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# SATELLITE ORBITAL DATA

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# SATELLITE ORBITAL DATA

Material prepared under the supervision of I. G. Izsak
Chief, Research and Analysis Division

Smithsonian Institution
Astrophysical Observatory

Cambridge, Massachusetts 02138

NOTE

It is in the nature of frequently used computer programs that from time to time they undergo modifications as dictated by the experience of people who use them. Thus our Differential Orbit Improvement Program, being in use since the end of 1958, has been changed on several occasions. In the past we did not give notice of any of these changes, because they affected merely the internal structure and the capabilities of the program. Some recent modifications, however, should be pointed out because they alter the definition of the mean orbital elements.

1. As before, the semimajor axis a of an orbit is being computed from the mean motion n of the satellite according to the formula

$$a = \sqrt[3]{\frac{GM}{n^2}} \left\{ 1 - \frac{J_2 a_E^2}{2p^2} \sqrt{1 - e^2} \left(1 - \frac{3}{2} \sin^2 I\right) \right\}$$

(Y. Kozai, Astron. Journ., vol. 64, pp. 367-377; in his equation (14) we put $A_2 = \frac{3}{2} J_2 a_E^2$). In the old program, the mean motion in turn was defined as the time derivative of the mean anomaly M. Therefore in cases where in addition to a polynomial part the mean anomaly also had a trigonometric part, the program produced small but unwanted, long-periodic variations in the semimajor axis. In the new program the mean motion is defined as the time derivative of the mean anomaly's polynomial part only.

2. The old program provided internally only for those first-order short-periodic perturbations that are caused by the second zonal harmonic ($J_2$-term) of the geopotential. The new program has the optional capability to account for lunar perturbations with periods of approximately two weeks. Their analytical expressions are quite complicated and will not be given here. As a rule, we use this feature of the program only in connection with orbits that are computed from precisely reduced Baker-Nunn observations. In our future publications of satellite orbital data we will always mention if lunar perturbations were included in the computations.

A detailed write-up of the new Differential Orbit Improvement Program, henceforth called DOI-3, will be given shortly by Mr. Edward M. Gaposchkin.

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# ORBITAL INFORMATION[1]

The orbital elements have been derived by the indicated staff members of the Satellite Tracking Program, Smithsonian Astrophysical Observatory, employing the SAO Differential Orbit Improvement Program (DØI).

Field-reduced photographs from SAO Baker-Nunn cameras comprise the majority of observations used in computing these orbital data. SAO Moonwatch teams, the NASA Minitrack network, foreign observatories, miscellaneous U.S. and foreign observers, and various radar installations also contribute valuable observations.

As opposed to osculating elements, the elements presented here are mean elements in the sense that the effects of the short-period perturbations due to the earth's oblateness have been eliminated.

SAO mean elements have been derived from observations covering several days and are given in the form of a table. The successive sets of elements are essentially independent of each other. They are dependent, however, in the sense that high-order coefficients in the secular and the long-periodic terms are generally considered as known and as constant for periods of several weeks or months, as dictated by convenience.

The times of epoch in the mean elements are reckoned in Julian Days, but for the sake of convenience the number 2400000.5 has been subtracted to provide an abbreviated notation which we call "Modified Julian Days," or "MJD."

The units of the orbital elements are degrees for angular quantities, megameters ($Mm = 10^6$ meters) for linear quantities, and revolutions for the mean anomaly M and its derivatives.

The tabulated values of the SAO mean elements give the values of argument of perigee $\omega$, right ascension of the ascending node $\Omega$, inclination i, eccentricity e, and mean anomaly M as functions of time $t = T - T_0$ (where $T_0$ is the reference epoch) expressed in days. The single digit placed at the right of each value represents the standard error for that element and refers to the last digit given.

The same tabulation also gives the mean (anomalistic) motion n, the orbital acceleration $n'/2$ or $n'(dn/dt)$, and the semimajor axis a or the geocentric distance of perigee q (in megameters). Of the last three columns, the one headed N indicates the number of observations used for the computation of a set of elements; the one headed D, the number of days used; and the one headed $\sigma$, the standard error of the representation of the observations relative to their assumed accuracy.

SAO smoothed elements have been derived from observations covering about two weeks or more. They are given as functions of time and generally include both secular and periodic terms. The general expression for any element E is

[1]This work was supported in part by grant NsG 87-60 from the National Aeronautics and Space Administration.

$$E = E_0 + E_1 t + E_2 t^2 + \ldots + \sum A_i \sin(B_i + C_i t)$$

where $t = T - T_0$ is again expressed in days. The presence of a standard error associated with a particular coefficient indicates that this quantity was determined by the process of differential orbit improvement; the absence of a standard error means that the quantity was taken from some other source.

In our computer program, the inclination and the argument of perigee are referred to the true equator of date; the right ascension of the ascending node, however, is reckoned from the mean equinox of 1950.0 along the corresponding mean equator to the intersection with the moving true equator of date, and then along the true equator of date. To transform from right ascension of the node as determined by the DØI to right ascension of the node referred to the mean equinox of date, one uses

$$\Omega^\circ = \Omega^\circ(\text{DØI}) + 3\overset{\circ}{.}508 \times 10^{-5}\ (\text{MJD} - 33281) \quad ,$$

where MJD stands for the Modified Julian Day of the date.

The mean (anomalistic) motion n can be obtained from the smoothed elements by differentiating the expression for M, and the orbital acceleration n' can be obtained by twice differentiating the same expression for M.

The sun-perigee data are related to the perturbing effects of atmospheric drag. From left to right are the Modified Julian Day (MJD); the perigee height Z (in kilometers) above the International Ellipsoid of Reference; the geocentric latitude of the perigee ($\varphi$); the angular geocentric distance ($\psi$) from the perigee of the sun; and the difference in right ascension (D.R.A.) between the perigee and the sun; all these angles are expressed in degrees. In the last column we give the rate of change of the period ($\dot{P}$) expressed in days per day.

I. SAO smoothed elements

The following elements are based on 31 observations and are valid for the period April 1 through April 15, 1963.

$T_0 = 38128.0$ MJD

$\omega = (268^\circ.06 \pm 3) + (7^\circ.600 \pm 6)t - {}^\circ.000296t^2 + {}^\circ.3144 \cos \omega$

$\Omega = (322^\circ.510 \pm 7) - (5^\circ.086 \pm 2)t - {}^\circ.36 \times 10^{-4}t^2 + {}^\circ.0031 \cos \omega$

$i = (33^\circ.203 \pm 2) - {}^\circ.000476t + {}^\circ.129 \times 10^{-4}t^2 - {}^\circ.0039 \sin \omega$

$e = (.08981 \pm 2) + .5249 \times 10^{-4}t - .1626 \times 10^{-5}t^2 + .0004980 \sin \omega$

$M = (.72097 \pm 8) + (13.68489 \pm 2)t + (.64 \pm 1) \times 10^{-4}t^2$

$\quad - (.26 \pm 11) \times 10^{-6}t^3 - (.32 \pm 19) \times 10^{-7}t^4 - .0008998 \cos \omega$

Standard error of one observation: $\sigma = \pm 2'.88$.

The following elements are based on 54 observations and are valid for the period April 15 through May 1, 1963.

$T_0 = 38142.0$ MJD

$\omega = (14^\circ.43 \pm 1) + (7^\circ.599 \pm 2)t - {}^\circ.000296t^2 + {}^\circ.3144 \cos \omega$

$\Omega = (251^\circ.279 \pm 4) - (5^\circ.0884 \pm 6)t - {}^\circ.36 \times 10^{-4}t^2 + {}^\circ.0031 \cos \omega$

$i = (33^\circ.201 \pm 1) - {}^\circ.000114t + {}^\circ.129 \times 10^{-4}t^2 - {}^\circ.0039 \sin \omega$

$e = (.08944 \pm 2) + .697 \times 10^{-5}t - .1626 \times 10^{-5}t^2 + .0004980 \sin \omega$

$M = (.32221 \pm 4) + (13.686831 \pm 7)t + (.701 \pm 5) \times 10^{-4}t^2$

$\quad - (.77 \pm 4) \times 10^{-6}t^3 - (.21 \pm 7) \times 10^{-7}t^4 - .0008998 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.53$.

The following elements are based on 75 observations and are valid for the period May 1 through May 16, 1963.

$T_0 = 38158.0$ MJD

$\omega = (136^\circ.00 \pm 1) + (7^\circ.603 \pm 2)t - {}^\circ.000296t^2 + {}^\circ.3144 \cos \omega$

$\Omega = (169^\circ.866 \pm 4) - (5^\circ.0886 \pm 8)t - {}^\circ.36 \times 10^{-4}t^2 + {}^\circ.0031 \cos \omega$

$i = (33^\circ.203 \pm 1) + {}^\circ.000298t + {}^\circ.129 \times 10^{-4}t^2 - {}^\circ.0039 \sin \omega$

$e = (.08929 \pm 2) - .4507 \times 10^{-4}t - .1626 \times 10^{-5}t^2 + .0004980 \sin \omega$

$M = (.32865 \pm 2) + (13.689148 \pm 5)t + (.933 \pm 6) \times 10^{-4}t^2$

$+ (.95 \pm 4) \times 10^{-6}t^3 - (.19 \pm 10) \times 10^{-7}t^4 - .0008998 \cos \omega$

Standard error of one observation: $\sigma = \pm 2'.00$.

The following elements are based on 124 observations and are valid for the period May 16 through June 1, 1963.

$T_0 = 38174.0$ MJD

$\omega = (257^\circ.80 \pm 3) + (7^\circ.531 \pm 2)t - {}^\circ.001255t^2 + {}^\circ.3144 \cos \omega$

$\Omega = (88^\circ.420 \pm 3) - (5^\circ.0928 \pm 7)t - {}^\circ.000121t^2 + {}^\circ.0031 \cos \omega$

$i = (33^\circ.2016 \pm 8) - {}^\circ.000199t - {}^\circ.11 \times 10^{-5}t^2 - {}^\circ.0039 \sin \omega$

$e = (.08896 \pm 4) + .000158t - .38 \times 10^{-5}t^2 + .0004980 \sin \omega$

$M = (.37731 \pm 9) + (13.691874 \pm 8)t + (.447 \pm 4) \times 10^{-4}t^2$

$- (.11 \pm 4) \times 10^{-6}t^3 + (.13 \pm 8) \times 10^{-6}t^4 - .0008998 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.60$.

The following elements are based on 38 observations and are valid for the period June 1 through June 15, 1963.

$T_0 = 38188.0$ MJD

$\omega = (4^\circ.03 \pm 2) + (7^\circ.584 \pm 4)t - {}^\circ.001255t^2 + {}^\circ.3144 \cos \omega$

$\Omega = (17^\circ.141 \pm 7) - (5^\circ.091 \pm 2)t - {}^\circ.000121t^2 + {}^\circ.0031 \cos \omega$

$i = (33^\circ.205 \pm 3) - {}^\circ.000230t - {}^\circ.11 \times 10^{-5}t^2 - {}^\circ.0039 \sin \omega$

$e = (.08926 \pm 4) + .52 \times 10^{-4}t - .38 \times 10^{-5}t^2 + .0004980 \sin \omega$

$M = (.07238 \pm 5) + (13.69361 \pm 1)t + (.111 \pm 1) \times 10^{-3}t^2$

$+ (.208 \pm 8) \times 10^{-5}t^3 - (.17 \pm 2) \times 10^{-6}t^4 - .0008998 \cos \omega$

Standard error of one observation: $\sigma = \pm 3'.03$.

The following elements are based on 109 observations and are valid for the period June 15 through July 1, 1963.

$T_0 = 38204.0$ MJD

$\omega = (125^\circ.71 \pm 2) + (7^\circ.628 \pm 5)t - {}^\circ.001255t^2 + {}^\circ.3144 \cos \omega$

$\Omega = (295^\circ.627 \pm 5) - (5^\circ.0969 \pm 7)t - {}^\circ.000121t^2 + {}^\circ.0031 \cos \omega$

$i = (33^\circ.202 \pm 2) - {}^\circ.000265t - {}^\circ.11 \times 10^{-5}t^2 - {}^\circ.0039 \sin \omega$

$e = (.08909 \pm 2) - .70 \times 10^{-4}t - .38 \times 10^{-5}t^2 + .0004980 \sin \omega$

$M = (.19902 \pm 7) + (13.69712 \pm 1)t + (.908 \pm 6) \times 10^{-4}t^2$

$\quad - (.68 \pm 4) \times 10^{-6}t^3 + (.154 \pm 9) \times 10^{-6}t^4 - .0008998 \cos \omega$

Standard error of one observation: $\sigma = \pm 2'.95$.

| T (MJD) | ω | Ω | i | e | M | n | n'/2 | q | N | D | σ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38120.0 | 207.09 4 | 3.180 9 | 33.205 2 | .08943 2 | .24647 9 | 13.683877 2 | .62E-4 1 | 6.721730 | 49 | 8 | 1.80 |
| 38124.0 | 237.51 2 | 342.860 8 | 33.208 2 | .08920 2 | .98288 5 | 13.684373 2 | .63E-4 8 | 6.723296 | 23 | 8 | .99 |
| 38128.0 | 268.04 3 | 322.51 1 | 33.208 3 | .08917 3 | .72108 7 | 13.684889 4 | .61E-4 1 | 6.723311 | 13 | 8 | 1.00 |
| 38132.0 | 298.60 3 | 302.156 7 | 33.202 3 | .08917 5 | .4610 1 | 13.685351 7 | .71E-4 2 | 6.723192 | 12 | 8 | .67 |
| 38136.0 | 329.08 4 | 281.796 9 | 33.196 4 | .0894 2 | .2033 2 | 13.685952 3 | .76E-4 1 | 6.721[illegible]8 | 21 | 8 | .51 |
| 38140.0 | 359.52 4 | 261.457 7 | 33.199 2 | .0895 2 | .9480 2 | 13.686557 2 | .739E-4 8 | 6.720684 | 29 | 8 | .55 |
| 38144.0 | 29.90 2 | 241.108 7 | 33.198 2 | .08965 3 | .69535 4 | 13.687118 2 | .64E-4 1 | 6.719091 | 28 | 8 | .68 |
| 38148.0 | 60.18 1 | 220.747 4 | 33.1979 9 | .08991 2 | .44504 2 | 13.687597 1 | .616E-4 5 | 6.717027 | 26 | 8 | .43 |
| 38152.0 | 90.378 6 | 200.401 3 | 33.1979 6 | .08993 2 | .19686 1 | 13.6881796 9 | .854E-4 6 | 6.716652 | 34 | 8 | .49 |
| 38156.0 | 120.56 1 | 180.042 5 | 33.199 1 | .08974 2 | .95137 2 | 13.688847 1 | .836E-4 6 | 6.717860 | 22 | 8 | .58 |
| 38160.0 | 150.92 1 | 159.689 4 | 33.201 1 | .08960 3 | .70812 3 | 13.689599 2 | .1070E-3 8 | 6.718667 | 33 | 8 | .63 |
| 38164.0 | 181.19 4 | 139.332 5 | 33.200 2 | .0895 1 | .4685 2 | 13.690414 2 | .870E-4 8 | 6.718982 | 76 | 8 | .63 |
| 38168.0 | 211.66 4 | 118.963 4 | 33.2026 8 | .08901 8 | .2310 1 | 13.691027 1 | .693E-4 5 | 6.722533 | 83 | 8 | .54 |
| 38172.0 | 242.29 1 | 98.593 6 | 33.207 1 | .08884 3 | .99527 3 | 13.691504 2 | .467E-4 8 | 6.723601 | 68 | 8 | .72 |
| 38176.0 | 272.77 1 | 78.230 6 | 33.208 2 | .08856 3 | .76147 2 | 13.691693 2 | .62E-4 1 | 6.725653 | 63 | 8 | .88 |
| 38180.0 | 303.34 1 | 57.881 7 | 33.205 2 | .08880 3 | .52904 3 | 13.692214 2 | .77E-4 1 | 6.723660 | 51 | 8 | .94 |
| 38184.0 | 333.94 2 | 37.51 1 | 33.206 3 | .08902 4 | .29878 5 | 13.692842 3 | .78E-4 1 | 6.721876 | 25 | 8 | 1.22 |
| 38188.0 | 4.37 3 | 17.14 1 | 33.200 4 | .08927 6 | .07142 8 | 13.693568 4 | .105E-3 2 | 6.719753 | 20 | 8 | 1.25 |
| 38192.0 | 34.67 1 | 356.774 3 | 33.202 2 | .08942 3 | .84776 4 | 13.694494 2 | .1137E-3 8 | 6.718338 | 22 | 8 | .50 |
| 38196.0 | 64.99 2 | 336.384 5 | 33.197 3 | .08949 2 | .62776 7 | 13.695452 2 | .128E-3 1 | 6.717503 | 36 | 8 | .66 |
| 38200.0 | 95.25 3 | 315.999 7 | 33.197 3 | .08946 3 | .41188 9 | 13.696491 3 | .123E-3 1 | 6.717392 | 43 | 8 | 1.04 |
| 38204.0 | 125.63 1 | 295.623 3 | 33.198 1 | .08945 1 | .19926 4 | 13.697294 1 | .840E-4 5 | 6.717236 | 40 | 8 | .49 |
| 38208.0 | 156.85 2 | 275.234 3 | 33.201 1 | .08911 1 | .98996 5 | 13.698035 1 | .1076E-3 6 | 6.719466 | 59 | 8 | .66 |

Table 1

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1958 ALPHA

| MJD | Z | $\varphi$ | $\psi$ | D.R.A. | $\dot{P}$ |
|---|---|---|---|---|---|
| | | PERIGEE IN EARTH SHADOW | | | |
| 38120. | 345. | -14.4 | 160.7 | 196.6 | -0.662E-06 |
| 38124. | 349. | -27.5 | 149.6 | 202.2 | -0.673E-06 |
| 38128. | 351. | -33.2 | 139.8 | 213.2 | -0.651E-06 |
| 38132. | 350. | -28.7 | 133.7 | 224.6 | -0.758E-06 |
| 38136. | 345. | -16.3 | 130.3 | 230.8 | -0.812E-06 |
| 38140. | 342. | -0.3 | 126.2 | 233.0 | -0.789E-06 |
| 38144. | 342. | 15.8 | 118.5 | 235.0 | -0.683E-06 |
| | | PERIGEE IN SUNLIGHT | | | |
| 38148. | 343. | 28.4 | 107.5 | 240.7 | -0.658E-06 |
| 38152. | 345. | 33.2 | 96.4 | 251.4 | -0.912E-06 |
| 38156. | 344. | 28.1 | 89.1 | 262.0 | -0.892E-06 |
| 38160. | 342. | 15.4 | 87.6 | 267.6 | -0.114E-05 |
| 38164. | 341. | -0.7 | 90.9 | 269.2 | -0.928E-06 |
| 38168. | 346. | -16.7 | 94.4 | 271.2 | -0.739E-06 |
| 38172. | 350. | -29.0 | 93.6 | 277.4 | -0.498E-06 |
| 38176. | 354. | -33.2 | 87.1 | 288.5 | -0.661E-06 |
| 38180. | 350. | -27.2 | 76.7 | 298.9 | -0.821E-06 |
| 38184. | 345. | -13.9 | 65.7 | 304.0 | -0.832E-06 |
| 38188. | 341. | 2.4 | 56.6 | 305.5 | -0.112E-05 |
| 38192. | 342. | 18.1 | 49.3 | 307.3 | -0.121E-05 |
| 38196. | 344. | 29.7 | 41.7 | 313.6 | -0.136E-05 |
| 38200. | 345. | 33.0 | 32.6 | 324.5 | -0.131E-05 |
| 38204. | 343. | 26.4 | 23.5 | 334.3 | -0.895E-06 |
| 38208. | 342. | 12.4 | 22.4 | 339.4 | -0.115E-05 |

Satellite 1959 Alpha 1 (Vanguard 2) Maria Gutierrez

I. SAO smoothed elements

The following elements are based on 91 observations and are valid for the period April 1 through May 1, 1963.

$T_0 = 38134.0$ MJD

$\omega = (232^\circ.390 \pm 4) + (5^\circ.2919 \pm 4)t - {}^\circ.59 \times 10^{-4}t^2 + {}^\circ.1523 \cos \omega$

$\Omega = (249^\circ.817 \pm 2) - (3^\circ.5209 \pm 2)t - {}^\circ.42 \times 10^{-5}t^2 + {}^\circ.0077 \cos \omega$

$i = (32^\circ.8772 \pm 5) - {}^\circ.0069 \sin \omega$

$e = (.16431 \pm 1) - .138 \times 10^{-5}t + .000457 \sin \omega$

$M = (.638852 \pm 7) + (11.4792753 \pm 8)t + (.395 \pm 4) \times 10^{-5}t^2$

$- (.22 \pm 3) \times 10^{-7}t^3 - .000439 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.00$.

The following elements are based on 126 observations and are valid for the period May 1 through June 1, 1963.

$T_0 = 38164.0$ MJD

$\omega = (31^\circ.121 \pm 5) + (5^\circ.2957 \pm 4)t + {}^\circ.000114t^2 + {}^\circ.1523 \cos \omega$

$\Omega = (144^\circ.206 \pm 2) - (3^\circ.5206 \pm 2)t + {}^\circ.11 \times 10^{-5}t^2 + {}^\circ.0077 \cos \omega$

$i = (32^\circ.8790 \pm 7) - {}^\circ.0069 \sin \omega$

$e = (.16433 \pm 1) - .75 \times 10^{-5}t + .000457 \sin \omega$

$M = (.01993 \pm 1) + (11.4794423 \pm 7)t + (.243 \pm 2) \times 10^{-5}t^2$

$- (.77 \pm 26) \times 10^{-8}t^3 - .000439 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.33$.

The following elements are based on 109 observations and are valid for the period June 1 through July 1, 1963.

$T_0 = 38184.0$ MJD

$\omega = (136^\circ.941 \pm 7) + (5^\circ.2933 \pm 5)t + {}^\circ.000114t^2 + {}^\circ.1523 \cos \omega$

$\Omega = (73^\circ.796 \pm 4) - (3^\circ.5202 \pm 2)t + {}^\circ.11 \times 10^{-5}t^2 + {}^\circ.0077 \cos \omega$

$i = (32^\circ.8795 \pm 9) - {}^\circ.0069 \sin \omega$

$e = (.164384 \pm 8) - .75 \times 10^{-5}t + .000457 \sin \omega$

$M = (.61000 \pm 2) + (11.479543 \pm 2)t + (.21 \pm 1) \times 10^{-5}t^2$

$- (.13 \pm 3) \times 10^{-7}t^3 - .000439 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.35$.

| T (MJD) | ω | Ω | i | e | M | n | n'/2 | q | N | D | σ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38122.0 | 168.722 9 | 292.057 6 | 32.877 2 | .16439 3 | .88862 3 | 11.479172 2 | .5E-5 1 | 6.935173 | 23 | 8 | .37 |
| 38126.0 | 189.911 7 | 277.974 4 | 32.879 2 | .16422 3 | .80533 2 | 11.479207 2 | .53E-5 6 | 6.936560 | 16 | 8 | .34 |
| 38130.0 | 211.10 1 | 263.892 7 | 32.878 3 | .16406 3 | .72218 2 | 11.479242 1 | .33E-5 6 | 6.937887 | 11 | 8 | .43 |
| 38134.0 | 232.289 7 | 249.813 5 | 32.881 1 | .16398 2 | .63913 1 | 11.479273 1 | .40E-5 3 | 6.938525 | 15 | 8 | .34 |
| 38138.0 | 253.510 5 | 235.734 4 | 32.883 8 | .16392 2 | .556139 8 | 11.479305 1 | .41E-5 2 | 6.939063 | 28 | 8 | .35 |
| 38142.0 | 274.737 8 | 221.652 7 | 32.884 1 | .16385 2 | .47325 1 | 11.479334 1 | .31E-5 7 | 6.939574 | 34 | 8 | .55 |
| 38146.0 | 295.944 5 | 207.565 3 | 32.8863 8 | .16390 2 | .39052 1 | 11.479357 9 | .29E-5 4 | 6.939172 | 31 | 8 | .36 |
| 38150.0 | 317.154 7 | 193.489 4 | 32.883 1 | .16397 2 | .30785 1 | 11.479399 1 | .8E-6 5 | 6.938545 | 37 | 8 | .46 |
| 38154.0 | 338.337 9 | 179.413 5 | 32.880 1 | .16411 2 | .22533 2 | 11.479421 1 | .41E-5 8 | 6.937353 | 36 | 8 | .45 |
| 38158.0 | 359.51 1 | 165.324 7 | 32.879 2 | .16423 3 | .14297 2 | 11.479449 2 | .33E-5 6 | 6.936331 | 29 | 8 | .38 |
| 38162.0 | 20.70 2 | 151.262 5 | 32.870 2 | .16454 5 | .06055 5 | 11.479469 2 | .2E-5 1 | 6.933754 | 21 | 8 | .46 |
| 38166.0 | 41.87 1 | 137.172 3 | 32.873 2 | .16459 2 | .97840 2 | 11.479482 3 | -.1E-6 9 | 6.933329 | 38 | 8 | .60 |
| 38170.0 | 62.979 7 | 123.087 3 | 32.873 1 | .16470 2 | .89645 2 | 11.479493 7 | .28E-5 4 | 6.932429 | 47 | 8 | .54 |
| 38174.0 | 84.086 8 | 108.999 4 | 32.872 1 | .16477 2 | .81460 2 | 11.479512 1 | .18E-5 4 | 6.931876 | 27 | 8 | .42 |
| 38178.0 | 105.18 1 | 94.922 5 | 32.872 1 | .16478 2 | .73283 2 | 11.479528 1 | .22E-5 6 | 6.931735 | 26 | 8 | .56 |
| 38182.0 | 126.30 1 | 80.836 4 | 32.874 1 | .16469 2 | .65110 2 | 11.479546 1 | .21E-5 6 | 6.932528 | 35 | 8 | .61 |
| 38186.0 | 147.42 1 | 66.744 5 | 32.877 1 | .16456 2 | .56942 2 | 11.479559 1 | .24E-5 5 | 6.933563 | 25 | 8 | .56 |
| 38190.0 | 168.568 8 | 52.670 4 | 32.878 2 | .16438 1 | .48772 2 | 11.479575 1 | .15E-5 4 | 6.935040 | 21 | 8 | .40 |
| 38194.0 | 189.737 9 | 38.591 4 | 32.880 2 | .16420 1 | .40603 2 | 11.479590 1 | .23E-5 6 | 6.936536 | 27 | 8 | .45 |
| 38198.0 | 210.93 1 | 24.512 5 | 32.880 3 | .16404 2 | .32434 3 | 11.479605 1 | .17E-5 6 | 6.937884 | 28 | 8 | .48 |
| 38202.0 | 232.157 9 | 10.420 4 | 32.887 3 | .16393 1 | .24266 2 | 11.479614 1 | .10E-5 5 | 6.938833 | 38 | 8 | .51 |
| 38206.0 | 253.385 9 | 356.344 3 | 32.883 2 | .16383 1 | .16098 2 | 11.479625 1 | .13E-5 4 | 6.939583 | 35 | 8 | .47 |
| 38210.0 | 274.59 1 | 342.265 6 | 32.887 3 | .16384 2 | .07942 3 | 11.479634 1 | -.2E-7 9 | 6.939513 | 21 | 8 | .60 |

Table 2

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1959 ALPHA 1

| MJD | Z | $\varphi$ | $\psi$ | D.R.A. | $\dot{P}$ |
|---|---|---|---|---|---|
| | | PERIGEE IN SUNLIGHT | | | |
| 38122. | 557. | 6.1 | 90.5 | 91.0 | -0.759E-07 |
| 38126. | 558. | -5.4 | 91.7 | 91.1 | -0.804E-07 |
| 38130. | 561. | -16.3 | 94.1 | 91.9 | -0.501E-07 |
| 38134. | 564. | -25.4 | 98.2 | 94.7 | -0.607E-07 |
| 38138. | 566. | -31.4 | 104.2 | 100.1 | -0.622E-07 |
| 38142. | 567. | -32.8 | 111.1 | 107.3 | -0.470E-07 |
| | | PERIGEE IN EARTH SHADOW | | | |
| 38146. | 566. | -29.2 | 117.3 | 113.9 | -0.440E-07 |
| 38150. | 563. | -21.7 | 121.1 | 118.1 | -0.121E-07 |
| 38154. | 560. | -11.6 | 121.4 | 119.6 | -0.622E-07 |
| 38158. | 558. | -0.3 | 118.4 | 119.7 | -0.501E-07 |
| 38162. | 556. | 11.1 | 113.8 | 119.8 | -0.304E-07 |
| | | PERIGEE IN SUNLIGHT | | | |
| 38166. | 558. | 21.2 | 109.6 | 121.1 | 0.152E-08 |
| 38170. | 559. | 28.9 | 107.7 | 124.8 | -0.425E-07 |
| 38174. | 560. | 32.7 | 108.9 | 130.9 | -0.273E-07 |
| | | PERIGEE IN EARTH SHADOW | | | |
| 38178. | 559. | 31.6 | 113.3 | 137.7 | -0.334E-07 |
| 38182. | 558. | 25.9 | 120.0 | 142.8 | -0.319E-07 |
| 38186. | 557. | 17.0 | 127.8 | 145.2 | -0.364E-07 |
| 38190. | 557. | 6.2 | 135.5 | 145.6 | -0.228E-07 |
| 38194. | 558. | -5.3 | 142.0 | 145.2 | -0.349E-07 |
| 38198. | 561. | -16.2 | 146.8 | 145.5 | -0.258E-07 |
| 38202. | 564. | -25.4 | 150.7 | 147.8 | -0.152E-07 |
| 38206. | 567. | -31.3 | 154.6 | 152.8 | -0.197E-07 |
| 38210. | 567. | -32.8 | 159.6 | 159.5 | 0.304E-09 |

Satellite 1959 Eta (Vanguard 3) Eleanor Ryan

I. SAO smoothed elements

The following elements are based on 103 observations and are valid for the period April 1 through May 1, 1963.

$T_0 = 38136.0$ MJD

$\omega = (39^\circ.264 \pm 4) + (4^\circ.8904 \pm 4)t + {}^\circ.000134t^2 + {}^\circ.1295 \cos \omega$

$\Omega = (263^\circ.848 \pm 2) - (3^\circ.28803 \pm 2)t + ({}^\circ.10 \times 10^{-4})t^2 + {}^\circ.0090 \cos \omega$

$i = (33^\circ.353 \pm 1) + {}^\circ.000185t - {}^\circ.0077 \sin \omega$

$e = (.18879 \pm 2) - (.62 \times 10^{-5})t + .000452 \sin \omega$

$M = (.830364 \pm 8) + (11.088466 \pm 1)t - (.54 \pm 3) \times 10^{-6}t^2$

$+ (.11 \pm 3) \times 10^{-7}t^3 - .000376 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.35$.

The following elements are based on 283 observations and are valid for the period May 1 through June 1, 1963.

$T_0 = 38166.0$ MJD

$\omega = (186^\circ.062 \pm 3) + (4^\circ.8917 \pm 3)t + {}^\circ.000134t^2 + {}^\circ.1295 \cos \omega$

$\Omega = (165^\circ.226 \pm 2) - (3^\circ.2865 \pm 2)t + ({}^\circ.10 \times 10^{-4})t^2 + {}^\circ.0090 \cos \omega$

$i = (33^\circ.3529 \pm 4) + {}^\circ.000185t - {}^\circ.0077 \sin \omega$

$e = (.18870 \pm 1) - (.62 \times 10^{-5})t + .000452 \sin \omega$

$M = (.484411 \pm 8) + (11.0884687 \pm 7)t - (.73 \pm 2) \times 10^{-6}t^2$

$+ (.54 \pm 2) \times 10^{-7}t^3 - .000376 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.15$.

The following elements are based on 151 observations and are valid for the period June 1 through July 1, 1963.

$$T_0 = 38196.0 \text{ MJD}$$

$$\omega = (332^\circ.855 \pm 3) + (4^\circ.8940 \pm 3)t + {}^\circ.000134t^2 + {}^\circ.1295 \cos \omega$$

$$\Omega = (66^\circ.618 \pm 2) - (3^\circ.2873 \pm 2)t + ({}^\circ.10 \times 10^{-4})t^2 + {}^\circ.0090 \cos \omega$$

$$i = (33^\circ.3567 \pm 7) + {}^\circ.000185t - {}^\circ.0077 \sin \omega$$

$$e = (.18857 \pm 1) - .62 \times 10^{-5}t + .000452 \sin \omega$$

$$M = (.139165 \pm 9) + (11.0885196 \pm 8)t - (.19 \pm 2) \times 10^{-6}t^2$$
$$- (.43 \pm 3) \times 10^{-7}t^3 - .000376 \cos \omega$$

Standard error of one observation: $\sigma = \pm 1'.23$.

| T (MJD) | ω | Ω | i | e | M | n | n'/2 | q | N | D | σ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38122.0 | 330.84 2 | 309.876 9 | 33.365 4 | .18856 3 | .59157 3 | 11.088488 2 | .38E-6 95 | 6.891868 | 16 | 6 | .45 |
| 38126.0 | 350.43 1 | 296.727 6 | 33.355 3 | .18864 4 | .94542 3 | 11.088504 5 | .30E-5 19 | 6.891204 | 14 | 6 | .54 |
| 38130.0 | 10.06 1 | 283.55 1 | 33.347 4 | .18891 7 | .29923 2 | 11.088504 4 | -.37E-5 23 | 6.888941 | 14 | 6 | .40 |
| 38134.0 | 29.56 1 | 270.40 1 | 33.344 4 | .18903 6 | .65338 3 | 11.088499 5 | -.64E-5 22 | 6.887895 | 23 | 6 | .72 |
| 38138.0 | 49.145 7 | 257.277 7 | 33.346 2 | .18911 4 | .00702 2 | 11.088481 3 | -.32E-5 13 | 6.887234 | 25 | 6 | .41 |
| 38142.0 | 68.672 5 | 244.112 5 | 33.343 2 | .18917 3 | .36100 1 | 11.088467 1 | .18E-6 63 | 6.886750 | 26 | 6 | .42 |
| 38146.0 | 88.181 4 | 230.967 4 | 33.344 1 | .18922 3 | .714984 9 | 11.088470 2 | .4E-6 10 | 6.886285 | 24 | 6 | .38 |
| 38150.0 | 107.702 5 | 217.816 4 | 33.345 1 | .18919 3 | .06897 1 | 11.088473 1 | .15E-5 9 | 6.886575 | 26 | 6 | .42 |
| 38154.0 | 127.245 8 | 204.662 6 | 33.349 2 | .18914 3 | .42295 2 | 11.088484 2 | .30E-5 9 | 6.886946 | 23 | 6 | .49 |
| 38158.0 | 146.783 8 | 191.509 6 | 33.349 1 | .18896 3 | .77698 2 | 11.088487 1 | .14E-5 7 | 6.888458 | 24 | 6 | .42 |
| 38162.0 | 166.354 9 | 178.366 5 | 33.351 1 | .18871 4 | .13089 3 | 11.088482 3 | -.14E-5 11 | 6.890596 | 45 | 6 | .47 |
| 38166.0 | 185.927 6 | 165.221 3 | 33.3546 9 | .18863 4 | .48480 3 | 11.088463 1 | -.20E-5 9 | 6.891322 | 80 | 6 | .46 |
| 38170.0 | 205.518 5 | 152.073 2 | 33.3569 8 | .18845 3 | .83858 2 | 11.088457 1 | .24E-5 7 | 6.892844 | 84 | 6 | .43 |
| 38174.0 | 225.117 5 | 138.927 2 | 33.3568 8 | .18834 3 | .19240 2 | 11.088462 1 | -.42E-6 93 | 6.893756 | 71 | 6 | .38 |
| 38178.0 | 244.729 3 | 125.779 3 | 33.360 1 | .18826 2 | .546194 9 | 11.088472 2 | .29E-5 9 | 6.894486 | 75 | 6 | .44 |
| 38182.0 | 264.351 5 | 112.635 4 | 33.359 2 | .18820 3 | .90002 1 | 11.088489 2 | .27E-5 10 | 6.894919 | 49 | 6 | .54 |
| 38186.0 | 283.963 6 | 99.493 5 | 33.361 2 | .18812 4 | .25390 2 | 11.088486 2 | -.10E-5 14 | 6.895605 | 27 | 6 | .52 |
| 38190.0 | 303.586 9 | 86.346 5 | 33.362 1 | .18816 4 | .60780 2 | 11.088496 2 | -.24E-5 10 | 6.895251 | 24 | 6 | .42 |
| 38194.0 | 323.171 7 | 73.195 5 | 33.362 1 | .18836 3 | .96184 2 | 11.088496 1 | .21E-5 10 | 6.893584 | 30 | 6 | .44 |
| 38198.0 | 342.779 8 | 60.046 6 | 33.360 1 | .18844 2 | .31583 2 | 11.088499 1 | .6E-7 82 | 6.892934 | 30 | 6 | .45 |
| 38202.0 | 2.35 1 | 46.916 8 | 33.356 2 | .18857 3 | .66989 3 | 11.088497 2 | -.1E-6 11 | 6.891777 | 29 | 6 | .54 |
| 38206.0 | 21.94 1 | 33.356 7 | 33.356 3 | .18870 3 | .02396 2 | 11.088476 2 | -.18E-5 10 | 6.890697 | 29 | 6 | .49 |
| 38210.0 | 41.48 1 | 20.608 6 | 33.356 4 | .18884 4 | .37802 3 | 11.088467 2 | .1E-6 12 | 6.889549 | 31 | 6 | .53 |

Table 3

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1959 ETA

| MJD | Z | φ | ψ | D.R.A. | Ṗ |
|---|---|---|---|---|---|
| | | PERIGEE IN SUNLIGHT | | | |
| 38122. | 515. | -15.5 | 88.1 | 273.4 | -0.618E-08 |
| 38126. | 513. | -5.2 | 87.1 | 273.5 | -0.488E-07 |
| 38130. | 511. | 5.5 | 86.1 | 273.1 | 0.602E-07 |
| 38134. | 511. | 15.7 | 84.4 | 273.2 | 0.104E-06 |
| 38138. | 513. | 24.6 | 81.0 | 275.1 | 0.521E-07 |
| 38142. | 514. | 30.8 | 76.0 | 279.1 | -0.293E-08 |
| 38146. | 514. | 33.3 | 70.1 | 285.1 | -0.651E-08 |
| 38150. | 514. | 31.6 | 64.4 | 291.2 | -0.244E-07 |
| 38154. | 513. | 26.0 | 60.4 | 295.6 | -0.488E-07 |
| 38158. | 512. | 17.5 | 59.3 | 297.6 | -0.228E-07 |
| 38162. | 513. | 7.5 | 61.3 | 297.8 | 0.228E-07 |
| 38166. | 513. | -3.3 | 65.7 | 297.1 | 0.325E-07 |
| 38170. | 516. | -13.7 | 70.7 | 296.8 | -0.390E-07 |
| 38174. | 519. | -22.9 | 74.7 | 297.9 | 0.683E-08 |
| 38178. | 521. | -29.8 | 76.3 | 301.2 | -0.472E-07 |
| 38182. | 523. | -33.2 | 75.0 | 306.7 | -0.439E-07 |
| 38186. | 523. | -32.3 | 71.0 | 312.8 | 0.163E-07 |
| 38190. | 521. | -27.3 | 64.9 | 317.4 | 0.390E-07 |
| 38194. | 518. | -19.2 | 57.9 | 319.6 | -0.342E-07 |
| 38198. | 515. | -9.4 | 51.2 | 319.8 | -0.976E-09 |
| 38202. | 513. | 1.3 | 45.5 | 319.0 | 0.163E-08 |
| 38206. | 513. | 11.9 | 41.6 | 317.9 | 0.293E-07 |
| 38210. | 514. | 21.4 | 38.0 | 318.9 | -0.163E-08 |

I. SAO smoothed elements

The following elements are based on 77 observations and are valid for the period April 1 through May 1, 1963.

$T_0 = 38135.0$ MJD

$\omega = (91^\circ.31 \pm 1) + (3^\circ.399 \pm 2)t + {}^\circ.940 \times 10^{-3}t^2 + 1^\circ.2206 \cos \omega$

$\Omega = (187^\circ.771 \pm 2) - (4^\circ.1914 \pm 3)t + {}^\circ.10 \times 10^{-6}t^2 + {}^\circ.0054 \cos \omega$

$i = (50^\circ.309 \pm 1) - {}^\circ.0014 \sin \omega$

$e = (.03621 \pm 2) - (.6 \pm 17) \times 10^{-6}t + .000790 \sin \omega$

$M = (.54571 \pm 4) + (14.234705 \pm 5)t - (.176 \pm 4) \times 10^{-5}t^2$

$- (.76 \pm 42) \times 10^{-8}t^3 - .003059 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.73$.

The following elements are based on 64 observations and are valid for the period May 1 through June 1, 1963.

$T_0 = 38165.0$ MJD

$\omega = (193^\circ.28 \pm 4) + (3^\circ.413 \pm 4)t + {}^\circ.940 \times 10^{-3}t^2 + 1^\circ.2206 \cos \omega$

$\Omega = (62^\circ.036 \pm 2) - (4^\circ.1909 \pm 1)t + {}^\circ.10 \times 10^{-6}t^2 + {}^\circ.0054 \cos \omega$

$i = (50^\circ.306 \pm 2) - {}^\circ.0014 \sin \omega$

$e = (.03610 \pm 1) + (.21 \pm 11) \times 10^{-5}t + .000790 \sin \omega$

$M = (.5877 \pm 1) + (14.234713 \pm 9)t - (.199 \pm 5) \times 10^{-5}t^2$

$+ (.62 \pm 4) \times 10^{-7}t^3 - .003059 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.58$.

The following elements are based on 77 observations and are valid for the period June 1 through July 1, 1963.

$T_0 = 38196.0$ MJD

$\omega = (299^\circ.09 \pm 3) + (3^\circ.409 \pm 3)t + {}^\circ.940 \times 10^{-3}t^2 + 1^\circ.2206 \cos \omega$

$\Omega = (292^\circ.100 \pm 4) - (4^\circ.1920 \pm 5)t + {}^\circ.10 \times 10^{-6}t^2 + {}^\circ.0054 \cos \omega$

$i = (50^\circ.303 \pm 4) - {}^\circ.0014 \sin \omega$

$e = (.03604 \pm 6) + (.29 \pm 49) \times 10^{-5}t + .000790 \sin \omega$

$M = (.86514 \pm 9) + (14.234828 \pm 9)t - (.50 \pm 3) \times 10^{-6}t^2$

$- (.60 \pm 5) \times 10^{-7}t^3 - .003059 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.75$.

The following elements are based on 118 observations and are valid for the period July 1 through August 1, 1963.

$T_0 = 38226.0$ MJD

$\omega = (41^\circ.38 \pm 2) + (3^\circ.408 \pm 2)t + {}^\circ.000225t^2 + 1^\circ.2206 \cos \omega$

$\Omega = (166^\circ.365 \pm 2) - (4^\circ.1916 \pm 2)t - {}^\circ.13 \times 10^{-4}t^2 + {}^\circ.0054 \cos \omega$

$i = (50^\circ.305 \pm 1) - {}^\circ.0014 \sin \omega$

$e = (.03613 \pm 2) + (.68 \pm 18) \times 10^{-5}t + .000790 \sin \omega$

$M = (.91122 \pm 4) + (14.234958 \pm 6)t + (.88 \pm 4) \times 10^{-6}t^2$

$- (.96 \pm 5) \times 10^{-7}t^3 - .003059 \cos \omega$

Standard error of one observation: $\sigma = \pm 2'.23$.

The following elements are based on 84 observations and are valid for the period August 1 through September 1, 1963.

$T_0 = 38256.0$ MJD

$\omega = (143^\circ.41 \pm 2) + (3^\circ.411 \pm 3)t + {}^\circ.000225t^2 + 1^\circ.2206 \cos \omega$

$\Omega = (40^\circ.620 \pm 1) - (4^\circ.1920 \pm 3)t - {}^\circ.13 \times 10^{-4}t^2 + {}^\circ.0054 \cos \omega$

$i = (50^\circ.309 \pm 2) - {}^\circ.0014 \sin \omega$

$e = (.03618 \pm 2) - (.4 \pm 19) \times 10^{-6}t + .000790 \sin \omega$

$M = (.96205 \pm 6) + (14.235052 \pm 8)t + (.54 \pm 5) \times 10^{-6}t^2$

$+ (.109 \pm 4) \times 10^{-6}t^3 - .003059 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.83$.

| T (MJD) | ω | Ω | i | e | M | n | n'/2 | q | N | D | σ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38122.0 | 47.81 5 | 242.24 1 | 50.295 7 | .03674 3 | .4931 1 | 14.234809 4 | -.14E-5 10 | 6.927240 | 22 | 8 | .73 |
| 38126.0 | 61.10 7 | 225.49 2 | 50.308 1 | .03681 5 | .4325 2 | 14.234823 4 | .30E-5 16 | 6.926731 | 15 | 8 | 1.14 |
| 38130.0 | 74.65 3 | 208.741 7 | 50.308 2 | .03712 5 | .37131 9 | 14.234825 2 | .33E-5 10 | 6.924501 | 13 | 8 | .48 |
| 38134.0 | 87.83 4 | 191.971 4 | 50.305 2 | .03709 3 | .3112 1 | 14.234827 3 | -.22E-5 12 | 6.924758 | 23 | 8 | .23 |
| 38138.0 | 101.1 2 | 175.203 6 | 50.305 4 | .03706 9 | .2510 6 | 14.234802 1 | -.37E-5 6 | 6.924998 | 32 | 8 | .47 |
| 38142.0 | 114.62 3 | 158.434 6 | 50.307 5 | .03683 3 | .18984 7 | 14.234776 2 | -.37E-5 5 | 6.926652 | 26 | 8 | .50 |
| 38146.0 | 127.95 4 | 141.666 3 | 50.306 2 | .03677 4 | .1294 1 | 14.234759 2 | -.34E-6 59 | 6.927061 | 19 | 8 | .72 |
| 38150.0 | 141.34 5 | 124.900 2 | 50.306 2 | .03663 3 | .0688 1 | 14.234757 2 | .75E-6 89 | 6.928044 | 20 | 8 | .75 |
| 38154.0 | 154.74 9 | 108.134 2 | 50.307 3 | .03646 3 | .0083 2 | 14.234767 2 | -.1E-7 80 | 6.929294 | 13 | 8 | .58 |
| 38158.0 | 168.25 7 | 91.363 4 | 50.307 4 | .03633 2 | .9475 2 | 14.234743 2 | -.51E-5 9 | 6.930255 | 10 | 8 | .51 |
| 38162.0 | 181.97 9 | 74.600 8 | 50.307 4 | .03610 4 | .8861 3 | 14.234717 4 | -.22E-5 14 | 6.931889 | 15 | 8 | .70 |
| 38166.0 | 195.2 2 | 57.87 2 | 50.29 1 | .0353 4 | .8259 5 | 14.234694 2 | -.33E-5 8 | 6.937608 | 26 | 8 | .62 |
| 38170.0 | 209.1 2 | 41.08 1 | 50.305 7 | .0354 5 | .7642 5 | 14.234681 2 | -.96E-6 82 | 6.937082 | 26 | 8 | .63 |
| 38174.0 | 223.28 7 | 24.29 1 | 50.32 1 | .03572 4 | .7020 2 | 14.234668 6 | -.11E-5 16 | 6.934673 | 13 | 8 | .66 |
| 38178.0 | 237.04 5 | 7.546 7 | 50.313 6 | .03547 2 | .6407 1 | 14.234690 2 | -.19E-5 9 | 6.936451 | 12 | 8 | .56 |
| 38182.0 | 250.98 5 | 350.786 3 | 50.308 3 | .03540 1 | .5790 1 | 14.234664 2 | -.16E-5 8 | 6.936923 | 23 | 8 | .66 |
| 38186.0 | 264.87 4 | 334.016 2 | 50.313 2 | .03532 1 | .5175 1 | 14.234644 1 | -.38E-5 5 | 6.937507 | 18 | 8 | .45 |
| 38190.0 | 278.60 9 | 317.245 4 | 50.299 8 | .03537 5 | .4564 2 | 14.234630 2 | .17E-5 11 | 6.937188 | 14 | 8 | .60 |
| 38194.0 | 292.67 8 | 300.490 8 | 50.307 9 | .0356 4 | .3944 3 | 14.234640 2 | .1E-5 1 | 6.935795 | 18 | 8 | .65 |
| 38198.0 | 306.55 5 | 283.371 9 | 50.300 7 | .0356 4 | .3331 2 | 14.234645 2 | -.49E-6 77 | 6.935810 | 27 | 8 | .64 |
| 38202.0 | 320.63 4 | 266.920 9 | 50.281 6 | .0349 2 | .2716 1 | 14.234636 1 | -.20E-5 5 | 6.940516 | 27 | 8 | .45 |
| 38206.0 | 334.7 1 | 250.15 2 | 50.28 1 | .0348 3 | .2100 3 | 14.234614 2 | -.25E-5 9 | 6.941597 | 22 | 8 | .69 |
| 38210.0 | 348.0 2 | 233.423 5 | 50.304 6 | .03587 5 | .1499 4 | 14.234584 3 | -.29E-5 11 | 6.933585 | 19 | 8 | .90 |

| T (MJD) | ω | Ω | i | e | M | n | n'/2 | q | N | D | σ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38214.0 | 1.87 4 | 216.666 3 | 50.302 2 | .03607 2 | .0887 1 | 14.235046 2 | .62E-5 8 | 6.931979 | 34 | 8 | .91 |
| 38218.0 | 15.28 3 | 199.902 2 | 50.305 1 | .03638 2 | .02878 7 | 14.235099 1 | .76E-5 6 | 6.930504 | 48 | 8 | .79 |
| 38222.0 | 28.71 3 | 183.135 3 | 50.306 2 | .03638 3 | .96907 7 | 14.235132 2 | .24E-5 8 | 6.929743 | 38 | 8 | .87 |
| 38226.0 | 42.18 3 | 166.374 3 | 50.305 2 | .03650 4 | .90931 8 | 14.235134 2 | -.17E-6 8 | 6.928850 | 32 | 8 | .85 |
| 38230.0 | 55.61 3 | 149.604 4 | 50.306 2 | .03676 4 | .84960 9 | 14.235124 2 | -.17E-5 8 | 6.927012 | 35 | 8 | .76 |
| 38234.0 | 68.96 3 | 132.829 5 | 50.308 2 | .03693 3 | .79012 8 | 14.235116 2 | -.48E-6 75 | 6.925805 | 29 | 8 | .58 |
| 38238.0 | 82.25 4 | 116.074 1 | 50.302 6 | .03697 4 | .7308 1 | 14.235131 2 | .56E-5 9 | 6.925534 | 19 | 8 | .71 |
| 38242.0 | 95.66 3 | 99.314 5 | 50.295 4 | .03686 3 | .67136 7 | 14.235162 2 | .18E-5 9 | 6.926293 | 16 | 8 | .46 |
| 38246.0 | 108.94 4 | 82.535 4 | 50.307 5 | .03684 6 | .6124 1 | 14.235203 2 | .57E-5 10 | 6.926434 | 16 | 8 | .61 |
| 38250.0 | 122.33 4 | 65.770 3 | 50.308 4 | .03680 4 | .5533 1 | 14.235216 2 | .8E-6 11 | 6.926712 | 27 | 8 | 1.01 |
| 38254.0 | 135.72 2 | 48.998 2 | 50.310 2 | .03669 2 | .49416 7 | 14.235214 2 | -.28E-5 6 | 6.927507 | 34 | 8 | .58 |
| 38258.0 | 149.08 4 | 32.226 2 | 50.308 3 | .03655 2 | .4351 1 | 14.235205 1 | -.49E-6 67 | 6.928475 | 22 | 8 | .58 |
| 38262.0 | 162.72 3 | 15.456 3 | 50.297 3 | .03645 1 | .37533 9 | 14.235219 1 | .51E-5 5 | 6.929217 | 20 | 8 | .38 |
| 38266.0 | 176.18 4 | 358.691 6 | 50.305 5 | .03624 2 | .31622 1 | 14.235258 1 | .54E-5 6 | 6.930690 | 25 | 8 | .48 |
| 38270.0 | 190.1 1 | 341.91 1 | 50.305 7 | .03603 5 | .2561 3 | 14.235286 2 | .23E-5 1 | 6.932191 | 18 | 8 | .78 |
| 38274.0 | 203.63 8 | 325.173 5 | 50.309 3 | .03584 3 | .1969 2 | 14.235296 7 | -.33E-5 19 | 6.933587 | 16 | 8 | .63 |

Table 4

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1959 IOTA 1

| MJD | Z | $\varphi$ | $\psi$ | D.R.A. | $\dot{P}$ |
|---|---|---|---|---|---|
| | | PERIGEE IN SUNLIGHT | | | |
| 38122. | 556. | 34.8 | 90.5 | 265.9 | 0.138E-07 |
| 38126. | 558. | 42.4 | 93.3 | 259.5 | -0.296E-07 |
| 38130. | 558. | 47.9 | 92.9 | 256.6 | -0.326E-07 |
| 38134. | 559. | 50.3 | 91.5 | 256.1 | 0.217E-07 |
| 38138. | 559. | 49.0 | 90.8 | 256.0 | 0.365E-07 |
| 38142. | 559. | 44.4 | 92.5 | 254.1 | 0.365E-07 |
| 38146. | 557. | 37.4 | 98.0 | 248.6 | 0.336E-08 |
| 38150. | 555. | 28.7 | 107.3 | 240.3 | -0.740E-08 |
| | | PERIGEE IN EARTH SHADOW | | | |
| 38154. | 553. | 19.2 | 119.5 | 230.0 | 0.987E-10 |
| 38158. | 552. | 9.0 | 133.8 | 218.6 | 0.503E-07 |
| 38162. | 554. | -1.5 | 148.9 | 206.7 | 0.217E-07 |
| 38166. | 560. | -11.6 | 164.0 | 194.7 | 0.326E-07 |
| 38170. | 562. | -22.0 | 176.1 | 183.6 | 0.948E-08 |
| 38174. | 562. | -31.8 | 167.8 | 174.3 | 0.109E-07 |
| 38178. | 567. | -40.2 | 158.2 | 167.0 | 0.188E-07 |
| 38182. | 570. | -46.7 | 151.9 | 163.2 | 0.158E-07 |
| 38186. | 572. | -50.0 | 149.4 | 162.7 | 0.375E-07 |
| 38190. | 571. | -49.5 | 150.3 | 163.2 | -0.168E-07 |
| 38194. | 568. | -45.2 | 153.6 | 162.1 | -0.987E-08 |
| 38198. | 566. | -38.2 | 155.4 | 156.9 | 0.484E-08 |
| 38202. | 567. | -29.2 | 152.0 | 149.4 | 0.197E-07 |

Table 4 (cont.)

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1959 IOTA 1

| MJD | Z | φ | ψ | D.R.A. | Ṗ |
|---|---|---|---|---|---|
| 38206. | 566. | -19.2 | 142.0 | 139.3 | 0.247E-07 |
| 38210. | 556. | -9.2 | 128.0 | 127.5 | 0.286E-07 |
| | | PERIGEE IN SUNLIGHT | | | |
| 38214. | 554. | 1.4 | 112.8 | 115.5 | -0.612E-07 |
| 38218. | 553. | 11.7 | 97.5 | 103.4 | -0.750E-07 |
| 38222. | 554. | 21.7 | 83.6 | 91.9 | -0.237E-07 |
| 38226. | 556. | 31.1 | 72.4 | 81.8 | 0.168E-08 |
| 38230. | 557. | 39.4 | 64.9 | 74.0 | 0.168E-07 |
| 38234. | 558. | 45.9 | 61.4 | 69.2 | 0.474E-08 |
| 38238. | 560. | 49.7 | 61.0 | 67.5 | -0.553E-07 |
| 38242. | 560. | 50.0 | 61.8 | 67.7 | -0.178E-07 |
| 38246. | 559. | 46.7 | 61.5 | 66.4 | -0.563E-07 |
| 38250. | 557. | 40.6 | 58.7 | 62.3 | -0.790E-08 |
| 38254. | 555. | 32.5 | 52.8 | 55.1 | 0.276E-07 |
| 38258. | 553. | 23.3 | 44.1 | 45.6 | 0.484E-08 |
| 38262. | 552. | 13.2 | 33.9 | 34.8 | -0.503E-07 |
| 38266. | 552. | 2.9 | 24.3 | 23.1 | -0.533E-07 |
| 38270. | 554. | -7.8 | 20.9 | 11.6 | -0.227E-07 |
| 38274. | 557. | -18.0 | 26.2 | 0.4 | 0.326E-07 |

| T (MJD) | ω | Ω | i | e | M | n | n'/2 | q | N | D | σ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38120.0 | 9. 1 | 52.58 1 | 47.203 7 | .00417 9 | .707 3 | 12.46568 2 | -.9E-4 4 | 7.823838 | 34 | 2 | 1.23 |
| 38121.0 | 16. 2 | 49.29 2 | 47.21 1 | .0042 2 | .165 7 | 12.46592 3 | -.20E-3 6 | 7.823579 | 31 | 2 | 1.89 |
| 38122.0 | 28.3 9 | 46.05 1 | 47.195 7 | .0051 1 | .607 3 | 12.46608 3 | -.6E-4 5 | 7.816298 | 29 | 2 | 1.41 |
| 38123.0 | 33. 1 | 42.78 2 | 47.20 1 | .0054 2 | .071 3 | 12.46630 3 | .14E-3 5 | 7.81[illegible] | 26 | 2 | 1.98 |
| 38124.0 | 42.3 6 | 39.51 1 | 47.196 6 | .0062 1 | .522 2 | 12.46657 2 | -.2E-4 5 | 7.807612 | 25 | 2 | 1.30 |
| 38125.0 | 46.7 6 | 36.26 1 | 47.202 6 | .0066 1 | .987 2 | 12.46677 3 | .14E-3 5 | 7.804178 | 27 | 2 | 1.36 |
| 38126.0 | 52.0 3 | 32.979 8 | 47.197 3 | .00749 7 | .4502 9 | 12.46693 1 | .9E-4 2 | 7.797214 | 20 | 2 | .65 |
| 38127.0 | 59.7 3 | 29.724 9 | 47.188 4 | .00827 9 | .9063 9 | 12.46723 1 | .15E-3 3 | 7.790958 | 15 | 2 | .54 |
| 38128.0 | 63.6 7 | 26.45 3 | 47.191 9 | .0087 2 | .374 2 | 12.46750 3 | .41E-3 8 | 7.787724 | 12 | 2 | 1.37 |
| 38129.0 | 68.6 2 | 23.175 7 | 47.186 3 | .00939 6 | .8381 5 | 12.46782 1 | .15E-3 2 | 7.781901 | 15 | 2 | .51 |
| 38130.0 | 73.5 2 | 19.90 1 | 47.188 4 | .01012 9 | .3031 5 | 12.46809 1 | .5E-4 3 | 7.776095 | 24 | 2 | .91 |
| 38131.0 | 77.5 2 | 16.65 1 | 47.187 4 | .01072 8 | .7707 5 | 12.46839 2 | .22E-3 3 | 7.771200 | 29 | 2 | .94 |
| 38132.0 | 81.6 1 | 13.385 7 | 47.188 2 | .01148 4 | .2385 3 | 12.46884 1 | .24E-3 2 | 7.765092 | 24 | 2 | .40 |
| 38133.0 | 86.4 1 | 10.102 8 | 47.184 3 | .01224 5 | .7049 3 | 12.469152 9 | .22E-3 2 | 7.758956 | 23 | 2 | .53 |
| 38134.0 | 90.20 8 | 6.841 6 | 47.181 3 | .01310 5 | .1742 2 | 12.469573 8 | .20E-3 1 | 7.752013 | 22 | 2 | .49 |
| 38135.0 | 94.35 7 | 3.561 6 | 47.192 3 | .01375 5 | .6431 2 | 12.47002 1 | .18E-3 2 | 7.746758 | 19 | 2 | .42 |
| 38136.0 | 98.11 7 | 0.298 6 | 47.194 4 | .01455 6 | .1133 2 | 12.470410 8 | .19E-3 2 | 7.740284 | 20 | 2 | .53 |
| 38137.0 | 101.90 4 | 357.034 5 | 47.186 3 | .01512 4 | .5840 2 | 12.470851 6 | .21E-3 1 | 7.735608 | 24 | 2 | .46 |
| 38138.0 | 105.76 4 | 353.766 4 | 47.188 3 | .01592 3 | .0548 1 | 12.471310 9 | .24E-3 1 | 7.729175 | 22 | 2 | .34 |
| 38139.0 | 109.47 6 | 350.492 5 | 47.194 4 | .01669 6 | .5266 2 | 12.471762 6 | .23E-3 1 | 7.722907 | 17 | 2 | .45 |
| 38140.0 | 113.23 7 | 347.224 6 | 47.191 5 | .01733 6 | .9986 2 | 12.47226 1 | .27E-3 2 | 7.717668 | 25 | 2 | .66 |
| 38141.0 | 116.91 7 | 343.958 6 | 47.196 6 | .01809 6 | .4713 2 | 12.47273 1 | .26E-3 2 | 7.711534 | 26 | 2 | .71 |
| 38142.0 | 120.51 5 | 340.681 4 | 47.204 5 | .01878 6 | .9447 2 | 12.47323 2 | .25E-3 2 | 7.705887 | 18 | 2 | .42 |
| 38143.0 | 124.29 8 | 337.412 6 | 47.211 5 | .01953 7 | .4181 2 | 12.47370 2 | .22E-3 3 | 7.699816 | 16 | 2 | .49 |
| 38144.0 | 127.9 1 | 334.148 9 | 47.212 7 | .0202 1 | .8925 3 | 12.47418 2 | .24E-3 3 | 7.694447 | 13 | 2 | .73 |
| 38145.0 | 131.41 7 | 330.874 4 | 47.207 4 | .02057 6 | .3676 2 | 12.47472 2 | .26E-3 2 | 7.691251 | 13 | 2 | .44 |
| 38146.0 | 135.17 5 | 327.616 4 | 47.212 3 | .02132 5 | .8425 2 | 12.475210 7 | .24E-3 1 | 7.685159 | 18 | 2 | .44 |
| 38147.0 | 138.92 5 | 324.347 4 | 47.215 4 | .02204 5 | .3179 2 | 12.475747 8 | .29E-3 1 | 7.679252 | 16 | 2 | .43 |
| 38148.0 | 142.57 6 | 321.085 4 | 47.211 4 | .02258 6 | .7942 2 | 12.47629 1 | .24E-3 2 | 7.674795 | 15 | 2 | .60 |
| 38149.0 | 146.29 4 | 317.815 2 | 47.213 3 | .02326 4 | .2707 1 | 12.476797 8 | .27E-3 1 | 7.669240 | 21 | 2 | .48 |

| T (MJD) | ω | Ω | i | e | M | n | n'/2 | q | N | D | σ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38150.0 | 150.02 7 | 314.541 3 | 47.214 3 | .02383 6 | .7478 2 | 12.477363 9 | .27E-3 2 | 7.664590 | 16 | 2 | .54 |
| 38151.0 | 153.7 1 | 311.274 4 | 47.217 4 | .02435 8 | .2257 3 | 12.47795 2 | .29E-3 4 | 7.660271 | 10 | 2 | .61 |
| 38152.0 | 157.38 9 | 308.005 3 | 47.216 3 | .02491 5 | .7039 3 | 12.47849 1 | .23E-3 2 | 7.655633 | 14 | 2 | .48 |
| 38153.0 | 161.39 5 | 304.732 3 | 47.219 3 | .02564 4 | .1818 2 | 12.479065 8 | .27E-3 2 | 7.649681 | 21 | 2 | .58 |
| 38154.0 | 165.18 6 | 301.464 3 | 47.218 3 | .02621 5 | .6609 2 | 12.47961 1 | .25E-3 2 | 7.644953 | 20 | 2 | .61 |
| 38155.0 | 168.95 5 | 298.190 3 | 47.213 3 | .02676 5 | .1406 1 | 12.480174 6 | .28E-3 1 | 7.640401 | 16 | 2 | .45 |
| 38156.0 | 172.66 6 | 294.919 3 | 47.215 3 | .02726 5 | .6210 2 | 12.48077 1 | .30E-3 2 | 7.636258 | 13 | 2 | .45 |
| 38157.0 | 176.65 9 | 291.648 5 | 47.214 5 | .02794 6 | .1012 3 | 12.48132 1 | .26E-3 2 | 7.630691 | 13 | 2 | .68 |
| 38158.0 | 180.4 1 | 288.372 7 | 47.215 6 | .02854 7 | .5825 3 | 12.48194 2 | .33E-3 3 | 7.625720 | 11 | 2 | .72 |
| 38159.0 | 184.3 1 | 285.087 9 | 47.22 2 | .02891 9 | .0642 3 | 12.48256 2 | .24E-3 4 | 7.622527 | 8 | 2 | .61 |
| 38160.0 | 188.0 2 | 281.82 2 | 47.22 1 | .0296 1 | .5470 4 | 12.48311 3 | .33E-3 5 | 7.616909 | 10 | 2 | .91 |
| 38161.0 | 192.0 1 | 278.55 1 | 47.211 9 | .03031 9 | .0295 3 | 12.48380 2 | .23E-3 3 | 7.611071 | 15 | 2 | .75 |
| 38162.0 | 195.72 7 | 275.274 9 | 47.206 7 | .03088 6 | .5133 2 | 12.48438 2 | .27E-3 3 | 7.606384 | 16 | 2 | .61 |
| 38163.0 | 199.55 8 | 271.99 1 | 47.208 8 | .03145 8 | .9975 2 | 12.48500 1 | .29E-3 2 | 7.601621 | 12 | 2 | .64 |
| 38164.0 | 203.43 6 | 268.704 6 | 47.201 5 | .03218 5 | .4822 2 | 12.48562 1 | .33E-3 2 | 7.595684 | 13 | 2 | .41 |
| 38165.0 | 207.18 4 | 265.424 5 | 47.201 4 | .03276 4 | .9679 1 | 12.486270 6 | .32E-3 1 | 7.590825 | 22 | 2 | .44 |
| 38166.0 | 210.90 4 | 262.144 4 | 47.206 3 | .03334 3 | .4542 1 | 12.486896 6 | .31E-3 1 | 7.586063 | 27 | 2 | .46 |
| 38167.0 | 214.64 5 | 258.862 6 | 47.210 4 | .03396 5 | .9411 1 | 12.487509 8 | .30E-3 2 | 7.580922 | 22 | 2 | .53 |
| 38168.0 | 218.39 6 | 255.572 7 | 47.205 6 | .03467 7 | .4286 2 | 12.488132 9 | .34E-3 2 | 7.575089 | 25 | 2 | .67 |
| 38169.0 | 221.99 4 | 252.287 5 | 47.205 4 | .03530 4 | .9172 1 | 12.488775 6 | .33E-3 1 | 7.569866 | 23 | 2 | .44 |
| 38170.0 | 225.68 5 | 248.999 9 | 47.205 6 | .03598 5 | .4061 1 | 12.489433 9 | .33E-3 2 | 7.564266 | 20 | 2 | .52 |
| 38171.0 | 229.31 6 | 245.714 9 | 47.211 6 | .03665 7 | .8958 2 | 12.49006 1 | .33E-3 2 | 7.558803 | 17 | 2 | .61 |
| 38172.0 | 232.89 4 | 242.430 7 | 47.215 4 | .03725 6 | .3863 1 | 12.49071 1 | .29E-3 2 | 7.553797 | 20 | 2 | .52 |
| 38173.0 | 236.50 4 | 239.128 7 | 47.212 4 | .03788 5 | .8773 1 | 12.49133 1 | .31E-3 2 | 7.548634 | 27 | 2 | .55 |
| 38174.0 | 239.89 6 | 235.84 1 | 47.216 6 | .03848 7 | .3696 2 | 12.49194 2 | .33E-3 3 | 7.543679 | 32 | 2 | .80 |
| 38175.0 | 243.48 4 | 232.560 7 | 47.221 4 | .03922 5 | .8619 1 | 12.492602 8 | .35E-3 2 | 7.537588 | 29 | 2 | .60 |
| 38176.0 | 247.03 4 | 229.264 8 | 47.223 3 | .03990 6 | .3550 1 | 12.49325 1 | .32E-3 2 | 7.532010 | 27 | 2 | .61 |
| 38177.0 | 250.51 3 | 225.968 6 | 47.227 3 | .04056 5 | .8489 1 | 12.49390 1 | .36E-3 2 | 7.526538 | 32 | 2 | .69 |
| 38178.0 | 253.89 2 | 222.674 3 | 47.229 2 | .04125 3 | .34370 5 | 12.494576 8 | .34E-3 1 | 7.520837 | 44 | 2 | .54 |
| 38179.0 | 257.38 2 | 219.379 3 | 47.232 1 | .04187 4 | .83886 5 | 12.495246 6 | .36E-3 1 | 7.515722 | 52 | 2 | .64 |
| 38180.0 | 260.88 2 | 216.083 2 | 47.235 1 | .04246 3 | .33466 5 | 12.495862 6 | .262E-3 9 | 7.510876 | 42 | 2 | .49 |

| T (MJD) | ω | Ω | i | e | M | n | n'/2 | q | N | D | σ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38181.0 | 264.19 3 | 212.788 4 | 47.240 2 | .04312 6 | .83158 9 | 12.496514 8 | .34E-3 1 | 7.505452 | 39 | 2 | .70 |
| 38182.0 | 267.54 3 | 209.489 4 | 47.249 2 | .04367 6 | .32899 9 | 12.497131 9 | .31E-3 2 | 7.500827 | 36 | 2 | .72 |
| 38183.0 | 270.86 3 | 206.202 4 | 47.256 3 | .04437 6 | .82703 9 | 12.49767 1 | .35E-3 2 | 7.495180 | 34 | 2 | .76 |
| 38184.0 | 274.32 3 | 202.906 4 | 47.260 3 | .04490 6 | .32532 8 | 12.498198 9 | .21E-3 1 | 7.490804 | 25 | 2 | .63 |
| 38185.0 | 277.65 4 | 199.609 4 | 47.262 4 | .04541 7 | .8243 1 | 12.49862 1 | .22E-3 2 | 7.486598 | 28 | 2 | .75 |
| 38186.0 | 281.02 2 | 196.309 3 | 47.261 2 | .04591 4 | .32365 7 | 12.498905 7 | .10E-3 1 | 7.482604 | 28 | 2 | .55 |
| 38187.0 | 284.37 3 | 193.008 3 | 47.260 3 | .04647 5 | .82316 7 | 12.499152 7 | .16E-3 1 | 7.478121 | 25 | 2 | .57 |
| 38188.0 | 287.78 3 | 189.711 3 | 47.259 3 | .04685 5 | .32281 9 | 12.499433 9 | .15E-3 1 | 7.475042 | 27 | 2 | .62 |
| 38189.0 | 291.18 3 | 186.411 3 | 47.263 3 | .04747 4 | .82270 9 | 12.499670 5 | .11E-3 1 | 7.470080 | 30 | 2 | .49 |
| 38190.0 | 294.55 2 | 183.111 3 | 47.265 1 | .04780 3 | .32298 6 | 12.499926 5 | .111E-3 8 | 7.467336 | 41 | 2 | .46 |
| 38191.0 | 298.04 2 | 179.811 3 | 47.265 1 | .04811 3 | .82313 6 | 12.500142 6 | .100E-3 8 | 7.464848 | 41 | 2 | .50 |
| 38192.0 | 301.41 3 | 176.511 3 | 47.266 1 | .04842 3 | .3238 1 | 12.500400 4 | .136E-3 8 | 7.462334 | 41 | 2 | .45 |
| 38193.0 | 304.93 3 | 173.215 3 | 47.267 1 | .04873 3 | .8244 1 | 12.500648 5 | .129E-3 8 | 7.459774 | 42 | 2 | .45 |
| 38194.0 | 308.42 3 | 169.909 3 | 47.268 1 | .04895 2 | .3252 1 | 12.500913 5 | .135E-3 9 | 7.457977 | 31 | 2 | .41 |
| 38195.0 | 311.87 3 | 166.613 3 | 47.271 2 | .04913 2 | .82645 9 | 12.501179 6 | .14E-3 1 | 7.456427 | 36 | 2 | .47 |
| 38196.0 | 315.52 3 | 163.315 3 | 47.272 2 | .04930 2 | .32735 9 | 12.501435 6 | .17E-3 1 | 7.455009 | 47 | 2 | .49 |
| 38197.0 | 318.96 2 | 160.009 2 | 47.274 1 | .04932 1 | .82916 7 | 12.501700 4 | .109E-3 7 | 7.454768 | 48 | 2 | .39 |
| 38198.0 | 322.67 3 | 156.711 2 | 47.274 2 | .04946 1 | .33037 9 | 12.502007 5 | .155E-3 8 | 7.453528 | 49 | 2 | .43 |
| 38199.0 | 326.34 3 | 153.408 2 | 47.277 2 | .04953 1 | .83199 8 | 12.502315 5 | .122E-3 9 | 7.452839 | 51 | 2 | .39 |
| 38200.0 | 330.16 3 | 150.109 2 | 47.278 2 | .04959 1 | .33345 9 | 12.502570 6 | .11E-3 1 | 7.452250 | 46 | 2 | .48 |
| 38201.0 | 333.83 5 | 146.809 4 | 47.284 3 | .04963 3 | .8356 2 | 12.502826 8 | .14E-3 2 | 7.451869 | 48 | 2 | .77 |
| 38202.0 | 337.99 4 | 143.510 3 | 47.282 2 | .04960 2 | .3365 1 | 12.50316 5 | .4E-4 5 | 7.451935 | 34 | 2 | .50 |
| 38203.0 | 341.40 4 | 140.212 3 | 47.284 2 | .04966 2 | .8399 1 | 12.503293 6 | .9E-4 1 | 7.451441 | 53 | 2 | .51 |
| 38204.0 | 345.57 5 | 136.917 3 | 47.284 2 | .04968 2 | .3413 1 | 12.503517 6 | .5E-4 1 | 7.451165 | 41 | 2 | .51 |
| 38205.0 | 349.31 5 | 133.617 3 | 47.283 2 | .04974 2 | .8440 2 | 12.503673 7 | .5E-4 1 | 7.450670 | 42 | 2 | .56 |
| 38206.0 | 353.27 5 | 130.314 3 | 47.278 2 | .04977 2 | .3464 1 | 12.503878 7 | .10E-3 1 | 7.450347 | 50 | 2 | .58 |
| 38207.0 | 357.03 5 | 127.013 4 | 47.279 2 | .04982 2 | .8495 2 | 12.504074 8 | .4E-4 1 | 7.449877 | 46 | 2 | .58 |
| 38208.0 | 1.06 5 | 123.716 3 | 47.275 2 | .04981 2 | .3519 2 | 12.504274 8 | .5E-4 1 | 7.449899 | 41 | 2 | .46 |
| 38209.0 | 4.90 5 | 120.416 3 | 47.267 2 | .04988 2 | .8551 1 | 12.504437 6 | .9E-4 1 | 7.449290 | 39 | 2 | .42 |
| 38210.0 | 8.87 8 | 117.109 6 | 47.266 3 | .04995 3 | .3582 2 | 12.50465 1 | .9E-4 2 | 7.448638 | 37 | 2 | .73 |

Table 5

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1960 IOTA 1

| MJD | Z | φ | ψ | D.R.A. | $\dot{P}$ |
|---|---|---|---|---|---|
| | | PERIGEE IN SUNLIGHT | | | |
| 38120. | 1446. | 6.6 | 48.8 | 49.0 | 0.116E-05 |
| 38121. | 1446. | 11.7 | 49.6 | 49.7 | 0.257E-05 |
| 38122. | 1441. | 20.4 | 55.2 | 54.6 | 0.772E-06 |
| 38123. | 1439. | 23.6 | 55.1 | 54.1 | -0.180E-05 |
| 38124. | 1434. | 29.6 | 59.4 | 57.9 | 0.257E-06 |
| 38125. | 1432. | 32.3 | 59.7 | 57.8 | -0.180E-05 |
| 38126. | 1426. | 35.3 | 61.0 | 58.8 | -0.116E-05 |
| 38127. | 1421. | 39.3 | 64.8 | 62.9 | -0.193E-05 |
| 38128. | 1419. | 41.1 | 65.2 | 63.3 | -0.528E-05 |
| 38129. | 1414. | 43.1 | 66.9 | 65.3 | -0.193E-05 |
| 38130. | 1408. | 44.7 | 68.5 | 67.5 | -0.643E-06 |
| 38131. | 1404. | 45.7 | 69.3 | 68.8 | -0.283E-05 |
| 38132. | 1398. | 46.5 | 70.3 | 70.4 | -0.309E-05 |
| 38133. | 1392. | 47.1 | 72.0 | 73.2 | -0.283E-05 |
| 38134. | 1385. | 47.2 | 72.7 | 74.6 | -0.257E-05 |
| 38135. | 1380. | 47.0 | 73.7 | 76.5 | -0.232E-05 |
| 38136. | 1373. | 46.6 | 74.3 | 77.8 | -0.244E-05 |
| 38137. | 1368. | 45.9 | 74.8 | 79.0 | -0.270E-05 |
| 38138. | 1361. | 44.9 | 75.4 | 80.1 | -0.309E-05 |
| 38139. | 1355. | 43.8 | 75.7 | 80.8 | -0.296E-05 |
| 38140. | 1349. | 42.4 | 75.9 | 81.4 | -0.347E-05 |
| 38141. | 1342. | 40.9 | 76.0 | 81.7 | -0.334E-05 |

Table 5 (cont.)

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1960 IOTA 1

| MJD | Z | φ | ψ | D.R.A. | $\dot{P}$ |
|---|---|---|---|---|---|
| 38142. | 1336. | 39.2 | 75.9 | 81.7 | -0.321E-05 |
| 38143. | 1329. | 37.3 | 75.8 | 81.6 | -0.283E-05 |
| 38144. | 1323. | 35.4 | 75.5 | 81.2 | -0.308E-05 |
| 38145. | 1319. | 33.4 | 74.9 | 80.5 | -0.334E-05 |
| 38146. | 1313. | 31.2 | 74.5 | 79.9 | -0.308E-05 |
| 38147. | 1306. | 28.8 | 73.9 | 79.0 | -0.373E-05 |
| 38148. | 1301. | 26.5 | 73.2 | 78.0 | -0.308E-05 |
| 38149. | 1294. | 24.0 | 72.4 | 76.9 | -0.347E-05 |
| 38150. | 1289. | 21.5 | 71.5 | 75.6 | -0.347E-05 |
| 38151. | 1284. | 19.0 | 70.6 | 74.2 | -0.373E-05 |
| 38152. | 1279. | 16.4 | 69.6 | 72.8 | -0.295E-05 |
| 38153. | 1272. | 13.5 | 68.8 | 71.5 | -0.347E-05 |
| 38154. | 1267. | 10.8 | 67.9 | 69.9 | -0.321E-05 |
| 38155. | 1262. | 8.1 | 67.0 | 68.3 | -0.360E-05 |
| 38156. | 1258. | 5.4 | 66.1 | 66.6 | -0.385E-05 |
| 38157. | 1252. | 2.5 | 65.5 | 65.1 | -0.334E-05 |
| 38158. | 1247. | -0.3 | 64.8 | 63.4 | -0.424E-05 |
| 38159. | 1244. | -3.2 | 64.3 | 61.8 | -0.308E-05 |
| 38160. | 1239. | -5.9 | 63.8 | 60.1 | -0.424E-05 |
| 38161. | 1233. | -8.8 | 63.7 | 58.6 | -0.295E-05 |
| 38162. | 1229. | -11.5 | 63.5 | 57.0 | -0.346E-05 |
| 38163. | 1225. | -14.2 | 63.6 | 55.5 | -0.372E-05 |
| 38164. | 1219. | -17.0 | 64.0 | 54.0 | -0.423E-05 |
| 38165. | 1215. | -19.6 | 64.3 | 52.6 | -0.411E-05 |
| 38166. | 1211. | -22.1 | 64.9 | 51.2 | -0.398E-05 |
| 38167. | 1206. | -24.7 | 65.6 | 50.0 | -0.385E-05 |

Table 5 (cont.)

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1960 IOTA 1

| MJD | Z | φ | ψ | D.R.A. | $\dot{P}$ |
|---|---|---|---|---|---|
| 38168. | 1201. | -27.1 | 66.4 | 48.8 | -0.436E-05 |
| 38169. | 1197. | -29.4 | 67.3 | 47.7 | -0.423E-05 |
| 38170. | 1192. | -31.7 | 68.4 | 46.8 | -0.423E-05 |
| 38171. | 1187. | -33.8 | 69.5 | 46.0 | -0.423E-05 |
| 38172. | 1183. | -35.8 | 70.7 | 45.3 | -0.372E-05 |
| 38173. | 1178. | -37.7 | 71.9 | 44.8 | -0.397E-05 |
| 38174. | 1174. | -39.4 | 73.0 | 44.3 | -0.423E-05 |
| 38175. | 1168. | -41.1 | 74.3 | 44.2 | -0.449E-05 |
| 38176. | 1163. | -42.5 | 75.6 | 44.2 | -0.410E-05 |
| 38177. | 1158. | -43.8 | 76.7 | 44.4 | -0.461E-05 |
| 38178. | 1153. | -44.8 | 77.8 | 44.5 | -0.436E-05 |
| 38179. | 1148. | -45.8 | 78.8 | 45.0 | -0.461E-05 |
| 38180. | 1144. | -46.5 | 79.7 | 45.6 | -0.336E-05 |
| 38181. | 1139. | -46.9 | 80.4 | 46.1 | -0.435E-05 |
| 38182. | 1134. | -47.2 | 81.0 | 46.7 | -0.397E-05 |
| 38183. | 1128. | -47.2 | 81.4 | 47.3 | -0.448E-05 |
| 38184. | 1124. | -47.1 | 81.8 | 48.0 | -0.269E-05 |
| 38185. | 1120. | -46.7 | 81.9 | 48.5 | -0.282E-05 |
| 38186. | 1115. | -46.1 | 81.8 | 49.0 | -0.128E-05 |
| 38187. | 1111. | -45.4 | 81.5 | 49.4 | -0.205E-05 |
| 38188. | 1107. | -44.4 | 81.0 | 49.7 | -0.192E-05 |
| 38189. | 1102. | -43.2 | 80.3 | 49.8 | -0.141E-05 |
| 38190. | 1099. | -41.9 | 79.4 | 49.6 | -0.142E-05 |
| 38191. | 1095. | -40.4 | 78.4 | 49.5 | -0.128E-05 |
| 38192. | 1092. | -38.8 | 77.0 | 49.0 | -0.174E-05 |

Table 5 (cont.)

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1960 IOTA 1

| MJD | Z | φ | ψ | D.R.A. | $\dot{P}$ |
|---|---|---|---|---|---|
| 38193. | 1089. | -37.0 | 75.6 | 48.5 | -0.165E-05 |
| 38194. | 1087. | -35.1 | 73.9 | 47.8 | -0.173E-05 |
| 38195. | 1084. | -33.2 | 72.0 | 46.9 | -0.179E-05 |
| 38196. | 1082. | -31.0 | 69.9 | 46.0 | -0.218E-05 |
| 38197. | 1081. | -28.8 | 67.7 | 44.8 | -0.139E-05 |
| 38198. | 1079. | -26.5 | 65.3 | 43.6 | -0.198E-05 |
| 38199. | 1078. | -24.0 | 62.8 | 42.3 | -0.156E-05 |
| 38200. | 1077. | -21.4 | 60.1 | 41.1 | -0.141E-05 |
| 38201. | 1076. | -18.9 | 57.3 | 39.5 | -0.179E-05 |
| 38202. | 1075. | -16.0 | 54.4 | 38.3 | -0.512E-06 |
| 38203. | 1074. | -13.6 | 51.4 | 36.4 | -0.115E-05 |
| 38204. | 1073. | -10.5 | 48.3 | 35.1 | -0.640E-06 |
| 38205. | 1073. | -7.8 | 45.1 | 33.3 | -0.640E-06 |
| 38206. | 1072. | -4.9 | 41.9 | 31.7 | -0.128E-05 |
| 38207. | 1072. | -2.2 | 38.7 | 29.9 | -0.512E-06 |
| 38208. | 1072. | 0.8 | 35.5 | 28.3 | -0.640E-06 |
| 38209. | 1071. | 3.6 | 32.4 | 26.6 | -0.115E-05 |
| 38210. | 1071. | 6.5 | 29.3 | 25.0 | -0.115E-05 |

Satellite 1960 Xi 1 (Explorer 8) Phyllis Stern

I. SAO smoothed elements

The following elements are based on 100 observations and are valid for the period April 1 through May 1, 1963.

$T_0 = 38135.0$ MJD

$\omega = (41^\circ.955 \pm 7) + (2^\circ.8167 \pm 7)t + {}^\circ.55 \times 10^{-4}t^2 + {}^\circ.3431 \cos \omega$

$\Omega = (234^\circ.857 \pm 2) - (3^\circ.3899 \pm 2)t + {}^\circ.14 \times 10^{-5}t^2 + {}^\circ.0143 \cos \omega$

$i = (49^\circ.940 \pm 1) + {}^\circ.117 \times 10^{-4}t + {}^\circ.0043 \sin \omega$

$e = (.11900 \pm 2) - .46 \times 10^{-5}t + .0007285 \sin \omega$

$M = (.89567 \pm 2) + (12.811465 \pm 2)t + (.722 \pm 4) \times 10^{-5}t^2$

$- (.26 \pm 4) \times 10^{-7}t^3 - .00087990 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.58$.

The following elements are based on 101 observations and are valid for the period May 1 through June 1, 1963.

$T_0 = 38165.0$ MJD

$\omega = (126^\circ.396 \pm 6) + (2^\circ.8130 \pm 9)t + {}^\circ.55 \times 10^{-4}t^2 + {}^\circ.3431 \cos \omega$

$\Omega = (133^\circ.163 \pm 1) - (3^\circ.3902 \pm 2)t + {}^\circ.14 \times 10^{-5}t^2 + {}^\circ.0143 \cos \omega$

$i = (49^\circ.9463 \pm 9) + {}^\circ.117 \times 10^{-4}t - {}^\circ.0043 \sin \omega$

$e = (.119031 \pm 8) - .46 \times 10^{-5}t + .0007285 \sin \omega$

$M = (.24607 \pm 1) + (12.811920 \pm 2)t + (.732 \pm 4) \times 10^{-5}t^2$

$- (.100 \pm 4) \times 10^{-6}t^3 - .00087990 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.45$.

The following elements are based on 82 observations and are valid for the period June 1 through July 1, 1963.

$T_0 = 38196.0$ MJD

$\omega = (213^\circ.677 \pm 9) + (2^\circ.8188 \pm 9)t + {}^\circ.55 \times 10^{-4}t^2 + {}^\circ.3431 \cos \omega$

$\Omega = (\ldots^\circ.079 \pm 2) - (3^\circ.3901 \pm 3)t + {}^\circ.14 \times 10^{-5}t^2 + .0143 \cos \omega$

$i = (49^\circ.951 \pm 2) + {}^\circ.117 \times 10^{-4}t - {}^\circ.0043 \sin \omega$

$e = (.118907 \pm 9) - .46 \times 10^{-5}t + .0007285 \sin \omega$

$M = (.42103 \pm 2) + (12.812293 \pm 2)t + (.689 \pm 3) \times 10^{-5}t^2$

$\quad - (.43 \pm 4) \times 10^{-7}t^3 - .00087990 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.50$.

| T (MJD) | ω | Ω | i | e | M | n | n'/2 | q | N | D | σ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38122.0 | 5.668 6 | 278.944 2 | 49.945 2 | .11909 2 | .34709 1 | 12.811302 3 | .68E-5 14 | 6.796052 | 30 | 6 | .43 |
| 38126.0 | 16.92 1 | 265.38 1 | 49.940 4 | .11916 9 | .59230 5 | 12.811353 7 | .38E-5 36 | 6.795508 | 12 | 6 | .40 |
| 38130.0 | 28.20 2 | 251.812 6 | 49.940 4 | .11940 6 | .83773 4 | 12.811415 5 | .44E-5 27 | 6.793645 | 15 | 6 | .40 |
| 38134.0 | 39.393 6 | 238.245 3 | 49.934 2 | .11948 1 | .08354 1 | 12.811469 1 | .14E-4 1 | 6.792960 | 24 | 6 | .35 |
| 38138.0 | 50.60 1 | 224.692 5 | 49.941 3 | .11955 3 | .32964 3 | 12.811544 2 | .95E-5 12 | 6.792387 | 28 | 6 | .67 |
| 38142.0 | 61.81 1 | 211.137 6 | 49.943 2 | .11966 3 | .57598 3 | 12.811599 3 | .56E-5 20 | 6.791566 | 22 | 6 | .49 |
| 38146.0 | 73.00 1 | 197.572 7 | 49.943 4 | .11965 5 | .82254 3 | 12.811634 3 | .11E-5 20 | 6.791627 | 16 | 6 | .45 |
| 38150.0 | 84.24 6 | 184.01 1 | 49.945 8 | .1196 3 | .0691 3 | 12.811679 3 | .72E-5 20 | 6.791686 | 14 | 6 | .46 |
| 38154.0 | 95.45 6 | 170.456 8 | 49.945 8 | .1196 2 | .3160 2 | 12.811744 4 | .93E-5 23 | 6.792171 | 9 | 6 | .30 |
| 38158.0 | 106.56 2 | 156.891 2 | 49.943 2 | .11968 2 | .56341 4 | 12.811792 4 | .13E-4 1 | 6.791349 | 12 | 6 | .29 |
| 38162.0 | 117.75 1 | 143.331 2 | 49.944 1 | .11963 2 | .81090 3 | 12.811875 1 | .93E-5 7 | 6.791652 | 37 | 6 | .46 |
| 38166.0 | 128.97 1 | 129.769 2 | 49.942 2 | .11957 1 | .05859 3 | 12.811941 2 | .78E-5 8 | 6.792104 | 29 | 6 | .62 |
| 38170.0 | 140.23 1 | 116.206 5 | 49.948 5 | .11943 2 | .30645 4 | 12.811998 3 | .5E-6 19 | 6.793142 | 16 | 6 | .52 |
| 38174.0 | 151.40 2 | 102.643 5 | 49.949 5 | .11934 4 | .55468 4 | 12.812028 3 | .22E-5 13 | 6.793843 | 18 | 6 | .52 |
| 38178.0 | 162.62 2 | 89.067 9 | 49.946 3 | .11921 2 | .80296 6 | 12.812065 2 | .57E-5 15 | 6.794850 | 16 | 6 | .55 |
| 38182.0 | 173.87 2 | 75.510 9 | 49.950 3 | .11905 2 | .05129 6 | 12.812111 2 | .56E-5 14 | 6.796104 | 18 | 6 | .48 |
| 38186.0 | 185.17 1 | 61.971 6 | 49.947 4 | .11885 1 | .29968 4 | 12.812156 2 | .47E-5 14 | 6.797612 | 11 | 6 | .33 |
| 38190.0 | 196.47 2 | 48.411 8 | 49.947 8 | .11873 2 | .54828 5 | 12.812213 3 | .81E-5 13 | 6.798532 | 13 | 6 | .41 |
| 38194.0 | 207.73 2 | 34.852 5 | 49.948 6 | .11858 2 | .79724 4 | 12.812267 2 | .88E-5 13 | 6.799621 | 12 | 6 | .51 |
| 38198.0 | 219.04 1 | 21.293 5 | 49.951 4 | .11844 3 | .04631 3 | 12.812335 3 | .95E-5 14 | 6.800716 | 15 | 6 | .39 |
| 38202.0 | 230.37 1 | 7.730 2 | 49.955 2 | .11838 1 | .29559 3 | 12.812395 2 | .30E-5 13 | 6.801159 | 25 | 6 | .43 |
| 38206.0 | 241.690 9 | 354.170 1 | 49.954 2 | .11825 1 | .54507 2 | 12.812423 2 | .64E-5 11 | 6.802106 | 25 | 6 | .42 |
| 38210.0 | 253.01 1 | 340.612 3 | 49.956 4 | .11821 3 | .79471 3 | 12.812471 3 | .28E-5 22 | 6.802411 | 14 | 6 | .46 |

Table 6

RELATIVE POSTITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1960 XI 1

| MJD | Z | φ | ψ | D.R.A. | $\dot{P}$ |
|---|---|---|---|---|---|
| | | PERIGEE IN SUNLIGHT | | | |
| 38122. | 418. | 4.3 | 88.6 | 271.1 | -0.829E-07 |
| 38126. | 418. | 12.9 | 97.0 | 261.3 | -0.463E-07 |
| 38130. | 418. | 21.2 | 103.6 | 252.0 | -0.536E-07 |
| 38134. | 420. | 29.1 | 107.7 | 243.6 | -0.171E-06 |
| 38138. | 422. | 36.3 | 109.0 | 236.5 | -0.116E-06 |
| 38142. | 423. | 42.4 | 107.9 | 231.4 | -0.682E-07 |
| 38146. | 425. | 47.1 | 105.6 | 228.4 | -0.134E-07 |
| 38150. | 426. | 49.6 | 103.2 | 227.6 | -0.877E-07 |
| 38154. | 426. | 49.6 | 102.1 | 227.5 | -0.113E-06 |
| 38158. | 425. | 47.2 | 103.4 | 226.5 | -0.158E-06 |
| 38162. | 423. | 42.6 | 107.2 | 223.5 | -0.113E-06 |
| | | PERIGEE IN EARTH SHADOW | | | |
| 38166. | 421. | 36.5 | 113.7 | 218.2 | -0.950E-07 |
| 38170. | 420. | 29.3 | 122.3 | 211.0 | -0.609E-08 |
| 38174. | 418. | 21.5 | 132.5 | 202.3 | -0.268E-07 |
| 38178. | 418. | 13.2 | 143.2 | 192.6 | -0.694E-07 |
| 38182. | 418. | 4.7 | 153.1 | 182.4 | -0.682E-07 |
| 38186. | 419. | -4.0 | 159.9 | 172.0 | -0.573E-07 |
| 38190. | 421. | -12.5 | 159.8 | 161.8 | -0.987E-07 |
| 38194. | 424. | -20.9 | 154.0 | 152.0 | -0.107E-06 |
| 38198. | 427. | -28.8 | 146.6 | 143.1 | -0.116E-06 |
| 38202. | 430. | -36.1 | 139.9 | 135.7 | -0.366E-07 |
| 38206. | 433. | -42.4 | 134.8 | 130.2 | -0.780E-07 |
| 38210. | 436. | -47.1 | 131.7 | 127.0 | -0.341E-07 |

I. SAO smoothed elements

The following elements are based on 114 observations and are valid for the period April 1 through April 15, 1963.

$T_0 = 38126.0$ MJD

$\omega = (240^\circ.605 \pm 6) + (4^\circ.868 \pm 1)t + {}^\circ.99 \times 10^{-4}t^2 + {}^\circ.2484 \cos \omega$

$\Omega = (205^\circ.096 \pm 4) - (3^\circ.7325 \pm 7)t - {}^\circ.000248t^2 + {}^\circ.0066 \cos \omega$

$i = (38^\circ.888 \pm 1) + {}^\circ.000325t - {}^\circ.0045 \sin \omega$

$e = (.12391 \pm 3) + (.78 \pm 5) \times 10^{-4}t + .41 \times 10^{-6}t^2 + .0005258 \sin \omega$

$M = (.02223 \pm 2) + (12.288177 \pm 4)t + (.0002559 \pm 5)t^2 - (.22 \pm 1) \times 10^{-5}t^3$

$+ (.28 \pm 1) \times 10^{-6}t^4 - .0006974 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.83$.

The following elements are based on 182 observations and are valid for the period April 15 through May 1, 1963.

$T_0 = 38141.0$ MJD

$\omega = (313^\circ.638 \pm 3) + (4^\circ.8758 \pm 6)t + {}^\circ.99 \times 10^{-4}t^2 + {}^\circ.2484 \cos \omega$

$\Omega = (149^\circ.051 \pm 2) - (3^\circ.7398 \pm 3)t - {}^\circ.000248t^2 + {}^\circ.0066 \cos \omega$

$i = (38^\circ.8980 \pm 6) + {}^\circ.000325t - {}^\circ.0045 \sin \omega$

$e = (.12505 \pm 2) + (.55 \pm 3) \times 10^{-4}t + .41 \times 10^{-6}t^2 + .0005258 \sin \omega$

$M = (.404369 \pm 8) + (12.296080 \pm 2)t + (.0002319 \pm 2)t^2$

$- (.271 \pm 4) \times 10^{-5}t^3 + (.71 \pm 4) \times 10^{-7}t^4 - .0006974 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.38$.

The following elements are based on 135 observations and are valid for the period May 1 through May 16, 1963.

$T_0 = 38156.0$ MJD

$\omega = (26^\circ.901 \pm 8) + (4^\circ.899 \pm 2)t - {}^\circ.000487t^2 + {}^\circ.2484 \cos \omega$

$\Omega = (92^\circ.911 \pm 3) - (3^\circ.7457 \pm 7)t - {}^\circ.000325t^2 + {}^\circ.0066 \cos \omega$

$i = (38^\circ.905 \pm 1) + {}^\circ.000342t - {}^\circ.0045 \sin \omega$

$e = (.12587 \pm 4) + (.48 \pm 7) \times 10^{-4}t + .17 \times 10^{-6}t^2 + .0005258 \sin \omega$

$M = (.89772 \pm 3) + (12.304044 \pm 5)t + (.0003976 \pm 4)t^2$

$+ (.580 \pm 8) \times 10^{-5}t^3 - (.148 \pm 9) \times 10^{-6}t^4 - .0006974 \cos \omega$

Standard error of one observation: $\sigma = \pm 2'.55$.

The following elements are based on 119 observations and are valid for the period May 16 through June 1, 1963.

$T_0 = 38173.0$ MJD

$\omega = (110^\circ.241 \pm 6) + (4^\circ.912 \pm 1)t - {}^\circ.000487t^2 + {}^\circ.2484 \cos \omega$

$\Omega = (29^\circ.126 \pm 4) - (3^\circ.7586 \pm 5)t - {}^\circ.000325t^2 + {}^\circ.0066 \cos \omega$

$i = (38^\circ.907 \pm 2) + {}^\circ.000342t - {}^\circ.0045 \sin \omega$

$e = (.12681 \pm 3) + (.65 \pm 5) \times 10^{-4}t + .17 \times 10^{-6}t^2 + .0005258 \sin \omega$

$M = (.18781 \pm 2) + (12.317370 \pm 3)t + (.0002992 \pm 4)t^2$

$- (.46 \pm 39) \times 10^{-7}t^3 + (.432 \pm 7) \times 10^{-6}t^4 - .0006974 \cos \omega$

Standard error of one observation: $\sigma = \pm 2'.20$.

The following elements are based on 49 observations and are valid for the period June 1 through June 15, 1963.

$T_0 = 38187.0$ MJD

$\omega = (178^\circ.902 \pm 7) + (4^\circ.903 \pm 2)t - {}^\circ.000487t^2 + {}^\circ.2484 \cos \omega$

$\Omega = (336^\circ.459 \pm 3) - (3^\circ.767 \pm 1)t - {}^\circ.000325t^2 + {}^\circ.0066 \cos \omega$

$i = (38^\circ.907 \pm 3) + {}^\circ.000342t - {}^\circ.0045 \sin \omega$

$e = (.12767 \pm 4) + (.49 \pm 13) \times 10^{-4}t + .17 \times 10^{-6}t^2 + .0005258 \sin \omega$

$M = (.70006 \pm 2) + (12.327689 \pm 9)t + (.000428 \pm 1)t^2$

$+ (.196 \pm 8) \times 10^{-4}t^3 + (.21 \pm 1) \times 10^{-5}t^4 - .0006974 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.65$.

The following elements are based on 147 observations and are valid for the period June 15 through July 1, 1963.

$T_0 = 38203.0$ MJD

$$\omega = (257^\circ.563 \pm 9) + (4^\circ.910 \pm 2)t - {}^\circ.000487t^2 + {}^\circ.2484 \cos \omega$$

$$\Omega = (276^\circ.084 \pm 5) - (3^\circ.7786 \pm 9)t - {}^\circ.000325t^2 + {}^\circ.0066 \cos \omega$$

$$i = (38^\circ.911 \pm 1) + {}^\circ.000342t - {}^\circ.0045 \sin \omega$$

$$e = (.12884 \pm 4) + (.77 \pm 8) \times 10^{-4}t + .17 \times 10^{-6}t^2 + .0005258 \sin \omega$$

$$M = (.05675 \pm 3) + (12.340895 \pm 5)t + (.0002810 \pm 8)t^2$$
$$- (.419 \pm 5) \times 10^{-5}t^3 + (.49 \pm 1) \times 10^{-6}t^4 - .0006974 \cos \omega$$

Standard error of one observation: $\sigma = \pm 2^{\prime}.88$.

| T (MJD) | ω | Ω | i | e | M | n | n'/2 | q | N | D | ^ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38120.0 | 211.163 6 | 227.476 4 | 38.889 2 | .12318 3 | .30342 1 | 12.28501 1 | .252E-3 2 | 6.955612 | 32 | 4 | .37 |
| 38121.0 | 216.064 6 | 223.744 4 | 38.886 2 | .12327 3 | .58863 2 | 12.28551 1 | .248E-3 2 | 6.954739 | 31 | 4 | .38 |
| 38122.0 | 220.946 7 | 220.017 4 | 38.889 2 | .12327 3 | .87439 2 | 12.28606 1 | .238E-3 2 | 6.954557 | 35 | 4 | .41 |
| 38123.0 | 225.832 7 | 216.278 4 | 38.889 2 | .12327 3 | .16064 2 | 12.28654 2 | .239E-3 3 | 6.954337 | 34 | 4 | .42 |
| 38124.0 | 230.719 8 | 212.550 5 | 38.888 2 | .12335 4 | .44735 2 | 12.28707 1 | .277E-3 2 | 6.953472 | 36 | 4 | .47 |
| 38125.0 | 235.605 9 | 208.818 6 | 38.892 3 | .12337 4 | .73463 2 | 12.28758 1 | .281E-3 2 | 6.953174 | 30 | 4 | .44 |
| 38126.0 | 240.502 8 | 205.087 5 | 38.893 2 | .12348 6 | .02245 2 | 12.28816 2 | .273E-3 4 | 6.952055 | 21 | 4 | .40 |
| 38127.0 | 245.377 7 | 201.363 5 | 38.896 2 | .12348 4 | .31087 2 | 12.28870 1 | .259E-3 2 | 6.951871 | 24 | 4 | .41 |
| 38128.0 | 250.276 7 | 197.625 5 | 38.895 1 | .12358 4 | .59975 2 | 12.28923 1 | .253E-3 3 | 6.950839 | 28 | 4 | .41 |
| 38129.0 | 255.160 6 | 193.898 4 | 38.895 1 | .12364 3 | .88917 1 | 12.28970 1 | .243E-3 2 | 6.950244 | 30 | 4 | .39 |
| 38130.0 | 260.052 5 | 190.162 4 | 38.8935 9 | .12377 2 | .179062 9 | 12.290165 9 | .239E-3 2 | 6.948999 | 34 | 4 | .34 |
| 38131.0 | 264.940 5 | 186.429 4 | 38.8949 9 | .12385 2 | .46944 1 | 12.290703 9 | .257E-3 2 | 6.948147 | 35 | 4 | .38 |
| 38132.0 | 269.834 5 | 182.691 4 | 38.894 1 | .12397 3 | .76032 1 | 12.29124 1 | .282E-3 4 | 6.947044 | 36 | 4 | .43 |
| 38133.0 | 274.710 6 | 178.958 4 | 38.895 1 | .12401 3 | .05180 1 | 12.29184 1 | .312E-3 3 | 6.946478 | 42 | 4 | .46 |
| 38134.0 | 279.597 5 | 175.219 3 | 38.894 1 | .12401 2 | .34389 1 | 12.292457 8 | .307E-3 2 | 6.946233 | 45 | 4 | .43 |
| 38135.0 | 284.481 5 | 171.483 3 | 38.895 1 | .12409 2 | .63661 1 | 12.293008 9 | .279E-3 2 | 6.945435 | 56 | 4 | .56 |
| 38136.0 | 289.374 4 | 167.741 2 | 38.8971 9 | .12419 1 | .929866 7 | 12.293578 7 | .251E-3 1 | 6.944355 | 48 | 4 | .36 |
| 38137.0 | 294.264 5 | 164.006 3 | 38.899 1 | .12431 2 | .223623 9 | 12.294075 9 | .254E-3 2 | 6.943264 | 52 | 4 | .41 |
| 38138.0 | 299.147 5 | 160.268 3 | 38.900 1 | .12438 3 | .51792 1 | 12.294604 7 | .262E-3 1 | 6.942463 | 50 | 4 | .42 |
| 38139.0 | 304.040 5 | 156.526 3 | 38.900 1 | .12443 3 | .81272 1 | 12.295140 9 | .260E-3 2 | 6.941870 | 44 | 4 | .40 |
| 38140.0 | 308.910 6 | 152.797 3 | 38.900 1 | .12463 4 | .10808 1 | 12.29560 1 | .249E-3 2 | 6.940104 | 48 | 4 | .46 |
| 38141.0 | 313.803 5 | 149.057 3 | 38.900 1 | .12468 3 | .40389 1 | 12.29610 1 | .229E-3 3 | 6.939523 | 49 | 4 | .44 |
| 38142.0 | 318.684 5 | 145.320 3 | 38.899 1 | .12475 3 | .70099 1 | 12.29658 1 | .229E-3 3 | 6.938821 | 46 | 4 | .41 |
| 38143.0 | 323.558 6 | 141.578 4 | 38.902 1 | .12486 3 | .99699 2 | 12.29706 1 | .224E-3 2 | 6.937790 | 46 | 4 | .39 |
| 38144.0 | 328.453 6 | 137.837 4 | 38.901 1 | .12494 5 | .29416 2 | 12.29743 2 | .196E-3 2 | 6.937006 | 46 | 4 | .39 |
| 38145.0 | 333.340 5 | 134.093 3 | 38.903 1 | .12510 4 | .59173 1 | 12.297799 9 | .195E-3 2 | 6.935578 | 51 | 4 | .41 |
| 38146.0 | 338.227 4 | 130.350 2 | 38.9044 8 | .12522 3 | .88969 1 | 12.29817 1 | .206E-3 2 | 6.934512 | 58 | 4 | .37 |
| 38147.0 | 343.117 4 | 126.608 2 | 38.9037 7 | .12533 3 | .18805 1 | 12.29859 1 | .212E-3 2 | 6.933494 | 67 | 4 | .40 |
| 38148.0 | 348.002 4 | 122.868 2 | 38.9041 8 | .12540 3 | .48686 1 | 12.299001 8 | .202E-3 1 | 6.932786 | 76 | 4 | .46 |
| 38149.0 | 352.886 6 | 119.126 3 | 38.904 1 | .12552 3 | .78605 2 | 12.29943 2 | .212E-3 2 | 6.931640 | 55 | 4 | .61 |

| T (MJD) | ω | Ω | i | e | M | n | n'/2 | q | N | D | σ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38150.0 | 357.79 1 | 115.382 4 | 38.905 2 | .12560 5 | .08564 3 | 12.29996 3 | .277E-3 3 | 6.930789 | 60 | 4 | .95 |
| 38151.0 | 2.673 5 | 111.637 2 | 38.9050 9 | .12566 2 | .38583 2 | 12.30054 1 | .339E-3 1 | 6.930087 | 65 | 4 | .40 |
| 38152.0 | 7.559 6 | 107.896 2 | 38.905 1 | .12580 3 | .68671 2 | 12.30123 2 | .334E-3 2 | 6.928766 | 64 | 4 | .43 |
| 38153.0 | 12.437 7 | 104.152 3 | 38.904 1 | .12586 3 | .98828 3 | 12.30191 2 | .351E-3 2 | 6.927983 | 59 | 4 | .49 |
| 38154.0 | 17.331 8 | 100.410 3 | 38.904 1 | .12595 4 | .29050 3 | 12.30256 2 | .372E-3 3 | 6.927096 | 48 | 4 | .50 |
| 38155.0 | 22.226 9 | 96.662 4 | 38.903 2 | .12604 4 | .59346 3 | 12.30330 2 | .374E-3 2 | 6.926081 | 49 | 4 | .50 |
| 38156.0 | 27.11 1 | 92.915 4 | 38.903 2 | .12611 4 | .89719 3 | 12.30406 2 | .374E-3 3 | 6.925232 | 42 | 4 | .50 |
| 38157.0 | 32.005 8 | 89.172 4 | 38.903 2 | .12625 3 | .20163 2 | 12.30489 2 | .398E-3 2 | 6.923842 | 43 | 4 | .45 |
| 38158.0 | 36.882 7 | 85.429 3 | 38.905 1 | .12628 3 | .50692 2 | 12.30566 2 | .420E-3 3 | 6.923307 | 40 | 4 | .34 |
| 38159.0 | 41.759 7 | 81.680 3 | 38.905 1 | .12633 3 | .81306 2 | 12.30653 1 | .459E-3 2 | 6.922553 | 41 | 4 | .44 |
| 38160.0 | 46.652 5 | 77.932 3 | 38.9040 9 | .12643 2 | .12008 1 | 12.30747 1 | .469E-3 1 | 6.921429 | 39 | 4 | .34 |
| 38161.0 | 51.536 6 | 74.184 3 | 38.903 1 | .12653 2 | .42805 2 | 12.30840 1 | .465E-3 1 | 6.920269 | 33 | 4 | .37 |
| 38162.0 | 56.424 6 | 70.432 3 | 38.903 1 | .12664 2 | .73695 1 | 12.30932 1 | .469E-3 1 | 6.919046 | 33 | 4 | .40 |
| 38163.0 | 61.331 8 | 66.686 5 | 38.903 1 | .12675 3 | .04673 2 | 12.31020 2 | .461E-3 2 | 6.917892 | 27 | 4 | .56 |
| 38164.0 | 66.210 9 | 62.932 6 | 38.903 2 | .12677 4 | .35753 2 | 12.31115 2 | .426E-3 3 | 6.917352 | 31 | 4 | .72 |
| 38165.0 | 71.083 6 | 59.174 4 | 38.903 1 | .12684 2 | .66921 1 | 12.31198 1 | .377E-3 2 | 6.916488 | 34 | 4 | .47 |
| 38166.0 | 75.956 6 | 55.422 3 | 38.902 1 | .12689 2 | .98162 1 | 12.31271 1 | .367E-3 1 | 6.915801 | 40 | 4 | .45 |
| 38167.0 | 80.839 6 | 51.667 3 | 38.902 1 | .12695 2 | .29474 1 | 12.31341 1 | .357E-3 1 | 6.915063 | 43 | 4 | .42 |
| 38168.0 | 85.717 5 | 47.911 3 | 38.902 1 | .12702 2 | .60857 1 | 12.31413 1 | .360E-3 2 | 6.914280 | 36 | 4 | .44 |
| 38169.0 | 90.601 7 | 44.155 4 | 38.902 2 | .12708 3 | .92312 1 | 12.31485 1 | .363E-3 2 | 6.913485 | 37 | 4 | .57 |
| 38170.0 | 95.490 8 | 40.399 5 | 38.903 2 | .12720 4 | .23836 2 | 12.31558 2 | .352E-3 3 | 6.912269 | 31 | 4 | .68 |
| 38171.0 | 100.366 8 | 36.641 5 | 38.902 2 | .12721 5 | .55437 2 | 12.31624 1 | .318E-3 3 | 6.911949 | 30 | 4 | .62 |
| 38172.0 | 105.254 7 | 32.881 5 | 38.902 2 | .12726 4 | .87097 2 | 12.31684 1 | .302E-3 3 | 6.911329 | 30 | 4 | .59 |
| 38173.0 | 110.13 1 | 29.132 7 | 38.901 3 | .12734 5 | .18815 2 | 12.31740 2 | .286E-3 4 | 6.910477 | 24 | 4 | .62 |
| 38174.0 | 115.02 1 | 25.379 9 | 38.900 2 | .12740 6 | .50589 2 | 12.31796 2 | .275E-3 5 | 6.909818 | 23 | 4 | .54 |
| 38175.0 | 119.87 2 | 21.617 9 | 38.903 3 | .12751 6 | .82429 4 | 12.31865 4 | .311E-3 7 | 6.908653 | 21 | 4 | .53 |
| 38176.0 | 124.76 4 | 17.84 1 | 38.906 3 | .12751 7 | .1433 2 | 12.3193 1 | .312E-3 7 | 6.908478 | 21 | 4 | .54 |
| 38177.0 | 129.76 2 | 14.08 1 | 38.902 3 | .12760 5 | .46244 7 | 12.32008 6 | .355E-3 6 | 6.907442 | 28 | 4 | .60 |
| 38178.0 | 134.569 9 | 10.325 5 | 38.902 2 | .12757 4 | .78295 2 | 12.32063 4 | .402E-3 4 | 6.907425 | 33 | 4 | .50 |
| 38179.0 | 139.45 1 | 6.566 5 | 38.903 3 | .12764 4 | .10403 3 | 12.32146 3 | .404E-3 6 | 6.906620 | 31 | 4 | .51 |
| 38180.0 | 144.341 8 | 2.811 5 | 38.901 2 | .12766 3 | .42587 2 | 12.32219 1 | .386E-3 3 | 6.906178 | 34 | 4 | .45 |

| T (MJD) | ω | Ω | i | e | M | n | n'/2 | q | N | D | σ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38181.0 | 149.37 6 | 359.040 7 | 38.902 4 | .12779 9 | .7480 2 | 12.3234 2 | .400E-3 5 | 6.904712 | 28 | 4 | .46 |
| 38182.0 | 154.16 1 | 355.275 7 | 38.905 4 | .12765 4 | .07180 2 | 12.3239 4 | .424E-3 5 | 6.905615 | 22 | 4 | .48 |
| 38183.0 | 159.1 1 | 351.514 7 | 38.905 5 | .1277 1 | .3961 4 | 12.3247 4 | .413E-3 5 | 6.905124 | 23 | 4 | .48 |
| 38184.0 | 163.949 8 | 347.743 4 | 38.909 4 | .12775 5 | .72115 3 | 12.32540 1 | .385E-3 3 | 6.[illegible]87 | 20 | 4 | .53 |
| 38185.0 | 168.86 1 | 343.981 4 | 38.911 5 | .12777 7 | .04696 3 | 12.32624 4 | .334E-3 8 | 6.903793 | 20 | 4 | .68 |
| 38186.0 | 173.76 1 | 340.214 5 | 38.912 5 | .12781 7 | .37350 3 | 12.32683 3 | .34E-3 1 | 6.903253 | 20 | 4 | .78 |
| 38187.0 | 178.68 2 | 336.440 9 | 38.92 1 | .1277 1 | .70071 5 | 12.32760 5 | .40E-3 1 | 6.903832 | 20 | 4 | 1.42 |
| 38188.0 | 183.565 9 | 332.683 4 | 38.905 5 | .12780 5 | .02884 2 | 12.32863 2 | .522E-3 5 | 6.902649 | 22 | 4 | .68 |
| 38189.0 | 188.499 9 | 328.913 4 | 38.907 4 | .12782 5 | .35799 2 | 12.32975 2 | .488E-3 9 | 6.902110 | 20 | 4 | .58 |
| 38190.0 | 193.420 8 | 325.143 4 | 38.908 3 | .12781 3 | .68815 2 | 12.33060 1 | .456E-3 2 | 6.901860 | 25 | 4 | .54 |
| 38191.0 | 198.322 8 | 321.376 5 | 38.908 3 | .12783 3 | .01925 2 | 12.33152 2 | .434E-3 2 | 6.901338 | 27 | 4 | .53 |
| 38192.0 | 203.268 6 | 317.605 4 | 38.909 2 | .12785 2 | .35112 1 | 12.33238 1 | .433E-3 3 | 6.900858 | 23 | 4 | .39 |
| 38193.0 | 208.182 9 | 313.833 6 | 38.910 4 | .12790 4 | .68392 2 | 12.33324 2 | .438E-3 4 | 6.900148 | 24 | 4 | .60 |
| 38194.0 | 213.103 7 | 310.061 5 | 38.909 3 | .12799 3 | .01759 2 | 12.33408 2 | .434E-3 3 | 6.899125 | 23 | 4 | .48 |
| 38195.0 | 218.041 7 | 306.296 5 | 38.911 3 | .12802 4 | .35207 2 | 12.33498 1 | .427E-3 3 | 6.898545 | 24 | 4 | .50 |
| 38196.0 | 222.98 1 | 302.517 6 | 38.907 4 | .12808 4 | .68744 2 | 12.33589 3 | .386E-3 6 | 6.897730 | 26 | 4 | .63 |
| 38197.0 | 227.885 8 | 298.745 5 | 38.912 3 | .12812 3 | .02366 2 | 12.33665 1 | .397E-3 4 | 6.897106 | 31 | 4 | .59 |
| 38198.0 | 232.818 4 | 294.966 3 | 38.912 2 | .12817 2 | .360604 8 | 12.33745 1 | .432E-3 3 | 6.896457 | 25 | 4 | .29 |
| 38199.0 | 237.753 7 | 291.190 5 | 38.914 3 | .12818 3 | .69839 2 | 12.33825 2 | .421E-3 4 | 6.8960[illegible] | 31 | 4 | .50 |
| 38200.0 | 242.664 6 | 287.412 5 | 38.909 3 | .12831 3 | .03711 2 | 12.33912 1 | .379E-3 4 | 6.894722 | 37 | 4 | .51 |
| 38201.0 | 247.605 6 | 283.639 5 | 38.914 3 | .12822 3 | .37651 2 | 12.33991 3 | .322E-3 3 | 6.895109 | 40 | 4 | .41 |
| 38202.0 | 252.538 6 | 279.859 5 | 38.912 3 | .12829 3 | .71656 2 | 12.34040 2 | .284E-3 3 | 6.894420 | 41 | 4 | .44 |
| 38203.0 | 257.446 5 | 276.083 5 | 38.913 2 | .12837 3 | .05723 2 | 12.340925 9 | .252E-3 2 | 6.893540 | 39 | 4 | .36 |
| 38204.0 | 262.365 8 | 272.309 6 | 38.915 3 | .12841 4 | .39836 2 | 12.34144 2 | .240E-3 4 | 6.893029 | 37 | 4 | .42 |
| 38205.0 | 267.283 9 | 268.530 7 | 38.917 3 | .12846 5 | .73997 3 | 12.34192 2 | .262E-3 3 | 6.892439 | 36 | 4 | .55 |
| 38206.0 | 272.216 7 | 264.742 6 | 38.913 2 | .12862 3 | .08204 2 | 12.34242 2 | .323E-3 3 | 6.891017 | 35 | 4 | .42 |
| 38207.0 | 277.168 7 | 260.967 5 | 38.916 2 | .12867 3 | .42468 2 | 12.34312 2 | .317E-3 3 | 6.890469 | 36 | 4 | .40 |
| 38208.0 | 282.112 8 | 257.183 6 | 38.915 2 | .12873 3 | .76800 2 | 12.34366 3 | .286E-3 3 | 6.889680 | 37 | 4 | .40 |
| 38209.0 | 287.10 3 | 253.406 5 | 38.9184 8 | .12897 9 | .1117 1 | 12.3440 1 | .279E-3 3 | 6.887640 | 38 | 4 | .44 |
| 38210.0 | 291.99 1 | 249.623 3 | 38.9180 5 | .12898 8 | .45630 1 | 12.34492 6 | .289E-3 3 | 6.887227 | 43 | 4 | .39 |

Table 7

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1961 DELTA 1

| MJD | Z | φ | ψ | D.R.A. | Ṗ |
|---|---|---|---|---|---|
| | | PERIGEE IN SUNLIGHT | | | |
| 38120. | 579. | -19.0 | 66.1 | 63.0 | -0.334E-05 |
| 38121. | 579. | -21.7 | 66.7 | 62.7 | -0.329E-05 |
| 38122. | 580. | -24.3 | 67.5 | 62.5 | -0.315E-05 |
| 38123. | 580. | -26.8 | 68.4 | 62.5 | -0.317E-05 |
| 38124. | 580. | -29.1 | 69.6 | 62.8 | -0.367E-05 |
| 38125. | 581. | -31.2 | 70.8 | 63.2 | -0.372E-05 |
| 38126. | 580. | -33.1 | 72.3 | 63.9 | -0.362E-05 |
| 38127. | 580. | -34.8 | 73.8 | 64.8 | -0.343E-05 |
| 38128. | 580. | -36.2 | 75.4 | 65.9 | -0.335E-05 |
| 38129. | 580. | -37.4 | 77.0 | 67.2 | -0.322E-05 |
| 38130. | 579. | -38.2 | 78.6 | 68.6 | -0.316E-05 |
| 38131. | 578. | -38.7 | 80.2 | 70.2 | -0.340E-05 |
| 38132. | 577. | -38.9 | 81.6 | 71.8 | -0.373E-05 |
| 38133. | 577. | -38.7 | 83.0 | 73.4 | -0.413E-05 |
| 38134. | 576. | -38.3 | 84.3 | 75.0 | -0.406E-05 |
| 38135. | 575. | -37.4 | 85.4 | 76.4 | -0.369E-05 |
| 38136. | 573. | -36.3 | 86.3 | 77.7 | -0.332E-05 |
| 38137. | 572. | -34.9 | 87.0 | 78.8 | -0.336E-05 |
| 38138. | 571. | -33.3 | 87.5 | 79.7 | -0.347E-05 |
| 38139. | 569. | -31.4 | 8[illegible].7 | 80.3 | -0.344E-05 |
| 38140. | 567. | -29.3 | 87.7 | 80.8 | -0.329E-05 |
| 38141. | 566. | -27.0 | 87.5 | 81.0 | -0.303E-05 |

Table 7 (cont.)

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1961 DELTA 1

| MJD | Z | φ | ψ | D.R.A. | $\dot{P}$ |
|---|---|---|---|---|---|
| 38142. | 564. | -24.5 | 87.0 | 81.0 | -0.303E-05 |
| 38143. | 562. | -21.9 | 86.3 | 80.8 | -0.296E-05 |
| 38144. | 561. | -19.2 | 85.5 | 80.5 | -0.259E-05 |
| 38145. | 559. | -16.4 | 84.4 | 80.0 | -0.258E-05 |
| 38146. | 557. | -13.5 | 83.1 | 79.4 | -0.272E-05 |
| 38147. | 556. | -10.5 | 81.7 | 78.7 | -0.280E-05 |
| 38148. | 555. | -7.5 | 80.2 | 77.9 | -0.267E-05 |
| 38149. | 553. | -4.5 | 78.6 | 77.0 | -0.280E-05 |
| 38150. | 552. | -1.4 | 77.0 | 76.1 | -0.366E-05 |
| 38151. | 552. | 1.7 | 75.3 | 75.2 | -0.448E-05 |
| 38152. | 551. | 4.7 | 73.7 | 74.4 | -0.441E-05 |
| 38153. | 550. | 7.8 | 72.1 | 73.5 | -0.464E-05 |
| 38154. | 549. | 10.8 | 70.6 | 72.7 | -0.492E-05 |
| 38155. | 549. | 13.7 | 69.2 | 72.0 | -0.494E-05 |
| 38156. | 549. | 16.6 | 68.0 | 71.4 | -0.494E-05 |
| 38157. | 548. | 19.4 | 66.9 | 70.9 | -0.526E-05 |
| 38158. | 548. | 22.1 | 66.0 | 70.5 | -0.555E-05 |
| 38159. | 548. | 24.7 | 65.3 | 70.3 | -0.606E-05 |
| 38160. | 548. | 27.2 | 64.9 | 70.3 | -0.619E-05 |
| 38161. | 547. | 29.5 | 64.6 | 70.5 | -0.614E-05 |
| 38162. | 547. | 31.5 | 64.6 | 70.9 | -0.619E-05 |
| 38163. | 546. | 33.4 | 64.8 | 71.5 | -0.608E-05 |
| 38164. | 546. | 35.1 | 65.2 | 72.3 | -0.562E-05 |
| 38165. | 546. | 36.4 | 65.8 | 73.3 | -0.497E-05 |
| 38166. | 545. | 37.5 | 66.5 | 74.5 | -0.484E-05 |

Table 7 (cont.)

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1961 DELTA 1

| MJD | Z | φ | ψ | D.R.A. | $\dot{P}$ |
|---|---|---|---|---|---|
| 38167. | 545. | 38.3 | 67.3 | 75.9 | -0.471E-05 |
| 38168. | 544. | 38.8 | 68.3 | 77.4 | -0.475E-05 |
| 38169. | 544. | 38.9 | 69.3 | 78.9 | -0.479E-05 |
| 38170. | 542. | 38.7 | 70.4 | 80.4 | -0.464E-05 |
| 38171. | 542. | 38.2 | 71.4 | 81.8 | -0.419E-05 |
| 38172. | 541. | 37.3 | 72.5 | 83.2 | -0.398E-05 |
| 38173. | 540. | 36.1 | 73.6 | 84.3 | -0.377E-05 |
| 38174. | 538. | 34.7 | 74.6 | 85.3 | -0.362E-05 |
| 38175. | 537. | 33.0 | 75.5 | 86.0 | -0.410E-05 |
| 38176. | 536. | 31.1 | 76.4 | 86.5 | -0.411E-05 |
| 38177. | 534. | 28.9 | 77.3 | 86.9 | -0.468E-05 |
| 38178. | 533. | 26.6 | 78.0 | 86.9 | -0.530E-05 |
| 38179. | 532. | 24.1 | 78.6 | 86.8 | -0.532E-05 |
| 38180. | 531. | 21.5 | 79.1 | 86.5 | -0.508E-05 |
| 38181. | 529. | 18.7 | 79.7 | 86.1 | -0.527E-05 |
| 38182. | 529. | 15.9 | 80.0 | 85.4 | -0.558E-05 |
| 38183. | 528. | 12.9 | 80.4 | 84.8 | -0.544E-05 |
| 38184. | 527. | 10.0 | 80.6 | 83.9 | -0.507E-05 |
| 38185. | 526. | 7.0 | 80.9 | 83.0 | -0.440E-05 |
| 38186. | 525. | 3.9 | 81.2 | 82.1 | -0.448E-05 |
| 38187. | 525. | 0.8 | 81.5 | 81.1 | -0.526E-05 |
| 38188. | 524. | -2.2 | 81.8 | 80.1 | -0.687E-05 |
| 38189. | 524. | -5.3 | 82.2 | 79.2 | -0.642E-05 |
| 38190. | 524. | -8.4 | 82.6 | 78.2 | -0.600E-05 |
| 38191. | 524. | -11.4 | 83.1 | 77.4 | -0.571E-05 |
| 38192. | 524. | -14.4 | 83.7 | 76.6 | -0.569E-05 |

Table 7 (cont.)

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1961 Delta 1

| MJD | Z | $\varphi$ | $\psi$ | D.R.A. | $\dot{P}$ |
|---|---|---|---|---|---|
| 38193. | 524. | -17.3 | 84.5 | 75.9 | -0.576E-05 |
| 38194. | 523. | -20.1 | 85.3 | 75.4 | -0.571E-05 |
| 38195. | 523. | -22.8 | 86.2 | 75.0 | -0.561E-05 |
| 38196. | 523. | -25.4 | 87.3 | 74.8 | -0.507E-05 |
| 38197. | 523. | -27.8 | 88.4 | 74.8 | -0.522E-05 |
| 38198. | 523. | -30.0 | 89.6 | 75.0 | -0.568E-05 |
| 38199. | 524. | -32.1 | 90.9 | 75.4 | -0.553E-05 |
| 38200. | 523. | -33.9 | 92.2 | 76.0 | -0.498E-05 |
| 38201. | 524. | -35.5 | 93.5 | 76.9 | -0.423E-05 |
| 38202. | 524. | -36.8 | 94.9 | 78.0 | -0.373E-05 |
| 38203. | 523. | -37.8 | 96.2 | 79.2 | -0.331E-05 |
| 38204. | 523. | -38.5 | 97.5 | 80.6 | -0.315E-05 |
| 38205. | 523. | -38.9 | 98.7 | 82.0 | -0.344E-05 |
| 38206. | 521. | -38.9 | 99.7 | 83.6 | -0.424E-05 |
| 38207. | 520. | -38.6 | 100.7 | 85.1 | -0.416E-05 |
| 38208. | 519. | -37.9 | 101.5 | 86.5 | -0.375E-05 |
| 38209. | 517. | -36.9 | 102.1 | 87.8 | -0.366E-05 |
| 38210. | 516. | -35.6 | 102.4 | 88.9 | -0.379E-05 |

Satellite 1962 Alpha Epsilon 1 (Telstar 1) Maria Gutierrez

I. SAO smoothed elements

The following elements are based on 122 observations and are valid for the period April 1 through May 1, 1963.

$T_0 = 38134.0$ MJD

$\omega = (358^\circ.371 \pm 6) + (1^\circ.9871 \pm 6)t - {}^\circ.62 \times 10^{-5}t^2 + {}^\circ.1142 \cos \omega$

$\Omega = (45^\circ.699 \pm 2) - (1^\circ.8588 \pm 2)t - {}^\circ.71 \times 10^{-6}t^2 + {}^\circ.0145 \cos \omega$

$i = (44^\circ.808 \pm 1) - {}^\circ.83 \times 10^{-4}t - {}^\circ.0077 \sin \omega$

$e = (.24240 \pm 1) + .87 \times 10^{-6}t + .0005183 \sin \omega$

$M = (.82816 \pm 2) + (9.126180 \pm 2)t + (.47 \pm 38) \times 10^{-7}t^2$

$+ (.77 \pm 44) \times 10^{-8}t^3 - .0003171 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.03$.

The following elements are based on 160 observations and are valid for the period May 1 through June 1, 1963.

$T_0 = 38164.0$ MJD

$\omega = (57^\circ.995 \pm 5) + (1^\circ.9867 \pm 5)t - {}^\circ.62 \times 10^{-5}t^2 + {}^\circ.1142 \cos \omega$

$\Omega = (349^\circ.928 \pm 2) - (1^\circ.8592 \pm 2)t - {}^\circ.71 \times 10^{-6}t^2 + {}^\circ.0145 \cos \omega$

$i = (44^\circ.8054 \pm 9) - {}^\circ.83 \times 10^{-4}t - {}^\circ.0077 \sin \omega$

$e = (.242450 \pm 9) + .87 \times 10^{-6}t + .0005183 \sin \omega$

$M = (.61364 \pm 2) + (9.126186 \pm 2)t - (.71 \pm 48) \times 10^{-7}t^2$

$+ (.10 \pm 4) \times 10^{-7}t^3 - .0003171 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.00$.

The following elements are based on 230 observations and are valid for the period June 1 through July 1, 1963.

$$T_0 = 38196.0 \text{ MJD}$$

$$\omega = (121^\circ.590 \pm 5) + (1^\circ.9858 \pm 5)t - {}^\circ.62 \times 10^{-5}t^2 + {}^\circ.1142 \cos \omega$$

$$\Omega = (290^\circ.430 \pm 1) - (1^\circ.8588 \pm 2)t - {}^\circ.71 \times 10^{-6}t^2 + {}^\circ.0145 \cos \omega$$

$$i = (44^\circ.803 \pm 1) - {}^\circ.83 \times 10^{-4}t - {}^\circ.0077 \sin \omega$$

$$e = (.24233 \pm 1) + .87 \times 10^{-6}t + .0005183 \sin \omega$$

$$M = (.65156 \pm 2) + (9.126188 \pm 2)t - (.24 \pm 3) \times 10^{-6}t^2$$
$$- (.15 \pm 4) \times 10^{-7}t^3 - .0003171 \cos \omega$$

Standard error of one observation: $\sigma = \pm 1'.08$.

| T (MJD) | ω | Ω | i | e | M | n | n'/2 | q | N | D | σ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38122.0 | 334.64 1 | 68.020 5 | 44.806 2 | .24210 3 | .31368 5 | 9.126187 6 | -.3E-6 9 | 7.330485 | 28 | 6 | .40 |
| 38126.0 | 342.62 5 | 60.579 9 | 44.809 5 | .24229 8 | .8183 2 | 9.12621 1 | -.1E-5 6 | 7.328572 | 9 | 6 | .42 |
| 38130.0 | 350.4 1 | 53.16 2 | 44.810 4 | .2425 2 | .3234 3 | 9.12617 2 | .4E-5 5 | 7.326642 | 10 | 6 | .42 |
| 38134.0 | 358.44 4 | 45.717 5 | 44.809 3 | .2422 1 | .8280 2 | 9.126173 3 | .2E-5 2 | 7.329549 | 20 | 6 | .34 |
| 38138.0 | 6.45 1 | 38.277 3 | 44.808 1 | .24250 2 | .33247 5 | 9.126186 2 | .3E-5 1 | 7.326567 | 37 | 6 | .33 |
| 38142.0 | 14.39 1 | 30.842 3 | 44.811 2 | .24259 2 | .83726 4 | 9.126192 2 | -.1E-5 1 | 7.325663 | 33 | 6 | .33 |
| 38146.0 | 22.32 2 | 23.408 3 | 44.805 2 | .24261 5 | .34205 8 | 9.126184 4 | .2E-5 2 | 7.325564 | 25 | 6 | .42 |
| 38150.0 | 30.29 2 | 15.968 4 | 44.803 2 | .24265 3 | .84672 6 | 9.126179 5 | -.4E-6 9 | 7.325136 | 21 | 6 | .40 |
| 38154.0 | 38.21 2 | 8.537 8 | 44.804 2 | .24264 7 | .35148 6 | 9.126179 6 | .3E-5 4 | 7.325274 | 21 | 6 | .43 |
| 38158.0 | 46.13 3 | 1.097 8 | 44.804 4 | .24281 5 | .85636 9 | 9.126194 9 | -.2E-6 9 | 7.323570 | 14 | 6 | .60 |
| 38162.0 | 54.13 2 | 353.652 5 | 44.804 3 | .24287 3 | .3609 1 | 9.126191 5 | -.1E-5 4 | 7.322963 | 15 | 6 | .40 |
| 38166.0 | 62.026 8 | 346.214 2 | 44.801 1 | .24294 1 | .86586 3 | 9.126190 2 | -.2E-5 1 | 7.322357 | 42 | 6 | .29 |
| 38170.0 | 69.941 8 | 338.778 3 | 44.794 2 | .24298 2 | .37069 3 | 9.126191 3 | .2E-5 2 | 7.321964 | 45 | 6 | .42 |
| 38174.0 | 77.90 1 | 331.343 4 | 44.793 2 | .24296 3 | .87536 5 | 9.126194 4 | .1E-5 2 | 7.322121 | 30 | 6 | .46 |
| 38178.0 | 85.827 8 | 323.900 2 | 44.794 2 | .24294 2 | .38019 3 | 9.126191 3 | .2E-5 2 | 7.322344 | 48 | 6 | .41 |
| 38182.0 | 93.75 1 | 316.463 3 | 44.791 2 | .24295 4 | .88504 5 | 9.126194 3 | -.3E-5 2 | 7.322234 | 31 | 6 | .41 |
| 38186.0 | 101.69 2 | 309.013 4 | 44.791 4 | .24296 4 | .38983 7 | 9.126193 4 | -.3E-5 3 | 7.322087 | 16 | 6 | .44 |
| 38190.0 | 109.64 2 | 301.585 7 | 44.795 4 | .24283 5 | .89450 9 | 9.126181 7 | -.2E-5 7 | 7.323419 | 11 | 6 | .48 |
| 38194.0 | 117.55 1 | 294.144 3 | 44.797 2 | .24281 4 | .39936 5 | 9.126191 4 | -.2E-5 2 | 7.323565 | 37 | 6 | .44 |
| 38198.0 | 125.494 7 | 286.704 2 | 44.799 2 | .24278 2 | .90413 2 | 9.126195 2 | -.1E-5 1 | 7.323901 | 76 | 6 | .41 |
| 38202.0 | 133.435 6 | 279.265 2 | 44.799 2 | .24271 2 | .40888 2 | 9.126180 2 | -.16E-5 8 | 7.324580 | 86 | 6 | .43 |
| 38206.0 | 141.375 6 | 271.830 2 | 44.795 1 | .24256 2 | .91356 2 | 9.126176 1 | .6E-6 8 | 7.325960 | 61 | 6 | .31 |
| 38210.0 | 149.31 1 | 264.398 3 | 44.798 2 | .24250 3 | .41829 4 | 9.126188 2 | .3E-5 1 | 7.326626 | 36 | 6 | .32 |

Table 8

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1962 ALPHA EPSILON 1

| MJD | Z | φ | ψ | D.R.A. | $\dot{P}$ |
|---|---|---|---|---|---|
| | | PERIGEE IN SUNLIGHT | | | |
| 38122. | 954. | -17.6 | 43.7 | 37.9 | 0.720E-08 |
| 38126. | 951. | -12.2 | 37.6 | 32.9 | 0.240E-07 |
| 38130. | 949. | -6.7 | 31.1 | 27.5 | -0.961E-07 |
| 38134. | 951. | -1.1 | 24.4 | 22.1 | -0.480E-07 |
| 38138. | 948. | 4.5 | 17.6 | 16.6 | -0.720E-07 |
| 38142. | 948. | 10.1 | 11.2 | 11.2 | 0.240E-07 |
| 38146. | 949. | 15.5 | 6.1 | 5.9 | -0.480E-07 |
| 38150. | 949. | 20.8 | 6.1 | 1.0 | 0.961E-08 |
| 38154. | 951. | 25.8 | 10.4 | 356.4 | -0.720E-07 |
| 38158. | 951. | 30.5 | 15.1 | 352.3 | 0.480E-08 |
| 38162. | 952. | 34.8 | 19.3 | 349.0 | 0.240E-07 |
| 38166. | 952. | 38.5 | 22.7 | 346.3 | 0.480E-07 |
| 38170. | 953. | 41.4 | 25.2 | 344.5 | -0.480E-07 |
| 38174. | 954. | 43.5 | 26.6 | 343.5 | -0.240E-07 |
| 38178. | 955. | 44.6 | 27.1 | 342.9 | -0.480E-07 |
| 38182. | 954. | 44.7 | 26.8 | 342.6 | 0.720E-07 |
| 38186. | 954. | 43.6 | 25.8 | 342.0 | 0.720E-07 |
| 38190. | 954. | 41.6 | 24.6 | 340.9 | 0.480E-07 |
| 38194. | 954. | 38.7 | 23.7 | 338.9 | 0.480E-07 |
| 38198. | 953. | 35.0 | 23.8 | 336.1 | 0.240E-07 |
| 38202. | 952. | 30.8 | 25.4 | 332.5 | 0.384E-07 |
| 38206. | 952. | 26.1 | 28.9 | 328.2 | -0.144E-07 |
| 38210. | 951. | 21.1 | 33.9 | 323.4 | -0.720E-07 |

Satellite 1962 Beta Mu 1 (Anna 1B) Beatrice Miller

I. SAO smoothed elements

The following elements are based on 257 observations and are valid for the period April 1 through May 1, 1963.

$T_0 = 38135.0$ MJD

$\omega = (341^\circ.61 \pm 6) + (2^\circ.916 \pm 6)t + 6^\circ.2697 \cos \omega$

$\Omega = (172^\circ.8677 \pm 6) - (3^\circ.60899 \pm 7)t + {}^\circ.00085 \cos \omega$

$i = (50^\circ.1416 \pm 5) - {}^\circ.0002 \sin \omega$

$e = (.007046 \pm 5) + (.88 \pm 69) \times 10^{-6}t + .0007540 \sin \omega$

$M = (.5787 \pm 2) + (13.34498 \pm 2)t + (.175 \pm 1) \times 10^{-5}t^2$

$+ (.77 \pm 15) \times 10^{-8}t^3 - .015988 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.18$.

The following elements are based on 172 observations and are valid for the period May 1 through June 1, 1963.

$T_0 = 38164.0$ MJD

$\omega = (67^\circ.07 \pm 5) + (2^\circ.965 \pm 5)t + 6^\circ.2697 \cos \omega$

$\Omega = (68^\circ.209 \pm 1) - (3^\circ.60882 \pm 9)t + {}^\circ.00085 \cos \omega$

$i = (50^\circ.1406 \pm 8) - {}^\circ.0002 \sin \omega$

$e = (.00707 \pm 1) + (.01 \pm 11) \times 10^{-5}t + .0007540 \sin \omega$

$M = (.5321 \pm 1) + (13.34494 \pm 1)t + (.76 \pm 2) \times 10^{-6}t^2$

$- (.22 \pm 2) \times 10^{-7}t^3 - .015988 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.25$.

The following elements are based on 133 observations and are valid for the period June 1 through July 1, 1963.

$T_0 = 38195.0$ MJD

$\omega = (159^\circ.15 \pm 9) + (2^\circ.952 \pm 9)t + 6^\circ.2697 \cos \omega$

$\Omega = (316^\circ.327 \pm 1) - (3^\circ.6093 \pm 1)t + {}^\circ.00085 \cos \omega$

$i = (50^\circ.140 \pm 1) - {}^\circ.0002 \sin \omega$

$e = (.007087 \pm 8) + (.157 \pm 97)t + .0007540 \sin \omega$

$M = (.2746 \pm 2) + (13.34494 \pm 3)t - (.159 \pm 2) \times 10^{-5}t^2$

$- (.45 \pm 25) \times 10^{-8}t^3 - .015988 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.15$.

| T (MJD) | ω | Ω | i | e | M | n | n'/2 | q | N | D | σ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38122.0 | 307.0 2 | 219.783 2 | 50.141 2 | .00639 2 | .0859 7 | 13.345365 3 | .2E-5 3 | 7.459626 | 27 | 4 | .66 |
| 38126.0 | 319.6 4 | 205.351 3 | 50.140 2 | .00654 3 | .4632 1 | 13.345371 4 | -.4E-5 4 | 7.458464 | 18 | 4 | .71 |
| 38130.0 | 332.7 3 | 190.909 3 | 50.141 2 | .00665 3 | .8391 7 | 13.345372 7 | .10E-6 6 | 7.457690 | 17 | 4 | .51 |
| 38134.0 | 344.5 2 | 176.482 3 | 50.142 2 | .00679 1 | .2190 6 | 13.345392 3 | .2E-5 2 | 7.456599 | 22 | 4 | .35 |
| 38138.0 | 356.5 1 | 162.043 1 | 50.141 1 | .006937 9 | .5979 4 | 13.345399 2 | -.3E-5 2 | 7.455486 | 52 | 4 | .47 |
| 38142.0 | 8.5 2 | 147.605 2 | 50.138 2 | .00710 2 | .9770 5 | 13.345409 2 | .5E-5 2 | 7.454269 | 46 | 4 | .59 |
| 38146.0 | 19.8 1 | 133.167 2 | 50.138 1 | .00723 2 | .3582 3 | 13.345430 2 | .1E-5 2 | 7.453276 | 51 | 4 | .43 |
| 38150.0 | 31.1 1 | 118.729 2 | 50.145 1 | .00729 3 | .7392 3 | 13.345445 2 | .1E-5 2 | 7.452828 | 44 | 4 | .52 |
| 38154.0 | 42.6 1 | 104.300 2 | 50.137 2 | .00759 3 | .1196 3 | 13.345469 4 | .7E-5 3 | 7.450576 | 25 | 4 | .51 |
| 38158.0 | 53.3 1 | 89.860 4 | 50.135 3 | .00769 6 | .5022 4 | 13.345460 4 | -.4E-5 3 | 7.449792 | 13 | 4 | .43 |
| 38162.0 | 63.93 9 | 75.422 3 | 50.142 1 | .00770 3 | .8852 3 | 13.345482 3 | .1E-5 3 | 7.449745 | 24 | 4 | .33 |
| 38166.0 | 74.6 1 | 60.996 5 | 50.141 2 | .00773 4 | .2678 3 | 13.345478 3 | .2E-5 2 | 7.449515 | 32 | 4 | .48 |
| 38170.0 | 85.5 2 | 46.554 5 | 50.141 3 | .00792 4 | .6500 5 | 13.345486 4 | .8E-5 4 | 7.448105 | 24 | 4 | .65 |
| 38174.0 | 96.0 2 | 32.13 1 | 50.14 1 | .00779 5 | .0333 6 | 13.345487 4 | -.7E-5 4 | 7.449085 | 17 | 4 | .48 |
| 38178.0 | 106.2 4 | 17.69 1 | 50.127 9 | .00779 6 | .418 1 | 13.345515 9 | .7E-5 7 | 7.449063 | 14 | 4 | .73 |
| 38182.0 | 117.4 5 | 3.239 8 | 50.155 9 | .00777 8 | .799 1 | 13.345503 9 | .7E-5 6 | 7.449230 | 11 | 4 | .87 |
| 38186.0 | 128.4 2 | 348.809 2 | 50.141 2 | .00761 3 | .1806 6 | 13.345494 4 | -.7E-5 3 | 7.450401 | 17 | 4 | .51 |
| 38190.0 | 138.9 2 | 334.372 2 | 50.142 3 | .00753 2 | .5640 6 | 13.345468 3 | -.5E-5 2 | 7.450979 | 14 | 4 | .43 |
| 38194.0 | 150.3 2 | 319.930 3 | 50.136 3 | .00739 2 | .9447 5 | 13.345464 2 | .2E-5 3 | 7.452064 | 14 | 4 | .33 |
| 38198.0 | 162.0 3 | 305.483 4 | 50.125 6 | .00727 2 | .3248 9 | 13.345465 3 | .4E-8 3 | 7.452948 | 22 | 4 | .50 |
| 38202.0 | 173.4 3 | 291.056 5 | 50.138 4 | .00709 2 | .7056 7 | 13.345450 2 | -.6E-5 2 | 7.454321 | 23 | 4 | .41 |
| 38206.0 | 185.7 3 | 276.626 7 | 50.139 4 | .00695 2 | .0837 8 | 13.345451 3 | .3E-5 3 | 7.455356 | 18 | 4 | .43 |
| 38210.0 | 197.1 5 | 262.18 1 | 50.138 6 | .00684 4 | .464 1 | 13.345434 5 | .7E-5 4 | 7.456199 | 21 | 4 | .61 |

Table 9

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1962 BETA MU 1

| MJD | Z | $\varphi$ | $\psi$ | D.R.A. | $\dot{P}$ |
|---|---|---|---|---|---|
| | | PERIGEE IN EARTH SHADOW | | | |
| 38122. | 1089. | -37.8 | 145.3 | 167.9 | -0.225E-07 |
| 38126. | 1085. | -29.8 | 150.9 | 161.6 | 0.449E-07 |
| 38130. | 1082. | -20.6 | 151.7 | 153.8 | -0.112E-08 |
| 38134. | 1079. | -11.8 | 144.4 | 143.9 | -0.225E-07 |
| 38138. | 1077. | -2.7 | 133.2 | 133.6 | 0.337E-07 |
| | | PERIGEE IN SUNLIGHT | | | |
| 38142. | 1076. | 6.5 | 120.4 | 123.1 | -0.561E-07 |
| 38146. | 1076. | 15.1 | 107.3 | 112.4 | -0.112E-07 |
| 38150. | 1078. | 23.4 | 95.1 | 102.3 | -0.112E-07 |
| 38154. | 1078. | 31.3 | 84.6 | 93.5 | -0.786E-07 |
| 38158. | 1080. | 38.0 | 76.0 | 85.3 | 0.449E-07 |
| 38162. | 1082. | 43.6 | 69.7 | 79.0 | -0.112E-07 |
| 38166. | 1083. | 47.7 | 65.8 | 74.7 | -0.225E-07 |
| 38170. | 1082. | 49.9 | 63.7 | 72.5 | -0.898E-07 |
| 38174. | 1083. | 49.8 | 61.7 | 70.4 | 0.786E-07 |
| 38178. | 1082. | 47.5 | 58.9 | 67.0 | -0.786E-07 |
| 38182. | 1081. | 43.0 | 55.7 | 63.0 | -0.786E-07 |
| 38186. | 1080. | 37.0 | 50.4 | 56.6 | 0.786E-07 |
| 38190. | 1078. | 30.3 | 43.0 | 47.7 | 0.561E-07 |
| 38194. | 1077. | 22.4 | 35.2 | 38.3 | -0.225E-07 |
| 38198. | 1076. | 13.7 | 28.2 | 28.0 | -0.449E-10 |
| 38202. | 1076. | 5.1 | 24.6 | 16.9 | 0.674E-07 |
| 38206. | 1077. | -4.4 | 28.4 | 6.3 | -0.337E-07 |
| 38210. | 1079. | -13.0 | 36.6 | 355.2 | -0.786E-07 |

Satellite 1962 Beta Tau 2 (Injun 3) Beatrice Miller

I. SAO smoothed elements

The following elements are based on 74 observations and are valid for the period April 1 through April 15, 1963.

$T_0 = 38128.0$ MJD

$\omega = (21^\circ.68 \pm 2) - (1^\circ.103 \pm 4)t - {}^\circ.0001143t^2 + {}^\circ.2309 \cos \omega$

$\Omega = (20^\circ.486 \pm 3) - (1^\circ.6932 \pm 8)t - {}^\circ.917 \times 10^{-4}t^2 + {}^\circ.0330 \cos \omega$

$i = (70^\circ.365 \pm 4) - {}^\circ.0024 \sin \omega$

$e = (.15818 \pm 3) - (.47 \pm 8) \times 10^{-4}t + .284 \times 10^{-6}t^2 + .0007046 \sin \omega$

$M = (.55007 \pm 7) + (12.45946 \pm 1)t + (.000570 \pm 1)t^2$

$- (.59 \pm 12) \times 10^{-6}t^3 - (.13 \pm 2) \times 10^{-6}t^4 - .0006173 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.95$.

The following elements are based on 63 observations and are valid for the period April 15 through May 1, 1963.

$T_0 = 38143.0$ MJD

$\omega = (5^\circ.1 \pm 1) - (1^\circ.10 \pm 2)t - {}^\circ.0001143t^2 + {}^\circ.2309 \cos \omega$

$\Omega = (355^\circ.021 \pm 7) - (1^\circ.698 \pm 2)t - {}^\circ.917 \times 10^{-4}t^2 + {}^\circ.0330 \cos \omega$

$i = (70^\circ.40 \pm 2) - {}^\circ.0024 \sin \omega$

$e = (.1573 \pm 2) - (.67 \pm 57) \times 10^{-4}t + .284 \times 10^{-6}t^2 + .0007046 \sin \omega$

$M = (.5708 \pm 5) + (12.47618 \pm 6)t + (.000462 \pm 2)t^2$

$- (.62 \pm 2) \times 10^{-5}t^3 + (.01 \pm 26) \times 10^{-7}t^4 - .0006173 \cos \omega$

Standard error of one observation: $\sigma = \pm 2'.63$.

The following elements are based on 32 observations and are valid for the period May 1 through May 16, 1963.

$T_0 = 38158.0$ MJD

$\omega = (348^\circ.63 \pm 4) - (1^\circ.090 \pm 9)t - {}^\circ.0001143t^2 + {}^\circ.2309 \cos \omega$

$\Omega = (329^\circ.512 \pm 2) - (1^\circ.7037 \pm 6)t - {}^\circ.917 \times 10^{-4}t^2 + {}^\circ.0330 \cos \omega$

$i = (70^\circ.356 \pm 4) - {}^\circ.0024 \sin \omega$

$e = (.1571 \pm 2) - (.38 \pm 30) \times 10^{-4}t + .284 \times 10^{-6}t^2 + .0007046 \sin \omega$

$M = (.8090 \pm 2) + (12.48904 \pm 4)t + (.000426 \pm 2)t^2$

$- (.19 \pm 15) \times 10^{-6}t^3 + (.48 \pm 31) \times 10^{-7}t^4 - .0006173 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.35$.

The following elements are based on 32 observations and are valid for the period May 16 through June 1, 1963.

$T_0 = 38173.0$ MJD

$\omega = (332^\circ.02 \pm 2) - (1^\circ.094 \pm 6)t - {}^\circ.0001143t^2 + {}^\circ.2309 \cos \omega$

$\Omega = (303^\circ.95 \pm 1) - (1^\circ.7061 \pm 7)t - {}^\circ.917 \times 10^{-4}t^2 + {}^\circ.0330 \cos \omega$

$i = (70^\circ.35 \pm 2) - {}^\circ.0024 \sin \omega$

$e = (.15659 \pm 6) - (.89 \pm 28) \times 10^{-4}t + .284 \times 10^{-6}t^2 + .0007046 \sin \omega$

$M = (.23339 \pm 6) + (12.49960 \pm 2)t + (.000242 \pm 2)t^2$

$- (.19 \pm 1) \times 10^{-5}t^3 + (.23 \pm 2) \times 10^{-6}t^4 - .0006173 \cos \omega$

Standard error of one observation: $\sigma = \pm 2'.25$.

The following elements are based on 51 observations and are valid for the period June 1 through June 15, 1963.

$T_0 = 38188.0$ MJD

$\omega = (315^\circ.38 \pm 8) - (1^\circ.10 \pm 1)t - {}^\circ.0001143 + {}^\circ.2309 \cos \omega$

$\Omega = (278^\circ.36 \pm 1) - (1^\circ.7071 \pm 6)t - {}^\circ.917 \times 10^{-4}t^2 + {}^\circ.0330 \cos \omega$

$i = (70^\circ.37 \pm 2) - {}^\circ.0024 \sin \omega$

$e = (.1551 \pm 4) - (.73 \pm 49) \times 10^{-4}t + .284 \times 10^{-6}t^2 + .0007046 \sin \omega$

$M = (.78215 \pm 9) + (12.50678 \pm 2)t + (.0002381 \pm 9)t^2$

$+ (.15 \pm 7) \times 10^{-6}t^3 - (.19 \pm 2) \times 10^{-6}t^4 - .0006173 \cos \omega$

Standard error of one observation: $\sigma = \pm 2'.43$.

The following elements are based on 164 observations and are valid for the period June 15 through July 1, 1963.

$$T_0 = 38203.0 \text{ MJD}$$

$$\omega = (298^\circ.79 \pm 2) - (1^\circ.112 \pm 3)t - {}^\circ.0001143t^2 + {}^\circ.2309 \cos \omega$$

$$\Omega = (252^\circ.727 \pm 8) - (1^\circ.7089 \pm 4)t - {}^\circ.917 \times 10^{-4}t^2 + {}^\circ.0330 \cos \omega$$

$$i = (70^\circ.366 \pm 9) - {}^\circ.0024 \sin \omega$$

$$e = (.1558 \pm 3) - (.21 \pm 43) \times 10^{-4}t + .284 \times 10^{-6}t^2 + .0007046 \cos \omega$$

$$M = (.43462 \pm 6) + (12.51336 \pm 1)t + (.0001753 \pm 5)t^2$$
$$- (.186 \pm 4) \times 10^{-5}t^3 + (.263 \pm 8) \times 10^{-6}t^4 - .0006173 \cos \omega$$

Standard error of one observation: $\sigma = \pm 2'.85$.

| T (MJD) | ω | Ω | i | e | M | n | n'/2 | q | N | D | σ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38120.0 | 30.72 1 | 34.053 4 | 70.360 4 | .15889 3 | .90999 5 | 12.450585 3 | .507E-3 1 | 6.614859 | 79 | 6 | .50 |
| 38122.0 | 28.53 1 | 30.667 4 | 70.363 4 | .15878 3 | .81318 5 | 12.452659 3 | .526E-3 2 | 6.614968 | 59 | 6 | .44 |
| 38124.0 | 26.33 2 | 27.288 5 | 70.368 5 | .15862 5 | .72059 8 | 12.454883 4 | .581E-3 3 | 6.615413 | 39 | 6 | .75 |
| 38126.0 | 24.14 2 | 23.908 5 | 70.367 5 | .15860 4 | .63264 8 | 12.457195 4 | .577E-3 2 | 6.614792 | 27 | 6 | .68 |
| 38128.0 | 21.93 2 | 20.518 3 | 70.367 3 | .15848 2 | .54943 6 | 12.459482 3 | .556E-3 2 | 6.614889 | 29 | 6 | .54 |
| 38130.0 | 19.69 1 | 17.137 1 | 70.366 2 | .15835 2 | .47077 4 | 12.461678 1 | .544E-3 2 | 6.615162 | 31 | 6 | .44 |
| 38132.0 | 17.54 2 | 13.742 2 | 70.365 3 | .15824 4 | .39612 8 | 12.463919 5 | .587E-3 3 | 6.615207 | 32 | 6 | .78 |
| 38134.0 | 15.30 2 | 10.348 1 | 70.366 2 | .15800 3 | .32648 7 | 12.466364 3 | .626E-3 2 | 6.616289 | 35 | 6 | .53 |
| 38136.0 | 13.06 3 | 6.954 8 | 70.37 1 | .15775 9 | .2619 1 | 12.468766 4 | .576E-3 2 | 6.617367 | 40 | 6 | .70 |
| 38138.0 | 10.91 3 | 3.561 5 | 70.368 9 | .1577 2 | .2015 2 | 12.471030 3 | .557E-3 1 | 6.616933 | 42 | 6 | .47 |
| 38140.0 | 9.10 6 | 0.175 7 | 70.35 1 | .1594 2 | .1441 3 | 12.473201 8 | .526E-3 5 | 6.603185 | 42 | 6 | 1.20 |
| 38142.0 | 7.34 5 | 356.781 4 | 70.34 1 | .15932 8 | .0910 2 | 12.475258 6 | .498E-3 3 | 6.602733 | 29 | 6 | .73 |
| 38144.0 | 5.49 9 | 353.395 3 | 70.338 5 | .15940 8 | .0421 3 | 12.477077 7 | .437E-3 4 | 6.601031 | 19 | 6 | 1.11 |
| 38146.0 | 3.0 1 | 349.998 1 | 70.340 1 | .15884 8 | .9990 4 | 12.478675 9 | .398E-3 9 | 6.605286 | 13 | 6 | .98 |
| 38148.0 | 0.7 1 | 346.597 1 | 70.340 1 | .15850 5 | .9584 4 | 12.48038 1 | .441E-3 5 | 6.607348 | 10 | 6 | .92 |
| 38150.0 | 357.9 1 | 343.169 5 | 70.368 6 | .1574 2 | .9230 4 | 12.48200 3 | .44E-3 1 | 6.615553 | 14 | 6 | 1.08 |
| 38152.0 | 355.57 4 | 339.75 1 | 70.34 2 | .1570 1 | .8890 2 | 12.48385 2 | .458E-3 7 | 6.617973 | 21 | 6 | .58 |
| 38154.0 | 353.32 2 | 336.355 5 | 70.354 7 | .15684 8 | .8587 1 | 12.485656 3 | .438E-3 2 | 6.618549 | 33 | 6 | .43 |
| 38156.0 | 351.16 3 | 332.987 4 | 70.401 7 | .1564 1 | .8315 1 | 12.487367 8 | .419E-3 5 | 6.621186 | 36 | 6 | .79 |
| 38158.0 | 348.91 3 | 329.580 5 | 70.397 7 | .1563 1 | .8080 1 | 12.489039 6 | .420E-3 4 | 6.621235 | 29 | 6 | .79 |
| 38160.0 | 346.68 5 | 326.174 7 | 70.39 1 | .15627 9 | .7878 2 | 12.490785 7 | .444E-3 5 | 6.621235 | 25 | 6 | 1.10 |
| 38162.0 | 344.33 1 | 322.741 2 | 70.365 3 | .15642 4 | .77164 3 | 12.492549 7 | .445E-3 4 | 6.619374 | 31 | 6 | .77 |
| 38164.0 | 342.252 5 | 319.3339 5 | 70.3656 6 | .156483 8 | .75816 2 | 12.494237 2 | .361E-3 1 | 6.618314 | 40 | 6 | .38 |

| T (MJD) | ω | Ω | i | e | M | n | n'/2 | q | N | D | σ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38166.0 | 340.039 5 | 315.9256 5 | 70.3658 7 | .156365 9 | .74807 2 | 12.495638 2 | .339E-3 1 | 6.618742 | 45 | 6 | .41 |
| 38168.0 | 337.809 5 | 312.5172 9 | 70.3657 9 | .15627 1 | .74073 2 | 12.496923 2 | .313E-3 1 | 6.619026 | 38 | 6 | .35 |
| 38170.0 | 335.566 6 | 309.100 1 | 70.362 1 | .15618 1 | .73596 1 | 12.498122 2 | .281E-3 2 | 6.619294 | 39 | 6 | .40 |
| 38172.0 | 333.384 4 | 305.6886 9 | 70.3609 9 | .15609 1 | .73323 1 | 12.499184 3 | .241E-3 2 | 6.619632 | 32 | 6 | .31 |
| 38174.0 | 331.139 3 | 302.2793 6 | 70.3636 6 | .156009 9 | .73266 1 | 12.5001201 9 | .223E-3 1 | 6.619954 | 35 | 6 | .24 |
| 38176.0 | 328.929 5 | 298.8715 8 | 70.3646 5 | .15600 2 | .73372 2 | 12.501031 2 | .2494E-3 6 | 6.619741 | 33 | 6 | .43 |
| 38178.0 | 326.687 3 | 295.4578 7 | 70.3646 5 | .15592 2 | .73683 1 | 12.502033 1 | .2585E-3 7 | 6.619954 | 36 | 6 | .39 |
| 38180.0 | 324.438 5 | 292.0439 9 | 70.3647 6 | .15585 2 | .74200 1 | 12.503054 1 | .2531E-3 5 | 6.620159 | 39 | 6 | .39 |
| 38182.0 | 322.250 4 | 288.619 1 | 70.3625 9 | .15582 1 | .74904 1 | 12.504062 1 | .2449E-3 8 | 6.620048 | 44 | 6 | .35 |
| 38184.0 | 320.029 6 | 285.204 2 | 70.363 1 | .15573 3 | .75815 2 | 12.505001 2 | .218E-3 1 | 6.620404 | 40 | 6 | .40 |
| 38186.0 | 317.819 4 | 281.7924 6 | 70.3645 7 | .15578 2 | .76894 2 | 12.505864 1 | .2129E-3 9 | 6.619738 | 42 | 6 | .35 |
| 38188.0 | 315.613 2 | 278.3777 5 | 70.3621 7 | .15569 1 | .781455 7 | 12.506793 1 | .255E-3 1 | 6.620114 | 50 | 6 | .35 |
| 38190.0 | 313.380 2 | 274.9608 5 | 70.3642 7 | .15540 2 | .79614 1 | 12.507782 1 | .2282E-3 8 | 6.622001 | 60 | 6 | .37 |
| 38192.0 | 311.174 4 | 271.5472 8 | 70.3674 9 | .15551 1 | .81249 1 | 12.5086556 5 | .2153E-3 4 | 6.620874 | 56 | 6 | .28 |
| 38194.0 | 308.935 2 | 268.1259 4 | 70.3644 4 | .15542 1 | .830701 7 | 12.5095239 7 | .2209E-3 4 | 6.621239 | 64 | 6 | .28 |
| 38196.0 | 306.696 3 | 264.7051 5 | 70.3639 6 | .15532 1 | .850673 8 | 12.5103975 8 | .2175E-3 5 | 6.621739 | 66 | 6 | .38 |
| 38198.0 | 304.432 4 | 261.2881 6 | 70.3657 9 | .155318 8 | .87241 1 | 12.511295 1 | .2318E-3 9 | 6.621428 | 90 | 6 | .57 |
| 38200.0 | 302.234 7 | 257.8718 8 | 70.362 1 | .155296 8 | .89584 2 | 12.512240 1 | .228E-3 1 | 6.621268 | 95 | 6 | .63 |
| 38202.0 | 300.032 8 | 254.4496 8 | 70.362 1 | .15516 1 | .92112 2 | 12.513035 2 | .1836E-3 8 | 6.622085 | 96 | 6 | .67 |
| 38204.0 | 297.786 6 | 251.033 2 | 70.368 2 | .15510 2 | .94796 2 | 12.5136958 9 | .1569E-3 6 | 6.622324 | 90 | 6 | .42 |
| 38206.0 | 295.562 7 | 247.615 1 | 70.369 2 | .15506 2 | .97592 2 | 12.514390 2 | .1945E-3 9 | 6.622337 | 78 | 6 | .50 |
| 38208.0 | 293.325 7 | 244.191 1 | 70.365 2 | .15499 2 | .00549 2 | 12.515161 1 | .1946E-3 9 | 6.622659 | 92 | 6 | .53 |
| 38210.0 | 291.095 6 | 240.7717 8 | 70.363 1 | .15495 2 | .03657 2 | 12.515916 1 | .1838E-3 8 | 6.622681 | 74 | 6 | .43 |

Table 10

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1962 BETA TAU 2

| MJD | Z | φ | ψ | D.R.A. | Ṗ |
|---|---|---|---|---|---|
| | | PERIGEE IN SUNLIGHT | | | |
| 38120. | 241. | 28.8 | 41.8 | 35.6 | -0.654E-05 |
| 38122. | 241. | 26.7 | 35.6 | 29.5 | -0.678E-05 |
| 38124. | 241. | 24.7 | 29.4 | 23.4 | -0.749E-05 |
| 38126. | 240. | 22.7 | 23.2 | 17.3 | -0.744E-05 |
| 38128. | 239. | 20.6 | 17.2 | 11.2 | -0.716E-05 |
| 38130. | 239. | 18.5 | 11.7 | 5.2 | -0.701E-05 |
| 38132. | 239. | 16.5 | 7.8 | 359.1 | -0.756E-05 |
| 38134. | 239. | 14.4 | 8.4 | 353.1 | -0.806E-05 |
| 38136. | 240. | 12.3 | 12.9 | 347.0 | -0.741E-05 |
| 38138. | 239. | 10.3 | 18.6 | 341.0 | -0.716E-05 |
| 38140. | 225. | 8.6 | 24.6 | 335.2 | -0.676E-05 |
| 38142. | 225. | 6.9 | 30.7 | 329.3 | -0.640E-05 |
| 38144. | 223. | 5.2 | 36.9 | 323.4 | -0.561E-05 |
| 38146. | 227. | 2.8 | 43.5 | 317.3 | -0.511E-05 |
| 38148. | 229. | 0.7 | 50.1 | 311.2 | -0.566E-05 |
| 38150. | 237. | -2.0 | 57.0 | 304.9 | -0.565E-05 |
| 38152. | 240. | -4.2 | 63.6 | 298.8 | -0.588E-05 |
| 38154. | 240. | -6.3 | 70.2 | 292.8 | -0.562E-05 |
| 38156. | 243. | -8.3 | 76.6 | 286.7 | -0.537E-05 |
| 38158. | 244. | -10.4 | 83.1 | 280.6 | -0.539E-05 |
| 38160. | 244. | -12.5 | 89.6 | 274.5 | -0.569E-05 |
| 38162. | 242. | -14.7 | 96.2 | 268.2 | -0.570E-05 |
| 38164. | 242. | -16.7 | 102.5 | 262.1 | -0.463E-05 |
| | | PERIGEE IN EARTH SHADOW | | | |
| 38166. | 243. | -18.8 | 108.8 | 255.9 | -0.434E-05 |
| 38168. | 243. | -20.8 | 115.2 | 249.7 | -0.401E-05 |

Table 10 (cont.)

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1962 BETA TAU 2

| MJD | Z | φ | ψ | D.R.A. | $\dot{P}$ |
|---|---|---|---|---|---|
| 38170. | 244. | -22.9 | 121.4 | 243.4 | -0.360E-05 |
| 38172. | 245. | -25.0 | 127.5 | 237.1 | -0.309E-05 |
| 38174. | 246. | -27.0 | 133.5 | 230.7 | -0.285E-05 |
| 38176. | 246. | -29.1 | 139.3 | 224.4 | -0.319E-05 |
| 38178. | 247. | -31.1 | 144.9 | 217.9 | -0.331E-05 |
| 38180. | 248. | -33.2 | 150.0 | 211.4 | -0.324E-05 |
| 38182. | 249. | -35.2 | 154.6 | 204.9 | -0.313E-05 |
| 38184. | 250. | -37.2 | 158.3 | 198.2 | -0.279E-05 |
| 38186. | 250. | -39.2 | 160.6 | 191.6 | -0.272E-05 |
| 38188. | 251. | -41.2 | 161.1 | 184.8 | -0.326E-05 |
| 38190. | 254. | -43.2 | 159.7 | 178.0 | -0.292E-05 |
| 38192. | 253. | -45.2 | 156.8 | 171.0 | -0.275E-05 |
| 38194. | 254. | -47.1 | 152.9 | 164.0 | -0.282E-05 |
| 38196. | 256. | -49.0 | 148.5 | 156.8 | -0.278E-05 |
| 38198. | 256. | -51.0 | 143.7 | 149.5 | -0.296E-05 |
| 38200. | 257. | -52.8 | 138.9 | 142.0 | -0.291E-05 |
| 38202. | 258. | -54.6 | 134.1 | 134.4 | -0.235E-05 |
| 38204. | 259. | -56.4 | 129.3 | 126.6 | -0.200E-05 |
| 38206. | 259. | -58.2 | 124.6 | 118.5 | -0.248E-05 |
| 38208. | 260. | -59.9 | 120.1 | 110.2 | -0.248E-05 |
| 38210. | 261. | -61.5 | 115.7 | 101.5 | -0.235E-05 |

Satellite 1962 Beta Upsilon 1 (Relay 1) Beatrice Miller

I. SAO smoothed elements

The following elements are based on 87 observations and are valid for the period April 1 through May 1, 1963.

$T_0 = 38135.0$ MJD

$\omega = (326^\circ.698 \pm 6) + (1^\circ.2148 \pm 9)t + {}^\circ.0960 \cos \omega$

$\Omega = (61^\circ.152 \pm 3) - (1^\circ.2794 \pm 3)t + {}^\circ.0158 \cos \omega$

$i = (47^\circ.522 \pm 1) - {}^\circ.0082 \sin \omega$

$e = (.28492 \pm 3) - (.26 \pm 31) \times 10^{-5}t + .0005027 \sin \omega$

$M = (.11452 \pm 2) + (7.780966 \pm 4)t - (.81 \pm 82) \times 10^{-7}t^2$

$- .0002583 \cos \omega$

Standard error of one observation: $\sigma = \pm 0^{\prime}.98$.

The following elements are based on 118 observations and are valid for the period May 1 through June 1, 1963.

$T_0 = 38164.0$ MJD

$\omega = (1^\circ.888 \pm 6) + (1^\circ.2135 \pm 6)t + {}^\circ.0960 \cos \omega$

$\Omega = (24^\circ.048 \pm 2) - (1^\circ.2797 \pm 3)t + {}^\circ.0158 \cos \omega$

$i = (47^\circ.527 \pm 1) - {}^\circ.0082 \sin \omega$

$e = (.28479 \pm 2) - (.65 \pm 25) \times 10^{-5}t + .0005027 \sin \omega$

$M = (.76255 \pm 2) + (7.780959 \pm 2)t - (.32 \pm 3) \times 10^{-6}t^2$

$- .0002583 \cos \omega$

Standard error of one observation: $\sigma = \pm 1^{\prime}.10$.

The following elements are based on 150 observations and are valid for the period June 1 through July 1, 1963.

$$T_0 = 38195.0 \text{ MJD}$$

$$\omega = (39^\circ.487 \pm 4) + (1^\circ.2115 \pm 6)t + {}^\circ.0960 \cos \omega$$

$$\Omega = (344^\circ.384 \pm 2) - (1^\circ.2802 \pm 2)t + {}^\circ.0158 \cos \omega$$

$$i = (47^\circ.518 \pm 1) - {}^\circ.0082 \sin \omega$$

$$e = (.28468 \pm 3) - (.53 \pm 41) \times 10^{-5}t + .0005027 \sin \omega$$

$$M = (.97206 \pm 1) + (7.780948 \pm 1)t - (.29 \pm 3) \times 10^{-6}t^2$$

$$- .0002583 \cos \omega$$

Standard error of one observation: $\sigma = \pm 1'.10$.

| T (MJD) | ω | Ω | i | e | M | n | n'/2 | q | N | D | σ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38122.0 | 310.986 3 | 77.8201 6 | 47.5212 6 | .284634 9 | .961614 6 | 7.780978 2 | -.1E-5 1 | 7.695350 | 19 | 6 | .37 |
| 38126.0 | 315.8361 7 | 72.7025 3 | 47.5142 3 | .284680 3 | .085508 2 | 7.7809764 1 | .23E-5 4 | 7.694852 | 26 | 6 | .24 |
| 38130.0 | 320.7137 4 | 67.5661 2 | 47.5245 1 | .284635 3 | .209422 2 | 7.7809848 4 | -.24E-5 3 | 7.695335 | 25 | 6 | .13 |
| 38134.0 | 325.586 4 | 62.452 2 | 47.5233 3 | .284639 7 | .33325 1 | 7.780955 1 | -.49E-5 4 | 7.695312 | 38 | 6 | .32 |
| 38138.0 | 330.419 6 | 57.343 3 | 47.518 1 | .28468 1 | .45711 2 | 7.780971 2 | .9E-5 1 | 7.694817 | 42 | 6 | .50 |
| 38142.0 | 335.289 7 | 52.257 3 | 47.5215 8 | .28479 1 | .58076 2 | 7.780979 2 | .15E-4 1 | 7.693681 | 55 | 6 | 1.14 |
| 38146.0 | 340.079 5 | 47.106 2 | 47.539 1 | .28491 1 | .70488 1 | 7.780993 4 | .35E-4 1 | 7.692337 | 50 | 6 | 1.11 |
| 38150.0 | 345.008 6 | 41.957 4 | 47.532 2 | .28463 2 | .82876 2 | 7.780960 1 | -.11E-4 2 | 7.695376 | 50 | 6 | .81 |
| 38154.0 | 349.856 6 | 36.882 3 | 47.510 2 | .28483 2 | .95257 1 | 7.780972 3 | -.10E-4 2 | 7.693224 | 44 | 6 | 1.11 |
| 38158.0 | 354.707 4 | 31.754 4 | 47.5275 4 | .28474 2 | .07637 1 | 7.780942 2 | .3E-6 9 | 7.694287 | 26 | 6 | .62 |
| 38162.0 | 359.563 6 | 26.655 2 | 47.5270 5 | .28461 2 | .20019 1 | 7.780964 3 | -.2E-5 1 | 7.695630 | 35 | 6 | .86 |
| 38166.0 | 4.414 2 | 21.508 1 | 47.5257 6 | .284773 6 | .324159 5 | 7.781005 1 | -.130E-4 7 | 7.693830 | 49 | 6 | .46 |
| 38170.0 | 9.2705 3 | 16.38914 9 | 47.52583 5 | .284847 2 | .4479996 5 | 7.7809506 2 | .6E-6 1 | 7.693076 | 50 | 6 | .25 |
| 38174.0 | 14.131 2 | 11.2655 6 | 47.5212 2 | .284795 2 | .571811 3 | 7.7809576 4 | -.7E-6 3 | 7.693623 | 56 | 6 | .30 |
| 38178.0 | 18.9624 6 | 6.1494 5 | 47.5197 2 | .284857 1 | .695673 1 | 7.7809559 2 | .2E-6 1 | 7.692963 | 60 | 6 | .26 |
| 38182.0 | 23.8214 5 | 1.0286 2 | 47.5214 2 | .284913 3 | .819471 2 | 7.7809479 2 | -.6E-6 2 | 7.692360 | 49 | 6 | .25 |
| 38186.0 | 28.6762 6 | 355.90992 7 | 47.52187 6 | .284939 2 | .943277 2 | 7.7809532 3 | -.47E-5 2 | 7.692077 | 41 | 6 | .24 |
| 38190.0 | 33.512 1 | 350.7959 5 | 47.5181 3 | .284912 2 | .067096 2 | 7.7809502 2 | -.15E-5 2 | 7.692379 | 51 | 6 | .28 |
| 38194.0 | 38.348 1 | 345.6768 6 | 47.5163 5 | .284946 3 | .190924 2 | 7.7809432 3 | -.23E-5 2 | 7.692010 | 63 | 6 | .37 |
| 38198.0 | 43.197 1 | 340.5565 7 | 47.5129 5 | .284999 3 | .314696 3 | 7.7809419 5 | -.2E-6 3 | 7.691444 | 105 | 6 | .38 |
| 38202.0 | 48.0288 5 | 335.4303 4 | 47.5101 3 | .284945 2 | .438516 1 | 7.7809404 4 | -.9E-6 2 | 7.692020 | 92 | 6 | .40 |
| 38206.0 | 52.8686 5 | 330.3119 4 | 47.5123 2 | .285030 2 | .562292 1 | 7.7809360 3 | .5E-6 1 | 7.691118 | 78 | 6 | .38 |
| 38210.0 | 57.696 1 | 325.2005 1 | 47.5104 2 | .285036 2 | .686084 2 | 7.7809372 2 | -.20E-5 1 | 7.691046 | 47 | 6 | .26 |

Table 11

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1962 BETA UPSILON 1

| MJD | Z | φ | ψ | D.R.A. | $\dot{P}$ |
|---|---|---|---|---|---|
| | | PERIGEE IN SUNLIGHT | | | |
| 38122. | 1324. | -33.8 | 47.2 | 28.4 | 0.330E-07 |
| 38126. | 1322. | -30.9 | 44.0 | 24.3 | -0.760E-07 |
| 38130. | 1322. | -27.8 | 40.6 | 19.8 | 0.793E-07 |
| 38134. | 1321. | -24.6 | 37.1 | 15.1 | 0.162E-06 |
| 38138. | 1319. | -21.4 | 33.7 | 10.1 | -0.297E-06 |
| 38142. | 1317. | -18.0 | 30.6 | 5.0 | -0.496E-06 |
| 38146. | 1315. | -14.6 | 28.1 | 359.6 | -0.116E-05 |
| 38150. | 1318. | -11.0 | 26.4 | 354.2 | 0.363E-06 |
| 38154. | 1315. | -7.5 | 26.0 | 348.6 | 0.330E-06 |
| 38158. | 1316. | -3.9 | 26.9 | 343.0 | -0.991E-08 |
| 38162. | 1317. | -0.3 | 29.0 | 337.2 | 0.661E-07 |
| 38166. | 1316. | 3.3 | 32.1 | 331.4 | 0.429E-06 |
| 38170. | 1315. | 6.8 | 35.8 | 325.6 | -0.198E-07 |
| 38174. | 1316. | 10.4 | 39.9 | 319.9 | 0.231E-07 |
| 38178. | 1316. | 13.9 | 44.2 | 314.1 | -0.661E-08 |
| 38182. | 1316. | 17.3 | 48.5 | 308.5 | 0.198E-07 |
| 38186. | 1316. | 20.7 | 52.8 | 302.9 | 0.155E-06 |
| 38190. | 1318. | 24.0 | 56.9 | 297.5 | 0.496E-07 |
| 38194. | 1318. | 27.2 | 60.7 | 292.2 | 0.760E-07 |
| 38198. | 1319. | 30.3 | 64.2 | 287.2 | 0.661E-08 |
| 38202. | 1320. | 33.2 | 67.4 | 282.5 | 0.297E-07 |
| 38206. | 1320. | 36.0 | 70.3 | 278.0 | -0.165E-07 |
| 38210. | 1321. | 38.6 | 72.9 | 273.9 | 0.661E-07 |

The following satellites sometimes have a two-figure error in the column n'/2 of the mean elements:

| | |
|---|---|
| 1959 | Eta |
| 1959 | Iota 1 |
| 1960 | Xi 1 |

## NOTICE

This series of Special Reports was instituted under the supervision of Dr. F. L. Whipple, Director of the Astrophysical Observatory of the Smithsonian Institution, shortly after the launching of the first artificial earth satellite on October 4, 1957. Contributions come from the Staff of the Observatory. First issued to ensure the immediate dissemination of data for satellite tracking, the Reports have continued to provide a rapid distribution of catalogues of satellite observations, orbital information, and preliminary results of data analyses prior to formal publication in the appropriate journals.

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