc. A list of some quantities, values, or expressions modified by "standard" is given in Table 1.

Results: Analysis and Discussion

The outcome of our calculations for both missions is summarized in Tables 3 to 18, which are all computer produced. The tables are arranged in five sets, where every set pertains to one specific type of data: the first set contains the "L-band" tables, the second the "Spectral Distribution and Exposure Index" tables, the third the table of "Peaks", the fourth the "Exposure Analysis" summary and the "Time Account" breakdown, and the fifth set the "Energetic Solar Proton" tables. The first three sets contain two similar members for every mission considered in the study: one for protons and one for electrons, in that order. The last two sets contain only one member for each mission. The tables are further explained in Appendix B, where a more detailed description of their contents is given. Figure 1 is a guide to table arrangement, as they are produced by a standard production run of the Orbital Flux Integration (OFI) program UNIFLUX for a single trajectory.

Some of the tabulated data is also computer plotted in Figures 3 to 14, with additional Figures 15 to 18 containing plots of flightpath data. Finally, the manually produced Figure 19 gives the mean annual solar proton fluence for both trajectories considered in this study. As with the tables, the computer plots are arranged in five sets, where each set pertains to one specific type of data: The first set contains "Time and Flux Histograms", the second "Spectral Profiles", the third "Peaks per Orbit", the fourth trajectory "World Map Projections", and the fifth "B-L Space Tracings". Again, the first three sets contain two similar members for every mission: one for each type of particle considered. The last two sets contain only one member for every mission. Appendix C describes and explains the plots. Figure 2 is a guide to plot arrangement, as they are produced by a standard production run. The final plot (Figure 19) is explained in the section "Energetic Solar Proton Fluxes".

I. Spectral Profiles

For tabulated data consult Tables 7-10.

For plotted data consult Figures 7-10.

The integral spectra presented in this report are orbit integrated, statistically averaged, trapped particle spectra, characteristic of the specific trajectories that produced them.

Noteworthy are the electron spectra obtained from the new environment models AE5 and AE4, especially in regards to the steep fall-off to zero flux in the energy range of about 4 to 5 Mev. The apparent cutoff at these energies is probably due to the extensive decay of the high energy Starfish artificials by 1967, since no significant numbers of trapped naturals exist with energies greater than 4 - 5 Mev.

To be exact, there are only two very small areas in B-L space where the solar max models contain trapped electrons with the energies $E > 5$ Mev.

These areas form "pockets" of high energy electrons on the magnetic equator in the L-ranges 1.45 - 1.75 and 3.65 - 4.10 earth radii. The inner zone pocket is obviously a Starfish remnant, whereas the outer zone pocket appears to be a normal feature of the natural electron radiation belt because artificial electrons never populated that area.

With regards to the protons, it should be noted that the high altitude TIMATION orbit does not encounter any particles with energies E > 30 Mev. This happens because the orbit never visits those regions of the magnetosphere where these protons are trapped. In comparison, the SOLRAD mission experiences a very hard proton spectrum above energies of about 18 Mev.

II. Peaks Per Orbit

Tabulated data is contained in Tables 11-14.

Plotted data is shown in Figures 11-14.

The absolute peaks per revolution presented in this report have been obtained for standard OFI (Orbital Flux Integration) energies; that is: E > 5. Mev for protons, and E > .5 Mev for electrons.

For a given circular trajectory at a fixed inclination and altitude, the peak-contour may display small or large amplitude variations or discontinuities, following periodic patterns based on the daily cycle of revolutions. However, the amplitude of the cyclic variations and the peak values are functions of inclination and altitude. Thus: the relative difference between the P_{max} and the P_{min} values of a curve, as well as the magnitude of the individual peaks, may vary significantly (several orders of magnitude) when i or h are changed.

Apparently, an increase in height has a dampening effect on the peak-curves: the amplitude variation shrinks, and the extrema approach each other; it also produces a relative rise in the magnitude of the encountered peaks.

As to the study at hand, if the peak fluxes for the SOLRAD Mission, shown in Figures 11 and 12 for one day only, were calculated and plotted for several days, the respective contours would follow the periodic pattern discussed in the previous paragraph. Allowing for small variations due to possible fractional precessions per day, this pattern would repeat itself indefinitely since the investigated trajectory is circular and no major changes with time are expected, assuming, of course, that the orbit is stable and experiences no external perturbations or atmospheric drag effects.

In contrast, the TIMATION trajectory experiences almost no variations in the peaks. Extending the duration of the run to longer flight-time intervals, as for example 48 hours or even several days, would not affect the approximately constant value of the peaks. There are two reasons for this, both applying to the case of TIMATION, although either one by itself would have sufficed to produce the obtained results. One is that the orbit period of about 8 hours is an integral divisor of 24 (hours in the day) and any extension of time would result in an almost exact retracing of the previously traversed flightpath, and hence yield about identical results. The second is that at the altitude of the orbit the higher order terms of the field model have dropped out and the field displays a nearly dipolar symmetry, without the distortions and anomalies that prevail at low altitudes; this, in turn assures that each revolution will be exposed to the same flux levels, regardless of orbit precision.

III. Trajectory Data

See Figures 15-16 for World Map projections.

See Figures 17-18 for B-L Space Tracings.

A. World Map

World map projections of trajectories are by definition the surface traces of their subsatellite points.

The apparent westward drift of successive orbit tracings is the "longitudinal precession" of the trajectory, resulting from the rotation of the geoid in reference to the orbit plane.

Under unperturbed dynamic conditions, the respective orbit period determines the nodal precession of the trajectory. For circular flightpaths, the period, and hence the precession, is a simple function of the geocentric distance. At the altitude levels proposed for the SOLRAD and TIMATION missions, the period is respectively 790 and 7.970 hours with corresponding precessions of 11 and 1.35 degrees approximately. This amounts to about 13 and 3 completed orbits for a twenty four hour flight-time duration.

Although a general 24-hour flight duration was considered in the study, if the number of orbits per day is large (small period) then, for reasons of clarity, the world map projections of the trajectories are not plotted for more than ten revolutions. The orbit numbers appear at the starting points of each revolution.

B. Magnetic Dipole Mapping

At large geocentric distances ($r_e > 6$), the quantities B and L have no physical meaning any more because of the interaction between solar wind and magnetosphere.

The noon-midnight distortion of the magnetosphere, produced by that interaction (compression in the solar and elongation in the antisolar directions), causes a breakdown in the symmetry of the dipole magnetic shell parameter L and introduces significant external currents and fields, whose contributions substantially alter the apparent field strength B that is presently being obtained for a given position from the dipole terms of the internal field model applied in the calculations.

Therefore, in this study (as well as in every model of charged-particle radiation utilized), these variables are being employed only as ordering parameters.

The magnetic B-L space tracings of the high inclination trajectories ($i \geq 55^{o}$) appear as long horizontal line segments on the plots (Figures 17 and 18), strikingly displaying the transverse motion of the satellite in that space-frame.

Incidentially, all inclined trajectories cross, of course, the magnetic equator twice per period; however, the nodes (and hence the point where the curves are tangent to the equatorial contour) are shifted due to the rotation of the geoid. This displacement in B-L space is analogous to the precession in geodetic space. The SOLRAD flightpath plotted in Figure 17 is a good example of such an orbit, on the other hand, the dipolar symmetry discussed under "Peaks per Orbit" for TIMATION is strikingly demonstrated by the clustering of the corresponding B-L tracings in Figure 18. The separation of the curves on the equator is due to the tilt of the magnetic dipole.

Again, for reasons of clarity, only three orbits are plotted per graph; here also, the orbit numbers appear at the starting points of each revolution.

Energetic Solar Proton Fluxes

Good measurements of solar cycle 20 interplanetary cosmic ray fluxes at about 1 A.U. are now available. These interplanetary particles are also observed over the high latitude polar cap regions. However, at other latitudes the geomagnetic field effectively shields the earth from some of these cosmic rays by deflecting the lower energy particles while only particles with increasingly higher energy penetrate to lower latitudes.

In order to consider the effect of geomagnetic shielding from cosmic rays on an orbiting spacecraft, the total time spent by the vehicle in regions of space accessible to these particles has to be calculated, as a function of particle energy, for the entire lifetime of the satellite. In other words, the exposure of a spacecraft to these particles is in essence a function of trajectory altitude and inclination, and mission duration. Of course, this applies only to the years of increased solar activity, and whether a satellite will "see" energetic solar protons or not, even in accessible regions of the magnetosphere, depends on the epoch within the solar cycle, at which the mission is to be flown. If it coincides with the period of low solar activity (years of solar minimum), it most likely will not encounter any significant number of energetic solar protons, and vice versa.

Having calculated a mission related exposure time for a specific trajectory, one can use experimentally determined low energy cosmic ray fluxes of solar origin from which the galactic background has been subtracted, to obtain vehicle-encountered energetic solar proton intensities. In the present study, the annual mean of event and cycle integrated proton fluxes of cycle 20, given by Stassinopoulos and King (1973) for energies ranging from E > 10 Mev to E > 100 Mev, were used to estimate cycle 21 intensities on the SOLRAD and TIMATION missions.

However, no thorough statistical treatment has yet been worked out in regards to the probability of actual cycle 21 fluxes exceeding the predicted intensities. Crude model confidence levels only are available at this time. The importance of such statistics must be emphasized; it is best demonstrated by the occurrence of the August 4-7, 1972, event, which was the largest recorded in solar cycles 19 and 20, its fluxes exceeding the accumulative total of all other cycle 20 events by about a factor of 2 for the E > 10 Mev protons and by a factor of 4 for the E > 30 and E > 60 Mev particles. Therefore, caution is advisable when using the data presented in this report.

The probability that the fluxes estimated for the SOLRAD and TIMATION missions will be exceeded by an actual event, is about 33% for a one year mission duration, and about 40% for a two year mission duration.

Figure 19 shows annual, omnidirectional, integral spectral profiles of vehicle-encountered energetic solar proton fluxes for the two missions, in units of total number of particles per square centimeter.

Note: These fluxes apply only to missions planned for periods of increased solar activity. It is not expected that solar-min missions will encounter energetic solar protons of any significance; at least, it is very unlikely (but not impossible) to have a major event occurring during the years of minimum solar activity. Thus, a 3 year mission, to be launched in mid 1974, will spend most of its lifetime in a solar min period. Hence, no solar protons have to be considered until about 1977. Thereafter, the predicted mean annual intensities should be applied to the remaining 0.5 years. Caution: In evaluating the energetic solar proton radiation hazard please bear in mind that the probability of at least one anomalously large event occurring during the time interval 1977 - 1979 is high.

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APPENDIX A

General Background Information

For the specified flight paths, orbit tapes were generated with a constant integration stepsize of one minute, and for a 24 hour flight duration each. This time interval is adequate for a sufficient sampling of the ambient environment. (For more details see section: "Results, III. Trajectory Data".) The following circular trajectories were thus produced:

Inclination	Altitude	Mission
65^{o}	1111 km	SOLRAD
55^{o}	13890 km	TIMATION

with the combined GEODYN-BLCONV system (Stassinopoulos et al. 1973), which subsequently converted the orbits from geodetic polar (h,λ,ϕ) into magnetic B-L coordinates with McIlwain's INVAR Program of 1965 (Hassit and McIlwain, 1967) with the field routine ALLMAG by Stassinopoulos and Mead (1972), utilizing the IGRF (1965) geomagnetic field model by Cain and Cain (1971), calculated for the epoch 1973.0.

Orbital flux integrations were performed with Vette's current models of the environment, the new solar max AE5-AE4 for the inner and outer zone electrons, the AP6-AP7 for high energy protons, and the AP5 for low energy protons. All are static models which do not consider temporal variations; this includes the new electron models, at least as far as the present calculations are concerned. See text for further details on this matter.

The documents that describe these models are listed below:

Models	
AE4	Singley and Vette, 1972
AE5	Teague and Vette, 1972
AP5	King, 1967
AP6	Lavine and Vette, 1969
AP7	Lavine and Vette, 1970

The results, relating to omnidirectional, vehicle-encountered, integral, trapped particle fluxes, are presented in graphical and tabular form with the following unit conventions:

1. Daily averages: total trajectory integrated flux averaged into particles/cm^2 day,
2. Average instantaneous: time integrated average, characteristic of the orbit, in particles/cm^2 sec,
3. Totals per orbit: non-averaged, single-orbit integrated flux in particles/cm^2 orbit, and
4. Peaks per orbit: highest orbit-encountered instantaneous flux in particles/cm^2 sec,

where one orbit=one revolution.

Please note: We wish to emphasize the fact that the data presented in this report are only approximations. We do not believe the results to be any better than a factor of 2 for the protons and a factor of 3 for the electrons. It is advisable to inform all potential users about this uncertainty in the data. Please also remember that the electrons have been calculated with a model describing the environment at solar maximum. The obtained fluxes are, therefore, an overestimate for those parts of the SOLRAD-TIMATION missions, which are scheduled to fly around solar minimum, (1974 - 1976, possibly part of 1977, depending on the duration of the present solar cycle). Consequently, it is suggested that for the solar min period of the mission the electron results be taken as an upper limit and the uncertainty factor be applied only in its reducing capacity (divisor).

APPENDIX B

Description of Tables

a) The L-band Table:

The table contains 36 L-bands L_i of equal size, covering the range from L = 1.0 to L = 8.2 earth radii in constant increments of .2 earth radii. For the L-intervals determined in this way, orbital spectral functions

$$N(>E,E_N;L_i) = \left[\sum_k J_k(>E;B)\right]_{L_i} \Bigg/ \left[\sum_k J_k(>E_N;B)\right]_{L_i} \qquad \begin{array}{c} i=1,36 \\ L_i : L_i < L \leq L_{i+1} \end{array} \tag{1}$$

are obtained at nine arbitrary energy levels such that the integral spectrum is equal to 1 for $E = E_N$, where E_N was taken to be .1, 5., and .5 Mev for low energy protons, the high energy protons, and the electrons, respectively. The notation L_i is used to indicate the L-band from L_i to L_{i+1}, while J(>E;B) is the integral, omnidirectional flux yielded by the environment model used in the calculation. The spectral functions N are evaluated for the total flight time simulated in the study, where the summing index k selects all trajectory points lying in each L_i.

The corresponding orbital distribution functions, representing fluxes above energy E_N, are given by

$$F(E;L_i) = \Delta t\left[\sum_k J_k(>E;B)\right]_{L_i} \tag{2}$$

where Δt is the constant time increment of orbit integration, whose standard value is 60 seconds. The distribution functions are fluxes accumulated in their respective L_i bands over the total flight period considered.

The orbital distribution functions are listed on the table at the bottom of each L-interval and are labeled "NORMFLUX". The nine integral energy levels selected for the low and high energy protons and for electrons are given below in units of "Mev" for all particles:

Protons Low	Protons High	Electrons
.1*	3.	.0
.5	5.	.5*
.9	10.	1.0
1.1	15.	1.5
1.5	20.	2.0
2.0	25.	2.5
2.5	30.	3.0
3.0	50.	4.0
3.5	100.	5.0

where the normalization energy is indicated by a star (*).

b) The Spectral Distribution and Exposure Index Table:

This table has three parts:

I. The spectrum $\Psi_j(\Delta E)$ given in % for energy intervals that correspond to the energy levels of the previously discussed table (L-bands), with two special columns showing the total orbit integrated flux for these energy intervals averaged into instantaneous I_j^s and daily I_j^D intensities

$$\Psi_j(\Delta E) = 100\,\frac{I_j^D(\Delta E)}{F(>E_1)} \qquad j=1,9 \tag{3}$$

where

$$F(>E_1) = C\sum_{k=1}^{k_0} J_k(>E_1;B,L)\Delta t \tag{4}$$

$$I_j^D(\Delta E) = C\sum_{k=1}^{k_0} \Delta t\left\{J_k(>E_j;B,L) - J_k(>E_{j+1};B,L)\right\} \tag{5}$$

$$I_j^S(\Delta E) = I_j^D(\Delta E)/86400 \tag{6}$$

$$C = \frac{24}{T} \qquad T = k_0\Delta t \qquad i=1,36$$

and where k_0 is the upper limit of k. It is equal to the total number of time increments considered in the study.

II. The composite orbit spectrum for integral energies, giving the total vehicle encountered fluxes averaged into daily $S^D(>E_j)$ and instantaneous $S^S(>E_j)$ intensities for 15 discrete energy levels:

$$S^D(>E_j) = c\Delta t\sum_{m=0}^{T} J_m(>E_j) \qquad j=1,15 \tag{7}$$

$$S^S(>E_j) = S^D(>E_j)/86400 \tag{8}$$

where the summation is performed for the entire simulated mission duration T and includes all fluxes with energies greater than E_j.

III. The exposure index, given (for the normalization energy used in the L-band table) at nine successive intensity ranges R_n one order of magnitude apart, in terms of exposure duration $\tau(R_n)$, converted to hours, and total number of particles $\phi(>E_N;R_n)$ accumulated while in that intensity range. The notation R_n is used to indicate the intensity range from r_n to r_{n+1}:

$$\phi(>E_N;R_n) = \tau(R_n)\ \theta(>E_N;R_n) \qquad \begin{matrix} n=1,9 \\ R_n = r_n < r \le r_{n+1} \end{matrix} \tag{9}$$

$$\theta(>E_N;R_n) = \left[\sum_{\ell} J(>E_N;r)\right]_{R_n} \Big/ \zeta_n \tag{10}$$

$$\tau(R_n) = \Delta t\ \zeta_n \tag{11}$$

where ζ_n is the upper limit of ℓ in each R_n.

c) The Table of Peaks:

In this table, the absolute instantaneous peak flux encountered during each successive orbit (revolution) is listed for the indicated energy range. There are nine columns on this table. Column 1 is an orbit counting device, based on the period of the orbit when the trajectory lies in the equatorial plane and is circular, on the physical perigee in all elliptical cases, and on the equatorial crossing for circular inclined trajectories. Column 2 gives the peak flux. Columns 3, 4, and 5 indicate the spacecraft position in geocentric coordinates at which the peak was encountered, while columns 6, 7, and 8 determine respectively the time and the magnetic B-L coordinates for this event. It should be noted that all simulated flight paths for the purpose of orbital radiation studies start at $t_0 = 0$ hours. Finally, the last column indicates the total flux encountered during that particular orbit. It is advisable to disregard the last line on this table because many times that orbit is incomplete and the fluxes or positions shown do not correspond to true peaks.

d) The Exposure Analysis Summary:

The summary is contained in the left half of this last table of each set as a semi-independent and separate table. It indicates what percent of its total lifetime T the satellite spends in "flux free" regions of space, what percent of T in "high intensity" regions, and while in the latter, what percent of its total daily flux it accumulates.

In the context of this study, the term "flux free" applies to all regions of space where trapped particle fluxes are less than one proton or electron per square centimeter per second, having energies $E > .1$, $E > 5.$, and $E > .5$ Mev for the low energy protons, the high energy protons, and the electrons, respectively; by definition, this includes all regions outside the radiation belts. The concept of "trapped particle fluxes" is meant to include stably trapped, pseudo-trapped, and transient fluxes, as long as they are part of or contained in the environment models used and, in the case of transients or pseudos, their sources are considered powerful enough to supply them in a substantial and ever present way.

Similarly, we define as "high intensity" those regions of space where the instantaneous, integral, omnidirectional, trapped-particle flux is greater than 10^3 protons with energies $E > .1$ or $E > 5.$ Mev, and greater than 10^5 electrons with energies $E > .5$ Mev.

The values given in this table are statistical averages, obtained over extended intervals of mission time. However, they may vary significantly from one orbit to the next, when individual orbits are considered.

c) The Time Account Breakdown:

The breakdown of orbit time is given in the right half of the last table of every set, in the same semi-independent form as the summary. The table shows the total lifetime spent by the vehicle in the inner zone T^i ($1.0 < L \leq 2.5$) and the outer zone T^o ($2.5 < L \leq 7.0$) of the trapped particle radiation belt, and also the percent duration spent outside that region ($L > 7.0$), which is denoted by T^e (T-external), such that for any mission

$$T = T^i + T^o + T^e = 100\%.$$

The confinement of the outer zone within the boundary of the $L = 7.0$ volume is arbitrary and has no physical meaning. It is intended only as a simplification to facilitate our calculations. The region considered "external" ($L = 7.0$) in this study is still partially a domain of the outer zone, at least as far out as $L = 11.0$ earth radii, according to the latest electron models (Singley and Vette, 1972).

A last item on this table: the inner zone time T^i may be subdivided into two parts: the percentage of time spent outside the region $(1.0 < L \leq 1.1)$ and inside the region $(1.1 < L \leq 2.5)$.

APPENDIX C

Description of Plots

a) The Time and Flux Histogram:

This plot shows two curves superimposed on the same graph, namely, one each for the variables "time" and "flux". Both are given as functions of the parameter L (earth radii) within the range $1 < L < 7$, on a semi-log scale. The plot depicts: (1) by a plain curve the characteristic trajectory intensities as obtained from the orbital integration process in terms of averaged, instantaneous, integral particle fluxes above a given energy, over constant L-bands of .1 earth radius width, and (2) by a contour marked with symbols the percent of total lifetime (%T) spent in each L-interval. The logarithmic ordinate relates to the time-flux variables. The printed numbers are powers of 10 and pertain to the fluxes; the scale values for the time curve are given in the upper part of the ordinate label: from 10^{-3} to 10^{2} percent of T. The type of particles, their integral energy, and the units, are all given in the lower part of the label. The label on top of the graph lists some useful information about the trajectory.

b) The Spectral Profile:

A graphical presentation of the final spectral distribution, obtained from the orbital integration process, The plot is a semi-log graph, where the abscissa is a linear energy scale for integral particle energies

E_0 in Mev, and the ordinate is a logarithmic scale for the orbit integrated fluxes, given in daily averages for energies greater than E_0; the printed scale values are powers of 10.

c) Peaks per Orbit:

Here the absolute peak intensities, encountered per period, are plotted for the duration of the total flight time considered (1 period = 1 revolution = 1 orbit). The logarithmic ordinate relates to instantaneous particle fluxes of the environment at the indicated energy threshold, while the abscissa is a linear orbit enumeration.

d) World Map Grid Projection of Orbits:

The trajectory is plotted for several revolutions on a global map produced by a Miller Cylindrical Projection. The contours of the continents have been omitted for clarity. The positions of either equatorial crossing, of physical perigee, or of period commencement are indicated by numbers identifying the orbits shown in this graph. For all trajectories, the distance between successive sequential numbers is a measure of the orbit precession.

e) B-L Trace of Orbits:

This plot shows a trace of the trajectory in B-L space on a semi-log scale. Several orbits are usually depicted, each identified by its sequential number. The magnetic equator is entered on all plots. The logarithmic ordinate relates to the field strength B in gauss; the printed values are exponents of 10. L is given in earth radii on the linear abscissa.

TABLE 1

Partial Listing of
Parameters, Constants, Variables, or Expressions
designated as "standard" in the text

1.	Standard Tables:	set of tables as listed in Figure 1, in the regular format described in Appendix B.
2.	Standard Plots:	set of plots as listed in Figure 2, in the regular format described in Appendix C.
3.	Standard Production Run:	a production run processed on default options.
4.	Standard Integration Stepsize:	constant time increment of orbit integration: 1' (60").
5.	Standard Energies:	protons E > 5. Mev and electrons E > .5 Mev.
6.	Standard Procedure:	established procedure normally followed vs. procedure followed in special cases.

TABLE 2

B and L Extrema of Circular SOLRAD and TIMATION Trajectories

	B-range		L-range	
	B-min	B-max*	L-min	L-max*
	(gamma)		(earth radii)	
SOLRAD:				
Inclination 65° Altitude 1111 km	.15632	.40227	1.09	29.08
TIMATION:				
Inclination 55° Altitude 13890 km	.00893	.01765	3.14	12.52

*These values are not true upper bounds for the respective trajectories because calculations and storage of B and L are suspended by an (h,λ,ϕ)-sensitive exclusion test.

Table 3

```
****************************************************************************************************************************
** ORBITAL FLUX STUDY WITH COMPCSITE PARTICLE ENVIRONMENTS: VETTES AP5, AP6, AP7; AE4, AE5, FOR SOLAR MAXIMUM **** UNIFLX CF 1973 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1973. 6 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES:              **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL  5:      IGRF 1965.0 80-TERM 10/68    * TIME= 1973.0 **
** VEHICLE : 2 NRL SOLRAD ** INCLINATION= 65DEG ** PERIGEE= 1111KM ** APOGEE=  1111KM ** B/L ORBIT TAPE: TD7963 ** PERIOD=  1.790 **
****************************************************************************************************************************
                              ******************************     PROTONS     ********************************
                              ** SPECTRAL DISTRIBUTION : NORMALIZED BY FLUX OF ENERGY GREATER THAN 5.000MEV **
                              *******************************************************************************
```

ENEFGY L - B A N D S (M A G N E T I C S H E L L P A R A M E T E R I N E A R T H R A D I I) L - B A N D S

LEVELS >(MEV)	*1.0-1.2*	*1.2-1.4*	*1.4-1.6*	*1.6-1.8*	*1.8-2.0*	*2.0-2.2*	*2.2-2.4*	*2.4-2.6*	*2.6-2.8*	*2.8-3.0*	*3.0-3.2*	*3.2-3.4*
.1000	3.46E 00	2.57E 00	2.76E 00	3.00E 00	3.47E 00	7.76E 00	2.16E 01	9.43E 01	9.85E 02	1.82E 04	7.96E 05	3.19E 06
1.000	2.44E 00	1.82E 00	1.95E 00	2.13E 00	2.53E 00	4.38E 00	6.45E 00	1.76E 01	1.54E 02	2.12E 03	6.54E 04	2.33E 05
3.000	1.44E 00	1.33E 00	1.42E 00	1.54E C0	1.74E 00	2.13E 00	2.48E 00	3.76E 00	8.20E 00	2.36E 01	2.88E 02	7.65E 02
5.000	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	0.0	0.0
10.00	6.89E-01	5.77E-01	4.62E-01	3.21E-01	2.09E-01	1.93E-01	1.74E-01	1.09E-01	7.42E-02	1.66E-02	0.0	0.0
20.00	5.08E-01	3.57E-01	2.45E-01	1.21E-01	5.13E-02	3.95E-02	3.04E-02	1.17E-02	2.03E-03	0.0	0.0	0.0
30.00	4.75E-01	2.99E-01	2.07E-01	8.50E-02	2.82E-02	1.77E-02	1.06E-02	3.23E-03	0.0	0.0	0.0	0.0
50.00	4.16E-01	2.12E-01	1.49E-01	4.27E-02	8.70E-03	3.61E-03	1.30E-03	2.93E-04	0.0	0.0	0.0	0.0
100.0	3.00E-01	1.38E-01	8.73E-02	2.11E-02	3.06E-03	6.84E-04	6.44E-05	0.0	0.0	0.0	0.0	0.0
NOPMFLUX=	3.49E 06	8.53E 07	4.10E 07	2.56E C7	2.86E 07	5.95E 06	5.22E 06	2.32E 06	2.14E 05	1.60E 04	0.0	0.0

ENERGY L - B A N D S (M A G N E T I C S H E L L P A R A M E T E R I N E A R T H R A D I I) L - B A N D S

LEVELS >(MEV)	*3.4-3.6*	*3.6-3.8*	*3.8-4.0*	*4.0-4.2*	*4.2-4.4*	*4.4-4.6*	*4.6-4.8*	*4.8-5.0*	*5.0-5.2*	*5.2-5.4*	*5.4-5.6*	*5.6-5.8*
.1000	2.57E 05	1.17E 06	1.94E 06	2.20E 06	4.98E 06	3.53E 06	3.49E 06	3.24E 06	2.25E 06	1.24E 06	1.85E 06	1.04E 06
1.000	1.61E 04	3.45E 04	1.99E 04	2.85E 03	1.53E 02	4.09E 01	2.89E 01	1.33E 01	6.34E 00	3.20E 00	5.71E 00	1.93E 00
3.000	3.66E 01	1.24E 01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ENEFGY L - B A N D S (M A G N E T I C S H E L L P A R A M E T E R I N E A R T H R A D I I) L - B A N D S

LEVELS >(MEV)	*5.8-6.0*	*6.0-6.2*	*6.2-6.4*	*6.4-6.6*	*6.6-6.8*	*6.8-7.0*	*7.0-7.2*	*7.2-7.4*	*7.4-7.6*	*7.6-7.8*	*7.8-8.0*	*8.0-OVR*
.1000	1.10E 06	4.41E 05	6.61E 05	2.96E 05	8.13E 04	3.90E 01	0.0	0.0	0.0	0.0	0.0	0.0
1.000	1.67E 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 4

```
*************************************************************************************************************************************
** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS: VETTES AP5, AP6, AP7; AE4, AE5, FOR SOLAR MAXIMUM **** UNIFLX OF 1973 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1973. 6 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES:                 **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL  5:      IGRF 1965.0 80-TERM 10/68     * TIME= 1973.0 **
** VEHICLE : 2 NRL SOLRAD ** INCLINATION= 65DEG ** PERIGEE= 1111KM ** APOGEE=  1111KM ** B/L ORBIT TAPE: T07963 ** PERIOD=  1.790 **
*************************************************************************************************************************************
                              *****************************     ELECTRONS     *********************************
                              ** SPECTRAL DISTRIBUTION : NORMALIZED BY FLUX OF ENERGY GREATER THAN .5000MEV **
                              ********************************************************************************
```

ENERGY LEVELS >(MEV)	L - B A N D S (M A G N E T I C			S H E L L		P A R A M E T E R		I N	E A R T H		R A D I I)	L - B A N D S
	1.0-1.2	*1.2-1.4*	*1.4-1.6*	*1.6-1.8*	*1.8-2.0*	*2.0-2.2*	*2.2-2.4*	*2.4-2.6*	*2.6-2.8*	*2.8-3.0*	*3.0-3.2*	*3.2-3.4*
.1000	3.83E 00	7.01E 00	1.21E 01	4.50E 01	6.89E 01	1.12E 02	1.70E 02	6.91E 01	1.25E 01	7.22E 00	5.75E 00	5.68E 00
.5000	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
1.000	5.19E-01	7.25E-02	1.94E-01	2.19E-01	6.64E-02	4.13E-02	4.15E-02	7.66E-02	2.05E-01	3.35E-01	3.67E-01	3.90E-01
1.500	3.33E-01	2.54E-02	1.01E-01	9.53E-02	1.60E-02	6.57E-03	5.63E-03	1.48E-02	7.91E-02	1.71E-01	1.80E-01	1.92E-01
2.000	1.59E-01	1.24E-02	5.95E-02	3.96E-02	4.58E-03	1.58E-03	1.11E-03	3.07E-03	3.34E-02	8.70E-02	8.84E-02	9.50E-02
2.500	4.89E-02	5.25E-03	2.41E-02	1.38E-02	1.24E-03	3.22E-04	1.64E-04	4.11E-04	8.76E-03	3.82E-02	3.82E-02	4.11E-02
3.000	1.38E-02	1.88E-03	8.02E-03	4.09E-03	2.89E-04	2.99E-05	0.0	0.0	6.01E-04	1.16E-02	1.41E-02	1.50E-02
4.000	1.16E-04	1.78E-05	7.17E-05	7.95E-05	2.40E-06	0.0	0.0	0.0	0.0	3.57E-04	3.97E-04	4.13E-04
5.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	4.50E 07	7.20E 09	3.18E 09	3.86E 08	1.76E 08	2.34E 07	1.42E 07	5.64E 06	1.30E 06	8.62E 06	9.46E 07	4.20E 08

ENERGY LEVELS >(MEV)	L - B A N D S (M A G N E T I C			S H E L L		P A R A M E T E R		I N	E A R T H		R A D I I)	L - B A N D S
	3.4-3.6	*3.6-3.8*	*3.8-4.0*	*4.0-4.2*	*4.2-4.4*	*4.4-4.6*	*4.6-4.8*	*4.8-5.0*	*5.0-5.2*	*5.2-5.4*	*5.4-5.6*	*5.6-5.8*
.1000	6.35E 00	5.80E 00	4.70E 00	3.87E 00	3.51E 00	3.31E 00	3.45E 00	3.64E 00	3.80E 00	3.87E 00	3.92E 00	3.94E 00
.5000	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
1.000	3.96E-01	3.81E-01	3.66E-01	3.55E-01	3.55E-01	3.54E-01	3.47E-01	3.38E-01	3.30E-01	3.22E-01	3.15E-01	2.79E-01
1.500	1.98E-01	1.91E-01	1.71E-01	1.52E-01	1.41E-01	1.34E-01	1.28E-01	1.22E-01	1.15E-01	1.06E-01	9.98E-02	8.49E-02
2.000	9.91E-02	9.53E-02	8.03E-02	6.47E-02	5.61E-02	5.06E-02	4.70E-02	4.40E-02	3.99E-02	3.47E-02	3.17E-02	2.59E-02
2.500	4.51E-02	4.83E-02	3.99E-02	2.90E-02	2.36E-02	2.03E-02	1.77E-02	1.57E-02	1.31E-02	1.03E-02	8.93E-03	7.08E-03
3.000	1.75E-02	2.06E-02	1.80E-02	1.30E-02	9.38E-03	7.42E-03	5.84E-03	4.64E-03	3.54E-03	2.61E-03	2.18E-03	1.76E-03
4.000	5.22E-04	6.93E-04	6.06E-04	4.11E-04	2.60E-04	1.88E-04	1.42E-04	1.10E-04	8.08E-05	5.56E-05	4.45E-05	2.83E-05
5.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	2.04E 08	3.63E 08	4.97E 08	4.46E 08	3.95E 08	2.85E 08	1.71E 08	1.63E 08	1.19E 08	7.62E 07	1.08E 08	6.02E 07

ENERGY LEVELS >(MEV)	L - B A N D S (M A G N E T I C			S H E L L		P A R A M E T E R		I N	E A R T H		R A D I I)	L - B A N D S
	5.8-6.0	*6.0-6.2*	*6.2-6.4*	*6.4-6.6*	*6.6-6.8*	*6.8-7.0*	*7.0-7.2*	*7.2-7.4*	*7.4-7.6*	*7.6-7.8*	*7.8-8.0*	*8.0-OVR*
.1000	3.96E 00	4.28E 00	5.07E 00	6.48E 00	6.99E 00	7.77E 00	1.01E 01	1.26E 01	0.0	2.26E 01	3.25E 01	6.66E 01
.5000	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	0.0	1.00E 00	1.00E 00	1.00E 00
1.000	2.50E-01	2.40E-01	2.36E-01	2.31E-01	2.10E-01	1.71E-01	1.42E-01	1.31E-01	0.0	1.03E-01	8.89E-02	5.79E-02
1.500	7.41E-02	6.88E-02	6.48E-02	5.96E-02	5.16E-02	3.87E-02	3.01E-02	2.69E-02	0.0	1.97E-02	1.61E-02	8.24E-03
2.000	2.19E-02	1.98E-02	1.78E-02	1.54E-02	1.27E-02	8.77E-03	6.35E-03	5.53E-03	0.0	3.74E-03	2.93E-03	1.33E-03
2.500	5.88E-03	5.14E-03	4.40E-03	3.57E-03	2.87E-03	1.89E-03	1.31E-03	1.12E-03	0.0	6.39E-04	3.45E-04	0.0
3.000	1.49E-03	1.25E-03	9.65E-04	6.90E-04	5.56E-04	3.78E-04	2.60E-04	2.14E-04	0.0	0.0	0.0	0.0
4.000	2.09E-05	5.78E-06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	5.84E 07	3.23E 07	3.79E 07	1.05E 07	6.45E 06	8.12E 06	6.23E 06	4.82E 06	0.0	1.58E 06	1.47E 06	9.02E 05

Table 5

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***************************************************************************************************************************
** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS: VETTES AP5, AP6, AP7; AE4, AE5, FOR SOLAR MAXIMUM **** UNIFLX OF 1973 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1973. 6 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES:          **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL  5:     IGRF 1965.0 80-TERM 10/68    * TIME= 1973.0 **
** VEHICLE : 1 NRL TIMATN ** INCLINATION= 55DEG ** PERIGEE=13890KM ** APOGEE= 13890KM ** B/L ORBIT TAPE: TD7963 ** PERIOD=  7.970 **
***************************************************************************************************************************
                    ********************************     PROTONS     ********************************
                    ** SPECTRAL DISTRIBUTION : NORMALIZED BY FLUX OF ENERGY GREATER THAN 5.000MEV **
                    ********************************************************************************
```

ENERGY LEVELS >(MEV)	L - B A N D S (M A G N E T I C S H E L L P A R A M E T E R I N E A R T H R A D I I) L - B A N D S											
	1.0-1.2	*1.2-1.4*	*1.4-1.6*	*1.6-1.8*	*1.8-2.0*	*2.0-2.2*	*2.2-2.4*	*2.4-2.6*	*2.6-2.8*	*2.8-3.0*	*3.0-3.2*	*3.2-3.4*
.1000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.79E 04	8.60E 04
1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.88E 03	7.69E 03
3.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.11E 01	3.68E 01
5.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.00E 00	1.00E 00
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.09E-02	4.75E-02
20.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.19E-03	9.87E-04
30.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.10E 07	3.36E 07

ENERGY LEVELS >(MEV)	L - B A N D S (M A G N E T I C S H E L L P A R A M E T E R I N E A R T H R A D I I) L - B A N D S											
	3.4-3.6	*3.6-3.8*	*3.8-4.0*	*4.0-4.2*	*4.2-4.4*	*4.4-4.6*	*4.6-4.8*	*4.8-5.0*	*5.0-5.2*	*5.2-5.4*	*5.4-5.6*	*5.6-5.8*
.1000	2.08E 05	9.83E 05	6.20E 06	4.22E 08	4.02E 08	3.41E 08	2.13E 08	1.34E 08	1.08E 08	6.00E 07	5.62E 07	3.89E 07
1.000	1.52E 04	5.07E 04	2.11E 05	5.51E 06	8.02E 05	1.08E 05	2.32E 04	7.49E 03	3.18E 03	1.17E 03	9.79E 02	6.97E 02
3.000	4.72E 01	7.28E 01	1.41E 02	6.88E 02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.000	1.00E 00	1.00E 00	1.00E 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.00	4.37E-02	1.75E-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20.00	5.56E-05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	3.24E 06	2.49E 05	2.10E 04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ENERGY LEVELS >(MEV)	L - B A N D S (M A G N E T I C S H E L L P A R A M E T E R I N E A R T H R A D I I) L - B A N D S											
	5.8-6.0	*6.0-6.2*	*6.2-6.4*	*6.4-6.6*	*6.6-6.8*	*6.8-7.0*	*7.0-7.2*	*7.2-7.4*	*7.4-7.6*	*7.6-7.8*	*7.8-8.0*	*8.0-OVR*
.1000	3.73E 07	2.88E 07	1.73E 07	4.48E 07	7.40E 06	4.38E 06	8.29E 05	6.38E 05	3.17E 05	3.87E 04	5.24E 04	2.39E 04
1.000	7.30E 02	4.47E 02	2.86E 02	4.81E 02	1.20E 02	1.24E 02	3.98E 01	4.10E 01	4.08E 01	1.07E 01	2.38E 01	7.07E 01
3.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 6

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****************************************************************************************************************
** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS: VETTES AP5, AP6, AP7; AE4, AE5, FOR SOLAR MAXIMUM **** UNIFLX OF 1973 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1973. 6 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES:              **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL  5:     IGRF 1965.0 80-TERM 10/68    * TIME= 1973.0 **
** VEHICLE : 1 NRL TIMATN ** INCLINATION= 55DEG ** PERIGEE=13890KM ** APOGEE= 13890KM ** B/L ORBIT TAPE: TD7963 ** PERIOD=  7.970 **
****************************************************************************************************************
                    ********************************   ELECTRONS   ********************************
                    ** SPECTRAL DISTRIBUTION : NORMALIZED BY FLUX OF ENERGY GREATER THAN .5000MEV **
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ENERGY LEVELS >(MEV)	L - B A N D S	(M A G N E T I C	S H E L L	P A R A M E T E R	I N	E A R T H	R A D I I)	L - B A N D S				
	1.0-1.2	*1.2-1.4*	*1.4-1.6*	*1.6-1.8*	*1.8-2.0*	*2.0-2.2*	*2.2-2.4*	*2.4-2.6*	*2.6-2.8*	*2.8-3.0*	*3.0-3.2*	*3.2-3.4*
.1000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.55E 00	5.74E 00
.5000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.00E 00	1.00E 00
1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.73E-01	3.91E-01
1.500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.82E-01	1.93E-01
2.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.92E-02	5.54E-02
2.500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.79E-02	4.14E-02
3.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.39E-02	1.51E-02
4.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.79E-04	4.14E-04
5.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.64E 10	4.02E 10

ENERGY LEVELS >(MEV)	L - B A N D S	(M A G N E T I C	S H E L L	P A R A M E T E R	I N	E A R T H	R A D I I)	L - B A N D S				
	3.4-3.6	*3.6-3.8*	*3.8-4.0*	*4.0-4.2*	*4.2-4.4*	*4.4-4.6*	*4.6-4.8*	*4.8-5.0*	*5.0-5.2*	*5.2-5.4*	*5.4-5.6*	*5.6-5.8*
.1000	6.35E 00	5.98E 00	4.66E 00	3.83E 00	3.53E 00	3.33E 00	3.45E 00	3.65E 00	3.80E 00	3.86E 00	3.91E 00	3.94E 00
.5000	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
1.000	3.97E-01	3.84E-01	3.65E-01	3.55E-01	3.55E-01	3.53E-01	3.46E-01	3.38E-01	3.30E-01	3.23E-01	3.14E-01	2.87E-01
1.500	1.98E-01	1.92E-01	1.70E-01	1.50E-01	1.41E-01	1.33E-01	1.27E-01	1.22E-01	1.15E-01	1.07E-01	9.98E-02	8.83E-02
2.000	9.90E-02	9.59E-02	7.94E-02	6.36E-02	5.63E-02	5.04E-02	4.69E-02	4.39E-02	4.00E-02	3.56E-02	3.17E-02	2.72E-02
2.500	4.51E-02	4.74E-02	3.94E-02	2.83E-02	2.37E-02	2.01E-02	1.77E-02	1.56E-02	1.32E-02	1.08E-02	9.01E-03	7.48E-03
3.000	1.74E-02	2.00E-02	1.77E-02	1.25E-02	9.51E-03	7.33E-03	5.80E-03	4.61E-03	3.57E-03	2.77E-03	2.21E-03	1.85E-03
4.000	5.13E-04	6.62E-04	5.97E-04	3.92E-04	2.66E-04	1.86E-04	1.42E-04	1.10E-04	8.25E-05	6.07E-05	4.54E-05	3.27E-05
5.000	0.0	1.34E-07	3.13E-07	2.39E-08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	2.39E 10	1.98E 10	2.04E 10	1.67E 10	1.57E 10	1.34E 10	1.02E 10	8.52E 09	7.66E 09	4.74E 09	5.07E 09	3.93E 09

ENERGY LEVELS >(MEV)	L - B A N D S	(M A G N E T I C	S H E L L	P A R A M E T E R	I N	E A R T H	R A D I I)	L - B A N D S				
	5.8-6.0	*6.0-6.2*	*6.2-6.4*	*6.4-6.6*	*6.6-6.8*	*6.8-7.0*	*7.0-7.2*	*7.2-7.4*	*7.4-7.6*	*7.6-7.8*	*7.8-8.0*	*8.0-OVR*
.1000	3.96E 00	4.38E 00	4.99E 00	6.08E 00	6.97E 00	7.79E 00	9.88E 00	1.19E 01	1.73E 01	2.39E 01	2.93E 01	6.74E 01
.5000	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
1.000	2.54E-01	2.39E-01	2.36E-01	2.32E-01	2.11E-01	1.71E-01	1.44E-01	1.34E-01	1.16E-01	1.02E-01	9.39E-02	5.74E-02
1.500	7.56E-02	6.84E-02	6.53E-02	6.10E-02	5.24E-02	3.87E-02	3.07E-02	2.79E-02	2.32E-02	1.96E-02	1.76E-02	7.22E-03
2.000	2.25E-02	1.95E-02	1.81E-02	1.60E-02	1.30E-02	8.79E-03	6.54E-03	5.81E-03	4.64E-03	3.76E-03	3.28E-03	9.93E-04
2.500	6.05E-03	5.07E-03	4.51E-03	3.79E-03	2.93E-03	1.91E-03	1.37E-03	1.20E-03	9.23E-04	6.80E-04	5.59E-04	1.18E-04
3.000	1.53E-03	1.23E-03	1.02E-03	7.65E-04	5.70E-04	3.86E-04	2.80E-04	2.41E-04	1.73E-04	1.00E-04	6.60E-05	0.0
4.000	2.24E-05	1.38E-05	8.62E-06	4.52E-06	2.35E-06	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	4.08E 09	2.54E 09	2.67E 09	1.95E 09	4.33E 08	4.88E 08	1.66E 08	1.73E 08	1.58E 08	2.98E 07	5.30E 07	5.56E 07

Table 7

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*******************************************************************************************************************
** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS: VETTES AP5, AP6, AP7; AE4, AE5, FOR SOLAR MAXIMUM **** UNIFLX OF 1973 *
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1973. 6 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES:                *
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL  5:     IGRF 1965.0 80-TERM 10/68     * TIME= 1973.0 **
** VEHICLE : 2 NRL SOLRAD ** INCLINATION= 65DEG ** PERIGEE= 1111KM ** APOGEE=  1111KM ** B/L ORBIT TAPE: TD7963 ** PERIOD=  1.790 **
*******************************************************************************************************************
                                   ****************      PROTONS      ****************
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****** SPECTRUM IN PERCENT DELTA ENERGY *******

ENERGY RANGES (MEV)	AVERAGED TOTAL FLUX #/CM**2/SEC	AVERAGED TOTAL FLUX #/CM**2/DAY	SPECTRUM PER CENT
.1000-1.000	7.948E 04	6.867E 09	91.900
1.000-3.000	3.503E 03	3.027E 08	4.051
3.000-5.000	1.214E 03	1.049E 08	1.404
5.000-10.00	1.280E 03	1.106E 08	1.480
10.00-20.00	4.617E 02	3.989E 07	0.534
20.00-30.00	9.733E 01	8.409E 06	0.113
30.00-50.00	1.363E 02	1.178E 07	0.158
50.00-100.0	1.157E 02	9.998E 06	0.134
100.0-OVER	1.969E 02	1.701E 07	0.228
TOTAL	8.648E 04	7.472E 09	100.000

*** COMPOSITE ORBIT SPECTRUM ***

ENERGY LEVELS >(MEV)	AVERAGED INTEG.FLUX #/CM**2/SEC	AVERAGED INTEG.FLUX #/CM**2/DAY
.1000	8.648E 04	7.472E 09
.5000	1.374E 04	1.187E 09
1.000	7.005E 03	6.053E 08
2.000	4.457E 03	3.851E 08
3.000	3.502E 03	3.026E 08
4.000	2.875E 03	2.484E 08
5.000	2.288E 03	1.977E 08
6.000	1.835E 03	1.586E 08
7.000	1.489E 03	1.286E 08
8.000	1.220E 03	1.054E 08
9.000	1.108E 03	9.571E 07
10.00	1.008E 03	8.709E 07
11.00	9.190E 02	7.940E 07
12.00	8.393E 02	7.252E 07
13.00	7.679E 02	6.635E 07
14.00	7.036E 02	6.079E 07
15.00	6.457E 02	5.579E 07
16.00	5.934E 02	5.127E 07
18.00	5.691E 02	4.917E 07
20.00	5.463E 02	4.720E 07
25.00	4.944E 02	4.271E 07
30.00	4.489E 02	3.879E 07
35.00	4.088E 02	3.532E 07
40.00	3.731E 02	3.224E 07
45.00	3.412E 02	2.948E 07
50.00	3.126E 02	2.701E 07
55.00	2.981E 02	2.575E 07
60.00	2.844E 02	2.457E 07
80.00	2.364E 02	2.042E 07
100.0	1.969E 02	1.701E 07

* EXPOSURE INDEX:ENERGY>5.000MEV *

INTENSITY RANGES #/CM**2/SEC	EXPOSURE DURATION (HOURS)	TOTAL # OF ACCUMULATED PARTICLES
ZERO FLUX	13.600	0.0
1.E0-1.E1	1.250	1.736E 04
1.E1-1.E2	2.050	3.197E 05
1.E2-1.E3	2.700	3.537E 06
1.E3-1.E4	2.600	4.090E 07
1.E4-1.E5	1.800	1.529E 08
1.E5-1.E6	0.0	0.0
1.E6-1.E7	0.0	0.0
1.E7-OVER	0.0	0.0
TOTAL	24.000	1.977E 08

Table 8

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*******************************************************************************************************************
** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS: VETTES AP5, AP6, AP7; AE4, AE5, FOR SOLAR MAXIMUM **** UNIFLX OF 1973
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1973. 6 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES:
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL  5:     IGRF 1965.0 80-TERM 10/68    * TIME= 1973.0
** VEHICLE : 2 NRL SOLRAD ** INCLINATION= 65DEG ** PERIGEE= 1111KM ** APOGEE=  1111KM ** B/L ORBIT TAPE: TD7963 ** PERIOD=  1.790
*******************************************************************************************************************
                                   ****************    ELECTRONS    ****************
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****** SPECTRUM IN PERCENT DELTA ENERGY *******

ENERGY RANGES (MEV)	AVERAGED TOTAL FLUX #/CM**2/SEC	AVERAGED TOTAL FLUX #/CM**2/DAY	SPECTRUM PER CENT
.1000-.5000	1.456E 06	1.256E 11	89.592
.5000-1.000	1.398E 05	1.208E 10	8.605
1.000-1.500	1.649E 04	1.425E 09	1.015
1.500-2.000	6.525E 03	5.638E 08	0.402
2.000-2.500	3.629E 03	3.135E 08	0.223
2.500-3.000	1.674E 03	1.447E 08	0.103
3.000-4.000	9.473E 02	8.184E 07	0.058
4.000-5.000	1.932E 01	1.670E 06	0.001
5.000-OVER	0.0	0.0	0.0
TOTAL	1.625E 06	1.404E 11	100.000

*** COMPOSITE ORBIT SPECTRUM ***

ENERGY LEVELS >(MEV)	AVERAGED INTEG.FLUX #/CM**2/SEC	AVERAGED INTEG.FLUX #/CM**2/DAY
.1000	1.625E 06	1.404E 11
.1250	1.358E 06	1.174E 11
.2500	5.943E 05	5.135E 10
.3750	3.387E 05	2.927E 10
.5000	1.691E 05	1.461E 10
.6250	9.685E 04	8.368E 09
.7500	5.713E 04	4.936E 09
1.000	2.929E 04	2.530E 09
1.250	1.946E 04	1.682E 09
1.500	1.280E 04	1.105E 09
1.750	9.157E 03	7.911E 08
2.000	6.270E 03	5.417E 08
2.500	2.641E 03	2.282E 08
3.000	9.666E 02	8.351E 07
3.125	6.229E 02	5.382E 07
3.250	4.058E 02	3.506E 07
3.375	2.690E 02	2.324E 07
3.500	1.810E 02	1.564E 07
3.625	1.036E 02	8.950E 06
3.750	5.931E 01	5.124E 06
3.875	3.392E 01	2.931E 06
4.000	1.932E 01	1.670E 06
4.125	9.439E 00	8.155E 05
4.250	3.833E 00	3.311E 05
4.375	1.472E 00	1.272E 05
4.500	4.332E-01	3.743E 04
4.625	1.530E-01	1.322E 04
4.750	3.353E-02	2.897E 03
4.875	0.0	0.0
5.000	0.0	0.0

* EXPOSURE INDEX:ENERGY>.5000MEV

INTENSITY RANGES #/CM**2/SEC	EXPOSURE DURATION (HOURS)	TOTAL # OF ACCUMULATI PARTICLES
ZERO FLUX	8.650	0.0
1.E0-1.E1	0.600	1.086E 0
1.E1-1.E2	0.600	8.504E 0
1.E2-1.E3	1.950	2.620E 0
1.E3-1.E4	2.250	3.207E 0
1.E4-1.E5	3.100	5.496E 0
1.E5-1.E6	6.100	5.829E C
1.E6-1.E7	0.750	8.197E C
1.E7-OVER	0.0	0.0
TOTAL	24.000	1.461E 1

Table 9

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*************************************************************************************************************************************
** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS: VETTES AP5, AP6, AP7; AE4, AE5, FOR SOLAR MAXIMUM **** UNIFLX OF 1973 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1973. 6 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES:                 **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL  5:     IGRF 1965.0 80-TERM 10/68     * TIME= 1973.0 **
** VEHICLE : 1 NRL TIMATN ** INCLINATION= 55DEG ** PERIGEE=13890KM ** APOGEE= 13890KM ** B/L ORBIT TAPE: TD7963 ** PERIOD=  7.970 **
*************************************************************************************************************************************
                                        ****************      PROTONS      ****************
                                        ***********************************************
```

****** SPECTRUM IN PERCENT DELTA ENERGY *******

ENERGY RANGES (MEV)	AVERAGED TOTAL FLUX #/CM**2/SEC	AVERAGED TOTAL FLUX #/CM**2/DAY	SPECTRUM PER CENT
.1000-1.000	6.620E 07	5.720E 12	91.582
1.000-3.000	6.054E 06	5.231E 11	8.375
3.000-5.000	3.017E 04	2.606E 09	0.042
5.000-10.00	8.600E 02	7.430E 07	0.001
10.00-20.00	4.336E 01	3.747E 06	0.000
20.00-30.00	9.491E-01	8.200E 04	0.000
30.00-50.00	0.0	0.0	0.0
50.00-100.0	0.0	0.0	0.0
100.0-OVER	0.0	0.0	0.0
TOTAL	7.229E 07	6.246E 12	100.000

*** COMPOSITE ORBIT SPECTRUM ***

ENERGY LEVELS >(MEV)	AVERAGED INTEG.FLUX #/CM**2/SEC	AVERAGED INTEG.FLUX #/CM**2/DAY
.1000	7.229E 07	6.246E 12
.5000	2.338E 07	2.020E 12
1.000	6.085E 06	5.258E 11
2.000	4.298E 05	3.714E 10
3.000	3.107E 04	2.685E 09
4.000	2.281E 03	1.971E 08
5.000	9.043E 02	7.813E 07
6.000	4.266E 02	3.686E 07
7.000	2.013E 02	1.739E 07
8.000	9.498E 01	8.206E 06
9.000	6.486E 01	5.604E 06
10.00	4.431E 01	3.829E 06
11.00	3.028E 01	2.616E 06
12.00	2.071E 01	1.789E 06
13.00	1.416E 01	1.224E 06
14.00	9.685E 00	8.368E 05
15.00	6.624E 00	5.723E 05
16.00	4.530E 00	3.914E 05
18.00	2.088E 00	1.804E 05
20.00	9.491E-01	8.200E 04
25.00	8.199E-02	7.084E 03
30.00	0.0	0.0
35.00	0.0	0.0
40.00	0.0	0.0
45.00	0.0	0.0
50.00	0.0	0.0
55.00	0.0	0.0
60.00	0.0	0.0
80.00	0.0	0.0
100.0	0.0	0.0

* EXPOSURE INDEX:ENERGY>5.000MEV *

INTENSITY RANGES #/CM**2/SEC	EXPOSURE DURATION (HOURS)	TOTAL # OF ACCUMULATED PARTICLES
ZERO FLUX	15.550	0.0
1.E0-1.E1	0.100	3.367E 03
1.E1-1.E2	1.650	2.246E 05
1.E2-1.E3	1.850	3.000E 06
1.E3-1.E4	4.850	7.490E 07
1.E4-1.E5	0.0	0.0
1.E5-1.E6	0.0	0.0
1.E6-1.E7	0.0	0.0
1.E7-OVER	0.0	0.0
TOTAL	24.000	7.813E 07

Table 10

****
** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS: VETTES AP5, AP6, AP7; AE4, AE5, FOR SOLAR MAXIMUM **** UNIFLX OF 1973 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1973. 6 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES: **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL 5: IGRF 1965.0 80-TERM 10/68 * TIME= 1973.0 **
** VEHICLE : 1 NRL TIMATN ** INCLINATION= 55DEG ** PERIGEE=13890KM ** APOGEE= 13890KM ** B/L ORBIT TAPE: TD7963 ** PERIOD= 7.970 **
****

**************** ELECTRONS ****************
****

****** SPECTRUM IN PERCENT DELTA ENERGY *******

ENERGY RANGES (MEV)	AVERAGED TOTAL FLUX #/CM**2/SEC	AVERAGED TOTAL FLUX #/CM**2/DAY	SPECTRUM PER CENT
.1000-.5000	9.970E 06	8.614E 11	79.548
.5000-1.000	1.643E 06	1.419E 11	13.107
1.000-1.500	5.147E 05	4.447E 10	4.107
1.500-2.000	2.228E 05	1.925E 10	1.777
2.000-2.500	1.032E 05	8.919E 09	0.824
2.500-3.000	4.901E 04	4.235E 09	0.391
3.000-4.000	2.993E 04	2.586E 09	0.239
4.000-5.000	9.052E 02	7.821E 07	0.007
5.000-OVER	1.091E-01	9.428E 03	0.000
TOTAL	1.253E 07	1.083E 12	100.000

*** COMPOSITE ORBIT SPECTRUM ***

ENERGY LEVELS >(MEV)	AVERAGED INTEG.FLUX #/CM**2/SEC	AVERAGED INTEG.FLUX #/CM**2/DAY
.1000	1.253E 07	1.083E 12
.1250	1.106E 07	9.558E 11
.2500	5.972E 06	5.160E 11
.3750	3.732E 06	3.224E 11
.5000	2.563E 06	2.215E 11
.6250	1.981E 06	1.712E 11
.7500	1.533E 06	1.325E 11
1.000	9.205E 05	7.954E 10
1.250	6.093E 05	5.264E 10
1.500	4.058E 05	3.507E 10
1.750	2.719E 05	2.349E 10
2.000	1.831E 05	1.582E 10
2.500	7.985E 04	6.899E 09
3.000	3.083E 04	2.664E 09
3.125	2.221E 04	1.919E 09
3.250	1.600E 04	1.383E 09
3.375	1.153E 04	9.965E 08
3.500	8.313E 03	7.182E 08
3.625	4.772E 03	4.123E 08
3.750	2.741E 03	2.368E 08
3.875	1.575E 03	1.361E 08
4.000	9.053E 02	7.822E 07
4.125	4.145E 02	3.581E 07
4.250	1.735E 02	1.499E 07
4.375	6.305E 01	5.448E 06
4.500	2.063E 01	1.782E 06
4.625	8.219E 00	7.101E 05
4.750	2.525E 00	2.181E 05
4.875	5.522E-01	4.771E 04
5.000	1.091E-01	9.428E 03

* EXPOSURE INDEX:ENERGY>.5000MEV *

INTENSITY RANGES #/CM**2/SEC	EXPOSURE DURATION (HOURS)	TOTAL # OF ACCUMULATED PARTICLES
ZERO FLUX	2.250	0.0
1.E0-1.E1	0.050	1.657E 03
1.E1-1.E2	0.250	5.152E 04
1.E2-1.E3	0.500	5.691E 05
1.E3-1.E4	1.000	1.582E 07
1.E4-1.E5	0.850	1.219E 08
1.E5-1.E6	2.000	3.878E 09
1.E6-1.E7	17.100	2.175E 11
1.E7-OVER	0.0	0.0
TOTAL	24.000	2.215E 11

Table 11

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*****************************************************************************************************************************************
** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS: VETTES AP5, AP6, AP7; AE4, AE5, FOR SOLAR MAXIMUM **** UNIFLX OF 1973 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1973. 6 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES:                  **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL  5:     IGRF 1965.0 80-TERM 10/68     * TIME= 1973.0 **
** VEHICLE : 2 NRL SOLRAD ** INCLINATION= 65DEG ** PERIGEE= 1111KM ** APOGEE=  1111KM ** B/L ORBIT TAPE: TD7963 ** PERIOD=  1.790 **
*****************************************************************************************************************************************
                                        ************************      PROTONS      ************************
                                        ** TABLE OF PEAK AND TOTAL FLUXES PER PERIOD : ENERGY >5.000MEV **
                                        ******************************************************************
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PERIOD NUMBER	PEAK FLUX ENCOUNTERED #/CM**2/SEC	POSITION AT WHICH ENCOUNTERED LONGITUDE (DEG)	LATITUDE (DEG)	ALTITUDE (KM)	ORBIT TIME (HOURS)	FIELD(B) (GAUSS)	LINE(L) (E.R.)	TOTAL FLUX PER ORBIT #/CM**2/ORBIT
1	3.619E 02	-96.226	9.11	1111.61	0.05000	0.22517	1.32	2.855E 05
2	4.245E 03	52.621	-29.86	1108.36	2.85000	0.23685	1.93	2.029E 06
3	1.570E 04	26.550	-31.66	1108.89	4.65000	0.20381	1.96	8.379E 06
4	2.810E 04	0.528	-33.45	1109.51	6.45000	0.18755	1.87	1.902E 07
5	4.361E 04	-34.698	-17.51	1105.09	8.15000	0.15829	1.30	3.163E 07
6	3.658E 04	-56.633	-28.29	1107.99	10.00000	0.16088	1.34	2.575E 07
7	1.016E 04	-69.999	-46.94	1114.77	11.90000	0.20815	1.70	1.022E 07
8	1.580E 04	30.215	-30.25	1115.02	14.15000	0.20570	1.91	7.842E 06
9	2.431E 04	4.108	-28.44	1114.53	15.95000	0.18718	1.74	1.611E 07
10	3.448E 04	-22.035	-26.63	1114.10	17.74998	0.16808	1.49	3.099E 07
11	4.516E 04	-48.213	-24.80	1113.72	19.54999	0.15669	1.32	3.110E 07
12	1.590E 04	-74.424	-22.97	1113.42	21.34999	0.16798	1.26	1.202E 07
13	3.399E 03	-96.781	-12.12	1111.86	23.20000	0.18368	1.19	2.312E 06

Table 12

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** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS: VETTES AP5, AP6, AP7; AE4, AE5, FOR SOLAR MAXIMUM **** UNIFLX OF 1973 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1973. 6 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES: **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL 5: IGRF 1965.0 80-TERM 10/68 * TIME= 1973.0 **
** VEHICLE : 2 NRL SOLRAD ** INCLINATION= 65DEG ** PERIGEE= 1111KM ** APOGEE= 1111KM ** B/L ORBIT TAPE: TD7963 ** PERIOD= 1.790 **
****

************************ ELECTRONS ************************
** TABLE OF PEAK AND TOTAL FLUXES PER PERIOD : ENERGY >.5000MEV **
****

PERIOD NUMBER	PEAK FLUX ENCOUNTERED #/CM**2/SEC	POSITION AT WHICH ENCOUNTERED LONGITUDE (DEG)	LATITUDE (DEG)	ALTITUDE (KM)	ORBIT TIME (HOURS)	FIELD(B) (GAUSS)	LINE(L) (E.R.)	TOTAL FLUX PER ORBIT #/CM**2/ORBIT
1	2.599E 05	90.725	-45.09	1114.02	1.15000	0.35053	4.01	2.109E 08
2	2.289E 05	65.271	-46.73	1114.54	2.95000	0.29356	3.65	2.213E 08
3	1.149E 06	17.922	-13.79	1104.27	4.55000	0.19356	1.39	5.088E 08
4	3.249E 06	-8.396	-15.65	1104.63	6.35000	0.17521	1.38	1.131E 09
5	4.784E 06	-30.487	-26.47	1107.37	8.20000	0.16318	1.43	2.355E 09
6	5.023E 06	-56.633	-28.29	1107.99	10.00000	0.16088	1.34	2.150E 09
7	9.209E 05	-82.741	-30.10	1108.62	11.80000	0.18459	1.33	9.127E 08
8	2.536E 05	164.751	64.56	1122.03	13.00000	0.34613	4.19	3.922E 08
9	9.232E 05	8.460	-19.53	1112.71	16.00000	0.18809	1.51	4.961E 08
10	4.684E 06	-17.822	-17.69	1112.38	17.79999	0.16784	1.38	1.818E 09
11	5.535E 06	-48.213	-24.80	1113.72	19.54999	0.15669	1.32	2.843E 09
12	1.652E 06	-79.078	-31.81	1115.38	21.29999	0.18261	1.35	1.094E 09
13	3.041E 05	-63.320	4.22	1111.12	21.49998	0.20211	1.35	3.415E 08

Table 13

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****************************************************************************************************************************
** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS: VETTES AP5, AP6, AP7; AE4, AE5, FOR SOLAR MAXIMUM **** UNIFLX OF 1973 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1973. 6 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES:              **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL  5:     IGRF 1965.0 80-TERM 10/68     * TIME= 1973.0 **
** VEHICLE : I NRL TIMATN ** INCLINATION= 55DEG ** PERIGEE=13890KM ** APOGEE= 13890KM ** B/L ORBIT TAPE: TD7963 ** PERIOD=  7.970 **
****************************************************************************************************************************
                              ***********************      PROTONS      ************************
                              ** TABLE OF PEAK AND TOTAL FLUXES PER PERIOD : ENERGY >5.000MEV **
                              *****************************************************************
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PERIOD NUMBER	PEAK FLUX ENCOUNTERED #/CM**2/SEC	POSITION AT WHICH ENCOUNTERED LONGITUDE (DEG)	LATITUDE (DEG)	ALTITUDE (KM)	ORBIT TIME (HOURS)	FIELD(B) (GAUSS)	LINE(L) (E.R.)	TOTAL FLUX PER ORBIT #/CM**2/ORBIT
1	7.981E 03	-158.351	1.86	13890.03	0.05000	0.00991	3.16	1.663E 07
2	8.747E 03	84.176	10.18	13890.61	8.25000	0.01005	3.14	3.704E 07
3	8.507E 03	78.509	8.82	13886.75	19.70000	0.00999	3.15	2.306E 07

Table 14

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*****************************************************************************************************************
** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS: VETTES AP5, AP6, AP7; AE4, AE5, FOR SOLAR MAXIMUM **** UNIFLX OF 1973 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1973. 6 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES:              **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL  5:     IGRF 1965.0 80-TERM 10/68    * TIME= 1973.0 **
** VEHICLE : 1 NRL TIMATN ** INCLINATION= 55DEG ** PERIGEE=13890KM ** APOGEE= 13890KM ** B/L ORBIT TAPE: TD7963 ** PERIOD=  7.970 **
*****************************************************************************************************************
                         ***********************    ELECTRONS    ***********************
                         ** TABLE OF PEAK AND TOTAL FLUXES PER PERIOD : ENERGY >.5000MEV **
                         ******************************************************************
```

PERIOD NUMBER	PEAK FLUX ENCOUNTERED #/CM**2/SEC	POSITION AT WHICH ENCOUNTERED LONGITUDE (DEG)	LATITUDE (DEG)	ALTITUDE (KM)	ORBIT TIME (HOURS)	FIELD(B) (GAUSS)	LINE(L) (E.R.)	TOTAL FLUX PER ORBIT #/CM**2/ORBIT
1	5.531E 06	-24.844	-34.41	13893.28	4.95000	0.01106	4.06	6.520E 10
2	5.433E 06	-56.349	-38.76	13897.33	14.85000	0.01127	4.06	9.145E 10
3	5.407E 06	-32.985	18.39	13891.86	16.45000	0.01149	4.02	6.422E 10

Table 15

TABLE _

2 NRL SOLRAD

CIRCULAR

INCLINATION: 65 DEG

PERIGEE: 1111 KM

APOGEE: 1111 KM

DECAY DATE: 1973. 6.

**** EXPOSURE ANALYSIS ****

	PROTONS (E>5.000MEV)	ELECTRONS (E>.5000MEV)
PERCENT OF TOTAL LIFE-TIME SPENT IN FLUX-FREE REGIONS* OF SPACE :	56.67 %	36.04 %
PERCENT OF TOTAL LIFE-TIME SPENT IN HIGH-INTENSITY REGIONS+ OF VAN ALLEN BELTS :	18.33 %	28.54 %
PERCENT OF TOTAL DAILY FLUX ACCUMULATED IN HIGH-INTENSITY REGIONS:	98.04 %	96.00 %

****

* <1 PARTICLE/CM**2/SEC

\+ >1.E5 EL/CM**2/SEC OR 1.E3 PR/CM**2/SEC

TABLE _

2 NRL SOLRAD

CIRCULAR

INCLINATION: 65 DEG

PERIGEE: 1111 KM

APOGEE: 1111 KM

DECAY DATE: 1973. 6.

* PERCENT OF TOTAL LIFETIME SPENT INSIDE AND *

* OUTSIDE THE TRAPPED-PARTICLE RADIATION BELT *

INNER ZONE -TI-* : 65.62 %
(1.0 < L < 2.8)

OUTER ZONE -TO- : 31.46 %
(2.8 < L < 11.0)

EXTERNAL -TE- : 2.92 %
(L > 11.0)

TOTAL : 100.00 %

*TIME IN INNER ZONE MAY BE SUBDIVIDED AS FOLLOWS:

OUTSIDE TRAPPING REGION : 0.42 %
(1.0 < L < 1.1)

INSIDE TRAPPING REGION : 65.21 %
(1.1 < L < 2.8)

Table 16

TABLE _

1 NRL TIMATN

CIRCULAR

INCLINATION: 55 DEG

PERIGEE: 13890 KM

APOGEE: 13890 KM

DECAY DATE: 1973. 6.

**** EXPOSURE ANALYSIS ****

	PROTONS (E>5.000MEV)	ELECTRONS (E>.5000MEV)
PERCENT OF TOTAL LIFE-TIME SPENT IN FLUX-FREE REGIONS* OF SPACE :	64.79 %	9.38 %
PERCENT OF TOTAL LIFE-TIME SPENT IN HIGH-INTENSITY REGIONS+ OF VAN ALLEN BELTS :	20.21 %	79.58 %
PERCENT OF TOTAL DAILY FLUX ACCUMULATED IN HIGH-INTENSITY REGIONS:	95.87 %	99.94 %

****

* <1 PARTICLE/CM**2/SEC

+ >1.E5 EL/CM**2/SEC OR 1.E3 PR/CM**2/SEC

TABLE _

1 NRL TIMATN

CIRCULAR

INCLINATION: 55 DEG

PERIGEE: 13890 KM

APOGEE: 13890 KM

DECAY DATE: 1973. 6.

* PERCENT OF TOTAL LIFETIME SPENT INSIDE AND *
* OUTSIDE THE TRAPPED-PARTICLE RADIATION BELT *

INNER ZONE (1.0 < L < 2.8)	-TI-* :	0.0 %
OUTER ZONE (2.8 < L < 11.0)	-TO- :	98.54 %
EXTERNAL (L > 11.0)	-TE- :	1.46 %
TOTAL	:	100.00 %

*TIME IN INNER ZONE MAY BE SUBDIVIDED AS FOLLOWS:

OUTSIDE TRAPPING REGION : (1.0 < L < 1.1)	0.0 %
INSIDE TRAPPING REGION : (1.1 < L < 2.8)	0.0 %

Table 17

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****************************************************************************************************************
** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS: VETTES AP5, AP6, AP7; AE4, AE5, FOR SOLAR MAXIMUM **** UNIFLX OF 1973 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1973. 6 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES:              **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL  S:      IGRF 1965.0 80-TERM 10/68     * TIME= 1973.0 **
** VEHICLE : 2 NRL SOLRAD ** INCLINATION= 65DEG ** PERIGEE= 1111KM ** APOGEE=  1111KM ** B/L ORBIT TAPE: TD7963 ** PERIOD=  1.790 **
****************************************************************************************************************
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** ANNUAL ENERGETIC SOLAR PROTON FLUENCE **
************ (PARTICLES/CM**2) ************
****

ENERGY LEVELS >(MEV)	FOR CUTOFF DIPOLE SHELL ***L>5***
10.0	6.521E 08
20.0	3.388E 08
30.0	2.049E 08
40.0	1.342E 08
50.0	9.237E 07
60.0	6.592E 07
70.0	4.833E 07
80.0	3.621E 07
90.0	2.760E 07
100.0	2.136E 07

DIPOLE CUTOFF SHELL	PERCENT EXPOSURE TIME
L>4	21.04
L>5	14.79
L>6	11.25
L>7	8.96

Table 18

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****************************************************************************************************************
** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS: VETTES AP5, AP6, AP7; AE4, AE5, FOR SOLAR MAXIMUM **** UNIFLX OF 1973 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1973. 6 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES:                 **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL  5:      IGRF 1965.0 80-TERM 10/68     * TIME= 1973.0 **
** VEHICLE : 1 NRL TIMAIN ** INCLINATION= 55DEG ** PERIGEE=1389KM ** APOGEE= 1389KM ** B/L ORBIT TAPE: 107953 ** PERIOD=  7.970 **
****************************************************************************************************************
```

** ANNUAL ENERGETIC SOLAR PROTON FLUENCE **
*********** (PARTICLES/CM**2) ***********
****

ENERGY LEVELS >(MEV)	FOR CUTOFF DIPOLE SHELL ***L>5***
10.0	2.630E 09
20.0	1.054E 09
30.0	6.379E 08
40.0	4.176E 08
50.0	2.875E 08
60.0	2.052E 08
70.0	1.504E 08
80.0	1.127E 08
90.0	8.502E 07
100.0	6.648E 07

DIPOLE CUTOFF SHELL	PERCENT EXPOSURE TIME
L>4	61.87
L>5	46.04
L>6	33.33
L>7	23.12

TABLE ARRANGEMENT

Computer Produced Output Tables for Orbital Flux Integrations.

Standard Production Runs with UNIFLUX Program.

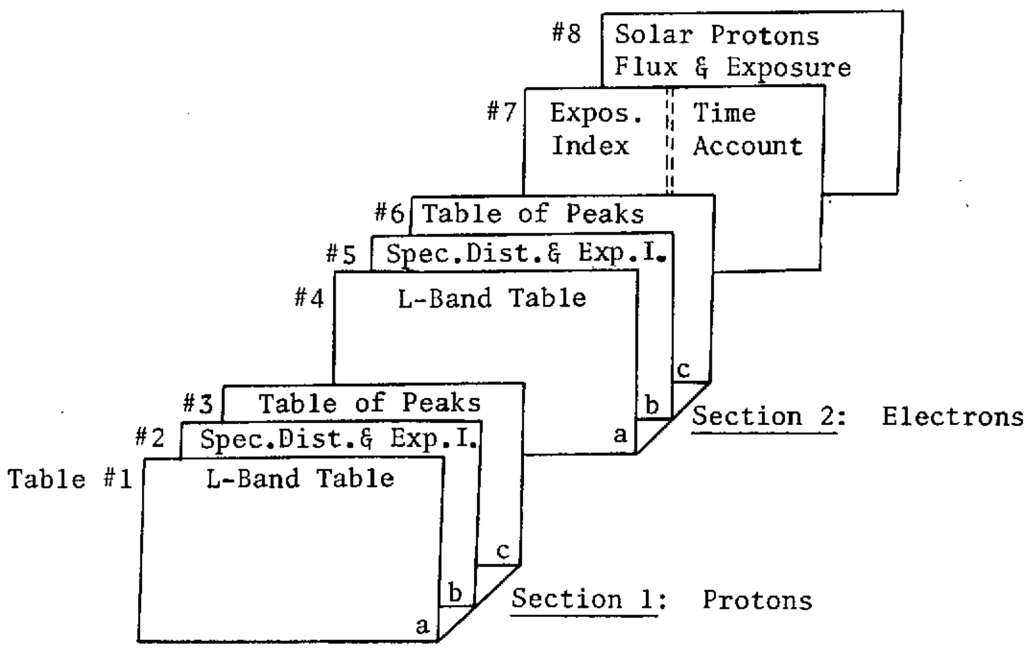


Figure 1: Set of tables produced for every trajectory considered in an orbital radiation study.

PLOT ARRANGEMENT

Computer Produced Plots for Orbital Flux Integrations.

Standard Production Runs with UNIFLUX Program.

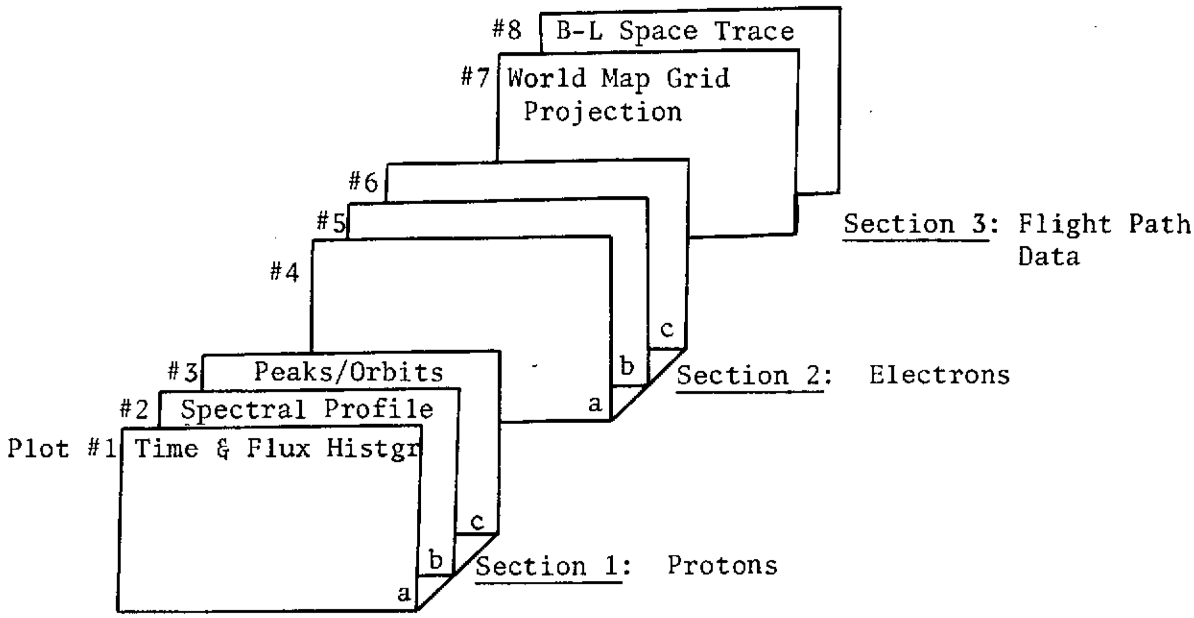
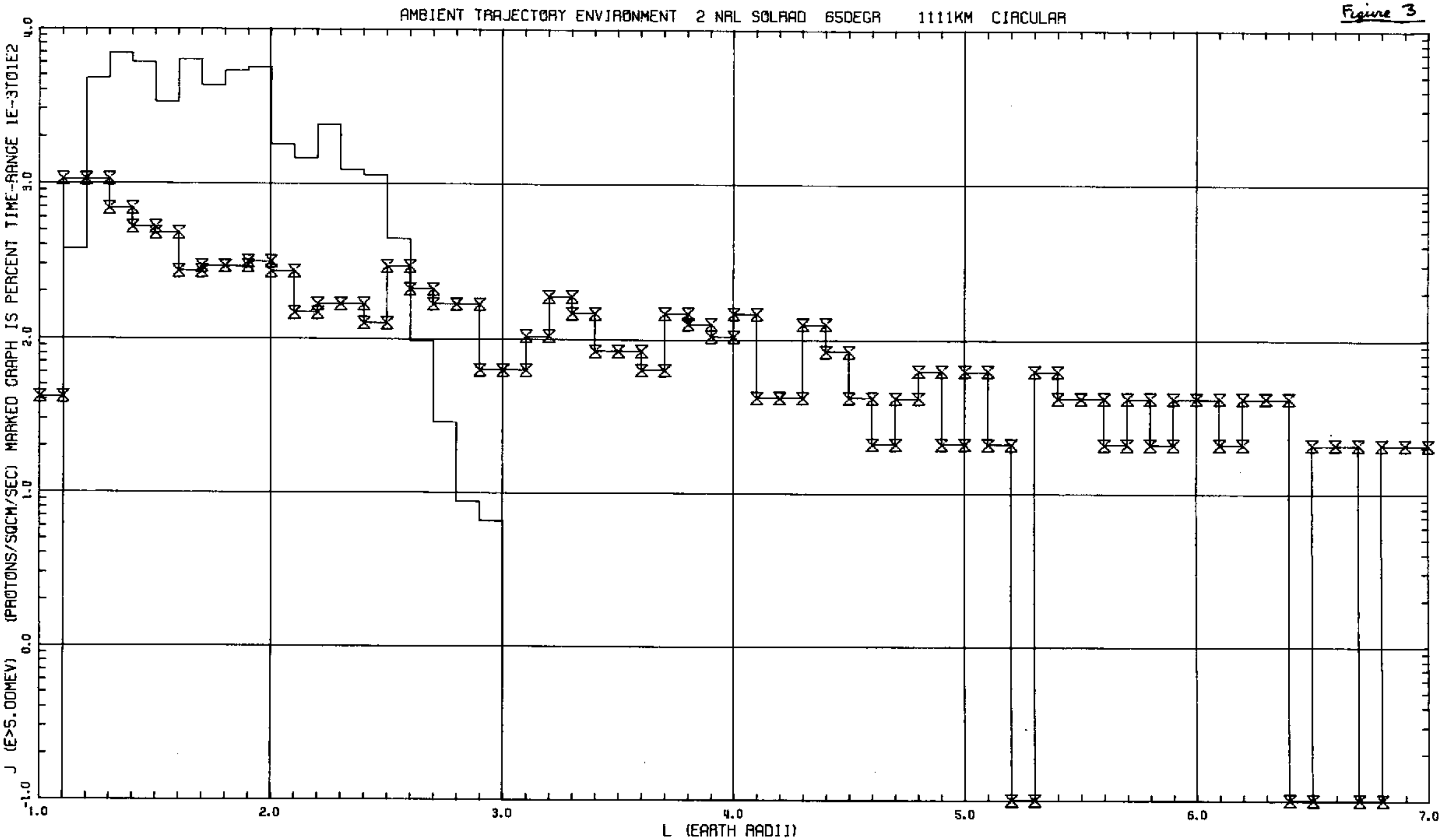
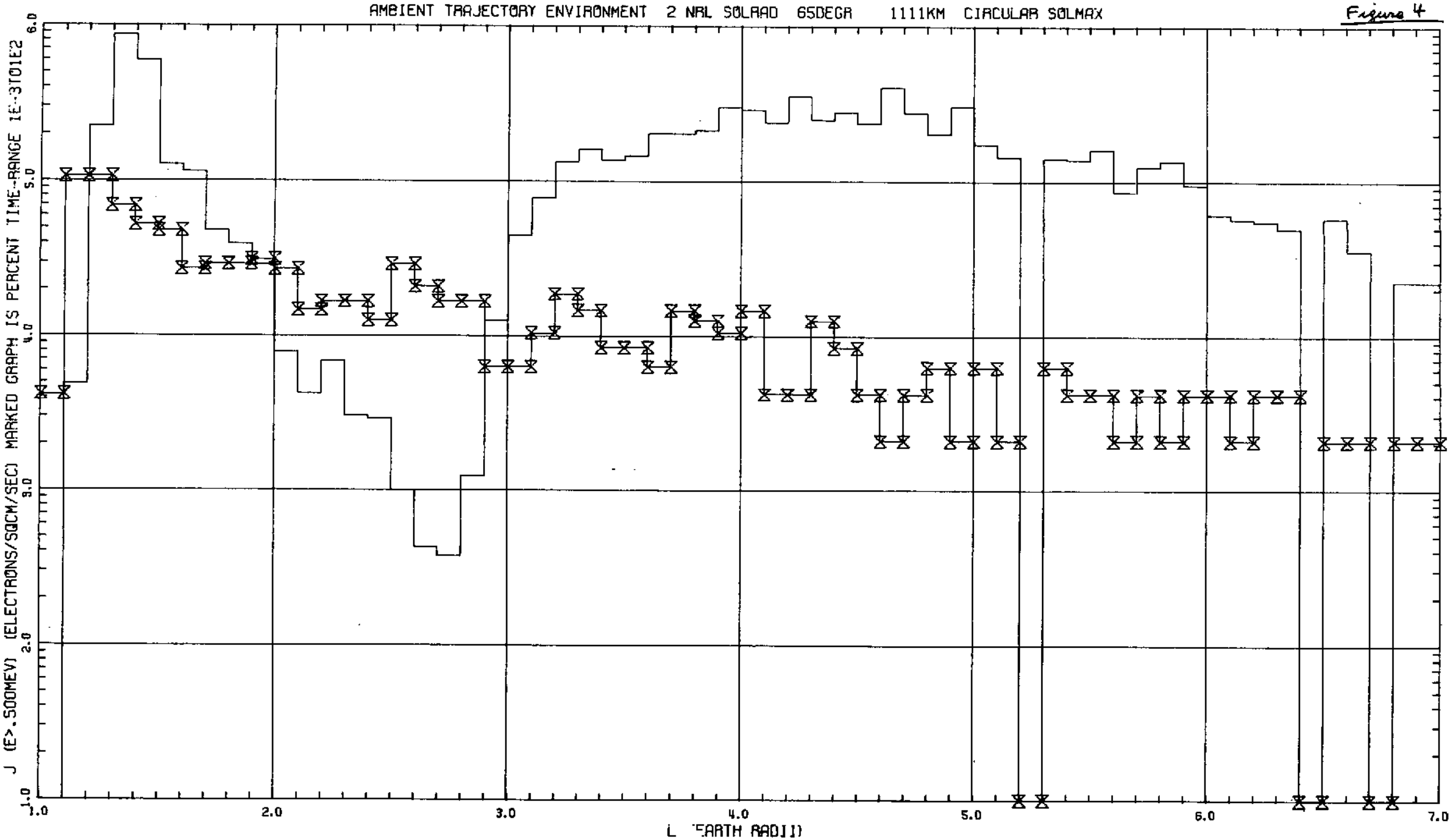


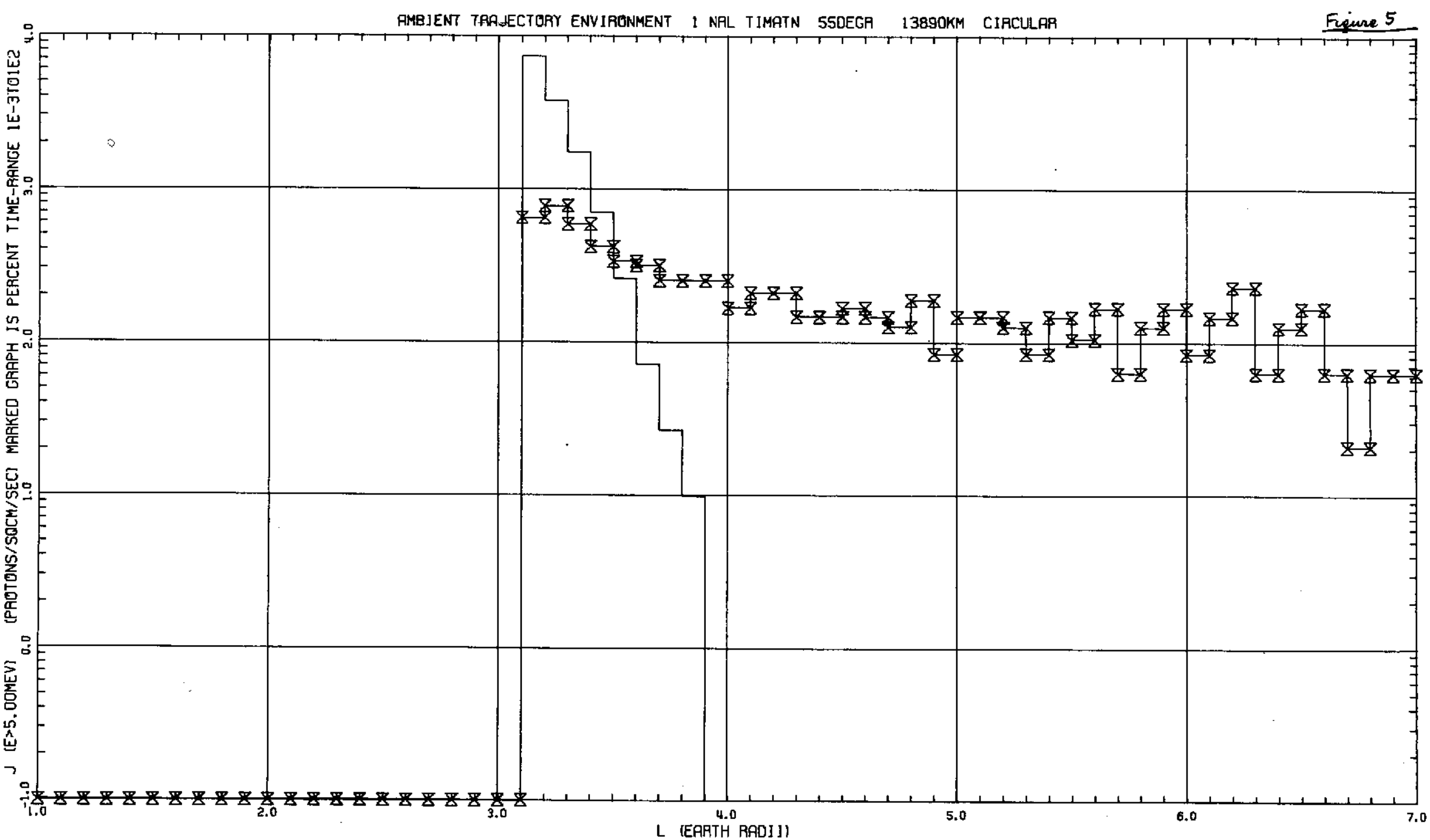
Figure 2: Set of plots produced for every trajectory considered in an orbital radiation study.


AMBIENT TRAJECTORY ENVIRONMENT 2 NRL SOLRAD 65DEGR 1111KM CIRCULAR
Figure 3
J (E>5.00MEV) (PROTONS/SQCM/SEC) MARKED GRAPH IS PERCENT TIME-RANGE 1E-3TO1E2
L (EARTH RADII)
-1.0
0.0
1.0
2.0
3.0
4.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0

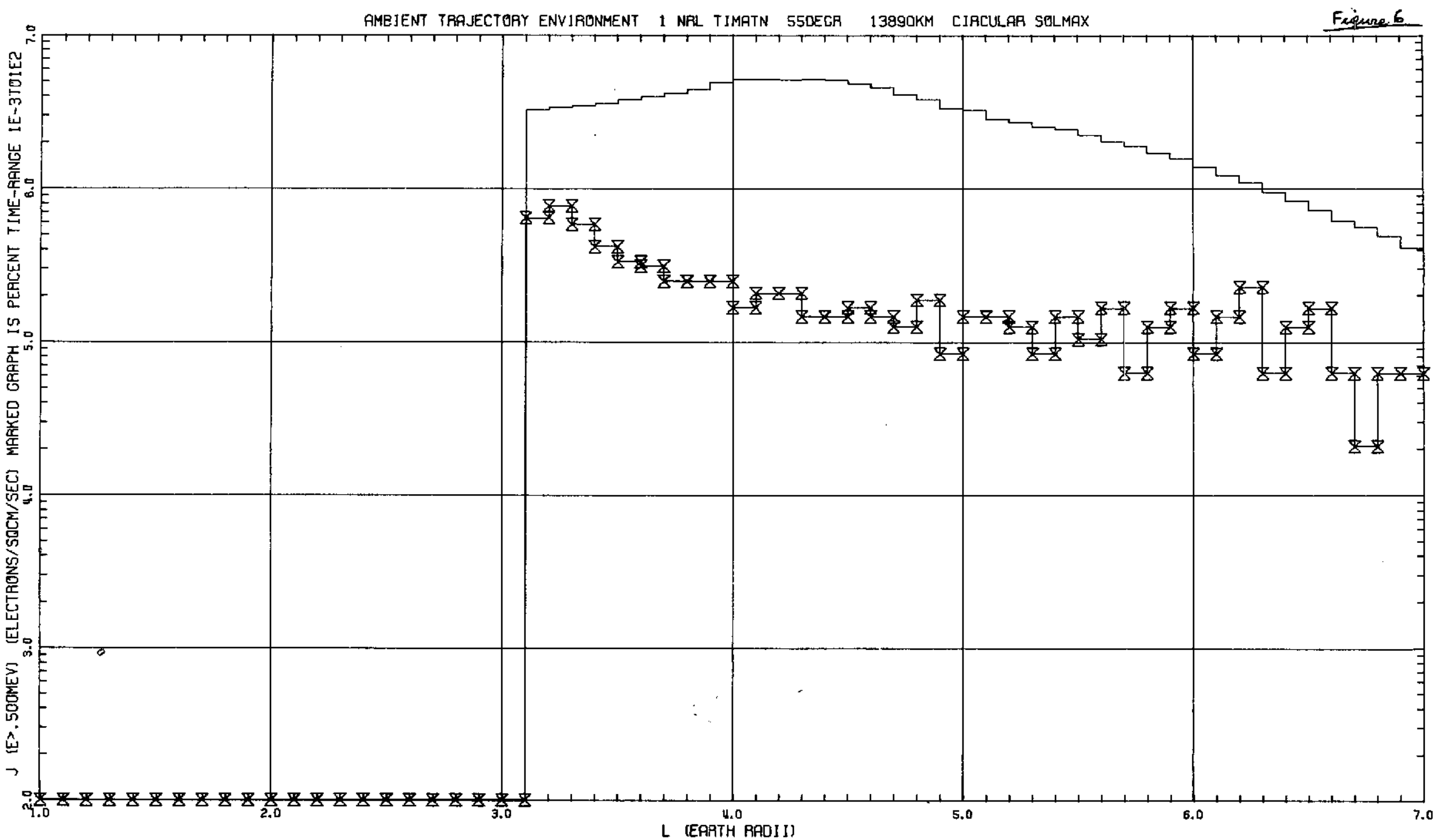
AMBIENT TRAJECTORY ENVIRONMENT 2 NRL SOLRAD 65DEGR 1111KM CIRCULAR SOLMAX

Figure 4





AMBIENT TRAJECTORY ENVIRONMENT 1 NAL TIMATN 55DEGR 13890KM CIRCULAR
Figure 5
J (E>5.00MEV) (PROTONS/SQCM/SEC) MARKED GRAPH IS PERCENT TIME-RANGE 1E-3TO1E2
4.0
3.0
2.0
1.0
0.0
-1.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
L (EARTH RADII)



AMBIENT TRAJECTORY ENVIRONMENT 1 NRL TIMATN 55DEGR 13890KM CIRCULAR SOLMAX
Figure 6
J (E>.500MEV) (ELECTRONS/SQCM/SEC) MARKED GRAPH IS PERCENT TIME-RANGE 1E-3TO1E2
2.0
3.0
4.0
5.0
6.0
7.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
L (EARTH RADII)

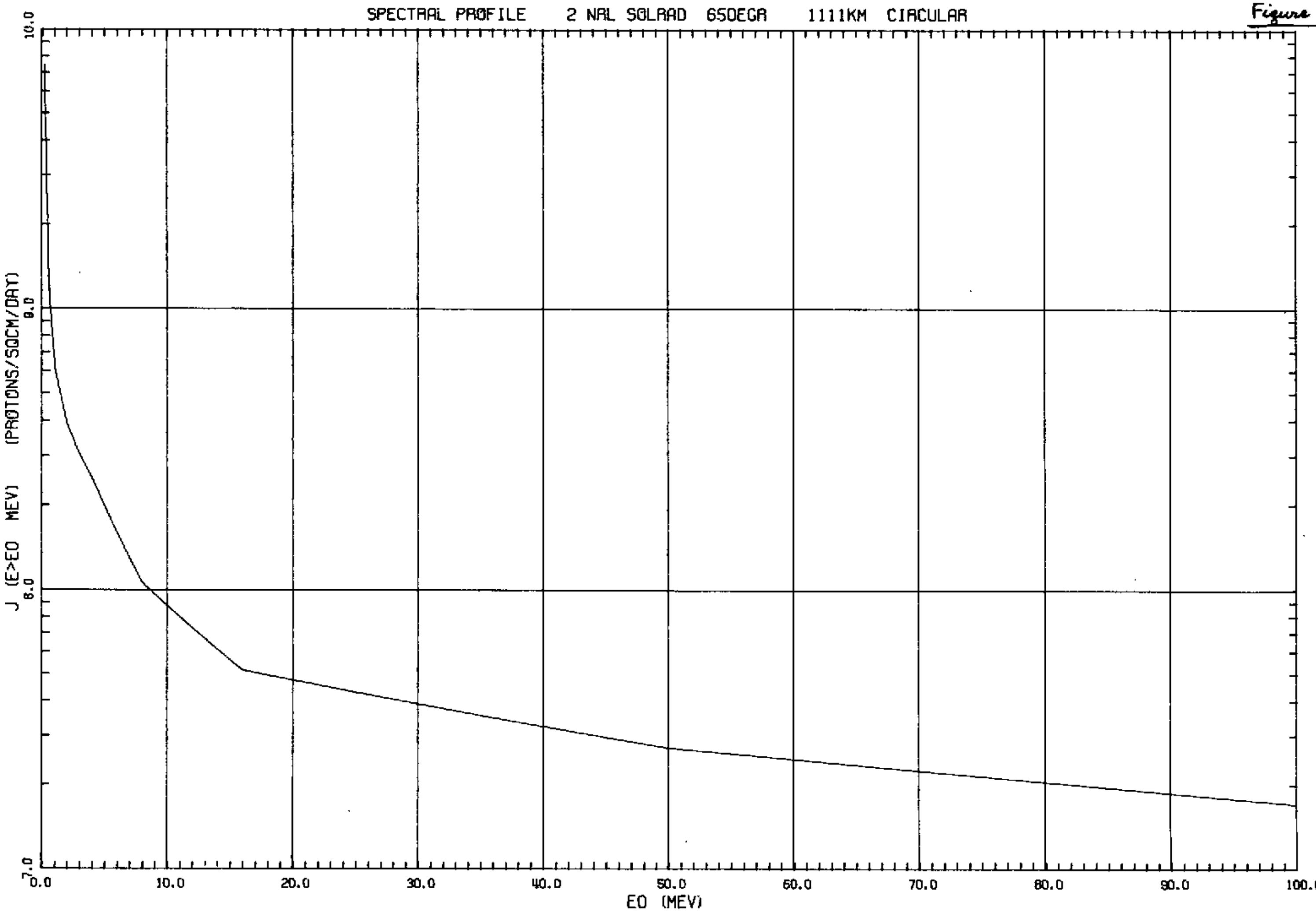
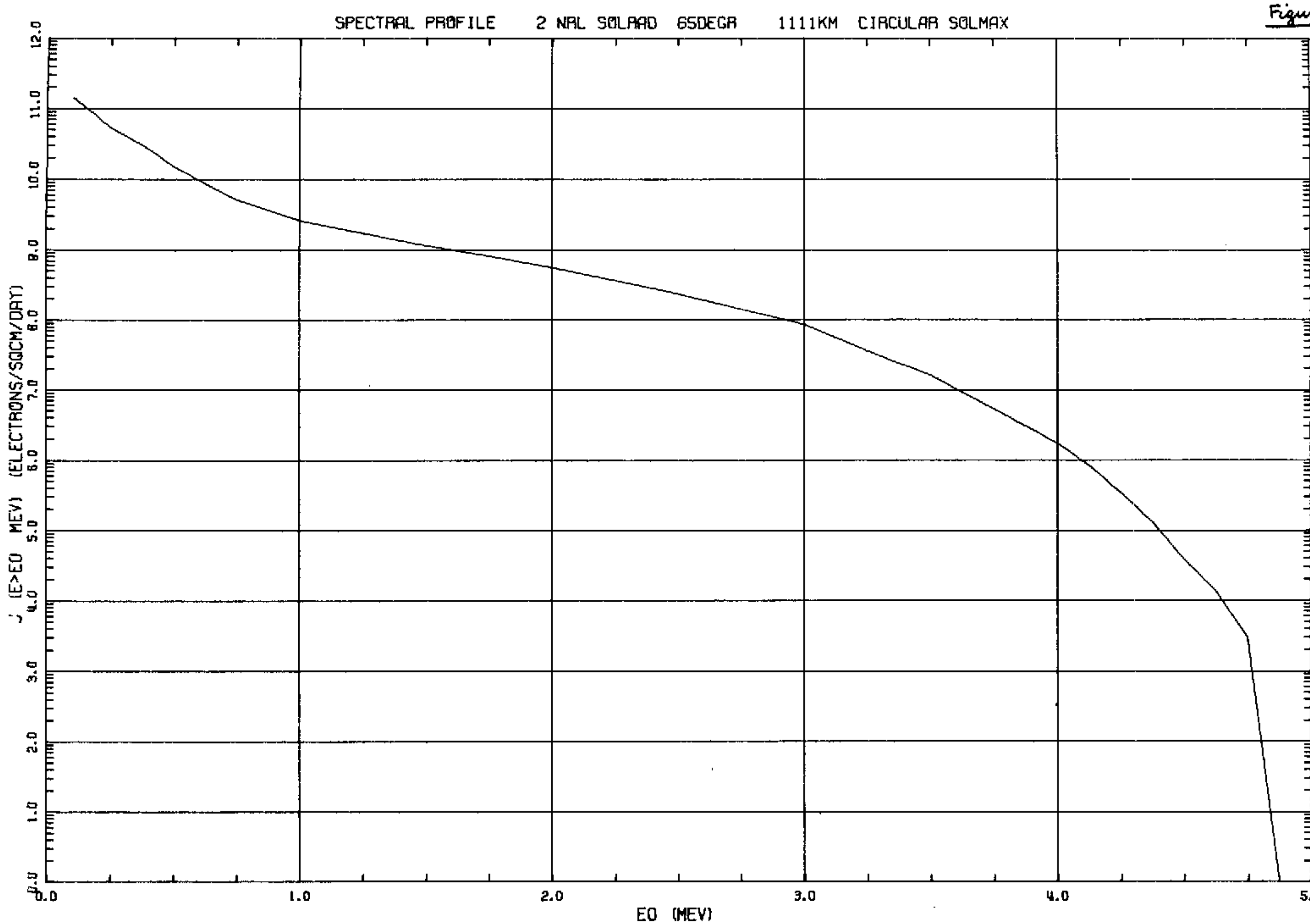
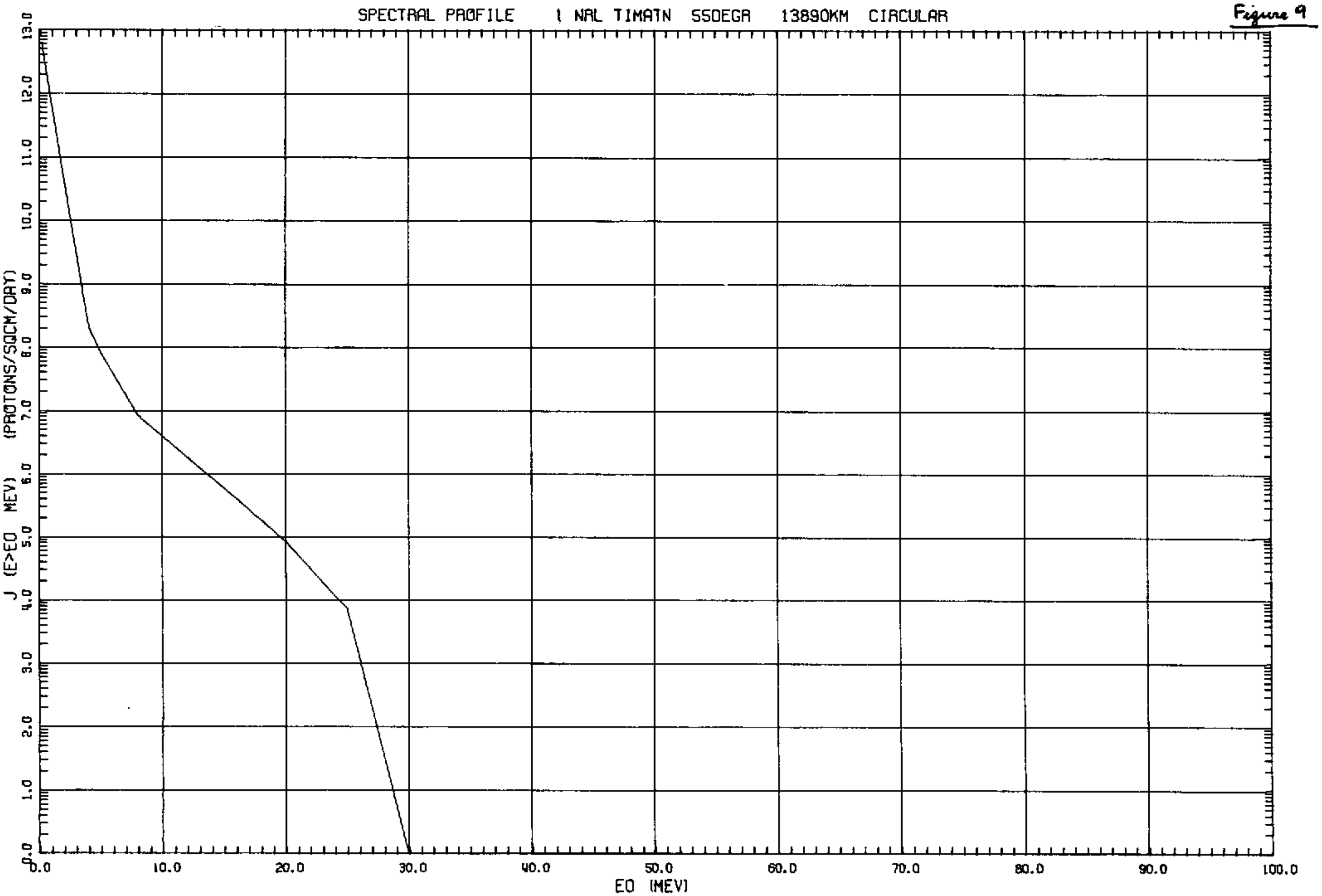

SPECTRAL PROFILE 2 NRL SOLRAD 65DEGR 1111KM CIRCULAR
J (E>EO MEV) (PROTONS/SQCM/DAY)
10.0
9.0
8.0
7.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
EO (MEV)

Figure 7

Figure 8


SPECTRAL PROFILE 2 NRL SOLRAD 65DEGR 1111KM CIRCULAR SOLMAX
J (E>EO MEV) (ELECTRONS/SQCM/DAY)
EO (MEV)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0



SPECTRAL PROFILE 1 NRL TIMATN 550EGR 13890KM CIRCULAR
Figure 9
J (E>EO MEV) (PROTONS/SQCM/DAY)
EO (MEV)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0

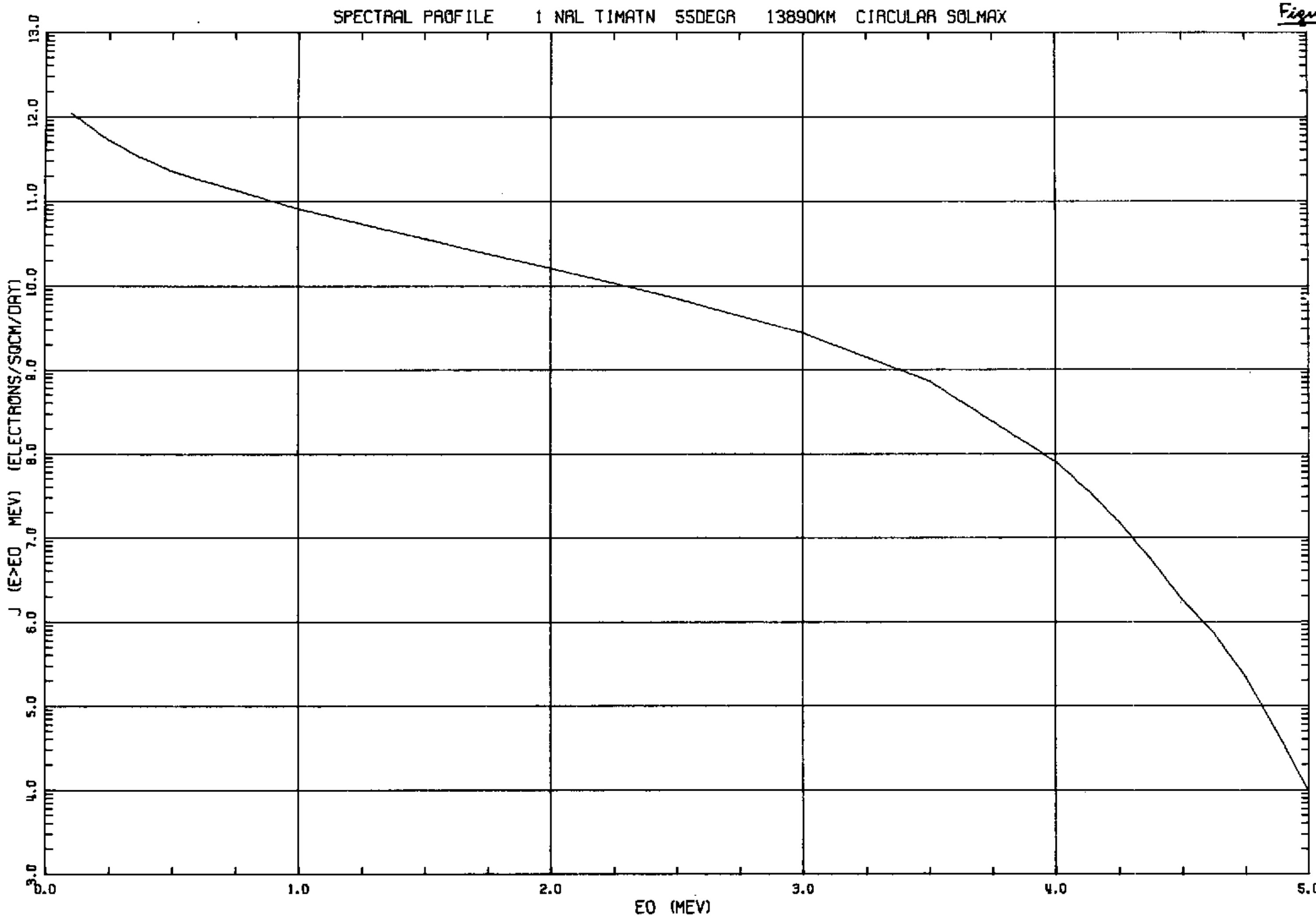
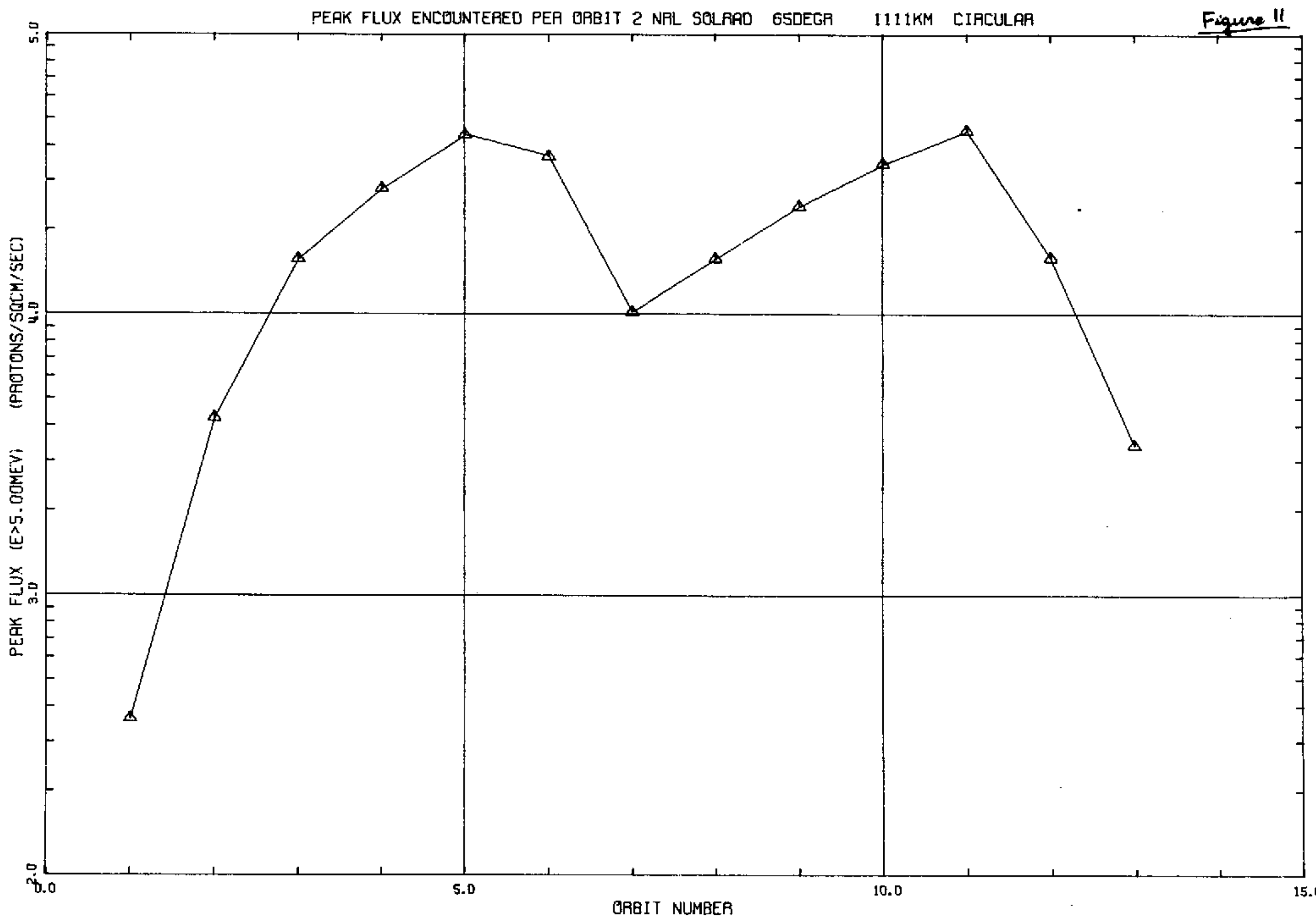

SPECTRAL PROFILE 1 NRL TIMATN 55DEGR 13890KM CIRCULAR SOLMAX
J (E>EO MEV) (ELECTRONS/SQCM/DAY)
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
0.0
1.0
2.0
3.0
4.0
5.0
EO (MEV)

Figure 10



PEAK FLUX ENCOUNTERED PER ORBIT 2 NRL SOLRAD 65DEGR 1111KM CIRCULAR
Figure 11
PEAK FLUX (E>5.00MEV) (PROTONS/SQCM/SEC)
ORBIT NUMBER
5.0
4.0
3.0
2.0
0.0
5.0
10.0
15.0

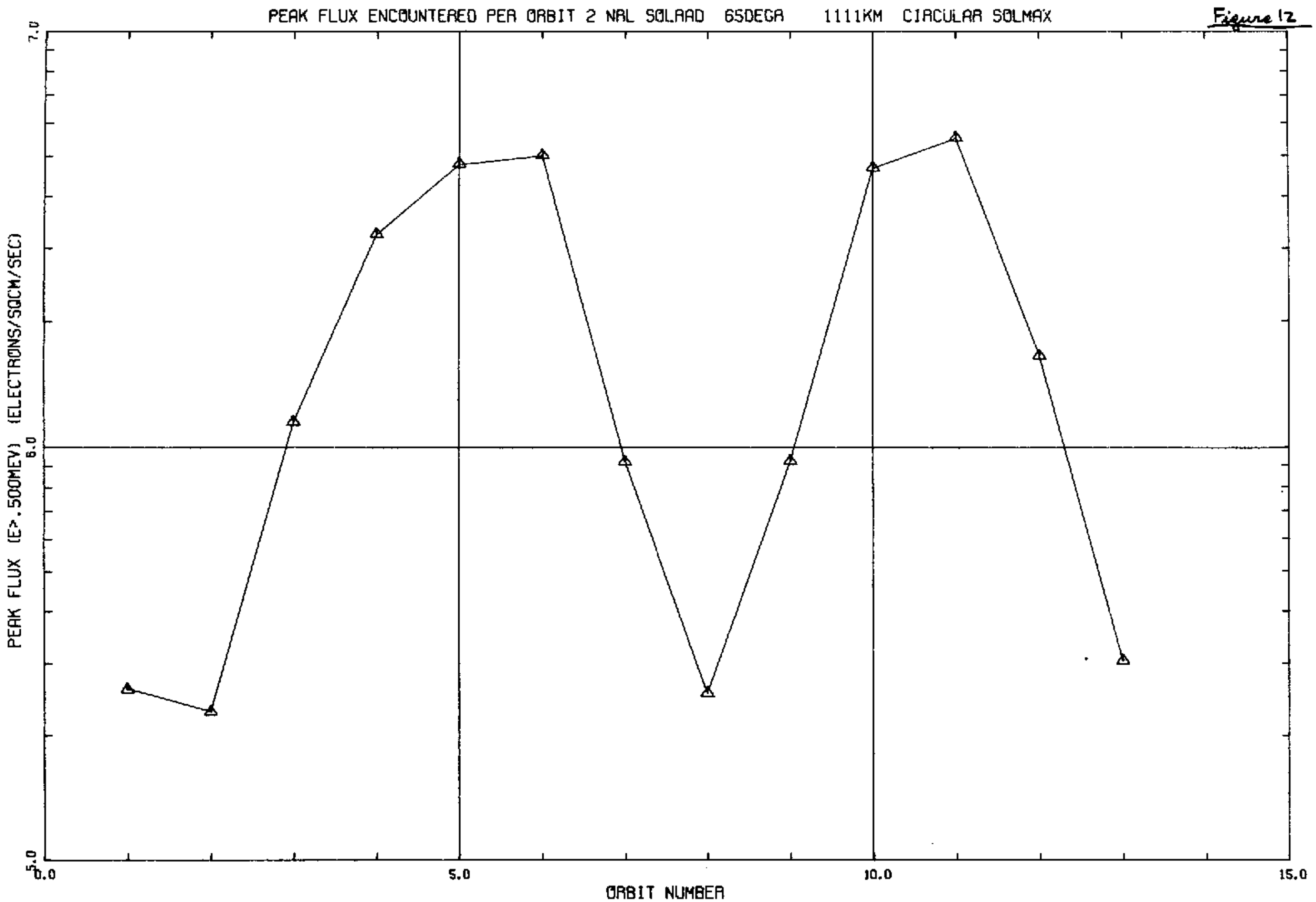


Figure 12
PEAK FLUX ENCOUNTERED PER ORBIT 2 NRL SOLRAD 65DEGR 1111KM CIRCULAR SOLMAX
PEAK FLUX (E>.500MEV) (ELECTRONS/SQCM/SEC)
7.0
6.0
5.0
0.0
5.0
10.0
15.0
ORBIT NUMBER

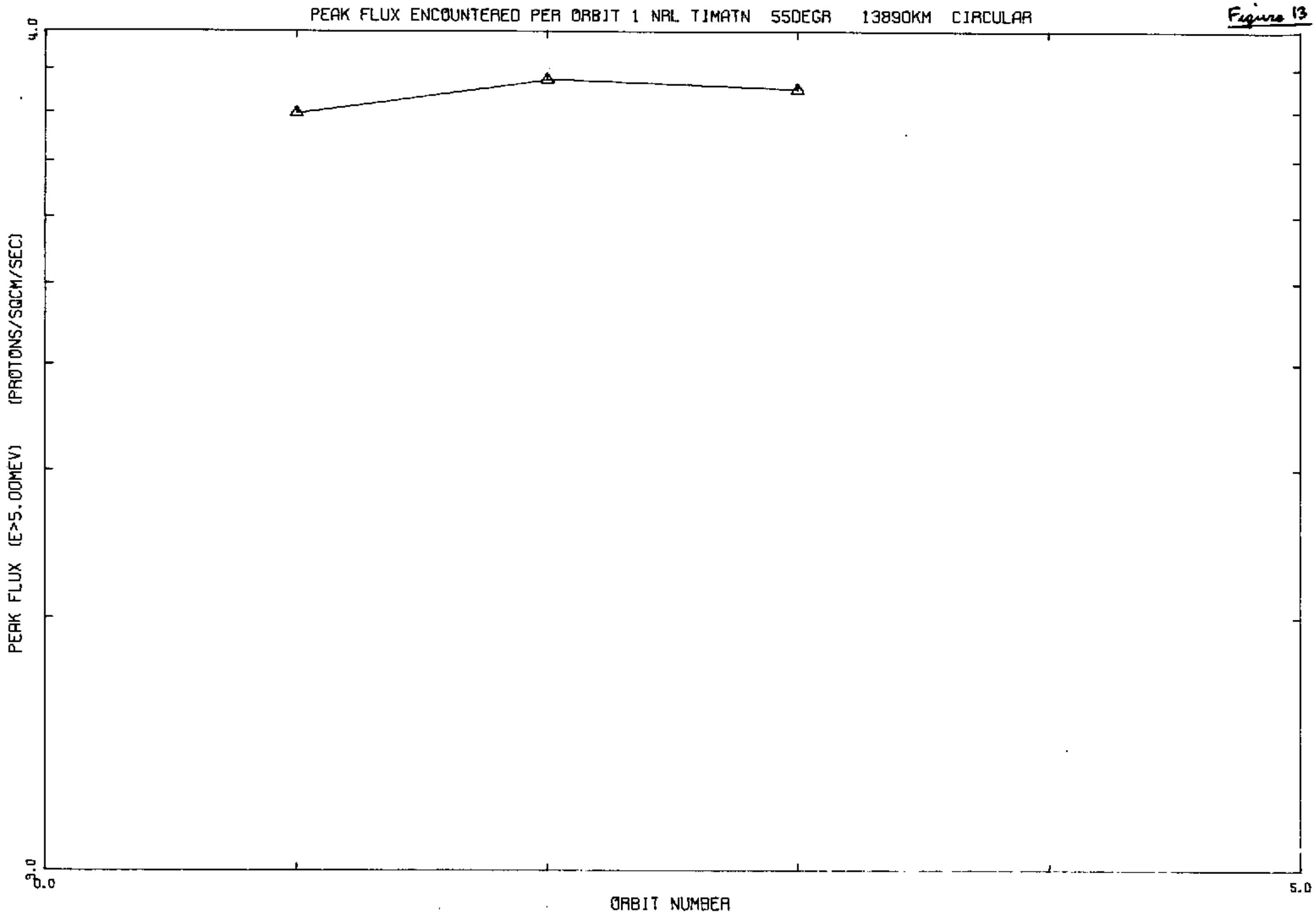
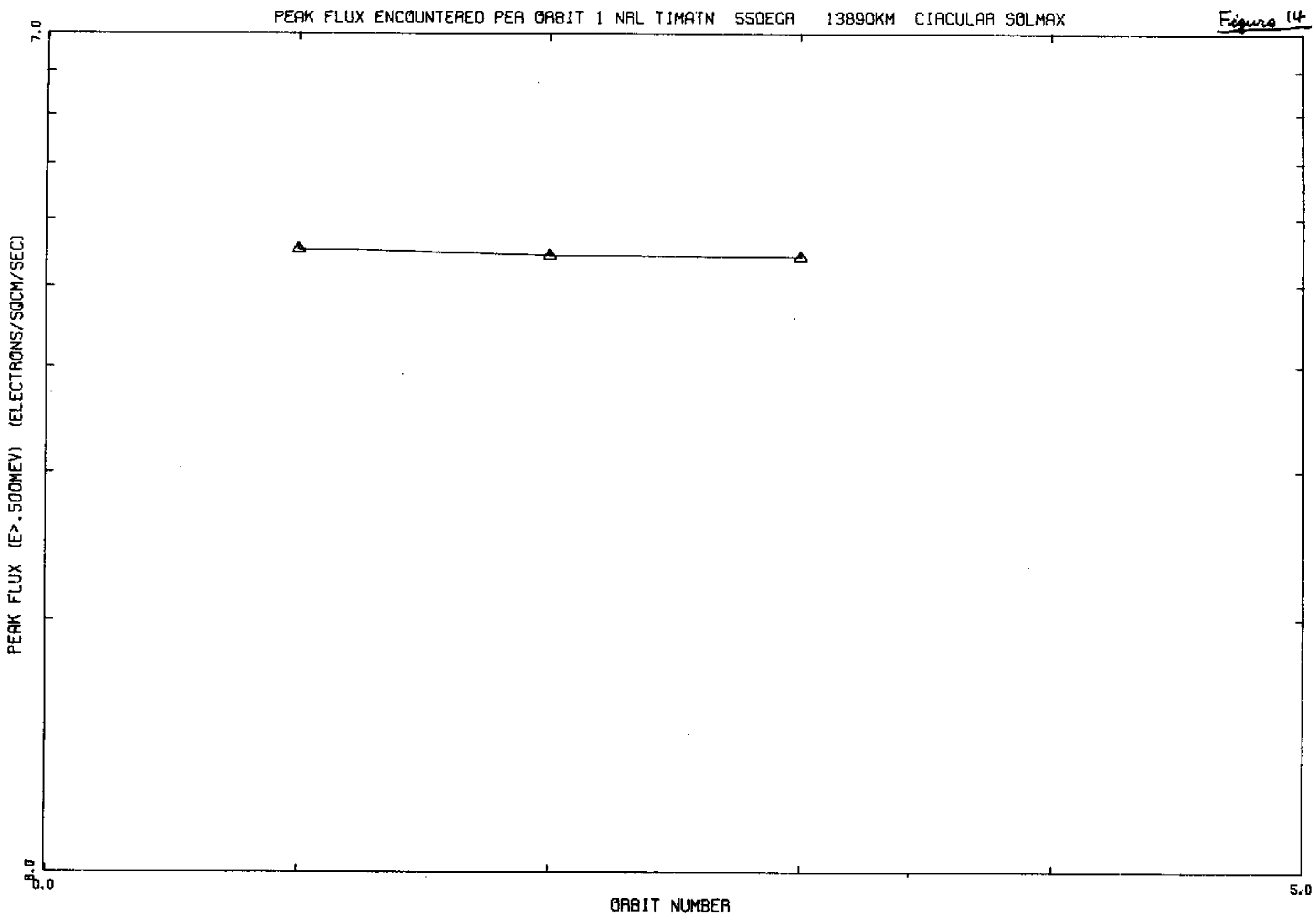
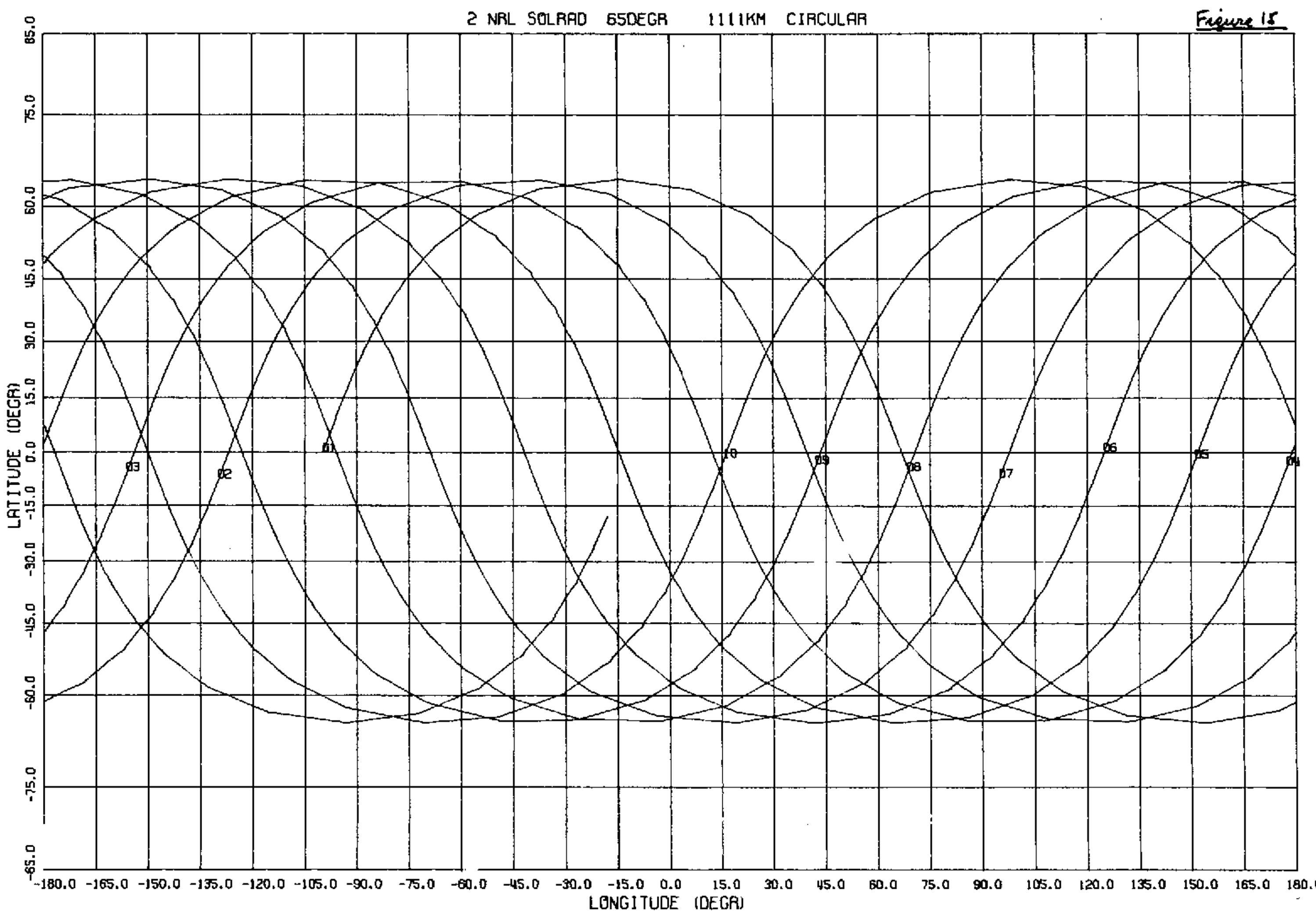
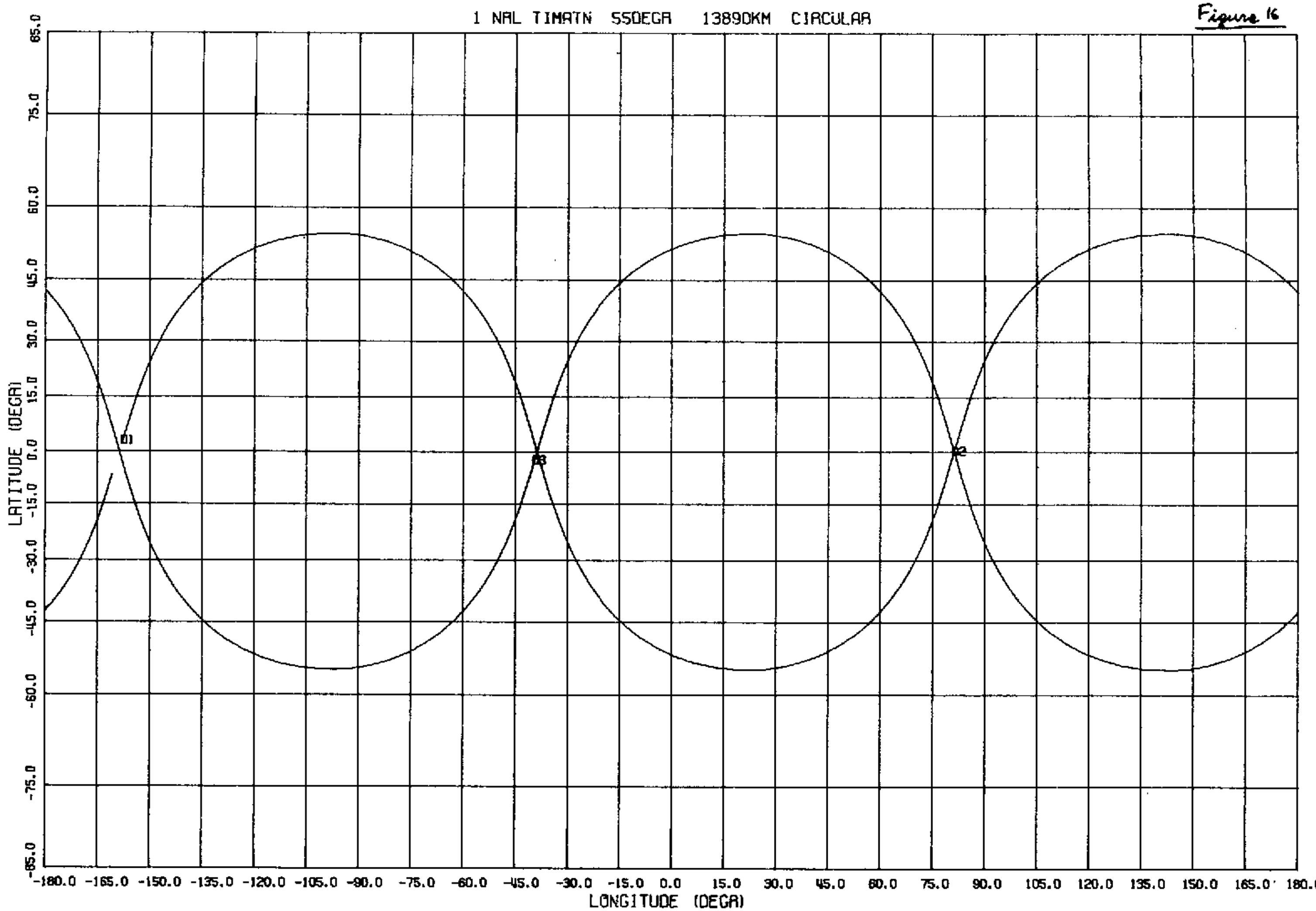

PEAK FLUX ENCOUNTERED PER ORBIT 1 NRL TIMATN 55DEGR 13890KM CIRCULAR
4.0
3.0
0.0
5.0
ORBIT NUMBER
PEAK FLUX (E>5.00MEV) (PROTONS/SQCM/SEC)

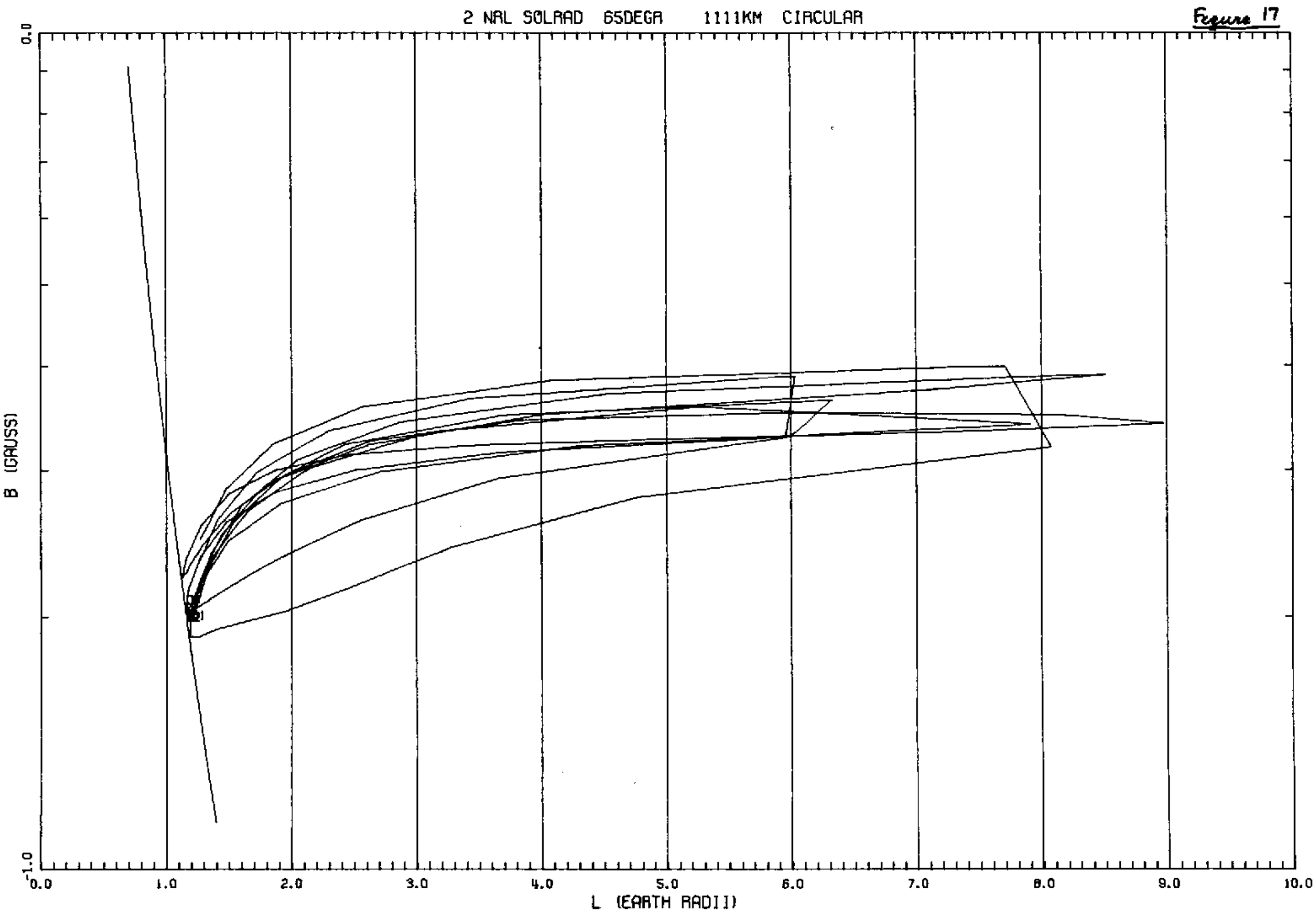
Figure 13



PEAK FLUX ENCOUNTERED PER ORBIT 1 NRL TIMATN 55DEGR 13890KM CIRCULAR SOLMAX
Figure 14
PEAK FLUX (E>.500MEV) (ELECTRONS/SQCM/SEC)
7.0
6.0
0.0
5.0
ORBIT NUMBER


2 NRL SOLRAD 65DEGR 1111KM CIRCULAR
Figure 15
LATITUDE (DEGR)
LONGITUDE (DEGR)
85.0
75.0
60.0
45.0
30.0
15.0
0.0
-15.0
-30.0
-45.0
-60.0
-75.0
-85.0
-180.0 -165.0 -150.0 -135.0 -120.0 -105.0 -90.0 -75.0 -60.0 -45.0 -30.0 -15.0 0.0 15.0 30.0 45.0 60.0 75.0 90.0 105.0 120.0 135.0 150.0 165.0 180.0
01
02
03
04
05
06
07
08
09
10


1 NAL TIMATN 55DEGA 13890KM CIRCULAR
Figure 16
LATITUDE (DEGR)
LONGITUDE (DEGR)
D1
D3
D2
85.0
75.0
60.0
45.0
30.0
15.0
0.0
-15.0
-30.0
-45.0
-60.0
-75.0
-85.0
-180.0 -165.0 -150.0 -135.0 -120.0 -105.0 -90.0 -75.0 -60.0 -45.0 -30.0 -15.0 0.0 15.0 30.0 45.0 60.0 75.0 90.0 105.0 120.0 135.0 150.0 165.0 180.0



2 NRL SOLRAD 65DEGR 1111KM CIRCULAR
Figure 17
B (GAUSS)
0.0
-1.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
L (EARTH RADII)

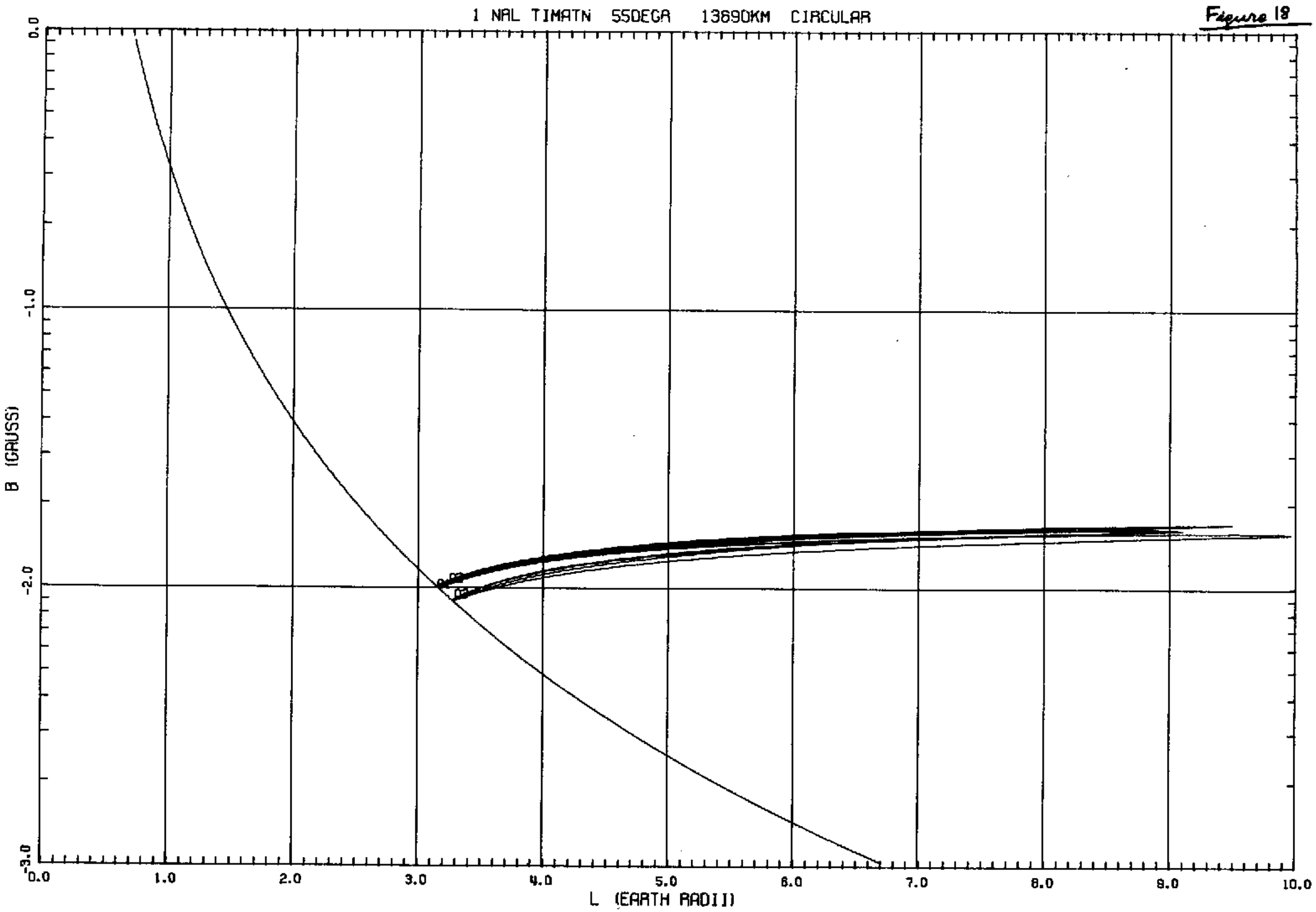
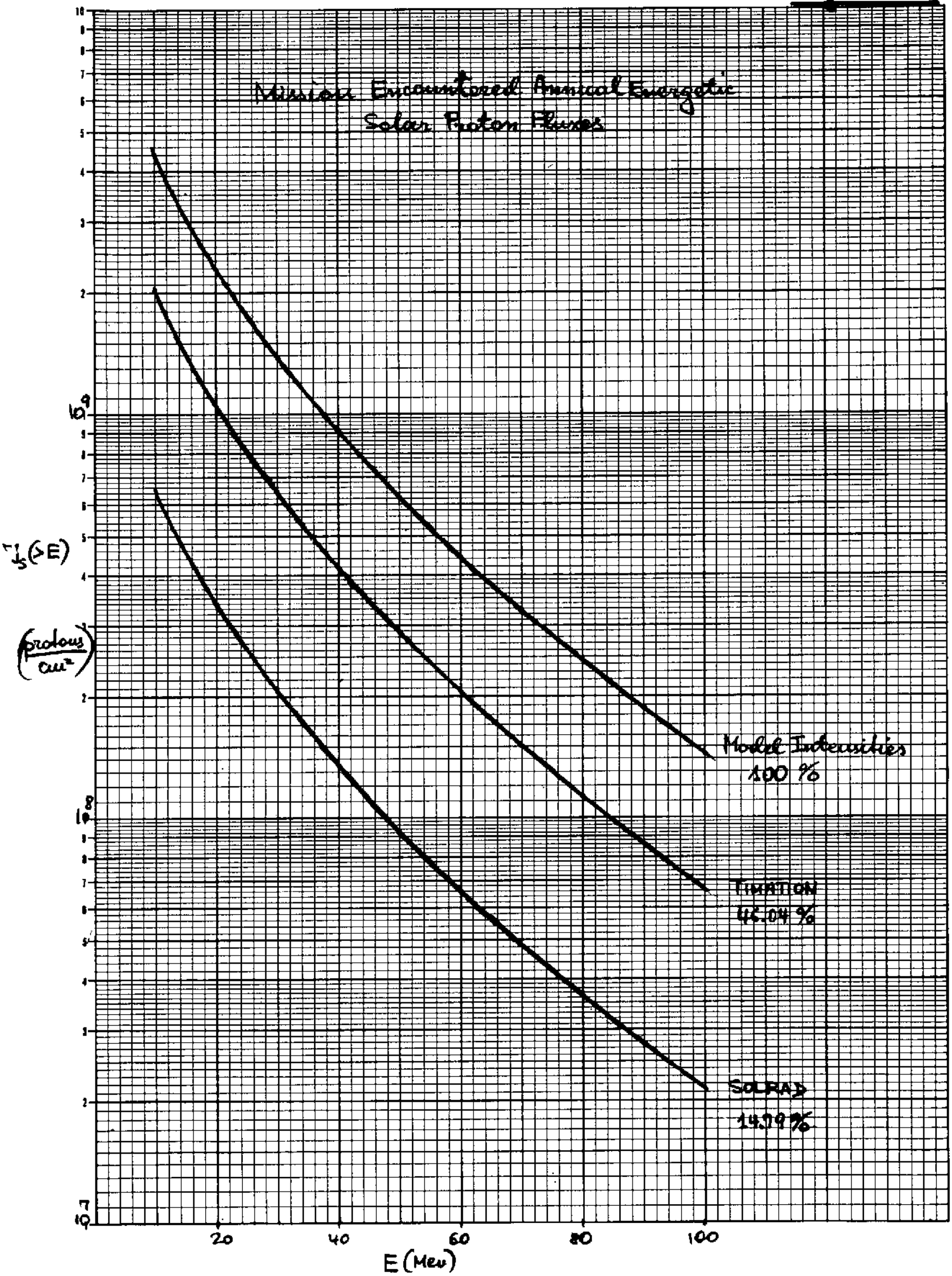

1 NAL TIMATN 55DEGA 13690KM CIRCULAR
Figure 18
0.0
-1.0
-2.0
-3.0
B (GAUSS)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
L (EARTH RADII)

Figure 19


Mission Encountered Annual Energetic
Solar Proton Fluxes
$F_S^T(>E)$
(protons / cm²)
10^9
10^8
10^7
20
40
60
80
100
E (Mev)
Model Intensities
100 %
TIMATION
46.04 %
SOLRAD
14.79 %