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SATELLITE ORBITAL DATA

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SATELLITE ORBITAL DATA

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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 ω, right ascension of the ascending node Ω, 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 σ, the standard error of the representation of the observations relative to their assumed accuracy.

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

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

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

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

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

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 (φ); the angular geocentric distance (ψ) 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.

Satellite 1958 Alpha (Explorer 1) Eleanor Ryan

I. SAO smoothed elements

The following elements are based on 35 observations and are valid for the period October 1 through October 15, 1963.

$T_0 = 38310.0$ MJD

$\omega = (213^\circ.83 \pm 1) + (7^\circ.640 \pm 4)t + {}^\circ.000213t^2 + {}^\circ.3144 \cos \omega$

$\Omega = (114^\circ.507 \pm 6) - (5^\circ.116 \pm 1)t - {}^\circ.37 \times 10^{-4}t^2 + {}^\circ.0031 \cos \omega$

$i = (33^\circ.203 \pm 2) + {}^\circ.97 \times 10^{-4}t + {}^\circ.71 \times 10^{-6}t^2 - {}^\circ.0039 \sin \omega$

$e = (.08792 \pm 3) - .91 \times 10^{-5}t + .32 \times 10^{-7}t^2 + .0004980 \sin \omega$

$M = (.32680 \pm 4) + (13.721805 \pm 9)t + (.855 \pm 2) \times 10^{-4}t^2$
$+ (.228 \pm 4) \times 10^{-5}t^3 - .0008998 \cos \omega$

Standard error of one observation: $\sigma = \pm 1''.28$

The following elements are based on 89 observations and are valid for the period October 15 through November 1, 1963.

$T_0 = 38326.0$ MJD

$\omega = (336^\circ.09 \pm 2) + (7^\circ.635 \pm 3)t + {}^\circ.000213t^2 + {}^\circ.3144 \cos \omega$

$\Omega = (32^\circ.641 \pm 4) - (5^\circ.1175 \pm 8)t - {}^\circ.37 \times 10^{-4}t^2 + {}^\circ.0031 \cos \omega$

$i = (33^\circ.203 \pm 1) + {}^\circ.000120t + {}^\circ.71 \times 10^{-6}t^2 - {}^\circ.0039 \sin \omega$

$e = (.08776 \pm 1) - .81 \times 10^{-5}t + .32 \times 10^{-7}t^2 + .0004980 \sin \omega$

$M = (.90348 \pm 4) + (13.725393 \pm 7)t + (.1253 \pm 4) \times 10^{-3}t^2$
$+ (.46 \pm 2) \times 10^{-6}t^3 - (.90 \pm 6) \times 10^{-7}t^4 - .0008998 \cos \omega$

Standard error of one observation: $\sigma = \pm 2''.28$

The following elements are based on 24 observations and are valid for the period November 1 through November 15, 1963.

T_0 = 38342.0 MJD

$\omega = (98^\circ.38 \pm 3) + 7^\circ.65100t + {}^\circ.85 \times 10^{-4}t^2 + {}^\circ.3144 \cos \omega$

$\Omega = (310^\circ.729 \pm 5) - 5^\circ.12102t - {}^\circ.79 \times 10^{-4}t^2 + {}^\circ.0031 \cos \omega$

$i = (33^\circ.202 \pm 3) - {}^\circ.95 \times 10^{-5}t^2 - {}^\circ.0039 \sin \omega$

$e = (.08761 \pm 3) - .102 \times 10^{-4}t + .91 \times 10^{-7}t^2 + .0004980 \sin \omega$

$M = (.53888 \pm 7) + (13.728790 \pm 5)t + (.969 \pm 4) \times 10^{-4}t^2$

$+ (.46 \pm 9) \times 10^{-6}t^3 - .0008998 \cos \omega$

Standard error of one observation: $\sigma = \pm 2''.38$

The following elements are based on 76 observations and are valid for the period November 15 through December 1, 1963.

T_0 = 38356.0 MJD

$\omega = (205^\circ.54 \pm 1) + (7^\circ.662 \pm 2)t + {}^\circ.85 \times 10^{-4}t^2 + {}^\circ.3144 \cos \omega$

$\Omega = (239^\circ.026 \pm 3) - (5^\circ.1229 \pm 6)t - {}^\circ.79 \times 10^{-4}t^2 + {}^\circ.0031 \cos \omega$

$i = (33^\circ.2010 \pm 8) - {}^\circ.000266t + {}^\circ.95 \times 10^{-5}t^2 - {}^\circ.0039 \sin \omega$

$e = (.08749 \pm 1) - .76 \times 10^{-5}t + .91 \times 10^{-7}t^2 + .0004980 \sin \omega$

$M = (.76119 \pm 3) + (13.731535 \pm 5)t + (.9347 \pm 8) \times 10^{-4}t^2$

$- (.90 \pm 2) \times 10^{-6}t^3 - .0008998 \cos \omega$

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

The following elements are based on 47 observations and are valid for the period December 1 through December 15, 1963.

T_0 = 38372.0 MJD

$\omega = (327^\circ.94 \pm 1) + (7^\circ.655 \pm 2)t + {}^\circ.85 \times 10^{-4}t^2 + {}^\circ.3144 \cos \omega$

$\Omega = (157^\circ.033 \pm 3) - (5^\circ.1270 \pm 8)t - {}^\circ.79 \times 10^{-4}t^2 + {}^\circ.0031 \cos \omega$

$i = (33^\circ.199 \pm 1) + {}^\circ.38 \times 10^{-4}t + {}^\circ.95 \times 10^{-5}t^2 - {}^\circ.0039 \sin \omega$

$e = (.08739 \pm 2) - .47 \times 10^{-5}t + .91 \times 10^{-7}t^2 + .0004980 \sin \omega$

$M = (.48674 \pm 4) + (13.734005 \pm 7)t + (.653 \pm 2) \times 10^{-4}t^2$
$- (.92 \pm 5) \times 10^{-6}t^3 - .0008998 \cos \omega$

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

The following elements are based on 52 observations and are valid for the period December 15, 1963, through January 1, 1964.

T_0 = 38386.0 MJD

$\omega = (75^\circ.04 \pm 1) + (7^\circ.641 \pm 3)t + {}^\circ.85 \times 10^{-4}t^2 + {}^\circ.3144 \cos \omega$

$\Omega = (85^\circ.272 \pm 4) - (5^\circ.126 \pm 1)t - {}^\circ.79 \times 10^{-4}t^2 + {}^\circ.0031 \cos \omega$

$i = (33^\circ.2032 \pm 8) + {}^\circ.000304t + {}^\circ.95 \times 10^{-5}t^2 - {}^\circ.0039 \sin \omega$

$e = (.08735 \pm 1) - .22 \times 10^{-5}t + .91 \times 10^{-7}t^2 + .0004980 \sin \omega$

$M = (.77516 \pm 3) + (13.735795 \pm 6)t + (.604 \pm 2) \times 10^{-4}t^2$
$- (.26 \pm 3) \times 10^{-6}t^3 - .0008998 \cos \omega$

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

T (MJD)	ω	Ω	i	e	M	n	n'/2	q	N	D	σ
38304.0	167.67 2	145.193 6	33.202 1	.08806 2	.99951 4	13.721001 3	.736E-4 6	6.719644	26	8	.60
38308.0	198.25 3	124.74 1	33.202 3	.0876 4	.8844 2	13.721505 5	.68E-4 2	6.722538	22	8	.78
38312.0	228.93 4	104.284 7	33.203 4	.08742 5	.7713 1	13.722183 8	.97E-4 1	6.724004	16	8	.92
38316.0	259.58 3	83.813 8	33.202 3	.08737 3	.66145 8	13.723123 9	.123E-3 2	6.724034	27	8	1.34
38320.0	290.37 1	63.346 2	33.2060 8	.087348 9	.55516 3	13.723994 2	.1016E-3 5	6.723927	40	8	.45
38324.0	321.07 1	42.881 3	33.2066 7	.087464 9	.45245 2	13.724857 2	.1171E-3 4	6.722792	53	8	.45
38328.0	351.67 1	22.414 3	33.2058 7	.087680 9	.35382 3	13.725945 2	.1241E-3 4	6.720846	52	8	.48
38332.0	22.24 1	1.940 5	33.2044 9	.08790 1	.25927 4	13.726787 3	.146E-3 2	6.718946	31	8	.52
38336.0											
38340.0											
38344.0	113.53 3	300.497 8	33.202 4	.08803 4	.99717 6	13.729268 6	.86E-4 5	6.717196	18	8	.51
38348.0	143.99 2	280.004 5	33.201 2	.08785 1	.91604 4	13.729951 3	.905E-4 6	6.718286	38	8	.64
38352.0	174.58 1	259.514 3	33.202 1	.08758 1	.83749 3	13.730784 3	.1057E-3 5	6.720034	44	8	.53
38356.0	205.22 1	239.024 4	33.2026 9	.08729 1	.76209 3	13.731518 2	.946E-4 6	6.721882	49	8	.73
38360.0	235.912 9	218.535 3	33.2040 6	.08705 1	.68953 2	13.732309 2	.824E-4 3	6.723377	36	8	.53
38364.0	266.68 1	198.041 4	33.203 1	.08697 2	.61941 3	13.732827 3	.664E-4 5	6.723841	24	8	.57
38368.0	297.45 1	177.538 3	33.2027 8	.08702 1	.55145 3	13.733442 3	.789E-4 5	6.723281	18	8	.44
38372.0	328.22 1	157.040 3	33.2013 9	.08718 2	.48598 4	13.733996 3	.611E-4 5	6.721927	20	8	.34
38376.0	358.83 1	136.531 3	33.2005 9	.08732 2	.42293 3	13.734456 3	.620E-4 5	6.720931	29	8	.45
38380.0	29.435 7	116.025 2	33.2000 5	.08757 1	.36193 2	13.735012 1	.653E-4 4	6.718684	40	8	.40
38384.0	59.966 8	95.520 3	33.1989 5	.08782 1	.30322 2	13.735499 1	.665E-4 4	6.716666	39	8	.49
38388.0	90.43 1	75.013 6	33.198 1	.08789 2	.24677 3	13.736021 4	.53E-4 2	6.716023	20	8	.56
38392.0											

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

MJD	Z	φ	ψ	D.R.A.	$\dot{P}$
		Perigee In Earth Shadow			
38304.	342.	6.7	127.5	127.4	-0.782E-06
38308.	345.	-9.9	127.2	129.1	-0.722E-06
38312.	349.	-24.4	125.2	133.4	-0.103E-05
38316.	352.	-32.6	126.4	143.0	-0.131E-05
38320.	351.	-30.9	133.3	155.2	-0.108E-05
38324.	347.	-20.1	144.9	162.9	-0.124E-05
38328.	343.	-4.6	158.1	165.7	-0.132E-05
38332.	341.	12.0	167.5	167.3	-0.155E-05
38344.	344.	30.1	162.7	192.6	-0.913E-06
38348.	342.	18.8	161.8	199.2	-0.960E-06
38352.	342.	3.0	153.5	201.4	-0.112E-05
38356.	345.	-13.5	139.6	202.7	-0.100E-05
38360.	349.	-27.0	125.2	207.5	-0.874E-06
38364.	352.	-33.1	114.4	217.8	-0.704E-06
38368.	350.	-29.1	110.5	228.7	-0.837E-06
38372.	345.	-16.8	113.6	234.6	-0.648E-06
38376.	343.	-0.6	120.5	236.2	-0.657E-06
38380.	342.	15.6	125.6	237.5	-0.692E-06
38384.	343.	28.3	124.1	242.6	-0.705E-06
38388.	344.	33.2	116.4	252.8	-0.562E-06

I. SAO smoothed elements

The following elements are based on 111 observations and are valid for the period October 1 through November 1, 1963.

$T_0 = 38318.0$ MJD

$\omega = (126°.174 \pm 3) + (5°.2902 \pm 3)t + °.59228 \times 10^{-4}t^2 + °.1524 \cos \omega$

$\Omega = (322°.040 \pm 2) - (3°.5199 \pm 2)t + °.42830 \times 10^{-5}t^2 + °.00769 \cos \omega$

$i = (32°.8826 \pm 6) - °.006856 \sin \omega$

$e = (.164305 \pm 9) - .76803 \times 10^{-5}t + .0004575 \sin \omega$

$M = (.886642 \pm 7) + (11.4797301 \pm 7)t + (.11 \pm 1) \times 10^{-6}t^2$
$+ (.94 \pm 15) \times 10^{-8}t^3 - .0004392 \cos \omega$

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

The following elements are based on 141 observations and are valid for the period November 1 through December 1, 1963.

$T_0 = 38348.0$ MJD

$\omega = (284°.929 \pm 2) + (5°.2914 \pm 3)t + °.59228 \times 10^{-4}t^2 + °.1524 \cos \omega$

$\Omega = (216°.425 \pm 2) - (3°.5201 \pm 2)t + °.42830 \times 10^{-5}t^2 + °.00769 \cos \omega$

$i = (32°.8765 \pm 5) - °.006856 \sin \omega$

$e = (.16431 \pm 1) - .76803 \times 10^{-5}t + .0004575 \sin \omega$

$M = (.278629 \pm 5) + (11.4797277 \pm 7)t - (.13 \pm 1) \times 10^{-6}t^2 + (.17 \pm 2)$
$\times 10^{-7}t^3 - .0004392 \cos \omega$

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

The following elements are based on 125 observations and are valid for the period December 1, 1963, through January 1, 1964.

$T_0 = 38378.0$ MJD

$\omega = (83^\circ.712 \pm 4) + (5^\circ.2900 \pm 5)t + {}^\circ.59228 \times 10^{-4}t^2 + {}^\circ.1524 \cos \omega$

$\Omega = (110^\circ.798 \pm 2) - (3^\circ.5198 \pm 2)t + {}^\circ.42830 \times 10^{-5}t^2 + {}^\circ.00769 \cos \omega$

$i = (32^\circ.8800 \pm 5) - {}^\circ.006856 \sin \omega$

$e = (.16431 \pm 1) - .76803 \times 10^{-5}t + .0004575 \sin \omega$

$M = (.671442 \pm 6) + (11.479407 \pm 1)t - (.183 \pm 3) \times 10^{-5}t^2$
$+ (.439 \pm 2) \times 10^{-6}t^3 - .004392 \cos \omega$

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

T (MJD)	ω	Ω	i	e	M	n	n'/2	q	N	D	σ
38306.0	62.741 9	4.288 4	32.8757 8	.16473 2	.12974 2	11.4797342 9	-.1E-6 4	6.932040	33	8	.54
38310.0	83.862 8	350.205 4	32.8758 8	.16482 2	.04878 2	11.4797294 7	-.6E-6 4	6.931307	36	8	.53
38314.0	104.979 7	336.118 5	32.877 1	.16482 1	.96782 1	11.4797280 6	.3E-6 3	6.931330	35	8	.47
38318.0	126.081 5	322.031 4	32.879 1	.16470 1	.88691 1	11.4797341 7	.6E-6 3	6.932301	30	8	.39
38322.0	147.205 6	307.955 3	32.882 3	.16456 2	.80595 1	11.4797302 9	-.3E-6 7	6.933487	24	8	.43
38326.0	168.368 6	293.872 2	32.882 3	.16438 3	.72489 1	11.479730 2	.1E-5 1	6.934940	23	8	.37
38330.0	189.55 2	279.787 5	32.879 3	.1642 1	.6438 1	11.479731 4	.1E-5 1	6.936604	21	8	.42
38334.0	210.714 6	265.704 5	32.880 3	.16412 3	.56277 1	11.479737 2	-.13E-5 8	6.937145	25	8	.40
38338.0	231.926 4	251.622 3	32.882 2	.16400 2	.481595 8	11.4797279 7	-.12E-5 4	6.938109	35	8	.39
38342.0	253.145 6	237.537 5	32.882 2	.16390 2	.40037 1	11.479725 1	.21E-5 6	6.938907	38	8	.51
38346.0	274.364 5	223.458 4	32.883 1	.16387 2	.319150 9	11.479724 1	-.24E-5 5	6.939193	50	8	.54
38350.0	295.583 4	209.382 3	32.8836 8	.16387 2	.23789 1	11.4797204 7	-.8E-6 3	6.939212	58	8	.47
38354.0	316.785 4	195.310 3	32.8811 7	.16399 2	.15692 1	11.4797206 8	.6E-6 4	6.938199	50	8	.35
38358.0	337.990 4	181.238 3	32.8790 6	.16412 1	.075504 9	11.4797214 9	-.9E-6 4	6.937096	31	8	.28
38362.0	359.19 1	167.135 7	32.879 2	.16432 4	.99441 3	11.479734 3	.3E-5 1	6.935423	13	8	.55
38366.0	20.38 1	153.046 5	32.877 2	.16442 6	.91337 4	11.479736 2	-.1E-5 9	6.934624	13	8	.46
38370.0	41.499 7	138.963 3	32.873 2	.16459 3	.83254 2	11.479745 2	.14E-5 9	6.933162	24	8	.46
38374.0	62.630 5	124.880 2	32.870 1	.16468 2	.75170 2	11.4797498 8	.9E-6 3	6.932420	34	8	.40
38378.0	83.745 5	110.795 3	32.871 1	.16476 2	.670918 9	11.4797508 7	-.4E-6 3	6.931816	42	8	.51
38382.0	104.836 7	96.713 4	32.8731 9	.16472 2	.59018 1	11.4797479 7	-.4E-6 4	6.932108	50	8	.63
38386.0	125.955 8	82.632 6	32.8751 8	.16466 2	.50936 1	11.4797446 8	-.1E-6 3	6.932660	42	8	.57
38390.0	147.09 2	68.56 1	32.877 2	.16452 2	.42847 2	11.4797388 9	-.6E-6 5	6.933816	29	8	.67
38394.0	168.24 2	54.47 1	32.882 3	.16434 6	.34756 4	11.479734 1	-.15E-5 6	6.935256	24	8	.68

Table 2

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

MJD	Z	φ	ψ	D.R.A.	$\dot{P}$
		Perigee In Earth Shadow			
38306.	559.	28.9	123.6	233.5	0.152E-08
38310.	559.	32.7	118.1	240.0	0.911E-08
		Perigee In Sunlight			
38314.	559.	31.6	113.0	247.2	-0.455E-08
38318.	558.	26.0	109.2	252.7	-0.911E-08
38322.	557.	17.1	106.6	255.5	0.455E-08
38326.	557.	6.3	104.6	256.3	-0.152E-07
38330.	558.	-5.2	102.2	256.2	-0.152E-07
38334.	560.	-16.1	98.4	256.7	0.197E-07
38338.	564.	-25.3	92.9	259.2	0.182E-07
38342.	566.	-31.3	86.2	264.3	-0.319E-07
38346.	567.	-32.8	79.5	271.2	0.364E-07
38350.	566.	-29.3	74.6	277.5	0.121E-07
38354.	563.	-21.8	72.7	281.3	-0.911E-08
38358.	560.	-11.7	74.3	282.6	0.137E-07
38362.	557.	-0.4	78.4	282.3	-0.455E-07
38366.	557.	10.9	83.3	281.9	0.152E-07
38370.	558.	21.1	87.0	282.8	-0.212E-07
38374.	559.	28.8	88.0	286.0	-0.137E-07
38378.	560.	32.7	85.8	291.8	0.607E-08
38382.	560.	31.6	80.8	298.2	0.607E-08
38386.	558.	26.1	74.1	303.0	0.152E-08
38390.	557.	17.2	67.2	305.1	0.911E-08
38394.	557.	6.4	61.1	305.2	0.228E-07

I. SAO smoothed elements

The following elements are based on 198 observations and are valid for the period October 1 through November 1, 1963.

$T_0 = 38318.0$ MJD

$\omega = (209^\circ.962 \pm 5) + (4^\circ.8947 \pm 4)t - ^\circ.000103t^2 + ^\circ.1295 \cos \omega$

$\Omega = (25^\circ.629 \pm 2) - (3^\circ.2863 \pm 3)t - ^\circ.18 \times 10^{-4}t^2 + ^\circ.0090 \cos \omega$

$i = (33^\circ.3529 \pm 6) - ^\circ.000128t - ^\circ.0077 \sin \omega$

$e = (.18843 \pm 1) + .33 \times 10^{-5}t + .000452 \sin \omega$

$M = (.95916 \pm 2) + (11.089143 \pm 1)t + (.1125 \pm 8) \times 10^{-4}t^2$

$+ (.88 \pm 4) \times 10^{-7}t^3 - (.104 \pm 4) \times 10^{-7}t^4 - .000376 \cos \omega$

Standard error of one observation: $\sigma = \pm 1''.13$

The following elements are based on 116 observations and are valid for the period November 1 through December 1, 1963.

$T_0 = 38348.0$ MJD

$\omega = (356^\circ.822 \pm 4) + (4^\circ.8963 \pm 6)t - ^\circ.000103t^2 + ^\circ.1295 \cos \omega$

$\Omega = (287^\circ.014 \pm 2) - (3^\circ.2875 \pm 2)t - ^\circ.18 \times 10^{-4}t^2 + ^\circ.0090 \cos \omega$

$i = (33^\circ.3517 \pm 5) - ^\circ.000128t - ^\circ.0077 \sin \omega$

$e = (.18852 \pm 1) + .33 \times 10^{-5}t + .000452 \sin \omega$

$M = (.641350 \pm 7) + (11.089613 \pm 1)t + (.678 \pm 2) \times 10^{-5}t^2$

$- .000376 \cos \omega$

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

The following elements are based on 100 observations and are valid for the period December 1, 1963, through January 1, 1964.

$T_0 = 38378.0$ MJD

$\omega = (143^\circ.672 \pm 5) + (4^\circ.8962 \pm 6)t - {}^\circ.000103t^2 + {}^\circ.1295 \cos \omega$

$\Omega = (188^\circ.371 \pm 3) - (3^\circ.2880 \pm 3)t - {}^\circ.18 \times 10^{-4}t^2 + {}^\circ.0090 \cos \omega$

$i = (33^\circ.346 \pm 1) - {}^\circ.000128t - {}^\circ.0077 \sin \omega$

$e = (.18850 \pm 2) + .33 \times 10^{-5}t + .000452 \sin \omega$

$M = (.335253 \pm 9) + (11.089915 \pm 1)t + (.251 \pm 3) \times 10^{-5}t^2 - .000376 \cos \omega$

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

$T_{(MJD)}$	ω	Ω	i	e	M	n	n'/2	q	N	D	σ
38306.0	151.09 2	65.059 6	33.347 1	.18863 4	.89102 6	11.088965 4	.4E-5 2	6.891021	19	6	.40
38310.0	170.69 1	51.917 5	33.348 1	.18850 3	.24696 5	11.088983 2	.3E-5 1	6.892141	34	6	.46
38314.0	190.28 1	38.768 3	33.353 1	.18835 2	.60303 3	11.089035 2	.94E-5 9	6.893394	49	6	.39
38318.0	209.855 6	25.618 2	33.3587 8	.18819 1	.95947 2	11.089125 1	.115E-4 7	6.894706	46	6	.29
38322.0	229.454 7	12.469 4	33.362 1	.18810 2	.31619 3	11.089220 2	.8E-5 1	6.895417	40	6	.41
38326.0	249.083 7	359.333 4	33.362 1	.18808 3	.67311 2	11.089293 1	.8E-5 1	6.895562	43	6	.42
38330.0	268.70 1	346.191 6	33.363 2	.18806 4	.03034 4	11.089358 3	.8E-5 1	6.895713	43	6	.50
38334.0	288.30 2	333.036 6	33.365 3	.18804 5	.38795 4	11.089432 3	.9E-5 2	6.895899	28	6	.45
38338.0	307.934 8	319.892 3	33.363 3	.18816 3	.74565 2	11.089476 2	.6E-5 1	6.894819	28	6	.41
38342.0	327.55 1	306.751 6	33.362 5	.18818 4	.10360 2	11.089535 2	.8E-5 1	6.894665	20	6	.43
38346.0	347.152 7	293.599 5	33.355 3	.18839 2	.46180 1	11.089589 1	.70E-5 7	6.892792	25	6	.33
38350.0	6.730 8	280.446 6	33.351 2	.18859 2	.82026 1	11.0896387 6	.73E-5 4	6.891112	30	6	.32
38354.0	26.30 3	267.30 1	33.348 2	.18877 7	.17893 4	11.089695 1	.81E-5 7	6.889538	24	6	.55
38358.0	45.87 1	254.146 8	33.3435 9	.18877 5	.53785 2	11.089756 2	.91E-5 8	6.889551	16	6	.41
38362.0	65.42 3	240.96 1	33.347 2	.18898 4	.89711 4	11.089803 2	.98E-5 8	6.887702	26	6	.57
38366.0	84.92 2	227.84 1	33.339 2	.18905 3	.25655 2	11.089855 1	.44E-5 9	6.887122	22	6	.61
38370.0	104.454 8	214.678 4	33.339 2	.18900 3	.61619 1	11.089892 1	-.1E-5 2	6.887472	25	6	.50
38374.0	124.007 7	201.520 3	33.341 2	.18886 3	.97586 1	11.089919 1	.43E-5 7	6.888685	23	6	.43
38378.0	143.538 7	188.363 5	33.340 2	.18872 4	.33569 2	11.089943 4	.2E-5 2	6.889864	17	6	.39
38382.0	163.121 9	175.208 5	33.339 2	.18871 6	.69534 3	11.089952 4	-.1E-5 9	6.889945	20	6	.54
38386.0	182.673 6	162.055 3	33.345 1	.18855 5	.05516 2	11.089965 5	.4E-5 2	6.891268	21	6	.40
38390.0	202.30 2	148.904 6	33.350 2	.18835 8	.41488 7	11.090013 5	.2E-5 2	6.893008	16	6	.51
38394.0	221.898 7	135.755 4	33.354 1	.18823 4	.77482 2	11.090045 2	.48E-5 9	6.893987	23	6	.43

Table 3

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

MJD	Z	φ	ψ	D.R.A.	$\dot{P}$
		Perigee In Sunlight			
38306.	514.	15.4	36.3	31.1	-0.651E-07
38310.	514.	5.1	33.0	31.2	-0.488E-07
38314.	515.	-5.6	30.7	30.8	-0.153E-06
38318.	518.	-15.9	31.1	31.0	-0.187E-06
38322.	521.	-24.7	34.4	32.8	-0.130E-06
38326.	523.	-30.9	39.3	37.0	-0.130E-06
38330.	524.	-33.4	44.2	43.0	-0.130E-06
38334.	523.	-31.5	48.1	49.2	-0.146E-06
38338.	520.	-25.7	50.8	53.5	-0.976E-07
38342.	518.	-17.2	52.8	55.4	-0.130E-06
38346.	515.	-7.0	54.9	55.4	-0.114E-06
38350.	513.	3.7	58.2	54.5	-0.119E-06
38354.	512.	14.1	63.0	54.0	-0.132E-06
38358.	515.	23.2	69.2	55.0	-0.148E-06
38362.	515.	30.0	75.8	58.1	-0.159E-06
38366.	515.	33.2	81.7	63.3	-0.716E-07
38370.	515.	32.2	85.6	69.0	0.163E-07
38374.	515.	27.1	86.6	73.2	-0.699E-07
38378.	514.	19.1	84.5	75.1	-0.325E-07
38382.	512.	9.2	80.1	74.9	0.163E-07
38386.	513.	-1.5	74.6	73.8	-0.650E-07
38390.	516.	-12.0	69.7	72.9	-0.325E-07
38394.	518.	-21.5	67.0	73.3	-0.781E-07

T (MJD)	ω	Ω	i	e	M	n	n'/2	q	N	D	σ
38303.0	7.21 5	168.816 6	47.261 2	.05817 2	.6772 2	12.537159 9	.16E-3 2	7.371382	30	2	.58
38304.0	11.15 4	165.481 5	47.267 2	.05818 1	.2138 1	12.537528 8	.17E-3 1	7.371157	29	2	.48
38305.0	15.04 3	162.150 4	47.272 2	.05817 1	.75091 9	12.537903 5	.21E-3 1	7.371108	32	2	.41
38306.0	18.93 4	158.834 4	47.272 2	.05817 1	.2884 1	12.538308 6	.20E-3 1	7.370925	36	2	.49
38307.0	22.71 4	155.506 3	47.274 2	.05817 1	.8267 1	12.538725 6	.21E-3 1	7.370807	34	2	.42
38308.0	26.75 4	152.183 3	47.276 2	.05828 1	.3646 1	12.539156 5	.236E-3 9	7.369790	36	2	.40
38309.0	30.49 4	148.852 3	47.278 2	.05828 1	.9039 1	12.539611 6	.22E-3 1	7.369586	32	2	.42
38310.0	34.46 4	145.530 3	47.289 3	.05832 1	.4429 1	12.540047 8	.23E-3 1	7.369127	31	2	.42
38311.0	38.20 5	142.209 3	47.286 4	.05832 2	.9830 1	12.540532 7	.26E-3 1	7.368919	37	2	.56
38312.0	42.08 6	138.880 3	47.291 3	.05839 2	.5233 2	12.540956 9	.19E-3 1	7.368185	28	2	.46
38313.0	45.78 6	135.562 3	47.286 4	.05835 3	.0645 2	12.541423 7	.21E-3 1	7.368296	27	2	.50
38314.0	49.64 5	132.236 3	47.292 3	.05840 3	.6057 2	12.54188 1	.23E-3 1	7.367750	30	2	.57
38315.0	53.41 6	128.908 5	47.293 4	.05841 3	.1476 2	12.54230 1	.21E-3 2	7.367484	29	2	.79
38316.0	57.13 5	125.573 4	47.288 4	.05838 2	.6901 1	12.54271 1	.20E-3 2	7.367620	20	2	.54
38317.0	60.93 4	122.246 3	47.284 3	.05832 2	.2328 1	12.543161 9	.20E-3 1	7.367875	25	2	.53
38318.0	64.69 4	118.914 3	47.283 2	.05818 2	.7761 1	12.543523 9	.19E-3 1	7.368809	29	2	.54
38319.0	68.41 5	115.569 4	47.280 3	.05813 3	.3199 2	12.54390 1	.18E-3 2	7.369080	16	2	.48
38320.0	72.00 7	112.242 4	47.282 3	.05800 4	.8644 2	12.544248 9	.17E-3 2	7.369924	16	2	.59
38321.0	75.74 4	108.911 4	47.284 2	.05773 3	.4089 1	12.54461 1	.18E-3 2	7.371905	18	2	.51
38322.0	79.46 4	105.569 3	47.281 2	.05747 2	.9538 1	12.544971 8	.17E-3 1	7.373832	22	2	.53
38323.0	83.11 4	102.241 4	47.281 2	.05724 3	.4992 1	12.54534 2	.20E-3 3	7.375475	24	2	.55
38324.0	86.69 5	98.907 5	47.286 4	.05694 5	.0453 2	12.54571 1	.19E-3 3	7.377695	20	2	.70
38325.0	90.40 5	95.579 5	47.284 6	.05660 7	.5913 2	12.54607 1	.20E-3 3	7.380178	15	2	.69
38326.0	94.04 4	92.246 4	47.282 4	.05611 3	.1378 1	12.54638 1	.17E-3 2	7.383924	18	2	.50
38327.0	97.64 4	88.904 4	47.278 4	.05579 4	.6849 1	12.546716 8	.9E-4 2	7.386244	27	2	.66
38328.0	101.27 6	85.576 5	47.275 5	.05535 6	.2321 2	12.54683 1	.1E-4 3	7.389656	26	2	.74
38329.0	104.83 7	82.245 6	47.274 6	.05504 9	.7796 2	12.54683 1	-.5E-4 2	7.392074	19	2	.82
38330.0	108.44 6	78.920 5	47.271 4	.05451 7	.3267 2	12.54673 1	-.8E-4 2	7.396320	20	2	.78
38331.0	112.20 5	75.590 4	47.265 4	.05389 6	.8734 2	12.546563 9	-.5E-4 2	7.401214	28	2	.80
38332.0	115.82 4	72.257 4	47.261 3	.05349 4	.4204 1	12.546499 6	-.1E-5 9	7.404376	29	2	.67
38333.0	119.46 4	68.926 4	47.255 3	.05296 5	.9672 1	12.546418 7	-.8E-4 1	7.408503	25	2	.63

T (MJD)	ω	Ω	i	e	M	n	n'/2	q	N	D	σ
38334.0	123.16 6	65.597 5	47.254 3	.05246 8	.5138 2	12.54619 1	-.15E-3 2	7.412506	14	2	.62
38335.0	126.94 5	62.263 5	47.249 3	.05172 6	.0598 1	12.545902 8	-.15E-3 2	7.418454	16	2	.55
38336.0	130.65 4	58.932 5	47.246 2	.05124 4	.6058 1	12.545622 8	-.10E-3 1	7.422303	22	2	.52
38337.0	134.52 6	55.594 7	47.246 3	.05062 6	.1511 2	12.54535 1	-.15E-3 2	7.427286	19	2	.70
38338.0	138.29 5	52.260 7	47.244 4	.05009 5	.6964 2	12.54500 1	-.18E-3 2	7.431535	18	2	.53
38339.0	142.08 4	48.940 5	47.240 3	.04951 4	.2413 1	12.544705 9	-.16E-3 2	7.436226	21	2	.48
38340.0	145.86 4	45.620 4	47.235 2	.04903 3	.7859 1	12.544394 9	-.17E-3 2	7.440084	16	2	.39
38341.0	149.69 6	42.284 5	47.230 3	.04852 6	.3302 2	12.544117 8	-.13E-3 2	7.444147	15	2	.45
38342.0	153.53 5	38.956 6	47.229 2	.04793 4	.8741 1	12.54385 1	-.14E-3 2	7.448913	17	2	.46
38343.0	157.46 7	35.631 8	47.232 4	.04737 5	.4175 2	12.54360 1	-.12E-3 2	7.453336	17	2	.67
38344.0	161.42 6	32.298 7	47.236 4	.04680 4	.9606 2	12.54331 1	-.17E-3 2	7.457954	21	2	.67
38345.0	165.35 7	28.964 9	47.238 5	.04625 4	.5035 2	12.54298 1	-.19E-3 2	7.462370	18	2	.65
38346.0	169.42 9	25.631 8	47.245 5	.04571 5	.0457 2	12.54271 2	-.20E-3 2	7.466681	16	2	.53
38347.0	173.3 1	22.32 1	47.240 8	.04521 7	.5882 4	12.54237 2	-.21E-3 3	7.470726	17	2	.83
38348.0	177.22 7	19.003 7	47.238 5	.04474 4	.1302 2	12.54212 1	-.10E-3 2	7.474519	20	2	.66
38349.0	181.07 8	15.682 8	47.236 5	.04417 4	.6722 2	12.54179 3	-.19E-3 4	7.479124	17	2	.65
38350.0	185.4 1	12.36 1	47.240 7	.04377 5	.2126 3	12.54118 2	-.19E-3 3	7.482427	20	2	.91
38351.0	189.37 5	9.043 6	47.239 3	.04321 3	.7536 2	12.540927 9	-.16E-3 1	7.486912	24	2	.45
38352.0	193.33 7	5.726 6	47.237 4	.04285 4	.2946 2	12.540674 6	-.100E-3 9	7.489838	22	2	.41
38353.0	197.4 1	2.408 8	47.245 7	.04225 6	.8349 4	12.54052 1	-.5E-4 2	7.494561	21	2	.79
38354.0	201.7 1	359.089 8	47.249 7	.04179 6	.3748 4	12.54026 2	-.9E-4 3	7.498330	18	2	.83
38355.0	205.5 1	355.772 6	47.240 5	.04151 6	.9157 3	12.540061 9	-.9E-4 2	7.500589	23	2	.75
38356.0	209.47 8	352.467 6	47.238 5	.04105 5	.4558 2	12.539853 7	-.8E-4 1	7.504244	23	2	.51
38357.0	213.6 1	349.149 5	47.242 5	.04054 5	.9954 3	12.53970 1	-.5E-4 2	7.508298	18	2	.58
38358.0	217.6 1	345.832 4	47.240 5	.03997 5	.5352 3	12.53975 6	-.10E-3 7	7.512770	12	2	.51
38359.0	221.5 1	342.527 5	47.240 6	.03970 7	.0754 4	12.53941 1	-.3E-4 2	7.515010	14	2	.79
38360.0	225.59 7	339.214 3	47.243 3	.03923 4	.6149 2	12.539280 9	-.5E-4 2	7.518745	27	2	.65
38361.0	229.77 8	335.897 3	47.243 4	.03870 4	.1540 2	12.539150 9	-.9E-4 2	7.522949	27	2	.54
38362.0	233.73 7	332.585 3	47.238 3	.03834 4	.6936 2	12.53899 1	-.12E-3 2	7.525777	20	2	.47
38363.0	237.97 6	329.271 2	47.238 3	.03777 3	.2322 2	12.538854 8	-.3E-4 1	7.530312	27	2	.50

T (MJD)	ω	Ω	i	e	M	n	n'/2	q	N	D	σ
38364.0	242.05 5	325.955 2	47.236 2	.03728 3	.7713 2	12.538742 6	-.5E-4 1	7.534213	34	2	.44
38365.0	246.20 6	322.642 2	47.234 3	.03678 3	.3101 2	12.538622 6	-.3E-4 1	7.538197	30	2	.41
38366.0	250.40 7	319.328 3	47.232 3	.03627 3	.8487 2	12.538547 8	-.4E-4 1	7.542149	20	2	.40
38367.0	254.4 1	316.021 6	47.237 6	.03582 5	.3876 3	12.538462 9	-.1E-4 2	7.545744	17	2	.52
38368.0	258.64 7	312.711 6	47.238 5	.03535 4	.9262 2	12.538405 9	-.3E-4 1	7.549419	21	2	.53
38369.0	262.92 7	309.391 8	47.230 5	.03486 4	.4645 2	12.538362 9	-.2E-4 2	7.553262	22	2	.46
38370.0	267.2 1	306.085 5	47.229 3	.03433 3	.0029 3	12.538351 6	-.2E-4 1	7.557417	26	2	.30
38371.0	271.07 6	302.771 3	47.235 2	.03392 2	.5423 2	12.538340 5	.23E-4 9	7.560652	28	2	.23
38372.0	275.49 5	299.465 3	47.237 2	.03344 2	.0803 1	12.538364 4	-.3E-4 1	7.564402	22	2	.25
38373.0	280.0 1	296.138 7	47.226 5	.03286 4	.6180 3	12.53837 1	-.3E-4 2	7.568956	24	2	.54
38374.0	284.3 1	292.81 1	47.223 6	.03240 6	.1565 4	12.53839 2	-.1E-5 3	7.572570	20	2	.64
38375.0	288.6 1	289.513 8	47.228 6	.03192 4	.6949 4	12.53846 2	-.2E-4 3	7.576231	18	2	.64
38376.0	293.0 1	286.197 5	47.230 4	.03157 3	.2335 3	12.538503 9	.2E-4 2	7.578966	32	2	.53
38377.0	297.5 1	282.876 6	47.229 4	.03118 3	.7717 3	12.53860 1	.5E-4 2	7.582017	35	2	.59
38378.0	302.0 1	279.561 6	47.226 4	.03075 3	.3097 3	12.538670 9	.4E-4 2	7.585316	39	2	.66
38379.0	306.51 8	276.246 4	47.227 3	.03037 2	.8482 2	12.538774 8	.9E-4 1	7.588228	37	2	.44
38380.0	311.01 7	272.926 3	47.226 2	.03003 2	.3868 2	12.538867 6	.5E-4 1	7.590888	24	2	.35
38381.0	315.7 1	269.616 6	47.229 3	.02973 3	.9248 3	12.53898 1	.2E-4 2	7.593226	32	2	.71
38382.0	320.36 6	266.286 3	47.226 1	.02938 1	.4634 2	12.539042 4	.49E-4 9	7.595892	34	2	.28
38383.0	324.91 6	262.975 3	47.230 2	.02915 2	.0022 2	12.539140 6	.5E-4 1	7.597701	35	2	.35
38384.0	329.57 7	259.657 4	47.233 2	.02891 2	.5408 2	12.539264 6	.7E-4 1	7.599489	27	2	.41
38385.0	334.1 1	256.342 5	47.235 3	.02871 2	.0800 4	12.53940 1	.8E-4 2	7.600998	28	2	.59
38386.0	338.9 1	253.024 5	47.239 2	.02854 2	.6187 3	12.539516 9	.8E-4 2	7.602316	36	2	.66
38387.0	343.5 1	249.711 5	47.243 2	.02837 2	.1580 4	12.53965 1	.5E-4 2	7.603576	29	2	.65
38388.0	347.7 2	246.401 9	47.251 4	.02829 4	.6985 7	12.53973 2	.7E-4 4	7.604178	16	2	.91
38389.0	352.6 1	243.075 4	47.255 2	.02820 2	.2373 3	12.53982 1	.4E-4 3	7.604834	21	2	.51
38390.0	357.23 9	239.766 4	47.256 2	.02813 2	.7770 2	12.539947 8	.3E-4 1	7.605305	35	2	.54
38391.0	1.89 9	236.456 3	47.259 2	.02807 1	.3167 3	12.540015 7	.2E-4 1	7.605774	40	2	.53
38392.0	6.33 8	233.145 3	47.264 2	.02803 2	.8572 2	12.540126 7	.6E-4 1	7.606056	34	2	.54
38393.0	10.72 9	229.831 3	47.267 2	.02802 2	.3979 3	12.540223 8	.6E-4 1	7.606064	28	2	.51
38394.0	15.09 8	226.518 3	47.2oo 2	.02795 2	.9389 2	12.540323 6	.4E-4 1	7.606553	26	2	.49

Table 4

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			
38303.	993.	5.3	15.1	347.2	-0.204E-05
38304.	993.	8.2	18.3	345.7	-0.216E-05
38305.	994.	11.0	21.5	344.2	-0.267E-05
38306.	994.	13.8	24.7	342.7	-0.254E-05
38307.	994.	16.5	27.9	341.2	-0.267E-05
38308.	994.	19.3	31.1	340.0	-0.300E-05
38309.	994.	21.9	34.2	338.7	-0.280E-05
38310.	994.	24.6	37.2	337.6	-0.293E-05
38311.	995.	27.0	40.0	336.5	-0.331E-05
38312.	995.	29.5	42.8	335.7	-0.242E-05
38313.	996.	31.8	45.3	334.8	-0.267E-05
38314.	996.	34.1	47.8	334.3	-0.292E-05
38315.	997.	36.2	50.0	333.8	-0.267E-05
38316.	997.	38.1	52.1	333.6	-0.254E-05
38317.	998.	40.0	54.0	333.6	-0.254E-05
38318.	1000.	41.6	55.6	333.8	-0.242E-05
38319.	1001.	43.1	57.1	334.1	-0.229E-05
38320.	1002.	44.3	58.3	334.5	-0.216E-05
38321.	1004.	45.4	59.4	335.3	-0.229E-05
38322.	1007.	46.2	60.1	336.2	-0.216E-05
38323.	1009.	46.8	60.7	337.2	-0.254E-05
38324.	1011.	47.2	61.1	338.2	-0.241E-05
38325.	1013.	47.3	61.2	339.3	-0.254E-05
38326.	1017.	47.1	61.1	340.4	-0.216E-05
38327.	1019.	46.7	60.8	341.4	-0.114E-05

Table 4 (cont.)

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			
38328.	1022.	46.1	60.4	342.3	-0.127E-06
38329.	1025.	45.2	59.7	342.9	0.635E-06
38330.	1028.	44.2	58.9	343.5	0.102E-05
38331.	1033.	42.8	57.9	344.0	0.635E-06
38332.	1035.	41.4	56.8	344.2	0.127E-07
38333.	1039.	39.7	55.5	344.2	0.102E-05
38334.	1042.	37.9	54.2	344.0	0.191E-05
38335.	1047.	35.9	52.7	343.7	0.191E-05
38336.	1051.	33.9	51.2	343.2	0.127E-05
38337.	1055.	31.6	49.6	342.5	0.191E-05
38338.	1058.	29.2	48.0	341.7	0.229E-05
38339.	1062.	26.8	46.5	340.7	0.203E-05
38340.	1065.	24.3	45.0	339.5	0.216E-05
38341.	1069.	21.7	43.6	338.2	0.165E-05
38342.	1073.	19.1	42.3	336.9	0.178E-05
38343.	1077.	16.3	41.1	335.5	0.153E-05
38344.	1081.	13.5	40.0	334.0	0.216E-05
38345.	1085.	10.7	39.1	332.5	0.242E-05
38346.	1089.	7.7	38.4	331.0	0.254E-05
38347.	1092.	4.9	38.0	329.3	0.267E-05
38348.	1096.	2.0	37.8	327.6	0.127E-05
38349.	1101.	-0.8	37.9	325.9	0.242E-05
38350.	1104.	-4.0	37.7	324.5	0.242E-05

Table 4 (cont.)

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			
38351.	1107.	-6.9	38.1	322.9	0.203E-05
38352.	1112.	-9.7	38.6	321.3	0.127E-05
38353.	1117.	-12.7	39.2	319.8	0.636E-06
38354.	1122.	-15.8	39.6	318.5	0.114E-05
38355.	1124.	-18.4	40.6	317.0	0.114E-05
38356.	1129.	-21.2	41.4	315.7	0.102E-05
38357.	1133.	-24.0	42.0	314.6	0.636E-06
38358.	1139.	-26.6	42.8	313.5	0.127E-05
38359.	1142.	-29.1	43.5	312.6	0.382E-06
38360.	1146.	-31.6	44.1	311.9	0.636E-06
38361.	1151.	-34.1	44.4	311.6	0.114E-05
38362.	1155.	-36.3	44.8	311.2	0.153E-05
38363.	1160.	-38.5	44.8	311.4	0.382E-06
38364.	1165.	-40.4	44.8	311.6	0.636E-06
38365.	1170.	-42.2	44.6	312.2	0.382E-06
38366.	1174.	-43.8	44.2	313.2	0.509E-06
38367.	1178.	-45.0	43.8	314.1	0.127E-06
38368.	1182.	-46.0	43.0	315.6	0.382E-06
38369.	1186.	-46.8	42.0	317.3	0.254E-06
38370.	1191.	-47.2	40.9	319.2	0.254E-06
38371.	1194.	-47.2	40.0	320.4	-0.293E-06
38372.	1197.	-47.0	38.6	322.5	0.382E-06
38373.	1202.	-46.3	36.9	324.6	0.382E-06
38374.	1205.	-45.3	35.4	326.2	0.127E-07

Table 4 (cont.)

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			
38375.	1208.	-44.1	33.9	327.6	0.254E-06
38376.	1210.	-42.5	32.3	328.8	-0.254E-06
38377.	1213.	-40.6	30.7	329.8	-0.636E-06
38378.	1215.	-38.5	29.3	330.6	-0.509E-06
38379.	1217.	-36.2	28.1	331.0	-0.114E-05
38380.	1219.	-33.6	27.3	331.1	-0.636E-06
38381.	1220.	-30.8	26.7	331.2	-0.254E-06
38382.	1222.	-27.9	26.6	330.9	-0.623E-06
38383.	1223.	-25.0	27.1	330.3	-0.636E-06
38384.	1224.	-21.8	28.0	329.7	-0.890E-06
38385.	1225.	-18.7	29.5	328.7	-0.102E-05
38386.	1225.	-15.3	31.3	327.9	-0.102E-05
38387.	1226.	-12.0	33.5	326.8	-0.636E-06
38388.	1226.	-9.0	36.2	325.3	-0.890E-06
38389.	1227.	-5.4	38.8	324.2	-0.509E-06
38390.	1227.	-2.0	41.7	323.0	-0.382E-06
38391.	1227.	1.4	44.7	321.7	-0.254E-06
38392.	1228.	4.6	47.7	320.3	-0.763E-06
38393.	1228.	7.9	50.8	318.9	-0.763E-06
38394.	1229.	11.0	53.8	317.5	-0.509E-06

I. SAO smoothed elements

The following elements are based on 253 observations and are valid for the period October 1 through November 1, 1963.

$T_0 = 38318.0$ MJD

$\omega = (197^\circ.329 \pm 8) + (2^\circ.8206 \pm 6)t + ^\circ.000134t^2 + ^\circ.3431 \cos \omega$

$\Omega = (334^\circ.418 \pm 1) - (3^\circ.3916 \pm 1)t + ^\circ.39 \times 10^{-7}t^2 + ^\circ.0143 \cos \omega$

$i = (49^\circ.9501 \pm 8) + ^\circ.522 \times 10^{-4}t - ^\circ.0043 \sin \omega$

$e = (.11885 \pm 1) - .800 \times 10^{-5}t + .0007285 \sin \omega$

$M = (.67712 \pm 2) + (12.815661 \pm 2)t + (.2259 \pm 8) \times 10^{-4}t^2$
$- (.89 \pm 30) \times 10^{-8}t^3 - (.171 \pm 4) \times 10^{-7}t^4 - .0008799 \cos \omega$

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

The following elements are based on 163 observations and are valid for the period November 1 through December 1, 1963.

$T_0 = 38348.0$ MJD

$\omega = (281^\circ.881 \pm 3) + (2^\circ.8185 \pm 4)t + ^\circ.000134t^2 + ^\circ.3431 \cos \omega$

$\Omega = (232^\circ.659 \pm 1) - (3^\circ.3918 \pm 1)t - ^\circ.39 \times 10^{-7}t^2 + ^\circ.0143 \cos \omega$

$i = (49.9489 \pm 8) + .522 \times 10^{-4}t - .0043 \sin \omega$

$e = (.11873 \pm 1) - .800 \times 10^{-5}t + .0007285 \sin \omega$

$M = (.161845 \pm 9) + (12.816531 \pm 1)t + (.1127 \pm 3) \times 10^{-4}t^2$
$- (.36 \pm 3) \times 10^{-7}t^3 - .0008799 \cos \omega$

Standard error of one observation: $\sigma = \pm 1''.13$

The following elements are based on 107 observations and are valid for the period December 1, 1963, through January 1, 1964.

$T_0 = 38378.0$ MJD

$\omega = (6^\circ.416 \pm 6) + (2^\circ.8161 \pm 6)t + {}^\circ.000134t^2 + {}^\circ.3431 \cos \omega$

$\Omega = (130^\circ.892 \pm 1) - (3^\circ.3926 \pm 1)t - {}^\circ.39 \times 10^{-7}t^2 + {}^\circ.0143 \cos \omega$

$i = (49^\circ.9491 \pm 8) + ({}^\circ.522 \times 10^{-4})t - {}^\circ.0043 \sin \omega$

$e = (.118649 \pm 7) - .800 \times 10^{-5}t + .0007285 \sin \omega$

$M = (.66683 \pm 1) + (12.817072 \pm 2)t + (.586 \pm 3) \times 10^{-5}t^2$
$- (.34 \pm 3) \times 10^{-7}t^3 - .0008799 \cos \omega$

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

T (MJD)	ω	Ω	i	e	M	n	n'/2	q	N	D	σ
38306.0	163.21 2	15.101 3	49.952 1	.11908 2	.89284 5	12.815250 2	.88E-5 9	6.794698	41	6	.48
38310.0	174.49 2	1.534 3	49.954 2	.11891 2	.15395 5	12.815336 2	.12E-4 1	6.795996	45	6	.45
38314.0	185.70 2	347.969 2	49.949 2	.11883 2	.41571 5	12.815480 1	.25E-4 1	6.796601	42	6	.38
38318.0	197.00 2	334.405 3	49.950 3	.11866 2	.67796 6	12.815678 2	.24E-4 1	6.797844	46	6	.49
38322.0	208.30 2	320.839 2	49.951 2	.11852 2	.94096 5	12.815841 1	.176E-4 8	6.798858	60	6	.47
38326.0	219.622 9	307.273 1	49.953 1	.11835 2	.20450 3	12.815979 1	.172E-4 6	6.800074	71	6	.47
38330.0	230.94 1	293.709 1	49.952 1	.11824 3	.46862 3	12.816097 2	.10E-4 1	6.800941	54	6	.53
38334.0	242.28 2	280.141 5	49.950 5	.11812 7	.73309 7	12.816204 2	.12E-4 1	6.801805	29	6	.42
38338.0	253.578 8	266.580 3	49.958 3	.11810 3	.99806 2	12.816265 2	.10E-4 1	6.801903	27	6	.39
38342.0	264.943 6	253.014 3	49.955 2	.11800 2	.26314 2	12.816367 2	.12E-4 1	6.802665	39	6	.45
38346.0	276.286 6	239.446 3	49.953 3	.11800 2	.52872 1	12.816466 1	.105E-4 7	6.802625	44	6	.44
38350.0	287.621 9	225.877 4	49.953 1	.11805 3	.79469 2	12.816548 2	.11E-4 1	6.802192	40	6	.44
38354.0	298.969 9	212.309 3	49.954 2	.11804 3	.06100 3	12.816636 2	.7E-5 1	6.802222	42	6	.43
38358.0	310.28 2	198.744 5	49.955 4	.11818 7	.32779 6	12.816723 4	.10E-4 2	6.801168	27	6	.66
38362.0	321.9 1	185.172 5	49.967 6	.11827 6	.5937 4	12.816789 2	.8E-5 1	6.800413	19	6	.30
38366.0	332.905 6	171.617 2	49.951 2	.11835 2	.86220 2	12.816852 2	.97E-5 8	6.799780	21	6	.33
38370.0	344.251 7	158.050 2	49.949 1	.11852 2	.12974 1	12.816925 1	.73E-5 8	6.798472	27	6	.41
38374.0	355.52 1	144.474 2	49.949 2	.11862 1	.39771 3	12.816979 1	.78E-5 8	6.797645	27	6	.52
38378.0	6.78 2	130.909 3	49.950 2	.11875 1	.66591 4	12.817026 2	.6E-5 1	6.796631	38	6	.75
38382.0	18.06 2	117.336 5	49.951 2	.11885 2	.93425 6	12.817060 3	.5E-5 2	6.795833	26	6	.72
38386.0	29.29 2	103.769 9	49.943 5	.11899 3	.20291 5	12.817113 4	.6E-5 3	6.794724	13	6	.48
38390.0	40.48 2	90.188 8	49.948 6	.11909 4	.47186 6	12.817145 4	.7E-5 2	6.794001	10	6	.54
38394.0	51.73 2	76.613 7	49.957 6	.11920 2	.74081 5	12.817181 2	.6E-5 2	6.793106	14	6	.55

Table 5

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

MJD	Z	φ	ψ	D.R.A.	$\dot{P}$
		Perigee In Sunlight			
38306.	417.	12.8	17.5	354.9	-0.107E-06
38310.	418.	4.2	17.8	345.1	-0.146E-06
38314.	418.	-4.4	24.9	335.1	-0.304E-06
38318.	421.	-12.9	34.4	325.3	-0.292E-06
38322.	423.	-21.3	43.7	316.0	-0.214E-06
38326.	427.	-29.2	51.8	307.5	-0.209E-06
38330.	430.	-36.5	58.0	300.5	-0.122E-06
38334.	433.	-42.7	61.9	295.4	-0.146E-06
38338.	435.	-47.3	63.5	292.6	-0.122E-06
38342.	437.	-49.7	63.4	291.8	-0.146E-06
38346.	437.	-49.5	62.6	291.7	-0.128E-06
38350.	435.	-46.9	62.4	290.6	-0.134E-06
38354.	433.	-42.0	64.3	287.3	-0.852E-07
38358.	430.	-35.7	69.0	281.6	-0.122E-06
38362.	427.	-28.2	76.6	274.2	-0.974E-07
38366.	424.	-20.4	86.9	264.9	-0.118E-06
38370.	421.	-12.0	98.9	255.0	-0.889E-07
		Perigee In Sunlight			
38374.	419.	-3.4	112.0	244.4	-0.950E-07
38378.	418.	5.2	125.3	233.7	-0.730E-07
38382.	419.	13.7	138.1	223.2	-0.609E-07
38386.	419.	22.0	149.5	213.1	-0.730E-07
38390.	421.	29.8	157.6	204.0	-0.852E-07
38394.	422.	36.9	160.2	196.5	-0.730E-07

I. SAO smoothed elements

The following elements are based on 105 observations and are valid for the period October 1 through October 8, 1963.

$T_0 = 38307.0$ MJD

$\omega = (54^\circ.342 \pm 5) + (5^\circ.056 \pm 2)t + {}^\circ.000718t^2 + {}^\circ.2242 \cos \omega$

$\Omega = (238^\circ.701 \pm 3) - (3^\circ.8951 \pm 9)t - {}^\circ.000943t^2 + {}^\circ.0072 \cos \omega$

$i = (38^\circ.946 \pm 1) + {}^\circ.24 \times 10^{-4}t - {}^\circ.0049 \sin \omega$

$e = (.13148 \pm 2) - (.29 \pm 7) \times 10^{-4}t - .139 \times 10^{-5}t^2 + .0005261 \sin \omega$

$M = (.20367 \pm 1) + (12.497949 \pm 7)t + (.001155 \pm 1)t^2 + (.16 \pm 1) \times 10^{-4}t^3 + (.31 \pm 9) \times 10^{-6}t^4 + (.64 \pm 7) \times 10^{-6}t^5 - .0006329 \cos \omega$

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

The following elements are based on 69 observations and are valid for the period October 8 through October 16, 1963.

$T_0 = 38314.0$ MJD

$\omega = (89^\circ.74 \pm 1) + (5^\circ.072 \pm 3)t + {}^\circ.00718t^2 + {}^\circ.2242 \cos \omega$

$\Omega = (211^\circ.379 \pm 5) - (3^\circ.911 \pm 1) - {}^\circ.000943t^2 + {}^\circ.0072 \cos \omega$

$i = (38^\circ.944 \pm 1) + {}^\circ.24 \times 10^{-4}t - {}^\circ.0049 \sin \omega$

$e = (.13127 \pm 4) - (.68 \pm 12) \times 10^{-4}t - .139 \times 10^{-5}t^2 + .0005261 \sin \omega$

$M = (.75847 \pm 2) + (12.520163 \pm 8)t + (.002330 \pm 3)t^2 + (.000131 \pm 1)t^3 - (.44 \pm 2) \times 10^{-5}t^4 - (.269 \pm 6) \times 10^{-5}t^5 - .0006329 \cos \omega$

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

The following elements are based on 77 observations and are valid for the period October 16 through October 24, 1963.

T_0 = 38322.0 MJD

$\omega = (130^\circ.490 \pm 9) + (5^\circ.085 \pm 5)t + ^\circ.003279t^2 + ^\circ.2364 \cos \omega$

$\Omega = (179^\circ.996 \pm 5) - (3^\circ.933 \pm 3)t - ^\circ.001847t^2 + ^\circ.0070 \cos \omega$

$i = (38^\circ.946 \pm 1) + ^\circ.0005623t - ^\circ.0047 \sin \omega$

$e = (.13032 \pm 2) - (.84 \pm 12) \times 10^{-4}t + .89 \times 10^{-6}t^2 + .0005312 \sin \omega$

$M = (.08122 \pm 2) + (12.55901 \pm 1)t + (.002353 \pm 2)t^2 + (.33 \pm 1) \times 10^{-4}t^3$
$- (.46 \pm 2) \times 10^{-5}t^4 - (.117 \pm 6) \times 10^{-5}t^5 - .0006674 \cos \omega$

Standard error of one observation: $\sigma = \pm 2''.38$

The following elements are based on 65 observations and are valid for the period October 24 through November 1, 1963.

T_0 = 38330.0 MJD

$\omega = (171^\circ.56 \pm 2) + (5^\circ.136 \pm 8)t + ^\circ.003279t^2 + ^\circ.2364 \cos \omega$

$\Omega = (148^\circ.39 \pm 1) - (3^\circ.961 \pm 3)t - ^\circ.001847t^2 + ^\circ.0070 \cos \omega$

$i = (38^\circ.946 \pm 4) + ^\circ.0005623t - ^\circ.0047 \sin \omega$

$e = (.12910 \pm 5) - (.00017 \pm 2)t + .89 \times 10^{-6}t^2 + .0005312 \sin \omega$

$M = (.70844 \pm 6) + (12.59677 \pm 2)t + (.00171 \pm 1)t^2 + (.000182 \pm 3)t^3$
$+ (.67 \pm 2) \times 10^{-4}t^4 - (.51 \pm 2) \times 10^{-5}t^5 - (.145 \pm 7) \times 10^{-5}t^6$
$- .0006674 \cos \omega$

Standard error of one observation: $\sigma = \pm 3''.90$

The following elements are based on 71 observations and are valid for the period November 1 through November 8, 1963.

T_0 = 38338.0 MJD

$\omega = (212^\circ.745 \pm 6) + (5^\circ.186 \pm 2)t + ^\circ.003279t^2 + ^\circ.2364 \cos \omega$

$\Omega = (116^\circ.578 \pm 2) - (3^\circ.9883 \pm 7)t - ^\circ.001847t^2 + ^\circ.0070 \cos \omega$

$i = (38^\circ.959 \pm 1) + ^\circ.0005623t - ^\circ.0047 \sin \omega$

$e = (.12787 \pm 2) - (.000155 \pm 6)t + .89 \times 10^{-6}t^2 + .0005312 \sin \omega$

$M = (.65899 \pm 1) + (12.639415 \pm 7)t + (.002355 \pm 2)t^2 - (.20 \pm 1) \times 10^{-4}t^3$
$+ (.157 \pm 1) \times 10^{-4}t^4 + (.362 \pm 7) \times 10^{-5}t^5 - .0006674 \cos \omega$

Standard error of one observation: $\sigma = \pm 1''.30$

The following elements are based on 88 observations and are valid for the period November 8 through November 16, 1963.

T_0 = 38345.0 MJD

$\omega = (249^\circ.185 \pm 5) + (5^\circ.222 \pm 2)t + {}^\circ.003279t^2 + {}^\circ.2364 \cos \omega$

$\Omega = (88^\circ.556 \pm 3) - (4^\circ.0183 \pm 7)t - {}^\circ.001847t^2 + {}^\circ.0070 \cos \omega$

$i = (38^\circ.961 \pm 1) + {}^\circ.0005623t - {}^\circ.0047 \sin \omega$

$e = (1.2666 \pm 2) - (.000183 \pm 5)t + .89 \times 10^{-6}t^2 + .0005312 \sin \omega$

$M = (.28296 \pm 1) + (12.683963 \pm 7)t + (.002998 \pm 2)t^2 - (.822 \pm 8) \times 10^{-4}t^3$

$+ (.13 \pm 1) \times 10^{-5}t^4 + (.77 \pm 4) \times 10^{-6}t^5 - .0006674 \cos \omega$

Standard error of one observation: $\sigma = \pm 1''.43$

The following elements are based on 97 observations and are valid for the period November 16 through November 23, 1963.

T_0 = 38353.0 MJD

$\omega = (291^\circ.077 \pm 8) + (5^\circ.265 \pm 4)t + {}^\circ.003279t^2 + {}^\circ.2364 \cos \omega$

$\Omega = (56^\circ.272 \pm 4) - (4^\circ.050 \pm 2)t - {}^\circ.001847t^2 + {}^\circ.0070 \cos \omega$

$i = (38^\circ.958 \pm 1) + {}^\circ.0005623t - {}^\circ.0047 \sin \omega$

$e = (.12544 \pm 3) - (.00016 \pm 1)t + .89 \times 10^{-6}t^2 + .0005312 \sin \omega$

$M = (.93012 \pm 2) + (12.72881 \pm 1)t + (.002817 \pm 2)t^2 - (.86 \pm 2) \times 10^{-4}t^3$

$+ (.23 \pm 2) \times 10^{-5}t^4 + (.32 \pm 1) \times 10^{-5}t^5 - .0006674 \cos \omega$

Standard error of one observation: $\sigma = \pm 2''.48$

The following elements are based on 95 observations and are valid for the period November 23 through December 1, 1963.

T_0 = 38360.0 MJD

$\omega = (328^\circ.023 \pm 9) + (5^\circ.332 \pm 4)t + {}^\circ.002094t^2 + {}^\circ.2364 \cos \omega$

$\Omega = (27^\circ.814 \pm 5) - (4^\circ.080 \pm 2)t - {}^\circ.002304t^2 + {}^\circ.0070 \cos \omega$

$i = (38^\circ.959 \pm 2) - {}^\circ.000213t - {}^\circ.0047 \sin \omega$

$e = (.12421 \pm 2) - (.00018 \pm 1)t - .179 \times 10^{-5}t^2 + .0005312 \sin \omega$

$M = (.17494 \pm 2) + (12.77210 \pm 1)t + (.003074 \pm 3)t^2 - (.000102 \pm 1)t^3$

$+ (.51 \pm 2) \times 10^{-5}t^4 + (.194 \pm 6) \times 10^{-5}t^5 - .0006674 \cos \omega$

Standard error of one observation: $\sigma = \pm 2''.13$

The following elements are based on 53 observations and are valid for the period December 1 through December 8, 1963.

T_0 = 38368.0 MJD

$\omega = (10^\circ.59 \pm 2) + (5^\circ.34 \pm 2)t + {}^\circ.002094t^2 + {}^\circ.2364 \cos \omega$

$\Omega = (355^\circ.040 \pm 8) - (4^\circ.117 \pm 2)t - {}^\circ.002304t^2 + {}^\circ.0070 \cos \omega$

$i = (38^\circ.959 \pm 5) - {}^\circ.000213t - {}^\circ.0047 \sin \omega$

$e = (.1227 \pm 1) - (.00022 \pm 10)t - .179 \times 10^{-5}t^2 + .0005312 \sin \omega$

$M = (.5443 \pm 1) + (12.8234 \pm 1)t + (.003899 \pm 3)t^2 - (.38 \pm 2) \times 10^{-4}t^3$
$- (.146 \pm 2) \times 10^{-4}t^4 + (.25 \pm 1) \times 10^{-5}t^5 - .0006674 \cos \omega$

Standard error of one observation: $\sigma = \pm 1!40$

The following elements are based on 34 observations and are valid for the period December 8 through December 16, 1963.

T_0 = 38375.0 MJD

$\omega = (48^\circ.14 \pm 2) + (5^\circ.389 \pm 7)t + {}^\circ.002094t^2 + {}^\circ.2364 \cos \omega$

$\Omega = (326^\circ.111 \pm 5) - (4^\circ.151 \pm 2)t - {}^\circ.002304t^2 + {}^\circ.0070 \cos \omega$

$i = (38^\circ.953 \pm 5) - .000213t - .0047 \sin \omega$

$e = (.12123 \pm 6) - (.00017 \pm 2)t - .179 \times 10^{-5}t^2 + .0005312 \sin \omega$

$M = (.48269 \pm 6) + (12.87097 \pm 3)t + (.002953 \pm 9)t^2 + (.62 \pm 3)$
$\times 10^{-4}t^3 + (.156 \pm 6) \times 10^{-4}t^4 - (.24 \pm 2) \times 10^{-5}t^5 - .0006674 \cos \omega$

Standard error of one observation: $\sigma = \pm 2!10$

The following elements are based on 70 observations and are valid for the period December 16 through December 24, 1963.

T_0 = 38383.0 MJD

$\omega = (91^\circ.28 \pm 2) + (5^\circ.406 \pm 7)t + {}^\circ.002094t^2 + {}^\circ.2364 \cos \omega$

$\Omega = (292^\circ.765 \bullet 9) - (4^\circ.186 \pm 2)t - {}^\circ.002304t^2 + {}^\circ.0070 \cos \omega$

$i = (38^\circ.952 \pm 5) - {}^\circ.000213t - {}^\circ.0047 \sin \omega$

$e = (.11970 \pm 4) - (.00021 \pm 1)t - {}^\circ.179 \times 10^{-5}t^2 + .0005312 \sin \omega$

$M = (.66096 \pm 6) + (12.92153 \pm 2)t + (.003061 \pm 4)t^2 + (.000140 \pm 2)t^3$

$(.42 \pm 3) \times 10^{-5}t^4 - (.346 \pm 9) \times 10^{-5}t^5 - .0006674 \cos \omega$

Standard error of one observation: $\sigma = \pm 3''.43$

The following elements are based on 49 observations and are valid for the period December 24, 1963, through January 1, 1964.

T_0 = 38391.0 MJD

$\omega = (134^\circ.79 \pm 2) + (5^\circ.462 \pm 7)t + {}^\circ.002094t^2 + {}^\circ.2364 \cos \omega$

$\Omega = (259^\circ.149 \pm 6) - (4^\circ.218 \pm 2)t - {}^\circ.002304t^2 + {}^\circ.0070 \cos \omega$

$i = (38^\circ.956 \pm 2) - {}^\circ.000213t - {}^\circ.0047 \sin \omega$

$e = (.11826 \pm 2) - (.000203 \pm 9)t - .179 \times 10^{-5}t^2 + .0005312 \sin \omega$

$M = (.24391 \pm 4) + (12.97117 \pm 2)t + (.002886 \pm 4)t^2 + (.000100 \pm 2)t^3$

$+ (.47 \pm 3) \times 10^{-5}t^4 - (.216 \pm 8) \times 10^{-5}t^5 - .0006674 \cos \omega$

Standard error of one observation: $\sigma = \pm 2''.60$

(MJD)	ω	Ω	i	e	M	n	n'/2	q	N	D	σ
38303.0	34.285 7	254.276 3	38.956 4	.13177 4	.22844 2	12.48952 1	.124E-2 2	6.811989	13	2	.28
38304.0	39.34 1	250.387 8	38.947 6	.13191 4	.71912 4	12.491744 8	.102E-2 3	6.810082	15	2	.57
38305.0	44.36 1	246.509 8	38.949 4	.13195 5	.21187 2	12.49366 1	.94E-3 3	6.809069	14	2	.51
38306.0	49.42 1	242.612 8	38.947 4	.13195 3	.70649 2	12.49571 1	.107E-2 2	6.808392	23	2	.54
38307.0	54.478 7	238.711 4	38.945 2	.13191 3	.20327 2	12.49795 1	.115E-2 1	6.807861	35	2	.41
38308.0	59.510 6	234.808 4	38.940 2	.13199 2	.70244 2	12.500375 4	.1265E-2 8	6.806330	32	2	.37
38309.0	64.552 9	230.904 5	38.938 2	.13203 3	.20410 2	12.502836 6	.121E-2 1	6.805133	30	2	.43
38310.0	69.603 8	227.006 4	38.938 2	.13200 3	.70821 2	12.505666 5	.1614E-2 9	6.804428	41	2	.49
38311.0	74.645 7	223.104 3	38.938 1	.13200 2	.21554 2	12.509026 7	.1732E-2 9	6.803127	35	2	.36
38312.0	79.71 1	219.202 7	38.939 3	.13201 4	.72620 2	12.51234 2	.160E-2 2	6.801869	23	2	.53
38313.0	84.76 2	215.30 1	38.940 3	.13197 6	.24023 6	12.51591 2	.192E-2 4	6.800830	16	2	.64
38314.0	89.87 2	211.367 5	38.938 2	.13156 6	.75812 4	12.52020 3	.254E-2 3	6.802508	12	2	.32
38315.0	94.87 2	207.457 5	38.938 1	.13165 5	.28100 4	12.52548 1	.274E-2 2	6.799898	14	2	.32
38316.0	99.89 1	203.552 4	38.940 1	.13163 3	.80933 3	12.5307900 7	.2546E-2 7	6.798133	11	2	.21
38317.0	104.94 2	199.649 8	38.946 4	.13154 4	.34267 4	12.53608 4	.277E-2 4	6.796939	11	2	.27
38318.0	110.02 2	195.73 1	38.944 5	.13135 8	.88126 4	12.54106 3	.250E-2 5	6.796599	7	2	.29
38319.0	115.06 3	191.80 1	38.943 4	.1312 1	.42484 6	12.54577 3	.227E-2 4	6.796016	7	2	.47
38320.0	120.199 9	187.842 5	38.941 1	.13102 2	.97272 2	12.550072 5	.211E-2 1	6.795970	15	2	.42
38321.0	125.26 1	183.922 6	38.941 1	.13085 3	.52495 3	12.554423 9	.225E-2 1	6.795721	24	2	.57
38322.0	130.342 7	179.993 3	38.941 1	.13073 2	.08162 2	12.559032 5	.235E-2 1	6.794966	30	2	.45
38323.0	135.405 7	176.050 4	38.943 1	.13050 2	.64311 2	12.56386 1	.250E-2 2	6.795071	31	2	.48
38324.0	140.50 2	172.094 7	38.946 3	.13046 4	.20946 4	12.56860 1	.218E-2 2	6.793601	23	2	.78
38325.0	145.60 2	168.151 6	38.946 3	.13025 3	.78018 3	12.57267 2	.195E-2 3	6.793810	20	2	.59
38326.0	151.1·1	164.21 5	38.90 1	.1298 2	.35344 3	12.57713 5	.32E-2 1	6.795544	15	2	1.59
38327.0	155.69 9	160.22 3	38.97 2	.1296 1	.9354 2	12.58411 8	.38E-2 2	6.794479	13	2	2.40
38328.0	161.01 2	156.325 9	38.944 4	.12968 4	.52227 5	12.589579 8	.218E-2 1	6.792208	15	2	.85
38329.0	166.10 2	152.346 8	38.951 2	.12946 3	.11412 4	12.593510 9	.177E-2 2	6.792517	19	2	.50
38330.0	171.22 1	148.393 6	38.952 1	.12926 2	.70943 3	12.597012 6	.172E-2 1	6.792742	22	2	.34
38331.0	176.35 3	144.43 2	38.953 5	.1291 3	.3082 2	12.60067 1	.202E-2 3	6.793120	21	2	.87
38332.0	181.50 7	140.40 4	38.978 1	.1270 7	.9119 3	12.60717 3	.464E-2 5	6.806793	14	2	1.61
38333.0	186.92 8	136.48 2	38.945 1	.1285 2	.5222 2	12.61538 5	.308E-2 7	6.791818	16	2	2.59

T (MJD)	ω	Ω	i	e	M	n	n'/2	q	N	D	σ
38334.0	191.81 1	132.504 4	38.961 3	.12843 3	.14126 3	12.62027 2	.204E-2 3	6.790912	18	2	.50
38335.0	197.01 1	128.518 3	38.957 2	.12821 3	.76350 3	12.624597 6	.230E-2 2	6.791023	17	2	.55
38336.0	202.17 1	124.542 4	38.960 3	.12799 4	.39048 3	12.62949 1	.258E-2 2	6.791001	18	2	.64
38337.0	207.34 2	120.561 5	38.964 4	.12778 4	.02259 5	12.63459 1	.247E-2 2	6.790802	19	2	.63
38338.0	212.54 1	116.568 4	38.964 3	.12756 4	.65959 4	12.639400 8	.237E-2 1	6.790805	17	2	.53
38339.0	217.72 1	112.583 3	38.958 2	.12751 3	.30133 2	12.644188 7	.241E-2 1	6.789525	18	2	.45
38340.0	222.95 1	108.588 4	38.958 3	.12732 4	.94795 3	12.649495 9	.285E-2 2	6.789088	21	2	.58
38341.0	228.14 2	104.585 5	38.963 3	.12702 4	.60064 3	12.65623 1	.364E-2 3	6.789022	22	2	.88
38342.0	233.403 7	100.589 3	38.964 2	.12679 2	.26059 1	12.663893 7	.368E-2 2	6.788021	23	2	.46
38343.0	238.616 8	96.582 4	38.954 2	.12666 3	.92801 2	12.670897 7	.351E-2 1	6.786528	24	2	.47
38344.0	243.831 8	92.571 5	38.964 3	.12628 3	.60250 2	12.677686 7	.318E-2 1	6.787091	22	2	.45
38345.0	249.10 2	88.57 2	38.98 1	.12613 9	.28315 5	12.68382 2	.310E-2 7	6.786063	18	2	1.17
38346.0	254.36 3	84.55 2	38.973 7	.12594 8	.96997 6	12.68969 2	.272E-2 5	6.785409	17	2	1.39
38347.0	259.602 8	80.498 4	38.962 2	.12575 2	.66244 3	12.695013 8	.257E-2 1	6.785047	17	2	.32
38348.0	264.839 8	76.481 5	38.966 3	.12562 3	.36004 2	12.70009 1	.252E-2 2	6.784217	20	2	.37
38349.0	270.100 8	72.453 5	38.967 2	.12548 3	.06272 2	12.705338 5	.263E-2 2	6.783390	24	2	.50
38350.0	275.36 1	68.414 6	38.965 3	.12534 4	.77065 2	12.710476 9	.259E-2 1	6.782655	29	2	.68
38351.0	280.63 1	64.372 9	38.963 3	.12520 4	.48385 4	12.71663 2	.347E-2 3	6.781614	28	2	.85
38352.0	285.911 6	60.328 5	38.963 1	.12501 2	.20391 2	12.723100 5	.281E-2 2	6.780751	30	2	.50
38353.0	291.207 8	56.281 4	38.963 1	.12487 3	.92981 2	12.728669 8	.270E-2 2	6.779894	33	2	.59
38354.0	296.491 8	52.229 4	38.963 1	.12479 3	.66121 2	12.73401 2	.262E-2 2	6.778565	25	2	.53
38355.0	301.75 1	48.172 6	38.961 2	.12469 3	.39804 3	12.739388 6	.264E-2 2	6.777440	29	2	.81
38356.0	307.037 7	44.110 4	38.961 1	.12458 2	.14018 2	12.744986 8	.303E-2 1	6.776301	23	2	.45
38357.0	312.32 1	40.048 7	38.961 2	.12443 4	.88828 3	12.75118 2	.322E-2 3	6.775277	22	2	.58
38358.0	317.68 2	35.986 9	38.959 3	.12440 4	.64263 6	12.75836 1	.385E-2 3	6.772935	17	2	.63
38359.0	322.93 4	31.893 2	38.961 4	.12396 7	.40520 8	12.76587 2	.341E-2 3	6.773745	18	2	1.01
38360.0	328.28 2	27.821 8	38.960 2	.12391 3	.17427 3	12.772204 9	.288E-2 2	6.771845	32	2	.61
38361.0	333.572 8	23.738 5	38.961 2	.12377 2	.94941 2	12.777953 6	.290E-2 1	6.770941	32	2	.48
38362.0	338.87 1	19.658 5	38.960 2	.12365 2	.73026 3	12.783586 7	.2742E-2 9	6.769826	23	2	.53
38363.0	344.27 1	15.574 5	38.955 2	.12361 3	.51629 4	12.789298 8	.308E-2 2	6.768123	26	2	.34

T (MJD)	ω	Ω	i	e	M	n	n'/2	q	N	D	σ
38364.0	349.57 4	11.467 8	38.958 3	.1235 1	.3088 2	12.795739 7	.335E-2 2	6.766922	26	2	.32
38365.0	354.85 8	7.354 1	38.969 6	.1233 4	.1078 4	12.801690 9	.288E-2 2	6.765807	16	2	.39
38366.0	359.5 3	3.27 2	38.96 1	.1208 9	.915 1	12.80788 2	.373E-2 4	6.783402	11	2	.76
38367.0	5.5 2	359.23 4	38.92 3	.1226 7	.7240 9	12.81567 2	.395E-2 4	6.766619	11	2	.62
38368.0	10.82 2	355.05 2	38.96 1	.12274 8	.54373 8	12.82340 2	.379E-2 3	6.762848	15	2	.49
38369.0	16.15 1	350.930 8	38.950 7	.12265 4	.37093 4	12.83093 1	.374E-2 2	6.760905	17	2	.40
38370.0	21.38 9	346.82 1	38.94 1	.1221 4	.20602 4	12.838223 7	.352E-2 1	6.762332	17	2	.37
38371.0	26.75 9	342.69 1	38.94 1	.1220 4	.0477 4	12.845176 9	.345E-2 2	6.760774	13	2	.33
38372.0	32.7 2	338.49 2	39.05 4	.1244 6	.8939 6	12.85231 2	.344E-2 4	6.740194	10	2	.43
38373.0	38.1 2	334.35 3	39.05 5	.1243 8	.7497 8	12.8592 1	.35E-2 3	6.738110	10	4	.45
38374.0	42.9 1	330.27 2	38.94 4	.1222 6	.6141 6	12.8656 1	.285E-2 8	6.752271	08	4	.51
38375.0	48.29 2	326.111 6	38.97 1	.12167 5	.4823 2	12.8707 6	.34E-2 7	6.754510	10	4	.52
38376.0	53.65 1	321.960 6	38.953 5	.12150 3	.35634 3	12.87724 2	.329E-2 2	6.753502	13	4	.51
38377.0	59.01 2	317.796 9	38.947 7	.12136 3	.23692 3	12.883941 7	.339E-2 1	6.752234	11	2	.51
38378.0	64.36 2	313.650 9	38.955 5	.12116 2	.12430 4	12.891119 7	.388E-2 2	6.751267	9	2	.60
38379.0	69.80 2	309.48 1	38.954 5	.12099 2	.01911 4	12.898541 7	.344E-2 3	6.749946	14	2	.80
38380.0	75.16 2	305.31 1	38.955 5	.12078 3	.92102 5	12.90491 2	.306E-2 2	6.749353	11	2	.67
38381.0	80.52 3	301.129 8	38.951 9	.12072 4	.82898 7	12.91071 4	.260E-2 7	6.747839	11	2	.54
38382.0	85.91 2	296.948 6	38.954 6	.12052 3	.74233 4	12.916006 9	.263E-2 2	6.747480	18	2	.51
38383.0	91.25 3	292.774 9	38.957 7	.12023 5	.66107 7	12.92136 1	.288E-2 3	6.747833	21	2	.92
38384.0	96.69 2	288.578 6	38.949 4	.12016 3	.58548 6	12.92826 1	.373E-2 2	6.745954	18	2	.59
38385.0	102.09 2	284.379 6	38.948 3	.11999 4	.51742 4	12.93546 1	.347E-2 3	6.744813	12	2	.47
38386.0	107.48 2	280.182 7	38.947 4	.11972 5	.45652 4	12.94259 1	.353E-2 2	6.744383	17	2	.54
38387.0	112.89 2	275.979 8	38.947 5	.11966 5	.40256 5	12.94939 2	.324E-2 3	6.742478	22	2	.42
38388.0	118.31 3	271.76 1	38.943 7	.11930 5	.35502 6	12.955185 7	.269E-2 2	6.743215	16	2	.53
38389.0	123.74 1	267.561 6	38.949 3	.11907 2	.31283 3	12.96049 1	.259E-2 2	6.743177	12	2	.38
38390.0	129.21 2	263.355 7	38.954 2	.11887 3	.27577 6	12.965817 7	.279E-2 1	6.742831	11	2	.56
38391.0	134.62 1	259.136 5	38.953 1	.11864 2	.24442 4	12.971398 6	.2830E-2 9	6.742626	17	2	.54
38392.0	140.02 1	254.910 5	38.953 1	.11840 2	.21871 3	12.97709 2	.289E-2 3	6.742525	17	2	.48
38393.0	145.480 9	250.687 4	38.954 1	.11810 2	.19893 2	12.984027 9	.378E-2 2	6.742393	13	2	.43
38394.0	150.97 2	246.456 6	38.954 2	.11772 3	.18650 4	12.991151 9	.340E-2 2	6.742845	12	2	.70

Table 6

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

MJD	Z	φ	ψ	D.R.A.	$\dot{P}$
		Perigee In Sunlight			
38303.	436.	20.7	96.3	95.7	-0.159E-04
38304.	435.	23.5	96.3	95.5	-0.131E-04
38305.	435.	26.1	96.5	95.4	-0.120E-04
38306.	435.	28.5	96.8	95.6	-0.137E-04
38307.	435.	30.8	97.4	96.0	-0.147E-04
38308.	434.	32.8	98.1	96.6	-0.162E-04
38309.	434.	34.6	99.1	97.5	-0.155E-04
38310.	433.	36.1	100.2	98.6	-0.206E-04
38311.	433.	37.3	101.4	99.9	-0.221E-04
38312.	432.	38.2	102.8	101.3	-0.204E-04
38313.	431.	38.7	104.2	102.9	-0.245E-04
38314.	433.	38.9	105.8	104.6	-0.324E-04
38315.	430.	38.8	107.3	106.2	-0.349E-04
38316.	428.	38.3	108.8	107.8	-0.324E-04
		Perigee In Earth Shadow			
38317.	426.	37.4	110.2	109.3	-0.353E-04
38318.	426.	36.2	111.6	110.6	-0.318E-04
38319.	425.	34.7	112.8	111.6	-0.288E-04
38320.	424.	32.9	113.9	112.5	-0.268E-04
38321.	423.	30.9	114.7	113.1	-0.286E-04
38322.	422.	28.6	115.3	113.5	-0.298E-04
38323.	421.	26.2	115.7	113.6	-0.317E-04
38324.	419.	23.6	115.7	113.5	-0.276E-04
38325.	418.	20.8	115.5	113.3	-0.247E-04
38326.	419.	17.7	115.3	113.2	-0.405E-04

Table 6 (cont.)

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

MJD	Z	φ	ψ	D.R.A.	$\dot{P}$
		Perigee In Earth Shadow			
38327.	418.	15.0	114.2	112.1	-0.480E-04
38328.	415.	11.8	113.3	111.7	-0.275E-04
38329.	415.	8.7	112.1	110.8	-0.223E-04
38330.	415.	5.5	110.6	109.9	-0.217E-04
		Perigee In Sunlight			
38331.	415.	2.3	109.0	109.0	-0.254E-04
38332.	428.	-0.9	107.3	108.0	-0.584E-04
38333.	414.	-4.3	105.7	107.4	-0.387E-04
38334.	413.	-7.4	103.8	106.3	-0.256E-04
38335.	413.	-10.6	102.0	105.4	-0.289E-04
38336.	414.	-13.7	100.2	104.7	-0.324E-04
38337.	414.	-16.8	98.6	104.0	-0.309E-04
38338.	415.	-19.8	97.0	103.5	-0.297E-04
38339.	414.	-22.6	95.7	103.2	-0.301E-04
38340.	415.	-25.4	94.5	103.1	-0.356E-04
38341.	415.	-27.9	93.5	103.1	-0.454E-04
38342.	415.	-30.3	92.8	103.5	-0.459E-04
38343.	414.	-32.5	92.3	104.1	-0.437E-04
38344.	416.	-34.4	92.1	104.9	-0.396E-04
38345.	415.	-36.0	92.1	106.0	-0.385E-04
38346.	415.	-37.3	92.4	107.3	-0.338E-04
38347.	415.	-38.2	92.8	108.8	-0.319E-04

Table 6 (cont.)

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

MJD	Z	φ	ψ	D.R.A.	$\dot{P}$
		Perigee In Sunlight			
38348.	414.	-38.8	93.5	110.4	-0.312E-04
38349.	413.	-39.0	94.4	112.1	-0.326E-04
38350.	413.	-38.8	95.5	113.8	-0.321E-04
38351.	411.	-38.2	96.7	115.4	-0.429E-04
38352.	410.	-37.2	98.1	116.9	-0.347E-04
38353.	409.	-35.9	99.5	118.2	-0.333E-04
38354.	407.	-34.2	100.9	119.2	-0.323E-04
38355.	405.	-32.3	102.4	119.9	-0.325E-04
38356.	403.	-30.1	103.8	120.5	-0.373E-04
38357.	402.	-27.7	105.2	120.7	-0.396E-04
38358.	398.	-25.0	106.6	120.8	-0.473E-04
38359.	398.	-22.3	107.7	120.5	-0.418E-04
38360.	396.	-19.3	108.9	120.1	-0.353E-04
		Perigee In Earth Shadow			
38361.	394.	-16.3	109.9	119.5	-0.355E-04
38362.	393.	-13.1	110.7	118.8	-0.336E-04
38363.	390.	-9.8	111.6	118.0	-0.377E-04
38364.	389.	-6.5	112.2	117.0	-0.409E-04
38365.	387.	-3.2	112.6	116.0	-0.351E-04
38366.	405.	-0.3	112.4	114.4	-0.455E-04
38367.	388.	3.5	113.5	114.0	-0.481E-04
38368.	385.	6.8	113.7	112.9	-0.461E-04
38369.	383.	10.1	114.0	111.9	-0.454E-04
38370.	385.	13.2	114.1	110.9	-0.427E-04

Table 6 (cont.)

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

MJD	Z	φ	ψ	D.R.A.	$\dot{P}$
		Perigee In Earth Shadow			
38371.	384.	16.4	114.5	110.2	-0.418E-04
38372.	364.	19.9	115.3	110.0	-0.417E-04
38373.	363.	22.9	115.8	109.6	-0.423E-04
38374.	378.	25.3	115.9	108.9	-0.344E-04
38375.	381.	28.0	116.5	108.9	-0.410E-04
38376.	381.	30.4	117.3	109.1	-0.397E-04
38377.	380.	32.6	118.2	109.6	-0.408E-04
38378.	380.	34.5	119.1	110.4	-0.467E-04
38379.	379.	36.2	120.3	111.4	-0.414E-04
38380.	379.	37.4	121.4	112.7	-0.367E-04
38381.	378.	38.3	122.7	114.1	-0.312E-04
38382.	378.	38.8	124.0	115.7	-0.315E-04
38383.	378.	38.9	125.2	117.2	-0.345E-04
38384.	376.	38.6	126.5	118.9	-0.446E-04
38385.	375.	37.9	127.7	120.4	-0.415E-04
38386.	374.	36.8	128.7	121.8	-0.421E-04
38387.	371.	35.4	129.5	122.9	-0.386E-04
38388.	371.	33.6	130.2	123.8	-0.321E-04
38389.	371.	31.5	130.5	124.4	-0.308E-04
38390.	370.	29.2	130.6	124.8	-0.332E-04
38391.	369.	26.6	130.3	124.9	-0.336E-04
38392.	368.	23.8	129.6	124.7	-0.343E-04
38393.	367.	20.9	128.6	124.3	-0.448E-04
38394.	366.	17.8	127.3	123.8	-0.403E-04

I. SAO smoothed elements

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

$T_0 = 38318.0$ MJD

$\omega = (3^\circ.862 \pm 5) + (1^\circ.9874 \pm 6)t - ^\circ.227 \times 10^{-4}t^2 + ^\circ.1139 \cos \omega$

$\Omega = (63^\circ.623 \pm 1) - (1^\circ.8591 \pm 2)t - ^\circ.49 \times 10^{-5}t^2 + ^\circ.0145 \cos \omega$

$i = (44^\circ.8062 \pm 8) + ^\circ.511 \times 10^{-4}t - ^\circ.0077 \sin \omega$

$e = (.242384 \pm 6) + .786 \times 10^{-5}t + .0005181 \sin \omega$

$M = (.04421 \pm 1) + (9.126128 \pm 1)t - (.21 \pm 2) \times 10^{-6}t^2$

$- (.10 \pm 18) \times 10^{-8}t^3 - .0003162 \cos \omega$

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

The following elements are based on 113 observations and are valid for the period November 1 through December 1, 1963.

$T_0 = 38348.0$ MJD

$\omega = (63^\circ.468 \pm 7) + (1^\circ.9880 \pm 7)t - ^\circ.227 \times 10^{-4}t^2 + ^\circ.1139 \cos \omega$

$\Omega = (7^\circ.848 \pm 3) - (1^\circ.8587 \pm 2)t - ^\circ.49 \times 10^{-5}t^2 + ^\circ.0145 \cos \omega$

$i = (44^\circ.814 \pm 2) + ^\circ.511 \times 10^{-4}t - ^\circ.0077 \sin \omega$

$e = (.242534 \pm 9) + .786 \times 10^{-5}t + .0005181 \sin \omega$

$M = (.82786 \pm 2) + (9.126113 \pm 2)t - (.79 \pm 27) \times 10^{-7}t^2$

$+ (.13 \pm 32) \times 10^{-8}t^3 - .0003162 \cos \omega$

Standard error of one observation: $\sigma = \pm 1''.43$

The following elements are based on 121 observations and are valid for the period December 1, 1963, through January 1, 1964.

$T_0 = 38378.0$ MJD

$\omega = (123^\circ.071 \pm 7) + (1^\circ.9898 \pm 7)t - {}^\circ.227 \times 10^{-4}t^2 + {}^\circ.1139 \cos \omega$

$\Omega = (312^\circ.080 \pm 3) - (1^\circ.8591 \pm 2)t - {}^\circ.49 \times 10^{-5}t^2 + {}^\circ.0145 \cos \omega$

$i = (44^\circ.808 \pm 2) + {}^\circ.511 \times 10^{-4}t - {}^\circ.0077 \sin \omega$

$e = (.242509 \pm 9) + .786 \times 10^{-5}t + .0005181 \sin \omega$

$M = (.61130 \pm 2) + (9.126113 \pm 2)t + (.23 \pm 4) \times 10^{-6}t^2$

$\quad - (.12 \pm 3) \times 10^{-7}t^3 - .0003162 \cos \omega$

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

T (MJD)	ω	Ω	i	e	M	n	n'/2	q	N	D	σ
38306.0	340.17 3	85.942 4	44.812 4	.24229 4	.53060 5	9.126146 3	.2E-6 9	7.328562	11	6	.48
38310.0	347.99 3	78.516 7	44.795 6	.24224 6	.03507 6	9.126131 4	-.7E-5 3	7.329024	13	6	.92
38314.0	356.01 1	71.073 2	44.801 2	.24232 1	.53940 2	9.126129 1	.2E-6 9	7.328273	27	6	.39
38318.0	3.97 1	63.638 3	44.804 2	.24244 1	.04392 2	9.126134 1	-.14E-5 8	7.327125	29	6	.48
38322.0	11.917 9	56.199 3	44.806 1	.24255 1	.54842 2	9.126126 1	.12E-5 7	7.326052	28	6	.38
38326.0	19.876 9	48.762 2	44.8049 9	.242611 9	.05291 2	9.126129 1	-.14E-5 7	7.325468	23	6	.32
38330.0	27.82 2	41.337 7	44.803 2	.24268 2	.55738 4	9.126126 2	.2E-6 9	7.324790	18	6	.52
38334.0	35.72 2	33.887 4	44.810 3	.24277 2	.06220 4	9.126122 2	.1E-5 1	7.323936	17	6	.49
38338.0	43.66 2	26.442 3	44.817 3	.24283 1	.56651 3	9.126117 2	-.2E-5 1	7.323220	14	6	.31
38342.0	51.64 2	19.002 6	44.807 4	.24289 2	.07093 4	9.126127 3	-.1E-5 1	7.322779	16	6	.39
38346.0	59.55 2	11.574 8	44.804 5	.24298 2	.57546 4	9.126121 2	.1E-5 2	7.321956	20	6	.57
38350.0	67.50 1	4.140 7	44.804 4	.24306 2	.07993 3	9.126122 2	-.1E-5 2	7.321103	24	6	.53
38354.0	75.41 1	356.693 5	44.807 4	.24307 2	.58447 3	9.126119 2	.1E-5 1	7.321015	23	6	.41
38358.0	83.34 1	349.269 5	44.798 5	.24309 2	.08896 3	9.126126 2	-.2E-6 9	7.320854	25	6	.59
38362.0	91.29 1	341.827 4	44.803 5	.24308 2	.59347 3	9.126120 2	.1E-5 2	7.320931	32	6	.57
38366.0	99.23 1	334.387 3	44.806 4	.24309 2	.09794 3	9.126119 2	-.2E-5 2	7.320814	29	6	.55
38370.0	107.17 1	326.952 4	44.802 5	.24307 2	.60242 4	9.126120 2	-.2E-5 1	7.321018	25	6	.39
38374.0	115.066 8	319.511 4	44.799 3	.24301 2	.10698 2	9.126126 2	.1E-6 9	7.321631	23	6	.30
38378.0	122.98 1	312.081 5	44.807 3	.24294 2	.61152 2	9.126140 2	-.1E-5 1	7.322273	22	6	.29
38382.0	130.95 1	304.638 6	44.802 4	.24292 1	.11599 2	9.126129 2	.4E-6 9	7.322519	30	6	.47
38386.0	138.88 1	297.197 6	44.801 3	.24285 1	.62050 3	9.126122 3	-.1E-5 2	7.323149	31	6	.51
38390.0	146.84 2	289.761 8	44.805 5	.24280 2	.12491 4	9.126121 4	.2E-5 3	7.323669	18	6	.60
38394.0	154.79 1	282.320 6	44.803 3	.24272 2	.62941 3	9.126144 2	.1E-5 2	7.324425	23	6	.59

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

MJD	Z	φ	ψ	D.R.A.	$\dot{P}$
		Perigee In Sunlight			
38306.	951.	-13.8	115.7	242.4	-0.480E-08
		Perigee In Earth Shadow			
38310.	951.	-8.4	121.4	237.0	0.168E-06
38314.	950.	-2.8	127.5	231.7	-0.480E-08
38318.	949.	2.8	133.7	226.2	0.336E-07
38322.	948.	8.4	139.8	220.7	-0.288E-07
38326.	948.	13.9	145.4	215.4	0.336E-07
38330.	949.	19.2	150.3	210.3	-0.480E-08
38334.	949.	24.3	154.0	205.4	-0.240E-07
38338.	950.	29.1	156.2	201.1	0.480E-07
38342.	951.	33.5	156.9	197.5	0.240E-07
38346.	951.	37.4	156.6	194.5	-0.240E-07
38350.	952.	40.6	155.7	192.3	0.240E-07
38354.	953.	43.0	155.0	190.9	-0.240E-07
38358.	953.	44.4	154.7	190.0	0.480E-08
38362.	953.	44.8	155.3	189.5	-0.240E-07
38366.	953.	44.1	156.7	188.8	0.480E-07
38370.	952.	42.3	159.2	187.7	0.480E-07
38374.	952.	39.7	162.6	185.7	-0.240E-08
38378.	951.	36.2	166.7	182.9	0.240E-07
38382.	950.	32.2	171.2	179.3	-0.961E-08
38386.	949.	27.6	173.8	174.9	0.240E-07
38390.	948.	22.7	170.7	170.0	-0.480E-07
38394.	948.	17.5	164.4	164.5	-0.240E-07

I. SAO smoothed elements

The following elements are based on 220 observations and are valid for the period October 1 through November 1, 1963.

T_0 =.38318.0 MJD

$\omega = (163^\circ.92 \pm 7) + (2^\circ.932 \pm 8)t + 5^\circ.9176 \cos \omega$

$\Omega = (232^\circ.4207 \pm 7) - (3^\circ.60909 \pm 7)t + ^\circ.00090 \cos \omega$

$i = (50^\circ.1426 \pm 5) - ^\circ.0003 \sin \omega$

$e = (.007161 \pm 5) + (.28 \pm 7) \times 10^{-5}t + .0007540 \sin \omega$

$M = (.6949 \pm 2) + (13.34499 \pm 2)t - (.160 \pm 1) \times 10^{-5}t^2$

$- .0150900 \cos \omega$

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

The following elements are based on 203 observations and are valid for the period November 1 through December 1, 1963.

T_0 = 38348.0 MJD

$\omega = (251^\circ.39 \pm 9) + (3^\circ.04 \pm 1)t + 5^\circ.9176 \cos \omega$

$\Omega = (124^\circ.148 \pm 1) - (3^\circ.6093 \pm 1)t + ^\circ.00090 \cos \omega$

$i = (50^\circ.1433 \pm 9) - ^\circ.0003 \sin \omega$

$e = (.00702 \pm 1) - (.98 \pm 12) \times 10^{-5}t + .0007540 \sin \omega$

$M = (.0446 \pm 2) + (13.34463 \pm 3)t - (.33 \pm 3) \times 10^{-6}t^2 - .0150900$

$\cos \omega$

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

The following elements are based on 221 observations and are valid for the period December 1, 1963, through January 1, 1964.

$T_0 = 38378.0$ MJD

$\omega = (341^\circ.90 \pm 6) + (3^\circ.012 \pm 8)t + 5^\circ.9176 \cos \omega$

$\Omega = (15^\circ.880 \pm 1) - (3^\circ.6088 \pm 2)t + {}^\circ.00090 \cos \omega$

$i = (50^\circ.145 \pm 1) - {}^\circ.0003 \sin \omega$

$e = (.00685 \pm 2) + (.57 \pm 20) \times 10^{-5} t + .0007540 \sin \omega$

$M = (.3855 \pm 2) + (13.34475 \pm 2)t + (.208 \pm 3) \times 10^{-5} t^2$

$- .0150900 \cos \omega$

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

T (MJD)	ω	Ω	i	e	M	n	n'/2	q	N	D	σ
38306.0	123.7 7	275.728 4	50.146 4	.00775 5	.568 2	13.344463 6	.59E-4 6	7.449714	49	4	1.90
38310.0	135.9 2	261.292 2	50.143 1	.00754 2	.9464 5	13.344510 2	-.1E-5 2	7.451257	39	4	.38
38314.0	146.6 2	246.860 3	50.142 2	.00746 3	.3292 7	13.344504 4	-.12E-4 3	7.451932	39	4	.59
38318.0	158.9 6	232.415 6	50.145 5	.00740 4	.708 2	13.344464 9	-.15E-4 9	7.452341	33	4	1.56
38322.0	169.8 2	217.983 3	50.145 2	.00717 1	.0897 7	13.344477 3	-.1E-5 2	7.454078	22	4	.45
38326.0	180.9 4	203.552 5	50.143 3	.00703 3	.471 1	13.344449 5	-.1E-5 5	7.455130	34	4	1.02
38330.0	194.3 6	189.114 7	50.144 5	.00692 6	.847 2	13.344458 8	-.6E-5 6	7.455951	29	4	1.08
38334.0	205.2 4	174.677 5	50.139 4	.00668 3	.229 1	13.344438 2	-.3E-5 3	7.457785	25	4	.53
38338.0	218.1 4	160.238 3	50.143 4	.00652 2	.606 1	13.344422 3	-.6E-5 3	7.458993	23	4	.63
38342.0	232.8 6	145.782 6	50.128 5	.00651 4	.977 2	13.344422 7	.5E-5 9	7.459074	24	4	1.01
38346.0	244.0 3	131.372 3	50.143 2	.00633 3	.3586 7	13.344405 3	-.2E-5 3	7.460445	29	4	.62
38350.0	257.2 2	116.929 2	50.142 2	.00631 2	.7346 4	13.344407 3	-.5E-5 3	7.460569	37	4	.54
38354.0	270.7 1	102.494 2	50.147 2	.00618 3	.1095 4	13.344397 2	.3E-5 2	7.461554	40	4	.61
38358.0	283.9 2	88.058 5	50.143 3	.00639 7	.4853 6	13.344407 5	-.5E-5 6	7.459956	22	4	.80
38362.0	297.4 4	73.620 6	50.141 4	.00615 7	.860 1	13.34444 1	-.13E-4 8	7.461743	35	4	1.41
38366.0	310. 1	59.18 1	50.15 1	.0064 2	.237 4	13.34445 3	-.4E-6 2	7.459541	9	4	1.04
38370.0	324.4 6	44.741 6	50.136 5	.00620 7	.611 2	13.344432 7	-.3E-4 9	7.461354	27	4	1.28
38374.0	330.8 6	30.35 1	50.19 1	.0078 2	.005 2	13.34454 1	-.00016 1	7.449038	34	4	2.69
38378.0	347.7 2	15.880 3	50.147 3	.00671 5	.3706 4	13.344473 5	-.4E-5 3	7.457566	38	4	1.01
38382.0	359.53 7	1.445 1	50.148 2	.00690 2	.7503 2	13.344488 3	.3E-5 2	7.456136	46	4	.59
38386.0	11.9 1	347.014 3	50.150 3	.00708 3	.1286 3	13.344506 4	.1E-5 3	7.454774	46	4	.77
38390.0	23.1 2	332.571 3	50.140 3	.00742 4	.5098 4	13.344522 4	.7E-5 5	7.452225	26	4	.58
38394.0	34.6 3	318.121 9	50.133 8	.0075 1	.8904 9	13.344530 5	-.6E-5 5	7.451393	9	4	.66

Table 8

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

MJD	Z	φ	ψ	D.R.A.	$\dot{P}$
		Perigee In Earth Shadow			
38306.	1080.	39.7	127.5	222.6	-0.663E-06
38310.	1079.	32.3	136.7	216.6	0.112E-07
38314.	1077.	25.0	148.3	207.4	0.135E-06
38318.	1076.	16.0	160.7	198.3	0.168E-06
38322.	1076.	7.8	172.4	187.4	0.112E-07
38326.	1077.	-0.7	167.4	176.4	0.112E-07
38330.	1078.	-10.9	152.9	166.8	0.674E-07
38334.	1082.	-19.1	139.2	156.0	0.337E-07
38338.	1085.	-28.3	126.2	147.5	0.674E-07
		Perigee In Sunlight			
38342.	1089.	-37.7	115.3	142.6	-0.562E-07
38346.	1092.	-43.6	106.9	136.7	0.225E-07
38350.	1094.	-48.5	102.1	135.9	0.562E-07
38354.	1096.	-50.1	100.9	137.9	-0.337E-07
38358.	1093.	-48.2	102.2	139.3	0.562E-07
38362.	1093.	-43.0	105.2	138.4	0.146E-06
38366.	1089.	-36.0	107.1	133.3	0.449E-08
38370.	1087.	-26.5	109.2	127.3	0.337E-06
38374.	1074.	-22.0	101.2	113.5	0.180E-05
38378.	1080.	-9.4	101.0	106.3	0.449E-07
38382.	1078.	-0.4	94.5	95.1	-0.337E-07
38386.	1077.	9.1	88.4	84.2	-0.112E-07
38390.	1076.	17.5	82.1	72.9	-0.786E-07
38394.	1077.	25.8	77.9	62.6	0.674E-07

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I. SAO smoothed elements

The following elements are based on 69 observations and are valid for the period October 1 through October 10, 1963.

T_0 = 38308.0 MJD

$\omega = (181^\circ.86 \pm 2) - (1^\circ.126 \pm 6)t - ^\circ.26 \times 10^{-6}t^2 + ^\circ.2411 \cos \omega$

$\Omega = (72^\circ.655 \pm 1) - (1^\circ.7248 \pm 4)t - ^\circ.601 \times 10^{-4}t^2 + ^\circ.0324 \cos \omega$

$i = (70^\circ.363 \pm 2) - ^\circ.0023 \sin \omega$

$e = (.15336 \pm 2) - (.51 \pm 6) \times 10^{-4}t - .701 \times 10^{-7}t^2 + .0007064 \sin \omega$

$M = (.49667 \pm 7) + (12.56884 \pm 2)t + (.000537 \pm 1)t^2 + (.70 \pm 2) \times 10^{-5}t^3 + (.19 \pm 6) \times 10^{-6}t^4 - .0006416 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.20$

The following elements are based on 174 observations and are valid for the period October 10 through October 21, 1963.

T_0 = 38318.0 MJD

$\omega = (170^\circ.69 \pm 1) - (1^\circ.123 \pm 4)t - ^\circ.26 \times 10^{-6}t^2 + ^\circ.2411 \cos \omega$

$\Omega = (55^\circ.390 \pm 1) - (1^\circ.7284 \pm 4)t - ^\circ.601 \times 10^{-4}t^2 + ^\circ.0324 \cos \omega$

$i = (70^\circ.362 \pm 1) - ^\circ.0023 \sin \omega$

$e = (.15274 \pm 1) - (.61 \pm 4) \times 10^{-4}t - .701 \times 10^{-7}t^2 + .0007064 \sin \omega$

$M = (.24813 \pm 4) + (12.58258 \pm 1)t + (.000780 \pm 1)t^2 - (.315 \pm 9) \times 10^{-5}t^3 - (.33 \pm 3) \times 10^{-6}t^4 - .0006416 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.63$

The following elements are based on 63 observations and are valid for the period October 21 through November 1, 1963.

T_0 = 38328.0 MJD

$\omega = (159°.52 \pm 7) - (1°.14 \pm 2)t - °.26 \times 10^{-6}t^2 + °.2411 \cos \omega$

$\Omega = (38°.079 \pm 9) - (1°.731 \pm 2)t - °.601 \times 10^{-4}t^2 + °.0324 \cos \omega$

$i = (70°.362 \pm 9) - °.0023 \sin \omega$

$e = (.1520 \pm 1) - (.47 \pm 30) \times 10^{-4}t - .701 \times 10^{-7}t^2 + .0007064 \sin \omega$

$M = (.1484 \pm 3) + (12.59736 \pm 9)t + (.000671 \pm 4)t^2 - (.63 \pm 5) \times 10^{-5}t^3 + (.70 \pm 14) \times 10^{-6}t^4 - .0006416 \cos \omega$

Standard error of one observation: $\sigma = \pm 3''.85$

The following elements are based on 99 observations and are valid for the period November 1 through November 16, 1963.

T_0 = 38342.0 MJD

$\omega = (143°.70 \pm 8) - (1°.14 \pm 1)t - °.26 \times 10^{-6}t^2 + °.2411 \cos \omega$

$\Omega = (13°.800 \pm 4) - (1°.7369 \pm 5)t - °.601 \times 10^{-4}t^2 + °.0324 \cos \omega$

$i = (70°.361 \pm 7) - °.0023 \sin \omega$

$e = (.15137 \pm 6) - (.53 \pm 17) \times 10^{-4}t - .701 \times 10^{-7}t^2 + .0007064 \sin \omega$

$M = (.6305 \pm 3) + (12.61340 \pm 5)t + (.000525 \pm 1)t^2 - (.19 \pm 1) \times 10^{-5}t^3 - (.70 \pm 2) \times 10^{-6}t^4 - .0006416 \cos \omega$

Standard error of one observation: $\sigma = \pm 2''.15$

The following elements are based on 102 observations and are valid for the period November 16 through December 1, 1963.

T_0 = 38357.0 MJD

$\omega = (126°.75 \pm 2) - (1°.126 \pm 3)t - °.26 \times 10^{-6}t^2 + °.2411 \cos \omega$

$\Omega = (347°.720 \pm 2) - (1°.7405 \pm 4)t - °.601 \times 10^{-4}t^2 + °.0324 \cos \omega$

$i = (70°.358 \pm 4) - °.0023 \sin \omega$

$e = (.15083 \pm 5) - (.427 \pm 95) \times 10^{-4}t - .701 \times 10^{-7}t^2 + .0007064 \sin \omega$

$M = (.92803 \pm 5) + (12.62546 \pm 1)t + (.0003440 \pm 9)t^2 - (.352 \pm 6) \times 10^{-5}t^3 - (.19 \pm 2) \times 10^{-6}t^4 - .0006416 \cos \omega$

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

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

T_0 = 38372.0 MJD

$\omega = (109^\circ.79 \pm 3) - (1^\circ.133 \pm 5)t - ^\circ.26 \times 10^{-6}t^2 + ^\circ.2411 \cos \omega$

$\Omega = (321^\circ.589 \pm 6) - (1^\circ.7423 \pm 6)t - ^\circ.601 \times 10^{-4}t^2 + ^\circ.0324 \cos \omega$

$i = (70^\circ.34 \pm 1) - ^\circ.0023 \sin \omega$

$e = (.15033 \pm 5) - (.34 \pm 35) \times 10^{-4}t - .701 \times 10^{-7}t^2 + .0007064 \sin \omega$

$M = (.37578 \pm 7) + (12.63395 \pm 1)t + (.000238 \pm 3)t^2 - (.27 \pm 2) \times 10^{-5}t^3 + (.34 \pm 4) \times 10^{-6}t^4 - .0006416 \cos \omega$

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

The following elements are based on 109 observations and are valid for the period December 16, 1963, through January 1, 1964.

T_0 = 38387.0 MJD

$\omega = (92^\circ.88 \pm 3) - (1^\circ.126 \pm 7)t - ^\circ.26 \times 10^{-6}t^2 + ^\circ.2411 \cos \omega$

$\Omega = (295^\circ.442 \pm 6) - (1^\circ.7449 \pm 5)t - ^\circ.601 \times 10^{-4}t^2 + ^\circ.0324 \cos \omega$

$i = (70^\circ.37 \pm 1) - ^\circ.0023 \sin \omega$

$e = (.1500 \pm 3) + (.48 \pm 39) \times 10^{-4}t - .701 \times 10^{-7}t^2 + .0007064 \sin \omega$

$M = (.9394 \pm 2) + (12.64132 \pm 3)t + (.0002511 \pm 9)t^2 - (.130 \pm 6) \times 10^{-5}t^3 - (.48 \pm 15) \times 10^{-7}t^4 - .0006416 \cos \omega$

Standard error of one observation: $\sigma = \pm 3''.00$

T (MJD)	ω	Ω	i	e	M	n	n'/2	q	N	D	σ
38304.0	186.10 3	79.523 2	70.358 3	.15345 3	.2302 1	12.564807 3	.489E-3 2	6.617135	32	6	.52
38306.0	183.85 3	76.073 2	70.363 3	.15340 3	.3618 1	12.566784 3	.504E-3 2	6.616885	34	6	.55
38308.0	181.67 3	72.624 2	70.361 3	.15334 3	.49715 9	12.568859 3	.534E-3 2	6.616576	44	6	.53
38310.0	179.38 3	69.173 2	70.363 3	.15328 3	.63716 9	12.571113 3	.585E-3 2	6.616306	55	6	.74
38312.0	177.11 3	65.721 2	70.363 4	.15318 3	.7818 1	12.573558 4	.643E-3 2	6.616206	65	6	.89
38314.0	174.94 2	62.271 1	70.362 2	.15302 2	.93110 6	12.576271 3	.779E-3 2	6.616536	79	6	.57
38316.0	172.69 1	58.815 1	70.361 2	.15293 1	.08677 4	12.579414 2	.798E-3 1	6.616126	103	6	.48
38318.0	170.44 2	55.361 1	70.362 2	.15287 1	.24882 5	12.582566 2	.778E-3 1	6.615452	95	6	.58
38320.0	168.19 1	51.903 2	70.362 2	.15274 1	.41711 4	12.585602 2	.743E-3 1	6.615414	85	6	.54
38322.0	165.97 1	48.445 1	70.362 1	.15263 1	.59121 4	12.588574 2	.745E-3 1	6.615245	59	6	.39
38324.0	163.77 2	44.979 3	70.362 2	.15254 2	.77117 5	12.591474 3	.719E-3 2	6.614956	48	6	.55
38326.0	161.56 3	41.512 6	70.361 5	.15230 5	.9570 1	12.594436 4	.737E-3 3	6.615773	43	6	.95
38328.0	159.28 5	38.05 1	70.36 1	.1522 1	.1489 2	12.597320 9	.701E-3 6	6.615512	39	6	1.47
38330.0	157.1 2	34.60 2	70.35 2	.1523 3	.3461 7	12.599923 6	.599E-3 4	6.613521	31	6	.72
38332.0	154.6 4	31.13 3	70.35 3	.1519 5	.549 2	12.60255 1	.699E-3 8	6.615704	21	6	1.25
38334.0	152.4 2	27.66 1	70.35 1	.1519 2	.7571 7	12.605103 6	.567E-3 5	6.614800	21	6	.81
38336.0	150.24 9	24.194 6	70.353 8	.15190 7	.9694 3	12.607285 4	.513E-3 2	6.614420	31	6	.51
38338.0	148.04 8	20.720 6	70.360 8	.15191 5	.1859 3	12.609269 4	.473E-3 3	6.613645	36	6	.54
38340.0	145.7 1	17.242 7	70.37 1	.15187 6	.4068 4	12.611222 5	.502E-3 3	6.613245	40	6	.81
38342.0	143.48 7	13.770 4	70.366 6	.15173 5	.6310 3	12.613329 3	.544E-3 2	6.613586	45	6	.52
38344.0	141.21 8	10.299 5	70.364 7	.15170 7	.8599 3	12.615383 4	.487E-3 3	6.613095	47	6	.69
38346.0	138.97 8	6.828 5	70.361 8	.15162 9	.0926 3	12.617168 4	.425E-3 3	6.613118	40	6	.74
38348.0	136.75 5	3.354 3	70.352 6	.15165 8	.3286 2	12.618766 3	.384E-3 2	6.612329	34	6	.50
38350.0	134.49 4	359.876 2	70.357 5	.15154 8	.5677 1	12.620309 4	.389E-3 2	6.612608	33	6	.50
38352.0	132.21 3	356.397 2	70.359 5	.1515 1	.8100 1	12.621865 4	.385E-3 4	6.612069	44	6	.68
38354.0	129.98 2	352.921 2	70.355 5	.15148 8	.05526 7	12.623333 3	.339E-3 2	6.612039	43	6	.58
38356.0	127.73 2	349.444 2	70.355 5	.15149 8	.30330 7	12.624689 3	.337E-3 2	6.611522	42	6	.62
38358.0	125.50 2	345.967 4	70.359 8	.15116 4	.55395 5	12.626116 4	.359E-3 2	6.613590	38	6	.92
38360.0	123.24 1	342.481 3	70.356 4	.15128 2	.80775 4	12.627406 3	.295E-3 2	6.612153	34	6	.85
38362.0	121.004 6	338.999 1	70.356 2	.15124 1	.06371 1	12.628517 2	.257E-3 1	6.612105	33	6	.42

T (MJD)	ω	Ω	i	e	M	n	n'/2	q	N	D	σ
38364.0	118.746 8	335.517 2	70.355 2	.15117 1	.32179 2	12.629548 2	.2584E-3 9	6.612289	29	6	.48
38366.0	116.57 4	332.033 5	70.350 8	.1517 3	.58189 4	12.630614 4	.271E-3 2	6.607517	20	6	.73
38368.0	114.29 8	328.55 1	70.35 2	.1515 5	.8442 1	12.631771 6	.304E-3 5	6.609055	16	6	1.26
38370.0	112.01 5	325.07 1	70.37 2	.15106 8	.1090 1	12.63290 1	.268E-3 6	6.612006	11	6	1.76
38372.0	109.86 7	321.58 2	70.39 3	.15107 8	.3756 2	12.63395 1	.257E-3 7	6.611555	10	6	2.04
38374.0	107.6 1	318.09 2	70.38 5	.15104 9	.6445 3	12.63488 2	.19E-3 1	6.611451	8	6	2.40
38376.0	105.18 6	314.59 2	70.30 3	.1515 1	.9153 2	12.63572 1	.28E-3 1	6.607231	13	6	1.51
38378.0	102.99 2	311.132 6	70.36 1	.1509 2	.18787 6	12.636811 3	.266E-3 2	6.611572	19	6	.51
38380.0	100.72 2	307.644 8	70.36 1	.1506 3	.4627 1	12.637823 3	.240E-3 2	6.613615	32	6	.86
38382.0	98.48 2	304.160 6	70.37 1	.1504 3	.7393 1	12.638774 3	.233E-3 2	6.614730	42	6	.82
38384.0	96.23 2	300.668 5	70.360 9	.1506 2	.0177 1	12.639781 3	.266E-3 2	6.612938	46	6	.74
38386.0	93.99 2	297.182 4	70.363 7	.1508 2	.2983 1	12.640859 2	.268E-3 1	6.611176	39	6	.57
38388.0	91.73 3	293.692 6	70.358 9	.1506 2	.5811 2	12.641866 3	.233E-3 2	6.612602	44	6	.71
38390.0	89.49 3	290.198 5	70.353 8	.1506 2	.8657 2	12.642763 3	.217E-3 1	6.611823	39	6	.55
38392.0	87.28 5	286.709 7	70.36 1	.1508 3	.1519 2	12.643689 3	.237E-3 2	6.609934	37	6	.68
38394.0	85.03 5	283.238 7	70.373 9	.1508 2	.4402 2	12.644649 2	.241E-3 2	6.609583	34	6	.52

Table 9

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

MJD	Z	φ	ψ	D.R.A.	$\dot{P}$
			Perigee In Sunlight		
38304.	239.	-5.7	73.9	74.2	-0.619E-05
38306.	239.	-3.6	68.0	68.1	-0.638E-05
38308.	238.	-1.6	62.1	62.1	-0.676E-05
38310.	238.	0.6	56.3	56.1	-0.740E-05
38312.	238.	2.7	50.8	50.0	-0.813E-05
38314.	238.	4.8	45.5	44.0	-0.985E-05
38316.	238.	6.9	40.6	37.9	-0.101E-04
38318.	238.	9.0	36.3	31.9	-0.983E-05
38320.	238.	11.1	32.7	25.8	-0.938E-05
38322.	238.	13.2	30.3	19.6	-0.940E-05
38324.	238.	15.3	29.2	13.5	-0 907E-05
38326.	239.	17.3	29.7	7.3	-0.929E-05
38328.	240.	19.5	31.6	1.1	-0.883E-05
38330.	238.	21.5	34.7	354.9	-0.755E-05
38332.	241.	23.8	39.0	348.5	-0.880E-05
38334.	241.	25.9	43.6	342.2	-0.714E-05
38336.	241.	27.9	48.6	335.9	-0.646E-05
38338.	241.	29.9	54.0	329.5	-0.595E-05
38340.	241.	32.1	59.8	322.9	-0.631E-05
38342.	242.	34.1	65.5	316.4	-0.684E-05
38344.	242.	36.2	71.4	309.8	-0.612E-05
38346.	243.	38.2	77.3	303.1	-0.534E-05

Table 9 (cont.)

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

MJD	Z	φ	ψ	D.R.A.	$\dot{P}$
		Perigee In Sunlight			
38348.	243.	40.2	83.1	296.3	-0.482E-05
38350.	244.	42.2	89.0	289.4	-0.488E-05
38352.	244.	44.2	94.8	282.5	-0.483E-05
38354.	245.	46.2	100.5	275.4	-0.425E-05
		Perigee In Earth Shadow			
38356.	245.	48.1	106.1	268.2	-0.423E-05
38358.	248.	50.1	111.4	260.8	-0.450E-05
38360.	247.	52.0	116.6	253.3	-0.370E-05
38362.	248.	53.8	121.4	245.6	-0.322E-05
38364.	249.	55.7	125.8	237.7	-0.324E-05
38366.	244.	57.4	129.7	229.6	-0.340E-05
38368.	246.	59.1	133.0	221.2	-0.381E-05
38370.	250.	60.8	135.5	212.5	-0.336E-05
38372.	250.	62.4	137.2	203.7	-0.322E-05
38374.	250.	63.9	138.0	194.3	-0.238E-05
38376.	247.	65.3	137.7	184.0	-0.351E-05
38378.	251.	66.6	136.5	174.0	-0.333E-05
38380.	254.	67.7	134.4	163.2	-0.301E-05
38382.	255.	68.7	131.7	152.1	-0.292E-05
38384.	253.	69.4	128.4	140.4	-0.333E-05
38386.	252.	70.0	124.7	128.4	-0.335E-05
38388.	253.	70.3	120.7	116.1	-0.292E-05
38390.	252.	70.3	116.6	103.8	-0.272E-05
38392.	251.	70.2	112.3	91.5	-0.297E-05
38394.	250.	69.8	108.1	79.4	-0.301E-05

Satellite 1962 Beta Upsilon 1 (Relay 1) Beatrice Miller

I. SAO smoothed elements

The following elements are based on 94 observations and are valid for the period October 1 through November 1, 1963.

$T_0 = 38318.0$ MJD

$\omega = (188^\circ.575 \pm 6) + (1^\circ.2143 \pm 6)t + ^\circ.0958 \cos \omega$

$\Omega = (187^\circ.023 \pm 1) - (1^\circ.2790 \pm 1)t + ^\circ.0158 \cos \omega$

$i = (47^\circ.512 \pm 1) - ^\circ.0082 \sin \omega$

$e = (.28429 \pm 1) + (.05 \pm 10) \times 10^{-5}t + .0005025 \sin \omega$

$M = (.02455 \pm 1) + (7.780893 \pm 1)t - (.24 \pm 15) \times 10^{-7}t^2$

$- .0002577 \cos \omega$

Standard error of one observation: $\sigma = \pm 1''.21$

The following elements are based on 140 observations and are valid for the period November 1 through December 1, 1963.

$T_0 = 38350.0$ MJD

$\omega = (227^\circ.419 \pm 1) + (1^\circ.2127 \pm 1)t + ^\circ.0958 \cos \omega$

$\Omega = (146^\circ.0866 \pm 5) - (1^\circ.27959 \pm 5)t + ^\circ.0158 \cos \omega$

$i = (47^\circ.5040 \pm 5) - ^\circ.0082 \sin \omega$

$e = (.284426 \pm 3) + (.37 \pm 3) \times 10^{-5}t + .0005025 \sin \omega$

$M = (.013209 \pm 2) + (7.7809008 \pm 2)t + (.58 \pm 7) \times 10^{-7}t^2$

$- .0002577 \cos \omega$

Standard error of one observation: $\sigma = \pm 0''.85$

The following elements are based on 30 observations and are valid for the period December 1, 1963, through January 1, 1964.

$T_0 = 38382.0$ MJD

$\omega = (266^\circ.25 \pm 1) + (1^\circ.2142 \pm 9)t + ^\circ.0958 \cos \omega$

$\Omega = (105^\circ.133 \pm 3) - (1^\circ.2800 \pm 2)t + ^\circ.0158 \cos \omega$

$i = (47^\circ.508 \pm 2) - ^\circ.0082 \sin \omega$

$e = (.28463 \pm 6) + (.85 \pm 37) \times 10^{-5} t + .0005025 \sin \omega$

$M = (.00199 \pm 5) + (7.780893 \pm 5)t - (.25 \pm 9) \times 10^{-6} t^2$

$- .0002577 \cos \omega$

Standard error of one observation: $\sigma = \pm 0''.99$

II. SAO mean elements -- Satellite Beta Upsilon 1

4 October - 27 December 1963

T (MJD)	ω	Ω	i	e	M	n	n'/2	q	N	D	σ
38306.0	173.90 1	202.357 3	47.511 2	.28434 1	.65410 2	7.780897 1	-.1E-6 8	7.698461	20	6	.31
38310.0	178.86 1	197.235 3	47.512 1	.28429 1	.77766 3	7.780903 1	.10E-5 7	7.699052	24	6	.40
38314.0	183.63 1	192.123 3	47.513 2	.28425 2	.90123 2	7.780902 1	-.12E-5 8	7.699450	24	6	.36
38318.0	188.46 2	187.004 8	47.517 5	.28416 6	.02483 3	7.780894 1	-.1E-5 1	7.700445	19	6	.39
38322.0	193.35 2	181.888 4	47.516 3	.28420 2	.14833 3	7.780900 1	.3E-5 1	7.700000	22	6	.45
38326.0	197.8 2	176.77 1	47.52 1	.2829 7	.2725 3	7.780902 1	-.5E-6 8	7.713572	18	6	.39
38330.0	202.7 7	171.67 2	47.51 2	.283 2	.3959 9	7.780898 4	.1E-5 2	7.711938	9	6	.44
38334.0	207.941 3	166.5439 7	47.5098 9	.284156 8	.519014 4	7.7809000 6	.33E-5 4	7.700474	19	6	.08
38338.0	212.784 2	161.4279 7	47.5099 6	.284093 6	.642631 3	7.7809065 5	.9E-6 4	7.701146	31	6	.08
38342.0	217.643 4	156.307 1	47.509 1	.28410 1	.766222 6	7.7808986 8	-.10E-5 5	7.701094	31	6	.14
38346.0	222.502 3	151.192 1	47.509 1	.284084 8	.889781 5	7.7809003 8	.3E-6 5	7.701249	29	6	.13
38350.0	227.359 3	146.076 1	47.510 1	.284059 9	.013370 5	7.7809103 8	-.4E-6 5	7.701512	26	6	.12
38354.0	232.209 3	140.960 1	47.5105 9	.284039 8	.136981 5	7.7809030 6	.2E-6 4	7.701733	27	6	.10
38358.0	237.073 4	135.842 1	47.511 1	.284041 9	.260550 6	7.7809031 9	-.5E-6 6	7.701710	29	6	.15
38362.0	241.928 2	130.7253 9	47.5120 7	.284037 5	.384135 4	7.7809088 5	.9E-6 4	7.701743	29	6	.08
38366.0	246.783 3	125.605 1	47.513 1	.284019 7	.507750 6	7.780905 1	-.4E-6 1	7.701947	23	6	.11
38370.0											
38374.0											
38378.0											
38382.0	266.3 3	105.15 2	47.53 2	.283 1	.0019 8	7.7811 2	-.1E-3 2	7.707879	4	6	.62
38386.0											
38390.0	276.0 1	94.87 4	47.49 2	.284 2	.249 1	7.78094 3	-.1E-4 3	7.702841	7	6	.40

Table 10

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 Earth Shadow			
38306.	1320.	4.5	171.0	189.0	0.330E-08
38310.	1321.	0.8	174.1	183.6	-0.330E-07
38314.	1321.	-2.7	170.1	178.0	0.396E-07
38318.	1322.	-6.2	163.4	172.5	0.330E-07
38322.	1322.	-9.8	156.3	167.0	-0.991E-07
38326.	1336.	-13.0	149.3	161.2	0.165E-07
38330.	1335.	-16.5	142.2	155.8	-0.330E-07
38334.	1325.	-20.2	135.2	150.8	-0.109E-06
38338.	1326.	-23.5	128.5	145.5	-0.297E-07
		Perigee In Sunlight			
38342.	1327.	-26.8	122.1	140.4	0.330E-07
38346.	1328.	-29.9	116.0	135.5	-0.991E-08
38350.	1329.	-32.8	110.2	130.8	0.132E-07
38354.	1331.	-35.6	104.9	126.3	-0.661E-08
38358.	1332.	-38.2	100.0	122.1	0.165E-07
38362.	1332.	-40.6	95.7	118.3	-0.297E-07
38366.	1333.	-42.7	91.8	114.7	0.132E-07
38382.	1341.	-47.4	81.6	103.6	0.330E-05
38390.	1336.	-47.1	78.7	98.8	0.330E-06

I. SAO smoothed elements

The following elements are based on 185 observations and are valid for the period October 1 through November 1, 1963.

$T_0 = 38318.0$ MJD

$\omega = (8^\circ.359 \pm 4) + (1^\circ.2181 \pm 5)t + ^\circ.0466 \cos \omega$

$\Omega = (14^\circ.606 \pm 2) - (1^\circ.0549 \pm 2)t + ^\circ.0196 \cos \omega$

$i = (42^\circ.7830 \pm 8) - ^\circ.00012t - ^\circ.0117 \sin \omega$

$e = (.401361 \pm 6) + .54 \times 10^{-5}t + .0003971 \sin \omega$

$M = (.236717 \pm 6) + (6.3913784 \pm 7)t + (.60 \pm 13) \times 10^{-7}t^2$

$- .0001396 \cos \omega$

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

The following elements are based on 134 observations and are valid for the period November 1 through December 1, 1963.

$T_0 = 38348.0$ MJD

$\omega = (44^\circ.918 \pm 5) + (1^\circ.2146 \pm 5)t + ^\circ.0466 \cos \omega$

$\Omega = (342^\circ.953 \pm 2) - (1^\circ.0548 \pm 2)t + ^\circ.0196 \cos \omega$

$i = (42^\circ.773 \pm 1) - ^\circ.00012t - ^\circ.0117 \sin \omega$

$e = (.401295 \pm 9) + .540 \times 10^{-5}t + .0003971 \sin \omega$

$M = (.978163 \pm 7) + (6.3913931 \pm 6)t + (.24 \pm 2) \times 10^{-6}t^2$

$- .0001396 \cos \omega$

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

The following elements are based on 130 observations and are valid for the period December 1, 1963, through January 1, 1964.

$T_0 = 38378.0$ MJD

$\omega = (81^\circ.436 \pm 7) + (1^\circ.2143 \pm 8)t + ^\circ.0466 \cos \omega$

$\Omega = (311^\circ.297 \pm 4) - (1^\circ.0548 \pm 4)t + ^\circ.0196 \cos \omega$

$i = (42^\circ.757 \pm 2) - ^\circ.00012t - ^\circ.0117 \sin \omega$

$e = (.40109 \pm 1) + .54 \times 10^{-5}t + .0003971 \sin \omega$

$M = (.720123 \pm 8) + (6.3914128 \pm 9)t + (.33 \pm 2) \times 10^{-6}$

$- .0001396 \cos \omega$

Standard error of one observation: $\sigma = \pm 2''.50$

T (MJD)	ω	Ω	i	e	M	n	n'/2	q	N	D	σ
38304.0	351.345 4	29.392 2	42.781 1	.401315 7	.757304 6	6.3913766 5	-.1E-5 2	7.342954	59	8	.35
38308.0	356.224 5	25.175 2	42.783 1	.401319 8	.322789 8	6.3913751 6	.6E-6 3	7.342558	41	8	.40
38312.0	1.097 5	20.953 2	42.782 1	.401329 6	.888308 7	6.3913831 5	.5E-6 2	7.342423	53	8	.40
38316.0	5.972 6	16.735 2	42.783 1	.401396 7	.453836 8	6.3913778 5	-.2E-5 2	7.341603	56	8	.45
38320.0	10.849 6	12.513 3	42.782 1	.401465 8	.019323 9	6.3913740 6	.4E-6 3	7.340758	50	8	.47
38324.0	15.727 7	8.291 3	42.780 1	.401448 9	.58483 1	6.3913801 6	.7E-6 3	7.340967	47	8	.48
38328.0	20.587 8	4.075 3	42.779 2	.40146 1	.15038 1	6.3913848 7	.5E-6 3	7.340845	41	8	.45
38332.0	25.45 2	359.862 7	42.779 2	.40152 3	.71592 2	6.391379 1	-.7E-6 7	7.340131	31	8	.65
38336.0	30.331 8	355.636 4	42.775 1	.40156 1	.281417 9	6.3913782 7	.8E-6 4	7.339596	29	8	.37
38340.0	35.205 8	351.413 4	42.771 2	.40158 1	.846952 9	6.3913871 6	.9E-6 3	7.339330	30	8	.35
38344.0	40.076 7	347.193 4	42.766 2	.40159 1	.41252 1	6.3913866 8	-.2E-5 4	7.339166	30	8	.39
38348.0	44.942 6	342.969 3	42.765 2	.40162 1	.978074 9	6.3913848 8	.2E-6 4	7.338848	36	8	.42
38352.0	49.813 7	338.746 3	42.764 2	.40159 1	.543629 9	6.3913884 8	.14E-5 3	7.339180	41	8	.50
38356.0	54.674 7	334.525 2	42.762 2	.40159 1	.109225 9	6.3913964 6	.7E-6 3	7.339240	37	8	.46
38360.0	59.535 5	330.306 2	42.760 2	.40162 1	.674828 7	6.3913938 6	-.3E-6 3	7.338842	37	8	.39
38364.0	64.415 7	326.084 2	42.754 2	.40161 1	.240395 9	6.3913967 7	.9E-6 3	7.339009	39	8	.57
38368.0	69.275 6	321.862 3	42.753 2	.40156 1	.806019 8	6.3914056 5	.5E-6 3	7.339568	33	8	.50
38372.0	74.131 5	317.640 2	42.755 2	.40155 1	.371666 6	6.3914043 6	-.3E-6 3	7.339694	35	8	.41
38376.0	79.013 7	313.415 4	42.753 2	.40152 1	.937269 7	6.3914044 5	.8E-6 2	7.340048	38	8	.53
38380.0	83.864 9	309.182 6	42.748 3	.40144 2	.502932 9	6.3914120 6	.8E-6 3	7.341038	39	8	.61
38384.0	88.719 7	304.973 5	42.751 2	.40139 1	.068603 7	6.3914160 6	.5E-6 3	7.341661	40	8	.53
38388.0	93.580 7	300.757 4	42.750 2	.40136 1	.634282 8	6.3914136 6	-.8E-6 5	7.342012	27	8	.41
38392.0	98.45 1	296.530 8	42.746 2	.40130 2	.19994 1	6.3914154 1	.13E-5 5	7.342777	20	8	.54

Table 11

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1963 13 A

MJD	Z	φ	ψ	D.R.A.	$\dot{P}$
		Perigee In Earth Shadow			
38304.	965.	-5.9	162.0	195.6	0.490E-07
38308.	964.	-2.6	166.5	191.3	-0.294E-07
38312.	964.	0.7	171.1	187.0	-0.245E-07
38316.	963.	4.1	175.4	182.7	0.979E-07
38320.	963.	7.3	177.5	178.4	-0.196E-07
38324.	963.	10.6	174.2	174.1	-0.343E-07
38328.	964.	13.8	169.9	169.8	-0.245E-07
38332.	964.	17.0	165.7	165.6	0.343E-07
38336.	964.	20.1	161.5	161.4	-0.392E-07
38340.	964.	23.0	157.6	157.4	-0.441E-07
38344.	965.	25.9	153.9	153.5	0.979E-07
38348.	965.	28.7	150.4	149.7	-0.979E-08
38352.	967.	31.2	147.3	146.1	-0.685E-07
38356.	967.	33.6	144.4	142.7	-0.343E-07
38360.	968.	35.8	141.8	139.6	0.147E-07
38364.	969.	37.8	139.5	136.7	-0.441E-07
38368.	970.	39.4	137.5	134.0	-0.245E-07
38372.	970.	40.8	135.6	131.5	0.147E-07
38376.	971.	41.8	134.0	129.2	-0.392E-07
38380.	972.	42.4	132.5	127.0	-0.392E-07
38384.	973.	42.7	131.0	125.0	-0.245E-07
38388.	973.	42.6	129.5	122.9	0.392E-07
38392.	974.	42.2	127.9	120.8	-0.636E-07

I. SAO smoothed elements

The following elements are based on 110 observations and are valid for the period October 1 through November 1, 1963.

T_0 = 38318.0 MJD

$\omega = (156^\circ.44 \pm 1) + (3^\circ.486 \pm 2)t + ^\circ.000351t^2 + ^\circ.7130 \cos \omega$

$\Omega = (287^\circ.303 \pm 1) - (4^\circ.1691 \pm 3)t - ^\circ.50 \times 10^{-5}t^2 + ^\circ.0085 \cos \omega$

$i = (49^\circ.738 \pm 2) - ^\circ.0023 \sin \omega$

$e = (.06135 \pm 2) - .3367 \times 10^{-4}t + .544 \times 10^{-6}t^2 + .0007662 \sin \omega$

$M = (.42898 \pm 3) + (14.101587 \pm 5)t + (.137 \pm 1) \times 10^{-4}t^2 + (.125 \pm 6) \times 10^{-6}t^3 - (.66 \pm 8) \times 10^{-8}t^4 - .0017968 \cos \omega$

Standard error of one observation: $\sigma = \pm 2''.08$

The following elements are based on 105 observations and are valid for the period November 1 through December 1, 1963.

T_0 = 38348.0 MJD

$\omega = (261^\circ.58 \pm 2) + (3^\circ.511 \pm 2)t + ^\circ.000351t^2 + ^\circ.7130 \cos \omega$

$\Omega = (162^\circ.203 \pm 2) - (4^\circ.1707 \pm 3)t - ^\circ.50 \times 10^{-5}t^2 + ^\circ.0085 \cos \omega$

$i = (49^\circ.738 \pm 2) - ^\circ.0023 \sin \omega$

$e = (.06124 \pm 1) - .103 \times 10^{-5}t + .544 \times 10^{-6}t^2 + .0007662 \sin \omega$

$M = (.48772 \pm 4) + (14.102310 \pm 6)t + (.1067 \pm 7) \times 10^{-4}t^2 - (.36 \pm 6) \times 10^{-7}t^3 - .0017968 \cos \omega$

Standard error of one observation: $\sigma = \pm 1''.90$

The following elements are based on 84 observations and are valid for the period December 1, 1963, through January 1, 1964.

$T_0 = 38378.0$ MJD

$\omega = (6^\circ.93 \pm 2) + (3^\circ.485 \pm 2)t + {}^\circ.000351t^2 + {}^\circ.7130 \cos \omega$

$\Omega = (37^\circ.083 \pm 4) - (4^\circ.1699 \pm 5)t - {}^\circ.50 \times 10^{-5}t^2 + {}^\circ.0085 \cos \omega$

$i = (49^\circ.734 \pm 3) - {}^\circ.0023 \sin \omega$

$e = (.06108 \pm 2) + .3163 \times 10^{-4}t + .544 \times 10^{-6}t^2 + .0007662 \sin \omega$

$M = (.56700 \pm 6) + (14.103035 \pm 6)t + (.1051 \pm 7) \times 10^{-4}t^2$

$+ (.46 \pm 6) \times 10^{-7}t^3 - .0017968 \cos \omega$

Standard error of one observation: $\sigma = \pm 2''.60$

T (MJD)	ω	Ω	i	e	M	n	n'/2	q	N	D	σ
38304.0	107.3 2	345.672 8	49.742 7	.0619 1	.0099 6	14.101308 3	.1E-5 1	6.788485	19	8	.66
38308.0	120.9 3	328.982 9	49.76 1	.0620 2	.416 1	14.101346 2	.98E-5 9	6.787762	23	8	.72
38312.0	134.94 2	312.311 3	49.740 3	.06194 3	.82144 4	14.101408 3	.82E-5 7	6.788467	32	8	.84
38316.0	148.811 8	295.632 1	49.738 1	.06174 1	.22752 2	14.1014924 8	.150E-4 4	6.789923	44	8	.55
38320.0	162.77 1	278.956 1	49.742 1	.06153 2	.63383 3	14.1016036 8	.128E-4 3	6.791358	50	8	.39
38324.0	176.76 2	262.272 3	49.741 3	.06134 2	.04053 5	14.101716 2	.129E-4 6	6.792747	39	8	.54
38328.0	190.85 3	245.579 5	49.735 3	.06119 3	.44751 8	14.101830 2	.121E-4 6	6.793743	18	8	.45
38332.0	204.94 3	228.898 5	49.733 4	.06095 3	.85487 9	14.101909 9	.8E-5 2	6.795486	10	8	.36
38336.0	219.0 2	212.25 3	49.73 2	.0606 8	.2627 8	14.102039 3	.9E-5 2	6.798042	10	8	.39
38340.0	233.22 9	195.56 1	49.735 7	.0603 3	.6705 4	14.102094 2	.1E-4 1	6.799893	27	8	.56
38344.0	247.39 5	178.876 6	49.740 4	.0604 2	.0790 2	14.102194 1	.135E-4 7	6.799062	32	8	.44
38348.0	261.54 2	162.200 1	49.739 2	.06051 1	.48783 4	14.102291 1	.103E-4 4	6.798571	36	8	.48
38352.0	275.75 2	145.520 1	49.739 2	.060493 9	.89684 4	14.102363 1	.81E-5 5	6.798641	37	8	.57
38356.0	289.94 3	128.842 2	49.742 2	.06057 2	.30621 7	14.102438 2	.110E-4 6	6.798093	26	8	.70
38360.0	304.15 3	112.164 5	49.745 4	.06071 2	.71591 9	14.102533 1	.96E-5 4	6.797032	23	8	.38
38364.0	318.37 2	95.488 4	49.747 2	.06062 4	.12603 7	14.102600 3	.77E-5 9	6.797684	20	8	.44
38368.0	332.48 9	78.80 1	49.739 6	.06081 5	.5367 3	14.102684 4	.13E-4 2	6.796279	12	8	.94
38372.0	346.39 6	62.10 1	49.752 8	.06107 4	.9483 2	14.102779 4	.8E-5 2	6.794346	15	8	1.14
38376.0	.51 4	45.437 9	49.744 6	.06128 3	.3596 1	14.102821 3	.4E-5 1	6.792770	25	8	.82
38380.0	14.55 3	28.746 6	49.748 5	.06149 3	.77145 7	14.102913 2	.110E-4 8	6.791220	41	8	.83
38384.0	28.44 2	12.065 2	49.746 2	.06154 3	.18420 5	14.102999 1	.90E-5 7	6.790883	42	8	.68
38388.0	42.51 2	355.385 2	49.740 3	.06180 3	.59666 6	14.103101 2	.170E-4 9	6.788968	25	8	.81
38392.0	56.37 6	338.70 1	49.74 1	.06197 5	.0102 1	14.103203 5	.4E-5 4	6.787678	17	8	1.67

Table 12

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1963 26 A

MJD	Z	φ	ψ	D.R.A.	$\dot{P}$
		Perigee In Sunlight			
38304.	421.	46.8	89.6	274.0	-0.101E-07
38308.	419.	40.9	92.6	270.7	-0.986E-07
38312.	416.	32.7	97.9	264.7	-0.825E-07
38316.	415.	23.3	106.0	255.9	-0.151E-06
		Perigee In Earth Shadow			
38320.	414.	13.1	115.8	245.5	-0.129E-06
38324.	414.	2.5	125.5	234.3	-0.130E-06
38328.	416.	-8.3	132.7	223.0	-0.122E-06
38332.	419.	-18.8	134.8	212.1	-0.805E-07
38336.	425.	-28.7	131.4	202.4	-0.905E-07
38340.	430.	-37.7	124.5	195.0	-0.101E-06
38344.	431.	-44.8	117.3	190.7	-0.136E-06
38348.	432.	-49.0	112.2	189.8	-0.104E-06
38352.	433.	-49.4	110.7	190.8	-0.815E-07
38356.	431.	-45.8	113.3	190.4	-0.111E-06
38360.	427.	-39.2	119.6	186.5	-0.965E-07
38364.	425.	-30.5	127.9	179.3	-0.774E-07
38368.	421.	-20.6	135.9	169.6	-0.131E-06
38372.	417.	-10.3	140.6	158.2	-0.804E-07
38376.	414.	0.4	140.2	146.4	-0.402E-07
38380.	414.	11.1	135.0	134.4	-0.111E-06
38384.	415.	21.3	127.7	123.1	-0.905E-07
38388.	416.	31.0	121.1	113.3	-0.171E-06
38392.	418.	39.4	116.3	105.7	-0.402E-07

Satellite 1963 30 D

Eleanor Ryan

I. SAO smoothed elements

The following elements are based on 78 observations and are valid for the period October 30 through November 15, 1963.

$T_0 = 38342.0$ MJD

$\omega = (247^\circ.5 \pm 1) - ^\circ.24156t - ^\circ.001382t^2$

$\Omega = (48^\circ.659 \pm 2) - ^\circ.05688t - ^\circ.22 \times 10^{-4}t^2$

$i = (88^\circ.387 \pm 3) + ^\circ.000459t$

$e = (.01527 \pm 4) + .000239t - .11 \times 10^{-5}t^2$

$M = (.8242 \pm 3) + (8.570385 \pm 1)t + (.333 \pm 3) \times 10^{-4}t^2$

$+ (.66 \pm 4) \times 10^{-6}t^3$

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

The following elements are based on 37 observations and are valid for the period November 15 through December 1, 1963.

$T_0 = 38356.0$ MJD

$\omega = (243^\circ.9 \pm 2) - ^\circ.28026t - ^\circ.001382t^2$

$\Omega = (47^\circ.856 \pm 5) - ^\circ.05750t - ^\circ.22 \times 10^{-4}t^2$

$i = (88^\circ.398 \pm 8) + ^\circ.000459t$

$e = (0.0186 \pm 3) + .000209t - .11 \times 10^{-5}t^2$

$M = (0.8164 \pm 5) + (8.571275 \pm 3)t + (.166 \pm 3) \times 10^{-4}t^2$

$- (.107 \pm 6) \times 10^{-5}t^3$

Standard error of one observation: $\sigma = \pm 1''.28$

The following elements are based on 34 observations and are valid for the period December 1 through December 15, 1963.

$T_0 = 38370.0$ MJD

$\omega = (239.2 \pm 1) - °.36079t - °.000965t^2$

$\Omega = (47°.071 \pm 3) - °.05598t - °.19 \times 10^{-4}t^2$

$i = (88°.393 \pm 4) + °.000207t$

$e = (.02195 \pm 6) + .000187t - .22 \times 10^{-5}t^2$

$M = (.8164 \pm 4) + (8.571428 \pm 2)t - (.69 \pm 3) \times 10^{-5}t^2$

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

The following elements are based on 92 observations and are valid for the period December 15, 1963, through January 1, 1964.

$T_0 = 38386.0$ MJD

$\omega = (233°.1 \pm 1) - °.39167t - °.000965t^2$

$\Omega = (46°.172 \pm 1) - °.05659t - °.19 \times 10^{-4}t^2$

$i = (88°.396 \pm 2) + °.000207t$

$e = (.02439 \pm 5) + .000117t - .22 \times 10^{-5}t^2$

$M = (.9579 \pm 3) + (8.5713088 \pm 8)t + (.17 \pm 1) \times 10^{-5}t^2$

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

T (MJD)	ω	Ω	i	e	M	n	n'/2	q	N	D	σ
38334.0	249.4 2	49.114 2	88.385 4	.01327 6	.2630 4	8.569987 4	.17E-4 2	9.953950	46	8	.47
38338.0	248.5 1	48.887 2	88.385 3	.01431 5	.5431 4	8.570151 2	.253E-4 9	9.943298	41	8	.45
38342.0	247.5 2	48.658 3	88.386 4	.01527 6	.8242 4	8.570395 2	.341E-4 8	9.933467	28	8	.42
38346.0	246.9 4	48.449 7	88.35 1	.0160 4	.105 1	8.570679 3	.36E-4 1	9.925420	17	8	.44
38350.0	245.6 3	48.213 6	88.37 1	.0170 4	.3894 8	8.570957 3	.32E-4 1	9.915281	20	8	.54
38354.0	244.3 3	47.976 6	88.39 1	.0182 5	.6744 6	8.571185 3	.24E-4 1	9.903119	24	8	.51
38358.0	243.4 3	47.741 7	88.40 1	.0189 4	.9589 7	8.571316 3	.11E-4 1	9.896402	18	8	.53
38362.0	242.4 5	47.50 1	88.42 2	.0194 9	.244 1	8.57136 1	-.10E-4 7	9.891521	9	8	.69
38366.0	240.6 3	47.30 1	88.38 2	.021 1	.531 1	8.571360 8	.2E-5 4	9.878643	11	8	.70
38370.0	239.2 2	47.071 8	88.39 1	.0221 4	.8163 6	8.571424 4	-.7E-5 3	9.864073	17	8	.53
38374.0	237.6 2	46.847 3	88.395 5	.02265 8	.1022 6	8.571372 3	-.7E-5 1	9.858264	21	8	.47
38378.0	236.1 2	46.624 2	88.395 4	.02328 6	.3877 5	8.571324 2	-.5E-5 1	9.851884	28	8	.46
38382.0	234.7 1	46.398 2	88.398 3	.02388 5	.6728 4	8.571300 2	-.6E-6 8	9.845875	41	8	.45
38386.0	232.9 2	46.171 2	88.394 3	.02437 8	.9585 6	8.571306 2	.8E-6 7	9.840946	45	8	.47
38390.0	231.7 2	45.944 2	88.395 4	.0249 1	.2427 5	8.571324 2	.22E-5 7	9.835505	41	8	.49
38394.0	230.1 2	45.718 2	88.395 3	.02517 8	.5279 5	8.571343 2	.34E-5 7	9.832863	43	8	.45

Table 13

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1963 30 D

MJD	Z	φ	ψ	D.R.A.	P
		Perigee In Sunlight			
38334.	3594.	-69.3	56.4	17.9	-0.463E-06
38338.	3583.	-68.4	53.8	13.6	-0.689E-06
38342.	3573.	-67.4	51.2	9.1	-0.929E-06
38346.	3565.	-66.8	49.2	4.9	-0.980E-06
38350.	3555.	-65.5	46.8	0.3	-0.871E-06
38354.	3542.	-64.3	44.6	355.6	-0.653E-06
38358.	3535.	-63.4	43.2	351.0	-0.299E-06
38362.	3530.	-62.4	42.1	346.4	0.272E-06
38366.	3517.	-60.6	40.7	341.7	-0.544E-07
38370.	3502.	-59.2	40.1	337.0	0.191E-06
38374.	3495.	-57.6	40.0	332.2	0.191E-06
38378.	3488.	-56.1	40.6	327.4	0.136E-06
38382.	3482.	-54.7	41.8	322.6	0.163E-07
38386.	3476.	-52.9	43.3	317.8	-0.218E-07
38390.	3470.	-51.7	45.6	313.1	-0.599E-07
38394.	3467.	-50.1	48.1	308.3	-0.926E-07