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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.

<u>SAO mean elements</u> 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."

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

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.

SAO smoothed elements have been derived from observations covering about 2 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

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

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.

I. SAO smoothed elements

The following elements are based on 50 observations and are valid for the period April 1 through April 15, 1964

$$T_0 = 38492.0 \text{ MJD}$$

$$\omega = +(167^\circ.63 \pm 2) + (7^\circ.692 \pm 3)t - {}^\circ.00077065t^2 + {}^\circ.3265 \cos\omega$$

$$\Omega = +(261^\circ.188 \pm 5) - (5^\circ.1448 \pm 9)t - {}^\circ.81070 \times 10^{-4}t^2 + {}^\circ.0030 \cos\omega$$

$$i = +(33^\circ.195 \pm 2) + ({}^\circ.0010 \pm 3)t - {}^\circ.18130 \times 10^{-4}t^2 - {}^\circ.0038 \sin\omega$$

$$e = +(.08635 \pm 4) - (.41 \pm 7) \times 10^{-4}t + .15401 \times 10^{-5}t^2 + .0004991 \sin\omega$$

$$M = +(.64234 \pm 4) + (13.757639 \pm 7)t + (.0002014 \pm 5)t^2 - (.255 \pm 5) \times 10^{-5}t^3 - .0009343 \cos\omega$$

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

The following elements are based on 72 observations and are valid for the period April 15 through May 1, 1964

$$T_0 = 38507.0 \text{ MJD}$$

$$\omega = +(282^\circ.83 \pm 3) + (7^\circ.674 \pm 6)t - {}^\circ.00077065t^2 + {}^\circ.3265 \cos\omega$$

$$\Omega = +(184^\circ.00 \pm 1) - (5^\circ.148 \pm 2)t - {}^\circ.81070 \times 10^{-4}t^2 + {}^\circ.0030 \cos\omega$$

$$i = +(33^\circ.198 \pm 3) + ({}^\circ.0009 \pm 6)t - {}^\circ.181301 \times 10^{-4}t^2 - {}^\circ.0038 \sin\omega$$

$$e = +(.08621 \pm 7) - (.68 \pm 16) \times 10^{-4}t + .15401 \times 10^{-5}t^2 + .0004991 \sin\omega$$

$$M = +(.04334 \pm 7) + (13.76190 \pm 2)t + (.986 \pm 7) \times 10^{-4}t^2 + (.33 \pm 9) \times 10^{-6}t^3 - .0009343 \cos\omega$$

Standard error of one observation: $\sigma = \pm 4'.55$

The following elements are based on 61 observations and are valid for the period May 1 through May 15, 1964

$$T_0 = 38522.0 \text{ MJD}$$

$$\omega = +(38^\circ.215 \pm 8) + (7^\circ.685 \pm 2)t - {}^\circ.000770 65t^2 + {}^\circ.3265 \cos\omega$$

$$\Omega = +(106^\circ.779 \pm 2) - (5^\circ.1486 \pm 6)t - {}^\circ.8107 \times 10^{-4}t^2 + {}^\circ.0030 \cos\omega$$

$$i = +(33^\circ.2011 \pm 9) - ({}^\circ.0002 \pm 2)t - {}^\circ.181301 \times 10^{-4}t^2 - {}^\circ.0038 \sin\omega$$

$$e = +(.08606 \pm 2) + (.84 \pm 52) \times 10^{-5}t + .15401 \times 10^{-5}t^2 + .0004991 \sin\omega$$

$$M = +(.49481 \pm 2) + (13.765189 \pm 5)t + (.0001092 \pm 2)t^2 - (.62 \pm 4) \times 10^{-6}t^3 - .0009343 \cos\omega$$

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

The following elements are based on 45 observations and are valid for the period May 15 through June 1, 1964

$$T_0 = 38538.0 \text{ MJD}$$

$$\omega = +(161^\circ.28 \pm 3) + (7^\circ.702 \pm 4)t - {}^\circ.000983 27t^2 + {}^\circ.3274 \cos\omega$$

$$\Omega = +(24^\circ.376 \pm 8) - (5^\circ.152 \pm 1)t - {}^\circ.14287 \times 10^{-4}t^2 + {}^\circ.0029 \cos\omega$$

$$i = +(33^\circ.202 \pm 2) - ({}^\circ.0008 \pm 7)t - {}^\circ.95005 \times 10^{-5}t^2 - {}^\circ.0038 \sin\omega$$

$$e = +(.08589 \pm 5) + (.08 \pm 11) \times 10^{-4}t + .11374 \times 10^{-5}t^2 + .0004993 \sin\omega$$

$$M = +(.76217 \pm 6) + (13.76797 \pm 1)t + (.706 \pm 2) \times 10^{-4}t^2 - (.29 \pm 4) \times 10^{-6}t^3 - .0009371 \cos\omega$$

Standard error of one observation: $\sigma = \pm 2''.5$

The following elements are based on 51 observations and are valid for the period June 1 through June 15, 1964.

$$T_0 = 38554.0 \text{ MJD}$$

$$\omega = +(284^\circ.44 \pm 2) + (7^\circ.695 \pm 5)t - {}^\circ.0009833t^2 + {}^\circ.3274 \cos \omega$$

$$\Omega = +(301^\circ.915 \pm 6) - (5^\circ.154 \pm 1)t - {}^\circ.14287 \times 10^{-4}t^2 + {}^\circ.0029 \cos \omega$$

$$i = +(33^\circ.199 \pm 4) + ({}^\circ.0002 \pm 6)t - {}^\circ.95005 \times 10^{-5}t^2 - {}^\circ.0038 \sin \omega$$

$$e = +(.08586 \pm 2) - (.11 \pm 4) \times 10^{-4}t + .11374 \times 10^{-5}t^2$$
$$+ .0004993 \sin \omega$$

$$M = +(.06457 \pm 6) + (13.76956 \pm 1)t + (.417 \pm 3) \times 10^{-4}t^2$$
$$+ (.110 \pm 7) \times 10^{-5}t^3 - .0009371 \cos \omega$$

Standard error of one observation: $\sigma = \pm 3''.10$

The following elements are based on 56 observations and are valid for the period June 15 through July 1, 1964.

$$T_0 = 38568.0 \text{ MJD}$$

$$\omega = +(32^\circ.15 \pm 2) + (7^\circ.711 \pm 3)t - {}^\circ.00098327t^2 + {}^\circ.3274 \cos \omega$$

$$\Omega = +(229^\circ.760 \pm 4) - (5^\circ.1538 \pm 6)t - {}^\circ.14287 \times 10^{-4}t^2 + {}^\circ.0029 \cos \omega$$

$$i = +(33^\circ.201 \pm 1) + ({}^\circ.0001 \pm 2)t - {}^\circ.95005 \times 10^{-5}t^2 - {}^\circ.0038 \sin \omega$$

$$e = +(.08582 \pm 1) - (.11 \pm 2) \times 10^{-4}t + .11374 \times 10^{-5}t^2$$
$$+ .0004993 \sin \omega$$

$$M = +(.84747 \pm 4) + (13.770783 \pm 8)t + (.440 \pm 1) \times 10^{-4}t^2$$
$$- (.52 \pm 2) \times 10^{-6}t^3 - .0009371 \cos \omega$$

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

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38488.0	136.61 2	281.763 7	33.195 4	.08679 5	.6158 6	13.75596 3	.213E-3 1	6.717574	16	8	.51
38492.0	167.30 3	261.19 1	33.193 5	.08645 7	.64330 9	13.757501 5	.202E-3 2	6.719635	23	8	1.39
38496.0	198.04 3	240.61 1	33.202 4	.08609 7	.67690 7	13.759006 5	.171E-3 2	6.721790	34	8	1.66
38500.0	228.859 9	220.025 4	33.201 1	.08595 3	.71576 2	13.760217 3	.124E-3 1	6.722417	43	8	.72
38504.0	259.87 1	199.443 5	33.204 1	.08577 4	.75819 3	13.761191 2	.118E-3 1	6.723439	42	8	.71
38508.0	290.61 2	178.86 1	33.205 2	.08572 4	.80508 4	13.761991 2	.870E-4 1	6.723493	35	8	.73
38512.0	321.61 2	158.27 1	33.203 2	.08578 4	.85397 5	13.762758 2	.110E-3 1	6.722800	30	8	.79
38516.0	352.40 1	137.667 3	33.204 1	.08594 3	.90693 3	13.763739 3	.1315E-3 6	6.721308	40	8	.57
38520.0	23.12 1	117.081 2	33.1976 7	.08622 2	.96407 3	13.764727 1	.1154E-3 4	6.718949	40	8	.47
38524.0	53.82 2	96.487 7	33.198 2	.08648 3	.02497 4	13.765602 2	.995E-4 8	6.716781	30	8	.99
38528.0	84.43 2	75.879 7	33.198 2	.08655 4	.08937 4	13.766409 2	.1013E-3 6	6.715990	28	8	.89
38532.0	115.04 3	55.284 9	33.201 2	.08634 5	.15688 7	13.767171 2	.91E-4 1	6.717283	25	8	.96
38536.0	145.67 3	34.66 1	33.200 2	.08620 4	.22715 6	13.767576 2	.64E-4 1	6.718138	18	8	.66
38540.0	176.33 3	14.063 4	33.203 2	.08582 5	.29939 6	13.768126 2	.76E-4 1	6.720756	14	8	.58
38544.0	207.15 2	353.463 4	33.197 3	.08570 4	.37333 5	13.768684 2	.612E-4 9	6.721462	18	8	.53
38548.0	238.07 1	332.840 2	33.202 2	.08545 2	.44894 4	13.769085 2	.431E-4 9	6.723193	20	8	.53
38552.0	269.06 3	312.226 7	33.205 4	.08540 2	.52560 6	13.769377 2	.30E-4 1	6.723436	18	8	.98
38556.0	299.98 3	291.597 8	33.204 3	.08542 2	.60337 7	13.769697 2	.60E-4 1	6.723206	30	8	1.09
38560.0	330.85 2	270.997 5	33.203 2	.08559 1	.68292 5	13.770139 2	.452E-4 7	6.721795	39	8	.85
38564.0	1.70 3	250.385 6	33.201 2	.08584 2	.76396 7	13.770466 1	.425E-4 8	6.719890	40	8	1.18
38568.0	32.43 2	229.765 6	33.199 1	.08613 2	.84662 5	13.770843 1	.493E-4 8	6.717599	29	8	.73
38572.0	63.17 2	209.148 4	33.198 1	.08615 2	.93077 6	13.771163 1	.369E-4 6	6.717354	18	8	.74
38576.0	93.73 3	188.528 4	33.196 2	.08631 2	.01640 7	13.771460 2	.36E-4 1	6.716071	21	8	1.06

Table 1

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

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
		Perigee In Sunlight			
38488.	342.	22.1	52.2	51.2	-0.225E-05
38492.	342.	6.9	54.2	54.6	-0.213E-05
38496.	344.	-9.8	58.9	56.3	-0.181E-05
38500.	348.	-24.4	68.2	60.6	-0.131E-05
38504.	351.	-32.6	80.1	70.5	-0.125E-05
38508.	351.	-30.8	90.0	82.4	-0.919E-06
38512.	347.	-19.9	94.9	90.3	-0.116E-05
38516.	343.	-4.2	94.0	93.1	-0.139E-05
38520.	342.	12.4	90.9	94.7	-0.122E-05
38524.	343.	26.2	90.5	99.4	-0.105E-05
38528.	344.	33.0	95.3	109.4	-0.107E-05
38532.	344.	29.7	104.7	120.7	-0.960E-06
		Perigee In Earth Shadow			
38536.	342.	18.0	115.6	127.1	-0.675E-06
38540.	342.	2.0	125.3	129.2	-0.802E-06
38544.	344.	-14.5	132.9	130.8	-0.646E-06
38548.	349.	-27.7	140.1	136.2	-0.455E-06

Table 1 (cont.)

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

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
38552.	351.	-33.2	149.2	147.0	-0.316E-06
38556.	350.	-28.3	159.5	158.0	-0.633E-06
38560.	345.	-15.5	162.7	163.6	-0.477E-06
38564.	342.	0.9	151.8	165.3	-0.448E-06
38568.	341.	17.1	137.6	167.1	-0.520E-06
38572.	344.	29.2	127.0	173.2	-0.389E-06
38576.	344.	33.1	123.6	184.0	-0.380E-06

I. SAO smoothed elements

The following elements are based on 232 observations and are valid for the period April 1 through May 1, 1964.

$$T_0 = 38500.0 \text{ MJD}$$

$$\omega = (9^\circ\!.462 \pm 6) + (5^\circ\!.2936 \pm 6)t - {}^\circ\!.00029302t^2 + {}^\circ\!.1529 \cos\omega$$

$$\Omega = (41^\circ\!.342 \pm 2) - (3^\circ\!.5202 \pm 2)t - {}^\circ\!.1283 \times 10^{-4}t^2 + {}^\circ\!.0077 \cos\omega$$

$$i = (32^\circ\!.8813 \pm 5) - {}^\circ\!.0068 \sin\omega$$

$$e = (.16404 \pm 1) + (.06 \pm 13) \times 10^{-5}t + .0004575 \sin\omega$$

$$M = (.20986 \pm 2) + (11.480087 \pm 2)t + (.422 \pm 3) \times 10^{-5}t^2$$
$$- (.15 \pm 3) \times 10^{-7}t^3 - .0004404 \cos\omega$$

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

The following elements are based on 133 observations and are valid for the period May 1 through June 1, 1964.

$$T_0 = 38530.0 \text{ MJD}$$

$$\omega = +(168^\circ\!.245 \pm 4) + (5^\circ\!.2963 \pm 3)t - {}^\circ\!.0002456t^2 + {}^\circ\!.1530 \cos\omega$$

$$\Omega = +(295^\circ\!.726 \pm 2) - (3^\circ\!.5212 \pm 2)t - {}^\circ\!.4083 \times 10^{-5}t^2 + {}^\circ\!.0077 \cos\omega$$

$$i = +(32^\circ\!.8766 \pm 6) - {}^\circ\!.0068 \sin\omega$$

$$e = +(.16410 \pm 1) + (.67 \pm 14) \times 10^{-5}t + .0004575 \sin\omega$$

$$M = +(.61550 \pm 1) + (11.4802836 \pm 9)t + (.412 \pm 2) \times 10^{-5}t^2$$
$$- (.13 \pm 2) \times 10^{-7}t^3 - .0004407 \cos\omega$$

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

The following elements are based on 334 observations and are valid for the period June 1 through July 1, 1964.

$$T_0 = 38561.0 \text{ MJD}$$

$$\omega = +(332^\circ\!.326 \pm 2) + (5^\circ\!.2943 \pm 3)t - {}^\circ\!.0002456t^2 + {}^\circ\!.1530 \cos\omega$$

$$\Omega = +(186^\circ\!.579 \pm 1) - (3^\circ\!.5210 \pm 2)t - {}^\circ\!.4083 \times 10^{-5}t^2 + {}^\circ\!.0077 \cos\omega$$

$$i = +(32^\circ\!.8775 \pm 4) - {}^\circ\!.0068 \sin\omega$$

$$e = +(.16418 \pm 1) - (.34 \pm 11) \times 10^{-5}t + .0004575 \sin\omega$$

$$M = +(.507452 \pm 5) + (11.4804577 \pm 6)t + (.238 \pm 1) \times 10^{-5}t^2$$

$$- (.17 \pm 2) \times 10^{-7}t^3 - .0004407 \cos\omega$$

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

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38486.0	295.40 2	90.620 3	32.887 1	.16363 2	.48920 6	11.479970 1	.48E-5 6	6.941079	54	8	.38
38490.0	316.62 1	76.547 3	32.8852 9	.16373 2	.40908 4	11.480006 1	.52E-5 5	6.940254	79	8	.41
38494.0	337.83 1	62.470 5	32.884 1	.16390 2	.32908 5	11.480043 1	.34E-5 5	6.938846	65	8	.46
38498.0	359.00 1	48.391 4	32.882 1	.16400 2	.24934 5	11.480077 1	.17E-5 7	6.937956	66	8	.48
38502.0	20.18 1	34.308 4	32.8792 9	.16417 2	.16968 4	11.480110 1	.59E-5 5	6.936511	79	8	.48
38506.0	41.319 8	20.223 3	32.8767 8	.16434 2	.09023 3	11.480144 1	.29E-5 4	6.935140	59	8	.35
38510.0	62.45 1	6.148 6	32.875 1	.16450 3	.01086 5	11.480173 1	.27E-5 6	6.933814	41	8	.46
38514.0	83.55 2	352.064 6	32.872 3	.16456 5	.93173 5	11.480203 2	.38E-5 9	6.933249	29	8	.54
38518.0	104.68 1	337.987 5	32.866 4	.16459 4	.85260 4	11.480241 2	.50E-5 8	6.933029	32	8	.62
38522.0	125.80 1	323.892 4	32.870 3	.16448 4	.77367 3	11.480272 2	.41E-5 7	6.933893	41	8	.60
38526.0	146.909 8	309.875 3	32.875 2	.16426 3	.69486 2	11.480217 1	.45E-5 5	6.935723	45	8	.57
38530.0	168.081 8	295.716 4	32.874 3	.16418 3	.61597 2	11.480250 1	.45E-5 6	6.936390	37	8	.58
38534.0	189.263 8	281.635 5	32.878 2	.16406 3	.53715 2	11.480286 1	.46E-5 4	6.937355	30	8	.52
38538.0	210.46 1	267.554 8	32.882 2	.16390 4	.45841 2	11.480319 1	.35E-5 5	6.938684	25	8	.52
38542.0	231.65 1	253.461 9	32.883 2	.16373 6	.37982 2	11.480347 1	.27E-5 7	6.940129	25	8	.81
38546.0	252.861 5	239.390 4	32.8830 9	.16375 3	.301192 9	11.480374 1	.44E-5 5	6.939895	47	8	.57
38550.0	274.092 4	225.312 3	32.8844 9	.16375 2	.222645 6	11.4803994 7	.22E-5 4	6.939914	64	8	.53
38554.0	295.308 4	211.235 3	32.8831 7	.16382 2	.144191 5	11.4804174 7	.12E-5 3	6.939342	76	8	.38
38558.0	316.529 3	197.146 2	32.8808 6	.16386 2	.065852 6	11.4804436 7	.19E-5 3	6.938968	07	8	.40
38562.0	337.741 3	183.062 2	32.8789 6	.16400 2	.987578 9	11.4804583 6	.16E-5 3	6.937850	25	8	.42
38566.0	358.934 4	168.981 2	32.8770 5	.16413 2	.909389 9	11.4804754 5	.27E-5 3	6.936733	15	8	.43
38570.0	20.108 4	154.899 2	32.8750 5	.16431 2	.83131 1	11.4804948 6	.16E-5 3	6.935228	84	8	.43
38574.0	41.256 5	140.815 4	32.8722 7	.16450 2	.75334 1	11.4805127 9	.20E-5 4	6.933677	63	8	.52

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 Sunlight		
38486.	568.	-29.4	38.8	19.7	-0.728E-07
38490.	565.	-21.9	36.5	24.1	-0.789E-07
38494.	561.	-11.8	32.2	25.9	-0.516E-07
38498.	560.	-0.5	27.8	26.2	-0.258E-07
38502.	559.	10.8	25.9	26.4	-0.695E-07
38506.	560.	21.0	28.2	27.9	-0.440E-07
38510.	560.	28.8	33.4	31.8	-0.410E-07
38514.	561.	32.6	39.1	38.1	-0.577E-07
38518.	561.	31.7	44.0	45.2	-0.759E-07
38522.	560.	26.1	47.7	50.5	-0.622E-07
38526.	559.	17.2	50.6	53.3	-0.683E-07
38530.	558.	6.4	53.8	53.8	-0.683E-07
38534.	559.	-5.0	58.2	53.6	-0.698E-07
38538.	562.	-16.0	64.4	54.0	-0.531E-07
38542.	566.	-25.2	71.8	56.3	-0.410E-07
38546.	567.	-31.3	79.2	61.3	-0.668E-07
38550.	568.	-32.8	85.3	68.2	-0.334E-07
38554.	566.	-29.4	88.6	74.5	-0.182E-07
38558.	564.	-21.9	88.5	78.4	-0.288E-07
38562.	560.	-11.9	85.4	79.7	-0.243E-07
38566.	558.	-0.6	80.6	79.5	-0.410E-07
38570.	558.	10.8	76.0	79.2	-0.243E-07
38574.	558.	21.0	73.4	80.3	-0.303E-07

Satellite 1959 Eta (Vanguard 3) Mary Grandfield

I. SAO smoothed elements

The following elements are based on 124 observations and are valid for the period April 1 through May 1, 1964.

$$T_0 = 38500.0 \text{ MJD}$$

$$\omega = (20^{\circ}.931 \pm 4) + (4^{\circ}.8980 \pm 4)t + {}^{\circ}.12 \times 10^{-4}t^2 + {}^{\circ}.1295 \cos \omega$$

$$\Omega = (147^{\circ}.189 \pm 2) - (3^{\circ}.2884 \pm 3)t - {}^{\circ}.65 \times 10^{-5}t^2 + {}^{\circ}.0090 \cos \omega$$

$$i = (33^{\circ}.3473 \pm 7) + {}^{\circ}.44 \times 10^{-4}t - {}^{\circ}.0077 \sin \omega$$

$$e = (.188511 \pm 6) - .21 \times 10^{-5}t + .000452 \sin \omega$$

$$M = (.35330 \pm 1) + (11.0906185 \pm 9)t + (.152 \pm 2) \times 10^{-5}t^2$$
$$+ (.37 \pm 2) \times 10^{-7}t^3 - .000376 \cos \omega$$

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

The following elements are based on 134 observations and are valid for the period May 1 through June 1, 1964.

$$T_0 = 38531.0 \text{ MJD}$$

$$\omega = (172^{\circ}.726 \pm 5) + (4^{\circ}.8963 \pm 4)t + {}^{\circ}.12 \times 10^{-4}t^2 + {}^{\circ}.1295 \cos \omega$$

$$\Omega = (45^{\circ}.253 \pm 2) - (3^{\circ}.2883 \pm 2)t - {}^{\circ}.65 \times 10^{-5}t^2 + {}^{\circ}.0090 \cos \omega$$

$$i = (33^{\circ}.3481 \pm 6) + {}^{\circ}.44 \times 10^{-4}t - {}^{\circ}.0077 \sin \omega$$

$$e = (.188460 \pm 6) - .21 \times 10^{-5}t + .000452 \sin \omega$$

$$M = (.16440 \pm 1) + (11.090697 \pm 1)t - (.119 \pm 7) \times 10^{-5}t^2$$
$$+ (.36 \pm 2) \times 10^{-7}t^3 + (.42 \pm 3) \times 10^{-8}t^4 - .000376 \cos \omega$$

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

The following elements are based on 124 observations and are valid for the period June 1 through July 1, 1964.

T_0 = 38561.0 MJD

$\omega = (319^\circ.649 \pm 4) + (4^\circ.8974 \pm 4)t + {}^\circ.12 \times 10^{-4}t^2 + {}^\circ.1295 \cos \omega$

$\Omega = (306^\circ.597 \pm 2) - (3^\circ.2889 \pm 2)t - {}^\circ.65 \times 10^{-5}t^2 + {}^\circ.0090 \cos \omega$

$i = (33^\circ.3431 \pm 6) + {}^\circ.44 \times 10^{-4}t - {}^\circ.0077 \sin \omega$

$e = (.188445 \pm 5) - .21 \times 10^{-5}t + .000452 \sin \omega$

$M = (.886075 \pm 9) + (11.090763 \pm 1)t + (.56 \pm 2) \times 10^{-6}t^2$
$- (.46 \pm 2) \times 10^{-7}t^3 - .000376 \cos \omega$

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

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38486.0	312.47 1	193.229 7	33.352 1	.18817 3	.08455 3	11.090591 9	.4E-5 1	6.894293	21	6	.42
38490.0	332.07 1	180.072 7	33.351 1	.18830 2	.44689 3	11.09061 1	.3E-5 1	6.893124	33	6	.53
38494.0	351.67 2	166.932 8	33.349 2	.18843 2	.80925 3	11.09060 2	.1E-5 2	6.892034	26	6	.48
38498.0	11.29 2	153.759 8	33.348 2	.18856 2	.17166 3	11.090623 9	.3E-5 1	6.890957	28	6	.39
38502.0	30.85 1	140.60 1	33.350 4	.18870 2	.53423 3	11.09061 2	.2E-5 1	6.889769	25	6	.32
38506.0	50.39 1	127.463 3	33.339 2	.18885 1	.89687 3	11.09066 1	.2E-5 1	6.888439	21	6	.33
38510.0	69.95 2	114.308 6	33.341 4	.18894 2	.25956 5	11.09066 3	.4E-5 2	6.887734	21	6	.58
38514.0	89.48 3	101.17 1	33.344 5	.18894 3	.62238 7	11.09075 4	.2E-5 2	6.887641	18	6	.89
38518.0	109.007 9	88.010 5	33.340 1	.18896 2	.98535 2	11.090741 9	.23E-5 8	6.887495	36	6	.46
38522.0	128.561 8	74.847 5	33.3414 9	.18887 1	.34830 2	11.090694 7	-.2E-6 7	6.888327	34	6	.41
38526.0	148.150 9	61.674 5	33.344 1	.18872 1	.71119 2	11.090712 8	.1E-5 9	6.889581	36	6	.44
38530.0	167.71 1	48.532 6	33.345 1	.18852 1	.07405 3	11.09071 1	-.3E-5 1	6.891250	37	6	.45
38534.0	187.31 1	35.381 9	33.346 2	.18835 2	.43680 3	11.09069 1	.1E-5 9	6.892697	21	6	.36
38538.0	206.66 5	22.23 4	33.36 1	.18820 7	.8002 1	11.091093 8	.1E-4 2	6.893772	28	10	1.77
38542.0	226.69 8	8.91 5	33.41 2	.1881 2	.1621 2	11.091084 9	-.4E-5 3	6.894601	23	10	2.56
38546.0	246.11 2	355.927 9	33.344 8	.18804 2	.52513 5	11.09076 3	-.2E-5 2	6.895274	15	6	.57
38550.0	265.77 1	342.772 3	33.352 4	.18800 1	.88784 4	11.09075 3	.2E-5 1	6.895650	28	6	.42
38554.0	285.39 1	329.622 4	33.354 4	.18803 1	.25072 3	11.09071 2	.1E-5 2	6.895399	27	6	.41
38558.0	305.04 2	316.47 1	33.349 6	.18809 2	.61356 3	11.09077 2	.1E-5 2	6.894868	19	6	.41
38562.0	324.60 6	303.34 3	33.357 8	.18812 4	.9766 1	11.09075 3	.3E-5 3	6.894669	14	6	.62
38566.0	344.269 6	290.150 4	33.343 2	.188287 9	.33954 1	11.090763 8	-.2E-6 9	6.893207	20	6	.26
38570.0	3.855 8	277.002 5	33.343 1	.18845 1	.70259 2	11.090760 7	-.16E-5 8	6.891813	28	6	.36
38574.0	23.453 9	263.846 5	33.3391 9	.18864 1	.06560 2	11.090759 7	-.2E-6 7	6.890196	35	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 Earth Shadow			
38486.	519.	-23.9	137.2	140.5	-0.650E-07
38490.	516.	-14.9	141.8	142.1	-0.488E-07
38494.	514.	-4.6	142.4	142.3	-0.163E-07
38498.	513.	6.2	139.1	141.8	-0.488E-07
38502.	513.	16.4	133.9	142.0	-0.325E-07
38506.	514.	25.0	129.1	143.9	-0.325E-07
38510.	515.	31.1	126.2	148.2	-0.650E-07
38514.	516.	33.3	126.3	154.2	-0.325E-07
38518.	515.	31.3	129.4	160.3	-0.374E-07
38522.	514.	25.5	135.2	164.5	0.325E-08
38526.	513.	16.9	142.8	166.3	-0.163E-07
38530.	513.	6.7	151.1	166.4	0.488E-07
38534.	514.	-4.0	159.0	165.7	-0.163E-07
38538.	517.	-14.3	164.5	165.2	-0.163E-06
38542.	520.	-23.6	167.4	166.6	0.650E-07
38546.	522.	-30.2	167.8	170.1	0.325E-07
38550.	524.	-33.2	168.5	175.7	-0.325E-07
38554.	523.	-32.0	170.7	181.7	-0.163E-07
38558.	521.	-26.8	173.3	186.2	-0.163E-07
38562.	518.	-18.6	171.0	188.2	-0.488E-07
38566.	515.	-8.6	163.1	188.3	0.325E-08
38570.	513.	2.1	153.4	187.5	0.260E-07
38574.	513.	12.6	143.4	186.9	0.325E-08

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38486.0	141.6 1	281.606 4	47.242 3	.03085 9	.8619 3	12.55869 1	.25E-3 2	7.576517	13	2	.55
38487.0	145.47 7	278.282 3	47.242 3	.03129 6	.4208 2	12.559150 8	.21E-3 2	7.572839	18	2	.57
38488.0	149.49 6	274.964 3	47.238 2	.03187 5	.9795 2	12.559615 7	.22E-3 1	7.568147	19	2	.49
38489.0	153.32 6	271.638 3	47.239 2	.03234 4	.5393 2	12.560047 7	.23E-3 1	7.564327	15	2	.42
38490.0	157.1 2	268.313 9	47.237 8	.0328 1	.0997 5	12.56055 2	.31E-3 4	7.560824	10	2	.95
38491.0	161.0 2	265.00 2	47.25 2	.0331 2	.6602 7	12.56094 4	.1E-3 1	7.557908	9	2	1.34
38492.0	165.3 1	261.678 7	47.240 8	.03366 8	.2199 3	12.56140 1	.22E-3 3	7.553397	10	2	.55
38493.0	169.12 8	258.356 4	47.251 5	.03401 5	.7815 2	12.561870 8	.19E-3 2	7.550483	14	2	.44
38494.0	173.1 2	255.031 6	47.25 1	.03446 9	.3432 4	12.56231 1	.26E-3 3	7.546840	18	2	.74
38495.0	176.9 2	251.704 8	47.25 1	.0348 1	.9057 5	12.56279 2	.26E-3 4	7.544315	16	2	.79
38496.0	180.7 2	248.38 1	47.26 1	.0352 2	.4687 7	12.56322 2	.16E-3 3	7.541017	14	2	.89
38497.0	185.2 2	245.06 1	47.24 1	.0358 1	.0303 5	12.56371 1	.24E-3 3	7.535825	14	2	.63
38498.0	189.22 7	241.727 7	47.230 7	.03631 5	.5935 2	12.564206 9	.22E-3 2	7.531573	18	2	.46
38499.0	193.19 6	238.392 5	47.229 6	.03680 5	.1575 2	12.564696 7	.24E-3 1	7.527551	22	2	.46
38500.0	197.14 6	235.061 6	47.228 5	.03730 4	.7220 2	12.565193 8	.27E-3 2	7.523443	25	2	.46
38501.0	201.09 6	231.738 6	47.236 5	.03778 4	.2871 2	12.565725 7	.28E-3 2	7.519495	24	2	.42
38502.0	205.13 5	228.404 6	47.230 4	.03835 4	.8524 2	12.566267 7	.27E-3 1	7.514807	31	2	.50
38503.0	209.04 6	225.065 7	47.228 4	.03888 4	.4187 2	12.566845 7	.29E-3 1	7.510433	29	2	.50
38504.0	213.05 6	221.733 1	47.230 6	.03952 5	.9853 2	12.56742 1	.32E-3 1	7.505243	16	2	.43
38505.0	217.00 5	218.391 7	47.225 4	.04006 4	.5527 1	12.568023 6	.29E-3 1	7.500736	20	2	.40
38506.0	220.82 5	215.058 6	47.227 3	.04057 4	.1210 1	12.568628 7	.23E-3 1	7.496553	28	2	.50
38507.0	224.62 6	211.731 9	47.231 4	.04110 6	.6899 2	12.569245 9	.30E-3 2	7.492178	25	2	.64
38508.0	228.48 6	208.38 1	47.227 4	.04176 6	.2594 2	12.56984 1	.31E-3 2	7.486758	17	2	.55
38509.0	232.23 7	205.04 1	47.229 4	.04235 8	.8297 2	12.57047 1	.35E-3 2	7.481897	18	2	.71
38510.0	236.05 7	201.70 1	47.231 4	.04292 7	.4006 2	12.57112 2	.35E-3 2	7.477222	17	2	.68
38511.0	239.72 4	198.363 9	47.239 3	.04345 5	.9724 1	12.571780 7	.36E-3 1	7.472780	25	2	.47
38512.0	243.54 4	195.010 8	47.238 3	.04401 5	.5446 1	12.572487 8	.36E-3 2	7.468122	28	2	.54
38513.0	247.34 3	191.657 6	47.239 2	.04473 5	.1176 1	12.573230 8	.38E-3 1	7.462180	27	2	.43
38514.0	250.70 3	188.322 5	47.240 2	.04521 5	.69256 9	12.573988 6	.38E-3 1	7.458193	25	2	.39
38515.0	254.57 6	184.974 9	47.250 3	.04609 9	.2668 2	12.57478 1	.42E-3 2	7.451001	21	2	.82

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38516.0	257.96 6	181.639 6	47.253 3	.04656 8	.8432 2	12.57551 1	.42E-3 2	7.447032	25	2	.80
38517.0	261.70 3	178.278 4	47.259 2	.04714 4	.41940 9	12.576286 8	.43E-3 1	7.442148	39	2	.58
38518.0	265.39 3	174.934 3	47.265 2	.04769 4	.99648 9	12.577066 8	.35E-3 1	7.437599	64	2	.81
38519.0	268.81 2	171.584 2	47.267 1	.04811 3	.57512 6	12.577753 5	.380E-3 8	7.433999	63	2	.55
38520.0	272.61 3	168.242 3	47.270 2	.04867 4	.15326 8	12.578384 7	.25E-3 1	7.429404	46	2	.63
38521.0	276.10 3	164.904 3	47.279 2	.04943 4	.73285 8	12.578998 7	.20E-3 1	7.423217	45	2	.74
38522.0	279.82 3	161.559 3	47.282 2	.04989 3	.31231 8	12.579313 6	.11E-3 1	7.419486	56	2	.65
38523.0	283.36 4	158.204 4	47.279 3	.05031 4	.8926 1	12.579548 7	.13E-3 1	7.416116	51	2	.71
38524.0	287.04 4	154.857 4	47.282 2	.05084 4	.4727 1	12.579810 6	.11E-3 1	7.411930	50	2	.60
38525.0	290.61 4	151.506 3	47.282 2	.05116 4	.0534 1	12.580049 5	.12E-3 1	7.409298	51	2	.66
38526.0	294.27 3	148.149 3	47.282 2	.05162 3	.63404 8	12.580366 4	.183E-3 8	7.405626	62	2	.52
38527.0	297.84 3	144.798 2	47.283 1	.05189 3	.21538 8	12.580691 4	.120E-3 7	7.403359	77	2	.46
38528.0	301.49 3	141.445 2	47.284 1	.05216 3	.7968 1	12.580953 4	.140E-3 7	7.401147	63	2	.45
38529.0	305.14 2	138.088 2	47.285 1	.05245 2	.37842 7	12.581240 3	.130E-3 6	7.398795	55	2	.34
38530.0	308.78 3	134.737 2	47.288 1	.05264 1	.96038 8	12.581554 4	.185E-3 7	7.397136	65	2	.43
38531.0	312.52 2	131.386 2	47.289 1	.05287 2	.54239 7	12.581880 4	.137E-3 7	7.395220	84	2	.44
38532.0	316.21 2	128.033 2	47.2892 9	.05297 2	.12490 8	12.582174 4	.136E-3 6	7.394325	82	2	.42
38533.0	319.97 2	124.681 2	47.294 1	.05312 2	.70743 6	12.582463 4	.146E-3 7	7.393061	78	2	.49
38534.0	323.77 3	121.326 2	47.295 1	.05331 2	.29020 8	12.582737 5	.116E-3 8	7.391490	71	2	.56
38535.0	327.53 4	117.976 3	47.298 2	.05329 2	.8733 1	12.583015 6	.13E-3 1	7.391499	49	2	.63
38536.0	331.54 6	114.627 4	47.298 3	.05334 2	.4560 2	12.58330 1	.8E-4 2	7.391007	35	2	.72
38537.0	335.20 7	111.269 4	47.303 3	.05338 2	.0399 2	12.58355 1	.11E-3 2	7.390595	36	2	.83
38538.0	339.17 6	107.920 4	47.302 3	.05346 2	.6232 2	12.583755 8	.7E-4 2	7.389928	38	2	.77
38539.0	343.00 6	104.569 4	47.302 2	.05352 2	.2071 2	12.583940 8	.7E-4 1	7.389359	37	2	.72
38540.0	346.8 1	101.229 6	47.300 4	.05341 3	.7913 4	12.58422 1	.10E-3 2	7.390141	34	2	1.17
38541.0	350.90 5	97.876 3	47.291 2	.05355 2	.3749 2	12.584415 7	.8E-4 1	7.388954	38	2	.59
38542.0	354.69 5	94.519 4	47.292 2	.05360 2	.9596 1	12.584651 7	.11E-3 1	7.388453	36	2	.52
38543.0	358.68 7	91.165 6	47.287 3	.05349 2	.5441 2	12.58493 1	.7E-4 2	7.389186	30	2	.65
38544.0	2.60 4	87.811 4	47.284 2	.05366 2	.1289 1	12.585163 5	.12E-3 1	7.387792	32	2	.39
38545.0	6.48 4	84.452 4	47.284 2	.05358 2	.7142 1	12.585449 7	.10E-3 1	7.388310	42	2	.39
38546.0	10.54 5	81.094 5	47.282 3	.05368 2	.2992 1	12.585721 7	.10E-3 1	7.387408	42	2	.51

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38547.0	14.48 4	77.750 5	47.276 2	.05355 2	.8849 1	12.586009 6	.18E-3 1	7.388288	27	2	.41
38548.0	18.45 7	74.388 7	47.278 3	.05377 2	.4707 2	12.586325 9	.14E-3 2	7.386472	26	2	.62
38549.0	22.41 5	71.026 8	47.278 4	.05386 3	.0569 2	12.586651 7	.15E-3 1	7.385638	34	2	.61
38550.0	26.30 5	67.683 6	47.266 3	.05389 2	.6436 1	12.586995 8	.17E-3 1	7.385283	36	2	.48
38551.0	30.28 8	64.315 6	47.270 4	.05409 3	.2305 2	12.587376 8	.17E-3 2	7.383582	24	2	.56
38552.0	34.35 7	60.965 7	47.273 5	.05421 2	.8174 2	12.58776 1	.19E-3 2	7.382467	32	2	.57
38553.0	38.30 5	57.602 5	47.277 4	.05438 2	.4051 1	12.588152 6	.20E-3 1	7.380959	44	2	.52
38554.0	42.23 5	54.245 5	47.278 4	.05454 2	.9932 1	12.588557 6	.22E-3 1	7.379610	37	2	.51
38555.0	46.12 4	50.894 5	47.277 4	.05471 2	.5818 1	12.588997 6	.21E-3 1	7.378112	30	2	.47
38556.0	50.03 5	47.547 6	47.267 6	.05480 3	.1709 2	12.589474 8	.26E-3 2	7.377222	22	2	.58
38557.0	54.04 4	44.194 4	47.269 3	.05502 1	.7601 1	12.589989 7	.26E-3 1	7.375302	29	2	.44
38558.0	57.92 4	40.834 4	47.269 3	.05523 2	.3503 1	12.590495 7	.25E-3 1	7.373456	41	2	.53
38559.0	61.87 3	37.479 3	47.274 3	.05543 2	.9407 1	12.59097 1	.24E-3 2	7.371683	38	2	.52
38560.0	65.77 3	34.120 3	47.277 3	.05562 2	.53178 9	12.591472 8	.26E-3 1	7.370038	29	2	.39
38561.0	69.69 7	30.758 5	47.275 3	.05581 3	.1233 2	12.591983 6	.28E-3 1	7.368363	14	2	.32
38562.0	73.8 2	27.418 9	47.28 1	.05608 8	.7147 5	12.59247 2	.25E-3 3	7.366005	10	2	.97
38563.0	77.7 2	24.058 9	47.28 1	.05631 7	.3075 5	12.59305 3	.30E-3 4	7.363986	9	2	.92
38564.0	81.56 8	20.695 5	47.277 6	.05633 3	.9005 2	12.59348 1	.26E-3 2	7.363670	10	2	.44
38565.0	85.3 1	17.340 8	47.28 1	.05649 4	.4945 4	12.59399 2	.26E-3 3	7.362236	11	2	.63
38566.0	89.15 7	13.991 4	47.270 5	.05668 3	.0888 2	12.59447 1	.27E-3 2	7.360602	16	2	.51
38567.0	93.06 6	10.627 4	47.274 5	.05688 3	.6834 2	12.59499 1	.26E-3 2	7.358794	17	2	.67
38568.0	97.01 7	7.268 4	47.277 5	.05705 3	.2783 2	12.595470 9	.24E-3 2	7.357291	12	2	.55
38569.0	100.88 6	3.916 2	47.268 3	.05717 2	.8739 2	12.595953 6	.24E-3 1	7.356203	17	2	.36
38570.0	104.76 5	0.554 2	47.262 3	.05732 2	.4700 1	12.596392 7	.21E-3 1	7.354839	19	2	.36
38571.0	108.64 5	357.193 2	47.263 3	.05742 2	.0666 1	12.596872 7	.24E-3 1	7.353840	19	2	.44
38572.0	112.55 5	353.831 3	47.266 3	.05757 2	.6635 1	12.597321 8	.22E-3 1	7.352498	19	2	.45
38573.0	116.43 4	350.466 2	47.267 3	.05771 2	.2610 1	12.597751 6	.20E-3 1	7.351298	20	2	.36
38574.0	120.14 5	347.106 3	47.272 4	.05777 2	.8594 2	12.598181 6	.19E-3 1	7.350631	19	2	.40
38575.0	124.16 5	343.753 3	47.272 3	.05784 2	.4573 1	12.598631 6	.23E-3 1	7.349912	14	2	.35
38576.0	127.98 8	340.391 5	47.274 6	.05788 3	.0563 2	12.59906 1	.14E-3 2	7.349454	18	2	.69

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			
38486.	1203.	27.1	63.9	62.9	-0.317E-05
38487.	1198.	24.6	62.5	61.9	-0.266E-05
38488.	1193.	21.9	61.1	60.9	-0.279E-05
38489.	1188.	19.2	59.5	59.7	-0.292E-05
38490.	1184.	16.6	57.9	58.3	-0.393E-05
38491.	1181.	13.8	56.4	56.9	-0.127E-05
38492.	1176.	10.7	55.1	55.7	-0.279E-05
38493.	1173.	8.0	53.6	54.1	-0.241E-05
38494.	1169.	5.1	52.3	52.6	-0.330E-05
38495.	1166.	2.3	51.1	51.0	-0.329E-05
38496.	1163.	-0.5	49.9	49.3	-0.203E-05
38497.	1158.	-3.8	49.6	48.1	-0.304E-05
38498.	1153.	-6.8	49.1	46.6	-0.279E-05
38499.	1150.	-9.6	48.8	45.1	-0.304E-05
38500.	1146.	-12.5	48.7	43.7	-0.342E-05
38501.	1143.	-15.3	49.0	42.3	-0.355E-05
38502.	1139.	-18.2	49.5	41.0	-0.342E-05
38503.	1135.	-20.9	50.2	39.7	-0.367E-05
38504.	1130.	-23.6	51.3	38.6	-0.405E-05
38505.	1127.	-26.2	52.5	37.6	-0.367E-05
38506.	1123.	-28.7	53.8	36.7	-0.291E-05
38507.	1120.	-31.0	55.2	35.8	-0.380E-05

Table 4 (cont.)

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

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
38508.	1115.	-33.3	56.8	35.2	-0.392E-05
38509.	1111.	-35.5	58.4	34.7	-0.443E-05
38510.	1107.	-37.5	60.1	34.4	-0.443E-05
38511.	1103.	-39.3	61.7	34.2	-0.456E-05
38512.	1099.	-41.1	63.4	34.3	-0.456E-05
38513.	1094.	-42.6	65.1	34.7	-0.481E-05
38514.	1090.	-43.9	66.3	34.7	-0.481E-05
38515.	1083.	-45.1	67.9	35.6	-0.531E-05
38516.	1080.	-45.9	69.0	36.0	-0.531E-05
38517.	1075.	-46.6	70.3	37.0	-0.544E-05
38518.	1071.	-47.1	71.4	38.0	-0.443E-05
38519.	1067.	-47.3	72.1	38.7	-0.480E-05
38520.	1063.	-47.2	72.8	40.0	-0.316E-05
38521.	1056.	-46.9	73.2	40.8	-0.253E-05
38522.	1052.	-46.4	73.6	41.9	-0.139E-05
38523.	1049.	-45.6	73.5	42.5	-0.164E-05
38524.	1044.	-44.6	73.4	43.2	-0.139E-05
38525.	1041.	-43.4	72.9	43.6	-0.152E-05
38526.	1037.	-42.0	72.3	43.9	-0.231E-05
38527.	1034.	-40.5	71.4	43.8	-0.152E-05
38528.	1031.	-38.8	70.2	43.7	-0.177E-05
38529.	1028.	-36.9	68.9	43.3	-0.164E-05

Table 4 (cont.)

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

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
38530.	1026.	-34.9	67.4	42.7	-0.234E-05
38531.	1023.	-32.8	65.6	42.1	-0.173E-05
38532.	1021.	-30.6	63.7	41.2	-0.172E-05
38533.	1019.	-28.2	61.5	40.2	-0.184E-05
38534.	1017.	-25.7	59.2	39.1	-0.147E-05
38535.	1016.	-23.2	56.8	37.8	-0.164E-05
38536.	1015.	-20.5	54.2	36.6	-0.101E-05
38537.	1014.	-18.0	51.5	35.1	-0.139E-05
38538.	1013.	-15.1	48.6	33.7	-0.884E-06
38539.	1012.	-12.4	45.7	32.0	-0.884E-06
38540.	1012.	-9.7	42.7	30.4	-0.126E-05
38541.	1011.	-6.7	39.7	28.8	-0.101E-05
38542.	1010.	-3.9	36.6	27.1	-0.139E-05
38543.	1011.	-1.0	33.4	25.4	-0.884E-06
38544.	1009.	1.9	30.3	23.7	-0.152E-05
38545.	1010.	4.8	27.2	22.0	-0.126E-05
38546.	1009.	7.7	24.2	20.4	-0.126E-05
38547.	1011.	10.6	21.3	18.8	-0.227E-05
38548.	1009.	13.4	18.5	17.2	-0.177E-05
38549.	1009.	16.3	16.0	15.7	-0.189E-05
38550.	1009.	19.0	13.7	14.2	-0.215E-05
38551.	1008.	21.7	12.0	12.9	-0.215E-05

Table 4 (cont.)

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

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
38552.	1008.	24.5	10.9	11.8	-0.240E-05
38553.	1007.	27.1	10.6	10.7	-0.252E-05
38554.	1006.	29.6	11.0	9.7	-0.278E-05
38555.	1006.	32.0	12.0	8.9	-0.265E-05
38556.	1006.	34.3	13.4	8.3	-0.328E-05
38557.	1005.	36.5	15.1	8.0	-0.328E-05
38558.	1003.	38.5	16.7	7.8	-0.315E-05
38559.	1002.	40.4	18.4	7.9	-0.303E-05
38560.	1001.	42.1	20.0	8.2	-0.328E-05
38561.	1000.	43.5	21.5	8.8	-0.353E-05
38562.	998.	44.9	23.0	9.8	-0.315E-05
38563.	997.	45.9	24.1	10.8	-0.378E-05
38564.	997.	46.6	25.1	11.9	-0.328E-05
38565.	995.	47.1	25.8	12.9	-0.328E-05
38566.	994.	47.3	26.4	14.2	-0.340E-05
38567.	992.	47.2	26.8	15.5	-0.328E-05
38568.	990.	46.8	27.0	16.9	-0.303E-05
38569.	989.	46.2	27.0	18.0	-0.303E-05
38570.	987.	45.3	26.8	19.0	-0.265E-05
38571.	986.	44.1	26.3	19.8	-0.302E-05
38572.	984.	42.7	25.7	20.5	-0.277E-05
38573.	982.	41.1	24.9	20.8	-0.252E-05
38574.	981.	39.4	23.9	20.8	-0.239E-05
38575.	979.	37.4	22.8	20.8	-0.290E-05
38576.	978.	35.4	21.5	20.4	-0.176E-05

I. SAO smoothed elements

The following elements are based on 294 observations and are valid for the period April 1 through May 1, 1964.

T_0 = 38500.0 MJD

ω = $(350^\circ.279 \pm 5) + (2^\circ.8207 \pm 5)t - {}^\circ.484 \times 10^{-5}t^2 + {}^\circ.34615 \cos \omega$

Ω = $(76^\circ.9617 \pm 8) - (3^\circ.3936 \pm 1)t - {}^\circ.639 \times 10^{-5}t^2 + {}^\circ.0142 \cos \omega$

i = $(49^\circ.9489 \pm 5) - {}^\circ.534 \times 10^{-4}t - {}^\circ.00423 \sin \omega$

e = $(.118589 \pm 8) + .269 \times 10^{-5}t + .0007291 \sin \omega$

M = $(.44754 \pm 2) + (12.819301 \pm 1)t + (.1896 \pm 2) \times 10^{-4}t^2$

$- (.81 \pm 2) \times 10^{-7}t^3 - .0008876 \cos \omega$

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

The following elements are based on 211 observations and are valid for the period May 1 through June 1, 1964.

T_0 = 38530.0 MJD

ω = $(74^\circ.843 \pm 6) + (2^\circ.8186 \pm 7)t - {}^\circ.484 \times 10^{-5}t^2 + {}^\circ.34615 \cos \omega$

Ω = $(335^\circ.1405 \pm 8) - (3^\circ.3945 \pm 1)t - {}^\circ.639 \times 10^{-5}t^2 + {}^\circ.0142 \cos \omega$

i = $(49^\circ.950 \pm 1) - {}^\circ.534 \times 10^{-4}t - {}^\circ.00423 \sin \omega$

e = $(.118625 \pm 5) + .269 \times 10^{-5}t + .0007291 \sin \omega$

M = $(.04174 \pm 2) + (12.820225 \pm 2)t + (.1164 \pm 2) \times 10^{-4}t^2$

$- (.50 \pm 2) \times 10^{-7}t^3 - .0008876 \cos \omega$

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

The following elements are based on 287 observations and are valid for the period June 1 through July 1, 1964.

$$T_0 = 38560.0 \text{ MJD}$$

$$\omega = (159^\circ.514 \pm 6) + (2^\circ.8208 \pm 5)t - {}^\circ.484 \times 10^{-5}t^2 + {}^\circ.34615 \cos \omega$$

$$\Omega = (233^\circ.305 \pm 1) - (3^\circ.3944 \pm 1)t - {}^\circ.639 \times 10^{-5}t^2 + {}^\circ.0142 \cos \omega$$

$$i = (49^\circ.9470 \pm 8) - {}^\circ.534 \times 10^{-4}t - .00423 \sin \omega$$

$$e = (.118544 \pm 9) + .269 \times 10^{-5}t + .0007291 \sin \omega$$

$$M = (.65717 \pm 2) + (12.820792 \pm 2)t + (.777 \pm 3) \times 10^{-5}t^2$$

$$- (.130 \pm 3) \times 10^{-6}t^3 - .0008876 \cos \omega$$

Standard error of one observation: $\sigma = \pm 1''.55$

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38488.0	316.697 6	117.696 2	49.951 1	.11810 3	.61810 2	12.818847 2	.21E-4 1	6.800978	50	6	.47
38492.0	328.021 5	104.124 1	49.9499 8	.11828 2	.89357 2	12.8190036 9	.209E-4 6	6.799488	89	6	.45
38496.0	339.311 5	90.549 1	49.9491 9	.11836 2	.16982 2	12.819176 1	.228E-4 6	6.798801	85	6	.42
38500.0	350.61 1	76.976 2	49.950 1	.11848 2	.44672 4	12.819330 2	.169E-4 9	6.797844	79	6	.47
38504.0	1.88 2	63.404 2	49.952 2	.11860 2	.72422 5	12.819476 2	.199E-4 9	6.796887	61	6	.45
38508.0	13.11 2	49.825 4	49.950 2	.11872 2	.00250 7	12.819609 2	.12E-4 1	6.795897	37	6	.53
38512.0	24.42 2	36.244 4	49.953 2	.11890 2	.28100 5	12.819742 2	.17E-4 1	6.794482	31	6	.47
38516.0	35.69 2	22.668 4	49.952 3	.11904 2	.56018 4	12.819892 1	.177E-4 9	6.793314	47	6	.50
38520.0	46.91 2	9.086 3	49.954 3	.11915 2	.84009 5	12.820000 2	.10E-4 1	6.792425	48	6	.53
38524.0	58.14 2	355.512 3	49.952 3	.11925 2	.12031 6	12.820098 2	.11E-4 1	6.791613	35	6	.50
38528.0	69.34 2	341.938 2	49.946 2	.119306 9	.40097 5	12.820194 2	.13E-4 1	6.791170	54	6	.48
38532.0	80.54 1	328.355 1	49.945 2	.119333 8	.68208 4	12.820296 1	.133E-4 9	6.790929	48	6	.42
38536.0	91.78 1	314.773 1	49.944 1	.119329 8	.96343 4	12.820383 1	.108E-4 8	6.790931	45	6	.34
38540.0	102.98 2	301.191 2	49.942 3	.11931 2	.24522 6	12.820464 2	.11E-4 1	6.791032	29	6	.40
38544.0	114.20 2	287.600 4	49.940 5	.11928 3	.52731 7	12.820542 3	.7E-5 1	6.791254	24	6	.56
38548.0	125.47 1	274.021 3	49.937 3	.11916 2	.80952 4	12.820608 2	.79E-5 9	6.792128	43	6	.49
38552.0	136.68 1	260.443 3	49.942 2	.11908 1	.09215 3	12.820665 1	.63E-5 7	6.792766	60	6	.46
38556.0	147.92 1	246.875 2	49.948 1	.11894 1	.37490 3	12.820743 1	.141E-4 7	6.793815	62	6	.46
38560.0	159.17 1	233.294 2	49.946 1	.11881 1	.65805 4	12.820833 1	.79E-5 7	6.794815	70	6	.42
38564.0	170.44 1	219.715 2	49.947 1	.11867 2	.94140 5	12.820877 2	.6E-5 1	6.795844	73	6	.51
38568.0	181.73 1	206.135 2	49.948 2	.11854 2	.22482 4	12.820923 1	.73E-5 9	6.796828	56	6	.44
38572.0	193.01 1	192.552 2	49.943 2	.11842 3	.50848 5	12.820951 2	.5E-5 1	6.797776	42	6	.51
38576.0	204.326 8	178.982 2	49.948 1	.11819 2	.79208 2	12.820971 2	.28E-5 9	6.799473	36	6	.59

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			
38488.	429.	-31.7	79.5	74.2	-0.256E-06
38492.	425.	-23.9	71.6	66.4	-0.254E-06
38496.	422.	-15.7	61.6	57.4	-0.277E-06
38500.	420.	-7.2	50.4	47.7	-0.206E-06
38504.	419.	1.4	38.6	37.7	-0.242E-06
38508.	418.	10.0	27.2	27.7	-0.146E-06
38512.	418.	18.5	18.0	18.1	-0.207E-06
38516.	419.	26.5	14.4	9.2	-0.215E-06
38520.	421.	34.0	17.8	1.5	-0.122E-06
38524.	422.	40.6	23.6	355.6	-0.134E-06
38528.	424.	45.7	28.3	351.7	-0.158E-06
38532.	425.	49.0	30.8	350.0	-0.162E-06
38536.	425.	49.9	30.9	349.7	-0.131E-06
38540.	425.	48.2	28.7	349.1	-0.134E-06
38544.	423.	44.3	25.2	346.7	-0.852E-07
38548.	422.	38.6	22.5	342.0	-0.961E-07
38552.	420.	31.7	23.8	335.1	-0.767E-07
38556.	419.	24.0	30.5	326.7	-0.172E-06
38560.	418.	15.8	40.9	317.2	-0.961E-07
38564.	418.	7.3	53.2	307.0	-0.730E-07
38568.	418.	-1.3	66.3	296.6	-0.888E-07
38572.	420.	-9.9	79.4	286.2	-0.608E-07
38576.	423.	-18.4	91.7	276.2	-0.341E-07

I. SAO smoothed elements

The following elements are based on 183 observations and are valid for the period April 1 through May 1, 1964.

$$T_0 = 38500.0 \text{ MJD}$$

$$\omega = (5^\circ.367 \pm 3) + 1^\circ.98464t + {}^\circ.14 \times 10^{-4}t^2 + {}^\circ.1136 \cos\omega$$

$$\Omega = (85^\circ.223 \pm 2) - 1^\circ.85974t - {}^\circ.94 \times 10^{-6}t^2 + {}^\circ.0145 \cos\omega$$

$$i = (44^\circ.8055 \pm 8) + {}^\circ.157 \times 10^{-4}t - {}^\circ.0077 \sin\omega$$

$$e = (.24252 \pm 2) - .867 \times 10^{-6}t + .0005181 \sin\omega$$

$$M = (.00113 \pm 1) + (9.1261800 \pm 2)t + (.7 \pm 2) \times 10^{-7}t^2 - .0003162 \cos\omega$$

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

The following elements are based on 202 observations and are valid for the period May 1 through June 1, 1964.

$$T_0 = 38531.0 \text{ MJD}$$

$$\omega = (66^\circ.951 \pm 4) + 1^\circ.98551t + {}^\circ.14 \times 10^{-4}t^2 + {}^\circ.1136 \cos\omega$$

$$\Omega = (27^\circ.583 \pm 2) - 1^\circ.85980t - {}^\circ.94 \times 10^{-6}t^2 + {}^\circ.0145 \cos\omega$$

$$i = (44^\circ.8059 \pm 9) + {}^\circ.157 \times 10^{-4}t - {}^\circ.0077 \sin\omega$$

$$e = (.24265 \pm 2) - .867 \times 10^{-6}t + .0005181 \sin\omega$$

$$M = (.91263 \pm 1) + (9.1261922 \pm 2)t + (.37 \pm 2) \times 10^{-6}t^2 - .0003162 \cos\omega$$

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

The following elements are based on 151 observations and are valid for the period June 1 through July 1, 1964.

T_0 = 38561.0 MJD

$\omega = (126^\circ.560 \pm 8) + 1^\circ.98635t + {}^\circ.14 \times 10^{-4}t^2 + {}^\circ.1136 \cos\omega$

$\Omega = (331^\circ.795 \pm 1) - 1^\circ.85985t - {}^\circ.94 \times 10^{-6}t^2 + {}^\circ.0145 \cos\omega$

$i = (44^\circ.807 \pm 1) + {}^\circ.157 \times 10^{-4}t - {}^\circ.0077 \sin\omega$

$e = (.24277 \pm 2) - .867 \times 10^{-6}t + .0005181 \sin\omega$

$M = (.69852 \pm 3) + (9.1262080 \pm 3)t + (.27 \pm 3) \times 10^{-6}t^2$

$- .0003162 \cos\omega$

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

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38486.0	337.667 5	111.263 2	44.804 2	.24240 3	.23436 1	9.126191 2	.2E-5 1	7.327469	30	6	.33
38490.0	345.622 5	103.828 3	44.804 2	.24238 4	.73909 1	9.126177 2	-.26E-5 9	7.327728	48	6	.45
38494.0	353.560 5	96.394 3	44.802 1	.24241 4	.24378 2	9.126177 2	.3E-6 9	7.327362	44	6	.44
38498.0	1.503 6	88.955 4	44.802 2	.24260 7	.74845 2	9.126181 2	.1E-5 1	7.325512	38	6	.43
38502.0	9.479 8	81.512 5	44.802 2	.24263 8	.25311 3	9.126182 2	-.1E-5 4	7.325266	27	6	.41
38506.0	17.418 6	74.079 3	44.800 2	.24271 5	.75781 3	9.126180 2	-.2E-5 1	7.324479	29	6	.37
38510.0	25.352 9	66.638 4	44.802 2	.24278 5	.26256 3	9.126187 3	-.2E-5 1	7.323827	35	6	.45
38514.0	33.28 1	59.196 7	44.806 3	.24286 6	.76732 4	9.126177 2	.1E-5 9	7.323071	34	6	.44
38518.0	41.216 8	51.772 4	44.800 2	.24289 3	.27201 3	9.126180 2	.1E-5 1	7.322732	48	6	.43
38522.0	49.146 7	44.329 3	44.798 1	.24292 3	.77678 2	9.126185 1	.17E-5 8	7.322464	53	6	.38
38526.0	57.094 7	36.890 2	44.801 2	.24309 3	.28149 2	9.126194 1	-.1E-6 8	7.320795	62	6	.39
38530.0	65.021 6	29.452 2	44.800 2	.24319 3	.78628 2	9.126187 1	-.15E-5 7	7.319858	52	6	.37
38534.0	72.94 1	22.014 4	44.796 2	.24318 4	.29108 4	9.126192 4	.2E-5 2	7.319966	31	6	.43
38538.0	80.89 2	14.574 5	44.799 3	.24328 8	.79582 7	9.126191 5	-.1E-5 3	7.319005	19	6	.38
38542.0	88.83 2	7.121 7	44.807 4	.24323 9	.30067 9	9.126208 5	.3E-5 3	7.319436	9	6	.36
38546.0	96.74 2	359.685 3	44.801 5	.24320 6	.80559 5	9.126207 3	-.1E-5 2	7.319783	21	6	.43
38550.0	104.67 1	352.250 2	44.798 2	.24322 4	.31040 5	9.126194 2	.2E-5 1	7.319504	46	6	.41
38554.0	112.60 1	344.808 2	44.797 2	.24323 3	.81525 5	9.126202 2	-.2E-5 1	7.319466	46	6	.36
38558.0	120.55 1	337.365 2	44.798 1	.24323 2	.32005 5	9.126215 2	-.1E-5 1	7.319476	39	6	.31
38562.0	128.50 3	329.923 3	44.798 3	.24323 5	.8249 1	9.126217 4	.2E-5 3	7.319487	23	6	.45
38566.0	136.31 6	322.489 4	44.812 6	.24305 8	.3301 2	9.126209 5	-.1E-5 8	7.321167	17	6	.37
38570.0	144.28 8	315.038 9	44.810 8	.24306 8	.8349 3	9.126193 5	.1E-5 4	7.321090	14	6	.47
38574.0	152.31 5	307.60 1	44.805 5	.24303 6	.3395 2	9.126225 4	-.2E-5 3	7.321378	21	6	.47

Table 6

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

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
		Perigee In Sunlight			
38486.	951.	-15.5	86.0	84.6	-0.480E-07
38490.	950.	-10.1	80.8	79.5	0.624E-07
38494.	949.	-4.5	74.9	74.1	-0.720E-08
38498.	947.	1.1	68.7	68.6	-0.240E-07
38502.	947.	6.7	62.5	63.2	0.240E-07
38506.	947.	12.2	56.5	57.8	0.480E-07
38510.	947.	17.6	50.8	52.7	0.480E-07
38514.	948.	22.7	45.9	47.8	-0.240E-07
38518.	949.	27.7	41.9	43.5	-0.240E-07
38522.	950.	32.2	39.0	39.7	-0.408E-07
38526.	950.	36.3	37.1	36.6	0.240E-08
38530.	950.	39.7	36.2	34.3	0.360E-07
38534.	951.	42.3	35.7	32.8	-0.480E-07
38538.	951.	44.1	35.5	32.0	0.240E-07
38542.	952.	44.8	35.1	31.6	-0.720E-07
38546.	952.	44.4	34.1	31.2	0.240E-07
38550.	951.	43.0	32.6	30.5	-0.480E-07
38554.	950.	40.6	30.2	29.1	0.480E-07
38558.	949.	37.4	27.1	26.8	0.240E-07
38562.	948.	33.5	23.1	23.8	-0.480E-07
38566.	948.	29.1	18.6	19.8	0.240E-07
38570.	946.	24.3	14.0	15.3	-0.240E-07
38574.	945.	19.1	10.5	10.3	0.480E-07

I. SAO smoothed elements

The following elements are based on 128 observations and are valid for the period April 1 through May 1, 1964.

$$T_0 = 38500.0 \text{ MJD}$$

$$\omega = (343^\circ.06 \pm 4) + (2^\circ.932 \pm 7)t + 6^\circ.6325 \cos\omega$$

$$\Omega = (295^\circ.5825 \pm 8) - (3^\circ.6092 \pm 1)t + {}^\circ.00080560 \cos\omega$$

$$i = (50^\circ.142 \pm 1) - {}^\circ.00023491 \sin\omega$$

$$e = (.00711 \pm 1) + (.06 \pm 11) \times 10^{-5}t + .00075397 \sin\omega$$

$$M = (.4650 \pm 1) + (13.34498 \pm 2)t + (.193 \pm 2) \times 10^{-5}t^2 - .016913 \cos\omega$$

Standard error of one observation: $\sigma = \pm 1'.125$

The following elements are based on 273 observations and are valid for the period May 1 through June 1, 1964.

$$T_0 = 38530.0 \text{ MJD}$$

$$\omega = (71^\circ.74 \pm 7) + (3^\circ.111 \pm 8)t + 6^\circ.6325 \cos\omega$$

$$\Omega = (187^\circ.307 \pm 1) - (3^\circ.6089 \pm 1)t + {}^\circ.0008056 \cos\omega$$

$$i = (50^\circ.1408 \pm 7) - {}^\circ.00023491 \sin\omega$$

$$e = (.00707 \pm 1) - (.32 \pm 9) \times 10^{-5}t + .00075397 \sin\omega$$

$$M = (.8142 \pm 2) + (13.34486 \pm 2)t + (.31 \pm 2) \times 10^{-6}t^2 - .016913 \cos\omega$$

Standard error of one observation: $\sigma = \pm 1'.825$

The following elements are based on 164 observations and are valid for the period June 1 through July 1, 1964.

$$T_0 = 38562.0 \text{ MJD}$$

$$\omega = (167^\circ.32 \pm 8) + (2^\circ.952 \pm 8)t + 6^\circ.6325 \cos\omega$$

$$\Omega = (71^\circ.8208 \pm 9) - (3^\circ.60893 \pm 8)t + {}^\circ.00080560 \cos\omega$$

$$i = (50^\circ.1420 \pm 7) - {}^\circ.00023491 \sin\omega$$

$$e = (.007053 \pm 9) - (.32 \pm 9) \times 10^{-5}t + .00075397 \sin\omega$$

$$M = (.8514 \pm 2) + (13.34497 \pm 2)t - (.185 \pm 2) \times 10^{-5}t^2 - .016913 \cos\omega$$

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

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38486.0	305.6 3	346.116 5	50.142 5	.00646 4	.6265 8	13.345035 3	-.10E-4 3	7.459161	29	4	.66
38490.0	318.3 3	331.682 6	50.134 6	.00656 3	.0037 7	13.344820 3	.1E-5 1	7.458459	18	4	.40
38494.0	330.6 2	317.238 5	50.141 7	.00666 8	.3824 6	13.344821 4	.6E-5 4	7.457704	14	4	.56
38498.0	343.38 6	302.802 2	50.142 2	.00678 2	.7593 2	13.344847 3	.1E-5 4	7.456790	17	4	.29
38502.0	355.51 8	288.365 2	50.143 2	.00700 3	.1382 2	13.344858 3	.3E-5 2	7.455154	24	4	.43
38506.0	6.8 3	273.91 1	50.12 1	.00704 7	.5195 9	13.344877 5	.2E-5 4	7.454875	13	4	.56
38510.0											
38514.0	30.2 2	245.055 8	50.140 7	.00738 3	.2797 7	13.344905 2	-.2E-5 2	7.452248	16	4	.37
38518.0	41.3 2	230.613 5	50.140 3	.00754 3	.6613 4	13.344924 3	.3E-5 2	7.451051	23	4	.38
38522.0	52.3 2	216.181 5	50.141 4	.00761 3	.0435 6	13.344936 4	.2E-5 4	7.450544	41	4	.82
38526.0	63.1 2	201.735 6	50.143 2	.00771 5	.4261 5	13.344945 4	.1E-5 5	7.449807	25	4	.53
38530.0	73.8 1	187.305 2	50.141 1	.00777 3	.8088 4	13.344954 2	.3E-5 2	7.449328	33	4	.42
38534.0	84.4 2	172.873 3	50.140 2	.00779 3	.1922 5	13.344952 4	.3E-5 4	7.449210	37	4	.72
38538.0	95.2 3	158.436 3	50.141 1	.00778 2	.5746 7	13.344957 2	.2E-5 2	7.449235	40	4	.60
38542.0	105.7 2	144.000 2	50.139 1	.00776 1	.9581 6	13.344951 2	.1E-5 2	7.449376	38	4	.54
38546.0	116.6 2	129.563 2	50.140 1	.00772 2	.3404 4	13.344939 2	-.3E-5 2	7.449689	42	4	.44
38550.0	127.3 2	115.125 2	50.140 2	.00767 2	.7233 5	13.344929 2	-.1E-5 2	7.450063	35	4	.53
38554.0	138.6 3	100.695 5	50.142 2	.00754 3	.1045 9	13.344921 3	-.5E-5 3	7.451058	30	4	.64
38558.0	149.4 3	86.252 7	50.143 4	.00741 3	.4869 7	13.344907 3	-.1E-5 6	7.452030	24	4	.51
38562.0	160.8 3	71.821 9	50.142 7	.00719 3	.8679 9	13.344899 4	-.2E-5 3	7.453723	20	4	.51
38566.0	172. 5	57.39 2	50.14 2	.0070 3	.25 1	13.344874 4	.1E-5 5	7.454799	11	4	.55
38570.0	184.7 3	42.950 4	50.139 4	.00688 4	.6268 9	13.344855 2	-.3E-5 2	7.456057	11	4	.30
38574.0	196.9 4	28.512 8	50.146 9	.00674 6	.005 1	13.344841 5	.4E-5 6	7.457113	16	4	.83

Table 7

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 Sunlight		
38486.	1089.	-38.6	74.5	293.9	0.112E-06
38490.	1086.	-30.7	77.9	287.9	-0.112E-07
38494.	1082.	-22.1	84.0	279.7	-0.674E-07
38498.	1079.	-12.7	91.4	270.6	-0.112E-07
38502.	1077.	-3.4	100.0	260.4	-0.337E-07
38506.	1077.	5.2	108.8	249.5	-0.225E-07
38514.	1077.	22.7	119.2	229.2	0.225E-07
38518.	1078.	30.4	120.1	219.8	-0.337E-07
38522.	1080.	37.4	118.1	211.8	-0.225E-07
38526.	1081.	43.2	114.6	205.5	-0.112E-07
38530.	1083.	47.5	111.0	201.1	-0.337E-07
38534.	1083.	49.8	108.6	198.4	-0.337E-07
38538.	1083.	49.9	108.1	196.7	-0.225E-07
38542.	1083.	47.6	110.0	193.8	-0.112E-07
38546.	1081.	43.3	114.2	189.7	0.337E-07
38550.	1080.	37.6	119.9	183.0	0.112E-07
			Perigee In Earth Shadow		
38554.	1078.	30.5	126.5	175.1	0.562E-07
38558.	1077.	23.0	131.7	165.2	0.112E-07
38562.	1077.	14.6	134.7	154.8	0.225E-07
38566.	1077.	6.1	133.8	143.7	-0.112E-07
38570.	1078.	-3.6	130.7	133.2	0.337E-07
38574.	1080.	-12.9	124.8	122.6	-0.449E-07

Satellite 1962 Beta Tau 2 (Injun 3)

Beatrice Miller

I. SAO smoothed elements

The following elements are based on 128 observations and are valid for the period April 1 through April 16, 1964.

$$T_0 = 38494.0 \text{ MJD}$$

$$\omega = (331^\circ.194 \pm 6) - (1^\circ.148 \pm 2)t - {}^\circ.357 \times 10^{-4}t^2 + {}^\circ.2546 \cos\omega$$

$$\Omega = (107^\circ.814 \pm 2) - (1^\circ.7651 \pm 3)t - {}^\circ.000133t^2 + {}^\circ.0315 \cos\omega$$

$$i = (70^\circ.350 \pm 2) - {}^\circ.0022 \sin\omega$$

$$e = (.14680 \pm 2) - (.44 \pm 4) \times 10^{-4}t + .159 \times 10^{-6}t^2$$
$$+ .0007090 \sin\omega$$

$$M = (.92515 \pm 2) + (12.713559 \pm 5)t + (.0004656 \pm 5)t^2$$
$$- (.299 \pm 5) \times 10^{-5}t^3 + (.88 \pm 10) \times 10^{-7}t^4 - .0006735 \cos\omega$$

Standard error of one observation: $\sigma = \pm 2'.05$

The following elements are based on 295 observations and are valid for the period April 16 through May 1, 1964.

$$T_0 = 38509.0 \text{ MJD}$$

$$\omega = (313^\circ.94 \pm 1) - (1^\circ.161 \pm 4)t - {}^\circ.357 \times 10^{-4}t^2 + {}^\circ.2546 \cos\omega$$

$$\Omega = (81^\circ.311 \pm 2) - (1^\circ.7687 \pm 4)t - {}^\circ.000133t^2 + {}^\circ.0315 \cos\omega$$

$$i = (70^\circ.354 \pm 2) - {}^\circ.0022 \sin\omega$$

$$e = (.14629 \pm 2) - (.22 \pm 5) \times 10^{-4}t + .159 \times 10^{-6}t^2$$
$$+ .0007064 \sin\omega$$

$$M = (.72703 \pm 5) + (12.72630 \pm 1)t + (.0003577 \pm 7)t^2$$
$$- (.207 \pm 5) \times 10^{-5}t^3 + (.30 \pm 1) \times 10^{-6}t^4 - .0006735 \cos\omega$$

Standard error of one observation: $\sigma = \pm 2'.53$

The following elements are based on 303 observations and are valid for the period May 1 through May 17, 1964.

$$T_0 = 38524.0 \text{ MJD}$$

$$\omega = (296^{\circ}.65 \pm 3) - (1^{\circ}.151 \pm 5)t - {}^{\circ}.357 \times 10^{-4}t^2 + {}^{\circ}.2546 \cos \omega$$

$$\Omega = (54^{\circ}.761 \pm 4) - (1^{\circ}.7704 \pm 3)t - {}^{\circ}.000133t^2 + {}^{\circ}.0315 \cos \omega$$

$$i = (70^{\circ}.359 \pm 4) - {}^{\circ}.0022 \sin \omega$$

$$e = (.14604 \pm 4) - (.89 \pm 77) \times 10^{-5}t + .159 \times 10^{-6}t^2$$
$$+ .0007090 \sin \omega$$

$$M = (.69667 \pm 9) + (12.73540 \pm 2)t + (.0002196 \pm 6)t^2$$
$$- (.119 \pm 5) \times 10^{-5}t^3 + (.56 \pm 10) \times 10^{-7}t^4 - .0006735 \cos \omega$$

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

The following elements are based on 94 observations and are valid for the period May 17 through June 1, 1964.

$$T_0 = 38540.0 \text{ MJD}$$

$$\omega = (278^{\circ}.36 \pm 2) - (1^{\circ}.143 \pm 3)t - {}^{\circ}.357 \times 10^{-4}t^2 + {}^{\circ}.2546 \cos \omega$$

$$\Omega = (26^{\circ}.421 \pm 4) - (1^{\circ}.7727 \pm 3)t - {}^{\circ}.000133t^2 + {}^{\circ}.0315 \cos \omega$$

$$i = (70^{\circ}.353 \pm 5) - {}^{\circ}.0022 \sin \omega$$

$$e = (.14585 \pm 8) - (.09 \pm 12) \times 10^{-4}t + .159 \times 10^{-6}t^2$$
$$+ .0007090 \sin \omega$$

$$M = (.51177 \pm 8) + (12.74086 \pm 1)t + (.0001375 \pm 8)t^2$$
$$+ (.19 \pm 6) \times 10^{-6}t^3 - (.89 \pm 13) \times 10^{-7}t^4 - .0006735 \cos \omega$$

Standard error of one observation: $\sigma = \pm 1''.93$

The following elements are based on 79 observations and are valid for the period June 1 through June 16, 1964.

$$T_0 = 38554.0 \text{ MJD}$$

$$\omega = (262^\circ.28 \pm 2) - (1^\circ.147 \pm 3)t - {}^\circ.375 \times 10^{-4}t^2 + {}^\circ.2546 \cos \omega$$

$$\Omega = (1^\circ.603 \pm 3) - (1^\circ.7742 \pm 6)t - {}^\circ.000133t^2 + {}^\circ.0315 \cos \omega$$

$$i = (70^\circ.352 \pm 4) - {}^\circ.0022 \sin \omega$$

$$e = (.14544 \pm 3) - (.29 \pm 6) \times 10^{-4}t + .159 \times 10^{-6}t^2 + .0007090 \sin \omega$$

$$M = (.90784 \pm 4) + (12.74407 \pm 1)t + (.000137 \pm 1)t^2$$
$$+ (.36 \pm 1) \times 10^{-5}t^3 - (.17 \pm 2) \times 10^{-6}t^4 - .0006735 \cos \omega$$

Standard error of one observation: $\sigma = \pm 3''.98$

The following elements are based on 64 observations and are valid for the period June 16 through July 1, 1964.

$$T_0 = 38570.0 \text{ MJD}$$

$$\omega = (243^\circ.97 \pm 3) - (1^\circ.140 \pm 6)t - {}^\circ.357 \times 10^{-4}t^2 + {}^\circ.2546 \cos \omega$$

$$\Omega = (333^\circ.211 \pm 2) - (1^\circ.7750 \pm 5)t - {}^\circ.000133t^2 + {}^\circ.0315 \cos \omega$$

$$i = (70^\circ.352 \pm 5) - {}^\circ.0022 \sin \omega$$

$$e = (.14533 \pm 8) + (.24 \pm 17) \times 10^{-4}t + .159 \times 10^{-6}t^2 + .0007090 \sin \omega$$

$$M = (.8515 \pm 1) + (12.74898 \pm 2)t + (.0001752 \pm 9)t^2$$
$$+ (.27 \pm 6) \times 10^{-6}t^3 - (.75 \pm 14) \times 10^{-7}t^4 - .0006735 \cos \omega$$

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

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38486.0	340.61 2	121.963 4	70.352 5	.14698 6	.24764 4	12.705510 7	.515E-3 2	6.618401	31	6	1.08
38488.0	338.30 1	118.430 3	70.351 3	.14683 4	.66073 2	12.707562 4	.555E-3 3	6.618920	37	6	.79
38490.0	336.016 7	114.898 2	70.350 2	.14663 3	.07801 2	12.709670 2	.502E-3 1	6.619723	41	6	.66
38492.0	333.707 8	111.369 2	70.350 2	.14651 4	.49938 3	12.711643 2	.484E-3 2	6.619977	41	6	.64
38494.0	331.393 8	107.837 2	70.351 2	.14635 3	.92464 3	12.713540 2	.469E-3 1	6.620520	48	6	.64
38496.0	329.11 1	104.310 3	70.348 2	.14631 4	.35354 4	12.715397 3	.455E-3 2	6.620187	51	6	.70
38498.0	326.824 9	100.778 2	70.351 2	.14628 2	.78609 3	12.717178 3	.438E-3 2	6.619842	44	6	.54
38500.0	324.56 2	97.242 3	70.371 3	.14620 3	.22203 6	12.718889 4	.420E-3 3	6.619874	67	6	.97
38502.0	322.29 2	93.708 3	70.374 3	.14601 2	.66138 6	12.720583 4	.429E-3 2	6.620688	127	6	1.04
38504.0	320.00 2	90.172 2	70.378 2	.14594 2	.10422 5	12.722338 4	.442E-3 2	6.620660	162	6	1.07
38506.0	317.65 1	86.638 2	70.371 2	.14590 2	.55080 5	12.724035 4	.406E-3 2	6.620394	161	6	1.06
38508.0	315.32 2	83.100 2	70.372 3	.14592 3	.00059 6	12.725526 3	.353E-3 2	6.619700	104	6	1.04
38510.0	312.92 2	79.562 3	70.363 3	.14605 3	.45340 7	12.726933 4	.349E-3 2	6.618182	73	6	.96
38512.0	310.64 3	75.993 5	70.406 5	.14608 5	.9086 1	12.728388 5	.374E-3 4	6.617502	61	6	1.26
38514.0	308.45 4	72.461 5	70.387 5	.14595 4	.3664 1	12.729871 5	.380E-3 3	6.617980	86	6	1.18
38516.0	306.05 3	68.913 3	70.392 3	.14572 3	.8281 1	12.731291 4	.314E-3 2	6.619280	96	6	.84
38518.0	303.87 3	65.388 3	70.372 3	.14538 3	.29146 9	12.732520 3	.286E-3 2	6.621497	106	6	.74
38520.0	301.57 3	61.873 3	70.345 3	.14533 3	.75762 9	12.733584 2	.242E-3 1	6.621462	97	6	.59
38522.0	299.18 3	58.309 3	70.367 3	.14544 3	.2262 1	12.734510 3	.214E-3 2	6.620275	110	6	.76
38524.0	296.80 3	54.762 4	70.370 4	.14548 3	.6963 1	12.735341 3	.215E-3 2	6.619719	114	6	.85
38526.0	294.65 3	51.218 4	70.372 4	.14518 3	.16721 9	12.736241 3	.251E-3 2	6.621764	100	6	.70
38528.0	292.23 6	47.686 6	70.362 7	.14521 9	.6411 2	12.737138 3	.210E-3 2	6.621187	83	6	.72
38530.0	289.71 3	44.145 5	70.363 5	.14570 4	.1171 1	12.737953 2	.200E-3 2	6.617069	81	6	.60

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38532.0	287.44 2	40.601 4	70.362 5	.14566 5	.59367 9	12.738715 3	.175E-3 2	6.617132	70	6	.63
38534.0	285.07 3	37.060 5	70.360 6	.14576 5	.07202 9	12.739364 3	.152E-3 2	6.616169	55	6	.73
38536.0	282.77 7	33.44 1	70.44 1	.1461 2	.5514 3	12.739866 7	.122E-3 5	6.613589	43	6	1.50
38538.0	280.65 7	29.88 1	70.45 1	.1460 1	.0310 3	12.74033 1	.125E-3 6	6.614299	33	6	1.61
38540.0	278.46 9	26.32 1	70.46 1	.1456 2	.5117 3	12.74086 1	.140E-3 8	6.617230	26	6	1.62
38542.0	276.12 3	22.880 8	70.35 1	.14512 8	.9939 1	12.741443 4	.144E-3 3	6.620367	22	6	.70
38544.0	273.64 3	19.333 8	70.36 1	.1459 1	.4781 1	12.741985 3	.125E-3 2	6.614201	23	6	.53
38546.0	271.48 2	15.780 4	70.362 7	.14535 7	.96201 6	12.742447 4	.105E-3 2	6.618300	30	6	.59
38548.0	269.12 2	12.249 5	70.346 8	.14527 7	.44746 6	12.742874 5	.110E-3 2	6.618722	29	6	.75
38550.0	266.94 1	8.693 3	70.343 6	.14482 2	.93314 3	12.743278 3	.100E-3 2	6.622068	25	6	.61
38552.0	264.63 1	5.145 2	70.341 4	.14478 1	.42010 3	12.743673 3	.97E-4 1	6.622254	24	6	.53
38554.0	262.37 2	1.591 3	70.330 6	.14478 2	.90773 4	12.744094 3	.110E-3 2	6.622086	28	6	1.12
38556.0	260.00 1	358.044 2	70.348 4	.14469 1	.39649 3	12.744651 2	.174E-3 2	6.622583	32	6	.95
38558.0	257.69 1	354.494 2	70.350 3	.14465 1	.88651 3	12.745335 2	.168E-3 1	6.622660	39	6	1.09
38560.0	255.34 1	350.945 1	70.354 2	.14464 1	.37798 2	12.745964 2	.144E-3 1	6.622508	38	6	.77
38562.0	253.04 1	347.396 1	70.352 2	.14461 1	.87044 2	12.746508 2	.133E-3 1	6.622571	31	6	.66
38564.0	250.74 1	343.849 2	70.352 3	.14457 2	.36397 3	12.747052 2	.138E-3 1	6.622675	30	6	.61
38566.0	248.43 1	340.296 2	70.355 5	.14454 3	.85863 3	12.747657 3	.170E-3 2	6.622739	27	6	.58
38568.0	246.11 1	336.745 2	70.357 4	.14454 2	.35464 3	12.748355 3	.178E-3 1	6.622519	28	6	.47
38570.0	243.80 2	333.193 2	70.351 5	.1446 1	.85207 8	12.749052 3	.170E-3 2	6.621649	24	6	.53
38572.0	241.52 4	329.640 3	70.348 7	.1448 1	.3507 2	12.749734 4	.170E-3 3	6.620325	21	6	.54
38574.0	239.20 5	326.090 4	70.353 8	.1447 2	.8509 2	12.750412 4	.171E-3 3	6.620607	18	6	.51
38576.0	236.92 8	322.538 4	70.349 8	.1447 2	.3523 3	12.751103 4	.172E-3 2	6.620240	23	6	.55

Table 8

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

Perigee In Sunlight

MJD	Z	ϕ	ψ	D. R. A.	$\dot{P}$
38486.	242.	-18.2	105.5	104.8	-0.638E-05
38488.	243.	-20.4	99.9	98.6	-0.687E-05
38490.	244.	-22.5	94.5	92.3	-0.622E-05
38492.	245.	-24.7	89.3	86.1	-0.599E-05
38494.	246.	-26.8	84.3	79.7	-0.580E-05
38496.	247.	-28.9	79.7	73.4	-0.563E-05
38498.	247.	-31.0	75.5	67.0	-0.542E-05
38500.	248.	-33.1	71.7	60.6	-0.519E-05
38502.	249.	-35.2	68.4	54.1	-0.530E-05
38504.	250.	-37.3	65.7	47.5	-0.546E-05
38506.	251.	-39.4	63.7	40.8	-0.502E-05
38508.	251.	-41.5	62.4	34.1	-0.436E-05
38510.	250.	-43.6	61.9	27.1	-0.431E-05
38512.	250.	-45.6	62.2	20.2	-0.462E-05
38514.	251.	-47.5	63.1	13.2	-0.469E-05
38516.	253.	-49.6	64.8	5.9	-0.387E-05
38518.	256.	-51.4	67.1	358.7	-0.353E-05
38520.	257.	-53.4	70.0	351.1	-0.298E-05
38522.	256.	-55.3	73.5	343.3	-0.264E-05
38524.	257.	-57.2	77.3	335.2	-0.265E-05
38526.	259.	-58.9	81.3	327.1	-0.309E-05
38528.	259.	-60.7	85.8	318.4	-0.259E-05
38530.	256.	-62.5	90.6	309.1	-0.247E-05

Table 8 (cont.)
RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1962 BETA TAU 2

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
38532.	256.	-64.0	95.2	299.9	-0.216E-05
38534.	256.	-65.4	100.0	290.0	-0.187E-05
38536.	253.	-66.8	104.7	279.7	-0.150E-05
		Perigee In Earth Shadow			
38538.	254.	-67.8	109.2	269.4	-0.154E-05
38540.	258.	-68.8	113.6	258.5	-0.172E-05
38542.	261.	-69.5	118.0	246.7	-0.177E-05
38544.	255.	-70.0	122.1	234.2	-0.154E-05
38546.	259.	-70.3	125.6	222.3	-0.129E-05
38548.	259.	-70.3	128.8	209.7	-0.135E-05
38550.	263.	-70.1	131.2	197.7	-0.123E-05
38552.	263.	-69.6	132.9	185.5	-0.119E-05
38554.	262.	-69.0	133.7	173.8	-0.135E-05
38556.	263.	-68.0	133.6	162.2	-0.214E-05
38558.	262.	-66.9	132.6	151.2	-0.207E-05
38560.	262.	-65.7	130.8	140.7	-0.177E-05
38562.	262.	-64.3	128.1	130.8	-0.164E-05
38564.	261.	-62.8	124.8	121.2	-0.170E-05
38566.	261.	-61.1	121.0	112.1	-0.209E-05
38568.	260.	-59.4	116.7	103.3	-0.219E-05
38570.	259.	-57.7	112.1	94.8	-0.209E-05
38572.	257.	-55.9	107.3	86.6	-0.209E-05
		Perigee In Sunlight			
38574.	256.	-54.0	102.3	78.6	-0.210E-05
38576.	255.	-52.1	97.2	70.9	-0.212E-05

Satellite 1962 Beta Upsilon 1 (Relay 1)

Beatrice Miller

I. SAO smoothed elements

The following elements are based on 64 observations and are valid for the period April 1 through May 1, 1964.

$$T_0 = 38501.0 \text{ MJD}$$

$$\omega = (50^\circ.51 \pm 1) + (1^\circ.218 \pm 2)t + {}^\circ.0954 \cos \omega$$

$$\Omega = (312^\circ.852 \pm 3) - (1^\circ.2807 \pm 4)t + {}^\circ.0159 \cos \omega$$

$$i = (47^\circ.515 \pm 2) - {}^\circ.0082 \sin \omega$$

$$e = (.28503 \pm 4) - (.79 \pm 37) \times 10^{-5} t + .0005025 \sin \omega$$

$$M = (.93410 \pm 7) + (7.780940 \pm 8)t - (.06 \pm 10) \times 10^{-6} t^2 - .0002568 \cos \omega$$

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

The following elements are based on 251 observations and are valid for the period May 1 through June 1, 1964.

$$T_0 = 38532.0 \text{ MJD}$$

$$\omega = (88^\circ.101 \pm 1) + (1^\circ.2123 \pm 2)t + {}^\circ.0954 \cos \omega$$

$$\Omega = (273^\circ.1500 \pm 6) - (1^\circ.28021 \pm 8)t + {}^\circ.0159 \cos \omega$$

$$i = (47^\circ.5095 \pm 3) - {}^\circ.0082 \sin \omega$$

$$e = (.284876 \pm 4) - (.74 \pm 5) \times 10^{-5} t + .0005025 \sin \omega$$

$$M = (.144000 \pm 2) + (7.7809573 \pm 3)t - (.32 \pm 1) \times 10^{-6} t^2 - .0002568 \cos \omega$$

Standard error of one observation: $\sigma = \pm 0''.81$

The following elements are based on 220 observations and are valid for the period June 1 through July 1, 1964.

$$T_0 = 38562.0 \text{ MJD}$$

$$\omega = (124^\circ\!.458 \pm 2) + (1^\circ\!.2133 \pm 3)t + {}^\circ\!.0954 \cos \omega$$

$$\Omega = (234^\circ\!.761 \pm 1) - (1^\circ\!.2791 \pm 1)t + {}^\circ\!.0159 \cos \omega$$

$$i = (47^\circ\!.5060 \pm 5) - {}^\circ\!.0082 \sin \omega$$

$$e = (.284525 \pm 6) + .0005025 \sin \omega$$

$$M = (.572389 \pm 4) + (7.7809384 \pm 5)t - (.73 \pm 14) \times 10^{-7} t^2$$

$$- .0002568 \cos \omega$$

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

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38490.0	37.22 5	326.954 7	47.514 6	.28536 7	.3434 2	7.78096 1	-.1E-5 6	7.687485	8	6	.44
38494.0	42.02 7	321.81 2	47.507 7	.2856 3	.4676 4	7.780975 8	.3E-5 5	7.684432	11	6	.40
38498.0	46.89 5	316.716 8	47.513 4	.2855 2	.5912 3	7.780967 5	.4E-5 4	7.685813	18	6	.39
38502.0	51.79 3	311.585 7	47.511 3	.2854 1	.7149 2	7.780961 6	-.10E-4 4	7.687211	31	6	.46
38506.0	56.68 3	306.450 6	47.508 3	.28527 9	.8386 1	7.780969 6	-.2E-5 4	7.688398	19	6	.40
38510.0											
38514.0											
38518.0	71.156 4	291.078 3	47.499 1	.28548 1	.21046 1	7.780960 9	.2E-5 3	7.686221	35	6	.36
38522.0	76.001 2	285.955 1	47.5006 5	.285446 6	.334336 3	7.7809666 4	-.9E-6 3	7.686552	61	6	.23
38526.0	80.846 2	280.833 1	47.5010 6	.285416 7	.458196 3	7.7809626 4	-.2E-6 3	7.686876	72	6	.28
38530.0	85.684 2	275.7116 9	47.5019 4	.285392 5	.582057 3	7.7809621 3	.3E-6 3	7.687129	62	6	.20
38534.0	90.520 2	270.5899 8	47.5012 3	.285360 5	.705927 4	7.7809599 3	-.9E-6 2	7.687476	50	6	.16
38538.0	95.370 3	265.4676 9	47.5018 4	.285322 6	.829752 4	7.7809535 5	-.8E-6 3	7.687896	40	6	.17
38542.0	100.221 7	260.348 2	47.503 1	.28528 2	.95355 1	7.780951 1	.7E-6 6	7.688352	26	6	.29
38546.0	105.06 2	255.21 1	47.492 9	.28528 8	.07740 3	7.780947 2	-.1E-5 1	7.688305	21	6	.49
38550.0	109.88 1	250.119 6	47.513 5	.28510 7	.20118 2	7.780949 2	-.1E-5 1	7.690260	23	6	.45
38554.0	114.732 4	244.986 2	47.5034 9	.28509 1	.324964 8	7.780940 1	.12E-5 6	7.690392	42	6	.34
38558.0	119.567 2	239.870 1	47.5004 5	.285019 6	.448748 4	7.7809453 4	.6E-6 3	7.691154	67	6	.25
38562.0	124.406 3	234.753 1	47.4992 5	.284959 7	.572538 4	7.7809419 5	-.8E-6 4	7.691810	47	6	.20
38566.0	129.247 4	229.635 2	47.4999 6	.284899 8	.696307 7	7.7809392 5	-.7E-6 4	7.692449	34	6	.24
38570.0	134.095 2	224.5195 9	47.4980 4	.284814 5	.820051 4	7.7809433 4	.19E-5 3	7.693363	46	6	.18
38574.0	138.935 2	219.3999 8	47.4967 5	.284754 5	.943845 3	7.7809458 4	-.1E-6 3	7.694008	48	6	.17

Table 9

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

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
		Perigee In Sunlight			
38490.	1313.	26.5	27.9	340.1	0.330E-07
38494.	1311.	29.6	31.9	335.4	-0.991E-07
38498.	1314.	32.6	35.6	331.1	-0.132E-06
38502.	1316.	35.4	38.9	327.1	0.330E-06
38506.	1318.	38.0	41.8	323.4	0.661E-07
38518.	1318.	44.2	48.1	314.1	-0.661E-07
38522.	1319.	45.7	49.4	311.7	0.297E-07
38526.	1320.	46.7	50.3	309.5	0.661E-08
38530.	1320.	47.3	51.1	307.5	-0.991E-08
38534.	1321.	47.5	51.8	305.6	0.297E-07
38538.	1321.	47.2	52.5	303.6	0.264E-07
38542.	1321.	46.5	53.3	301.5	-0.231E-07
38546.	1321.	45.4	54.4	299.0	0.330E-07
38550.	1322.	43.9	56.0	296.3	0.330E-07
38554.	1322.	42.0	58.1	293.1	-0.396E-07
38558.	1322.	39.9	60.7	289.6	-0.198E-07
38562.	1321.	37.5	64.0	285.7	0.264E-07
38566.	1321.	34.8	67.9	281.5	0.231E-07
38570.	1321.	32.0	72.3	276.9	-0.628E-07
38574.	1321.	29.0	77.3	272.0	0.330E-08

I. SAO smoothed elements

The following elements are based on 145 observations and are valid for the period April 1 through May 1, 1964.

T_0 = 38500.0 MJD

ω = $(229^\circ.874 \pm 3) + (1^\circ.2209 \pm 4)t + {}^\circ.0465 \cos \omega$

Ω = $(182^\circ.698 \pm 2) - (1^\circ.0556 \pm 2)t + {}^\circ.0197 \cos \omega$

i = $(42^\circ.747 \pm 1) + {}^\circ.924 \times 10^{-7}t - {}^\circ.0118 \sin \omega$

e = $(.40117 \pm 2) + .428 \times 10^{-5}t + .0003970 \sin \omega$

M = $(.476048 \pm 6) + (6.391471 \pm 1)t + (.30 \pm 2) \times 10^{-6}t^2$
$- (.24 \pm 35) \times 10^{-8}t^3 - .0001394 \cos \omega$

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

The following elements are based on 107 observations and are valid for the period May 1 through June 1, 1964.

T_0 = 38530.0 MJD

ω = $(266^\circ.394 \pm 2) + (1^\circ.2185 \pm 2)t + {}^\circ.0465 \cos \omega$

Ω = $(151^\circ.016 \pm 1) - (1^\circ.0567 \pm 1)t + {}^\circ.0197 \cos \omega$

i = $(42^\circ.7407 \pm 9) + {}^\circ.924 \times 10^{-7}t - {}^\circ.0118 \sin \omega$

e = $(.401639 \pm 6) + .4285 \times 10^{-5}t + .0003970 \sin \omega$

M = $(.220544 \pm 4) + (6.3914853 \pm 4)t - (.20 \pm 17) \times 10^{-7}$
$+ (.47 \pm 14) \times 10^{-8} - .0001394 \cos \omega$

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

The following elements are based on 206 observations and are valid for the period June 1 through July 1, 1964.

T_0 = 38560.0 MJD

ω = $(302^{\circ}.934 \pm 2) + (1^{\circ}.2187 \pm 2)t + {}^{\circ}.0465 \cos \omega$

Ω = $(119^{\circ}.315 \pm 1) - (1^{\circ}.0563 \pm 1)t + {}^{\circ}.0197 \cos \omega$

i = $(42^{\circ}.7528 \pm 8) + {}^{\circ}.924 \times 10^{-7}t - {}^{\circ}.0118 \sin \omega$

e = $(.401578 \pm 7) + .4285 \times 10^{-5}t + .0003970 \sin \omega$

M = $(.965147 \pm 3) + (6.3914836 \pm 3)t - (.56 \pm 14) \times 10^{-7}t^2$

$+ (.30 \pm 15) \times 10^{-8}t^3 - .0001394 \cos \omega$

Standard error of one observation: $\sigma = \pm 1''.56$

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38488.0	215.211 4	195.344 2	42.759 1	.40075 1	.778543 5	6.391476 1	.24E-5 3	7.349391	56	8	.34
38492.0	220.080 5	191.126 4	42.757 2	.40079 4	.34442 1	6.391480 1	-.10E-4 6	7.348883	47	8	.45
38496.0	224.952 5	186.903 3	42.758 2	.40082 3	.910293 9	6.391485 1	.16E-4 7	7.348530	50	8	.46
38500.0	229.840 5	182.683 3	42.757 3	.40096 4	.47613 1	6.391487 1	-.3E-6 6	7.346815	61	8	.49
38504.0	234.708 6	178.461 4	42.758 3	.40097 5	.04204 1	6.391487 4	-.1E-5 9	7.346682	41	8	.46
38508.0											
38512.0											
38516.0	249.338 5	165.802 2	42.748 2	.40116 2	.739760 7	6.391488 6	.2E-5 1	7.344402	28	8	.32
38520.0	254.195 5	161.578 2	42.749 2	.40117 2	.305728 7	6.391496 2	-.1E-6 6	7.344181	33	8	.34
38524.0	259.080 8	157.345 5	42.762 6	.40123 4	.87164 2	6.391491 3	.3E-5 2	7.343454	18	8	.50
38528.0	263.965 7	153.126 5	42.763 5	.40129 4	.43756 2	6.391491 4	-.4E-5 2	7.342794	23	8	.52
38532.0	268.830 8	148.904 6	42.763 5	.40130 5	.00347 3	6.391495 4	.3E-5 2	7.342676	20	8	.54
38536.0	273.702 4	144.678 2	42.750 1	.401314 9	.569447 6	6.391493 2	-.1E-6 6	7.342456	23	8	.20
38540.0	278.575 5	140.456 2	42.750 2	.401336 9	.135388 8	6.391492 4	-.1E-6 9	7.342189	25	8	.22
38544.0	283.467 3	136.225 1	42.753 1	.401303 7	.701315 4	6.391495 1	-.8E-6 4	7.342593	32	8	.19
38548.0	288.336 3	132.001 2	42.754 1	.401312 9	.267262 4	6.3914956 8	.4E-6 3	7.342479	40	8	.28
38552.0	293.208 4	127.777 3	42.756 2	.40133 2	.83321 1	6.391497 3	.1E-5 1	7.342270	25	8	.31
38556.0	298.088 3	123.549 2	42.761 1	.40129 1	.399126 6	6.391499 2	-.18E-5 7	7.342777	35	8	.26
38560.0	302.960 3	119.323 2	42.762 1	.401287 8	.965075 4	6.3914914 5	-.4E-6 3	7.342795	50	8	.26
38564.0	307.829 2	115.101 1	42.7605 9	.401290 6	.531014 3	6.3914907 4	-.5E-6 2	7.342758	43	8	.16
38568.0	312.712 3	110.877 1	42.764 1	.401282 8	.096927 4	6.3914885 7	-.5E-6 3	7.342860	53	8	.22
38572.0	317.580 3	106.655 1	42.7666 9	.401249 7	.662848 3	6.3914858 4	-.1E-6 9	7.343264	70	8	.23
38576.0	322.446 3	102.437 2	42.767 1	.401184 9	.228765 4	6.3914869 6	.3E-6 2	7.344062	91	8	.32

Table 10

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

MJD	Z	ϕ	ψ	D. R.A.	$\dot{P}$
		Perigee In Sunlight			
38488.	974.	-23.0	41.1	30.5	-0.118E-06
38492.	975.	-25.9	41.9	27.0	0.490E-06
38496.	975.	-28.7	43.4	23.6	-0.783E-06
38500.	974.	-31.3	45.4	20.5	0.147E-07
38504.	975.	-33.7	47.8	17.6	0.490E-07
38516.	975.	-39.4	55.3	10.4	-0.979E-07
38520.	975.	-40.8	57.5	8.4	0.490E-08
38524.	975.	-41.8	59.4	6.7	-0.147E-06
38528.	974.	-42.5	61.0	5.1	0.196E-06
38532.	974.	-42.8	62.1	3.5	-0.147E-06
38536.	974.	-42.6	62.8	1.9	0.490E-08
38540.	973.	-42.2	63.1	0.2	0.490E-08
38544.	974.	-41.3	62.9	358.4	0.392E-07
38548.	973.	-40.1	62.4	356.3	-0.196E-07
38552.	972.	-38.6	61.5	354.0	-0.490E-07
38556.	972.	-36.8	60.3	351.4	0.881E-07
38560.	971.	-34.7	59.0	348.4	0.196E-07
38564.	971.	-32.4	57.6	345.2	0.245E-07
38568.	970.	-29.9	56.2	341.7	0.245E-07
38572.	969.	-27.3	54.9	338.0	0.490E-08
38576.	969.	-24.4	53.9	334.0	-0.147E-07

Satellite 1963 26A (Geophysics Research) — Donald Chittick

I. SAO smoothed elements

The following elements are based on 116 observations and are valid for the period April 1 through May 1, 1964.

$$T_0 = 38500.0 \text{ MJD}$$

$$\omega = (74^\circ.96 \pm 1) + (3^\circ.513 \pm 2)t + {}^\circ.000614\, t^2 + {}^\circ.7265 \cos \omega$$

$$\Omega = (248^\circ.124 \pm 2) - (4^\circ.1733 \pm 2)t + 5^\circ.6 \times 10^{-6} t^2 + {}^\circ.0120 \cos \omega$$

$$i = (49^\circ.737 \pm 1) - {}^\circ.0024 \sin \omega$$

$$e = (.06103 \pm 2) - (.35 \pm 18) \times 10^{-5} t + 3.06 \times 10^{-7}\, t^2 + .0007944 \sin \omega$$

$$M = (.32723 \pm 3) + (14.106473 \pm 4)t + (1.060 \pm 3) \times 10^{-5} t^2$$

$$- (.90 \pm 4) \times 10^{-7} t^3 - .0020291 \cos \omega$$

Standard error of one observation: $\sigma = \pm\, 2'.05$

The following elements are based on 189 observations and are valid for the period May 1 through June 1, 1964.

$$T_0 = 38530.0 \text{ MJD}$$

$$\omega = (180^\circ.27 \pm 1) + (3^\circ.494 \pm 2)t + {}^\circ.000614 t^2 + {}^\circ.7265 \cos \omega$$

$$\Omega = (122^\circ.934 \pm 2) - (4^\circ.1731 \pm 2)t + 5^\circ.6 \times 10^{-6} t^2 + {}^\circ.0120 \cos \omega$$

$$i = (49^\circ.735 \pm 1) - {}^\circ.0024 \sin \omega$$

$$e = (.06115 \pm 2) + (.25 \pm 27) \times 10^{-5} t + 3.06 \times 10^{-7} t^2 + .0007944 \sin \omega$$

$$M = (.53098 \pm 3) + (14.107082 \pm 6)t + (.402 \pm 5) \times 10^{-5} t^2$$

$$- .0020291 \cos \omega$$

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

The following elements are based on 71 observations and are valid for the period June 1 through July 1, 1964.

$$T_0 = 38560.0 \text{ MJD}$$

$$\omega = (285\overset{\circ}{.}55 \pm 2) + (3\overset{\circ}{.}503 \pm 3)t + \overset{\circ}{.}000614\, t^2 + \overset{\circ}{.}7265 \cos \omega$$

$$\Omega = (357\overset{\circ}{.}731 \pm 2) - (4\overset{\circ}{.}1735 \pm 4)t + 5\overset{\circ}{.}6 \times 10^{-6} t^2 + \overset{\circ}{.}0120 \cos \omega$$

$$i = (49\overset{\circ}{.}742 \pm 4) - \overset{\circ}{.}0024 \sin \omega$$

$$e = (.06103 \pm 1) + (.14 \pm 23) \times 10^{-5} t + 3.06 \times 10^{-7} t^2 + .0007944 \sin \omega$$

$$M = (.74625 \pm 6) + (14.107297 \pm 7)t + (.170 \pm 7) \times 10^{-5} t^2$$

$$- .0020291 \cos \omega$$

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

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38488.0	33.55 4	298.212 4	49.742 4	.06152 3	.0494 1	14.106312 3	.6E-5 2	6.789851	33	6	.97
38492.0	47.32 2	281.518 1	49.736 1	.06167 2	.47496 5	14.106423 2	.178E-4 8	6.788777	27	6	.48
38496.0	61.26 4	264.818 7	49.733 6	.06177 8	.9005 1	14.106523 4	.8E-5 3	6.787990	22	6	1.18
38500.0	75.23 2	248.121 5	49.731 5	.06189 3	.32654 5	14.106587 2	.8E-5 1	6.787117	26	6	.77
38504.0	89.05 2	231.423 5	49.728 4	.06184 3	.75320 4	14.106671 2	.15E-4 1	6.787482	30	6	.79
38508.0	102.87 2	214.729 9	49.730 4	.06183 4	.18034 6	14.106760 4	.8E-5 3	6.787489	19	6	.77
38512.0	116.6 2	198.07 7	49.724 7	.0619 2	.6078 3	14.10679 2	.1E-5 6	6.787308	6	6	.44
38516.0	132.3 6	181.36 1	49.73 1	.06156 8	.030 2	14.10689 1	.12E-4 4	6.789412	11	6	.44
38520.0	144.65 2	164.654 1	49.734 2	.06158 2	.46269 5	14.106966 2	.30E-5 9	6.789227	34	6	.44
38524.0	158.574 9	147.961 2	49.734 2	.06138 2	.89072 3	14.106995 2	.65E-5 8	6.790705	64	6	.58
38528.0	172.55 1	131.267 2	49.736 1	.06114 2	.31884 2	14.107044 2	.67E-5 8	6.792409	52	6	.63
38532.0	186.57 2	114.569 4	49.735 2	.06097 2	.74711 5	14.107087 2	.48E-5 9	6.793607	28	6	.50
38536.0	200.64 2	97.870 6	49.733 2	.06073 2	.17542 7	14.107098 2	-.1E-5 1	6.795372	20	6	.53
38540.0	214.77 4	81.21 1	49.732 4	.06053 5	.6035 1	14.107116 4	.8E-5 3	6.796788	21	6	.65
38544.0	228.90 6	64.48 1	49.747 8	.0605 3	.0320 3	14.107157 2	.2E-5 2	6.796999	27	6	.60
38548.0	243.2 1	47.80 1	49.748 9	.0601 5	.4599 4	14.107165 2	-.1E-5 2	6.799853	19	6	.60
38552.0	257.35 4	31.115 7	49.743 7	.06032 3	.8886 1	14.107153 2	.3E-5 1	6.798293	17	6	.57
38556.0	271.56 3	14.420 6	49.750 6	.06028 2	.31705 7	14.107191 2	.6E-5 2	6.798603	18	6	.58
38560.0	285.83 4	357.733 3	49.744 4	.06030 2	.7455 1	14.107202 3	.1E-5 2	6.798432	16	6	.82
38564.0	300.08 6	341.042 6	49.740 8	.06042 4	.1741 2	14.107195 4	-.3E-5 2	6.797534	9	6	.57
38568.0	314.04 2	324.320 6	49.708 7	.06041 2	.60488 6	14.107228 2	.37E-5 8	6.797602	10	6	.31
38572.0	328.7 5	307.64 2	49.73 2	.0599 9	.031 1	14.107244 3	-.2E-5 1	6.801497	15	6	.80
38576.0	343.0 3	290.96 2	49.74 1	.0598 5	.4603 7	14.107234 3	-.2E-5 1	6.801701	11	6	.70

Table 11

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

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
		Perigee In Sunlight			
38488.	415.	24.9	52.5	309.2	-0.603E-07
38492.	417.	34.1	61.0	300.7	-0.179E-06
38496.	419.	42.0	66.0	295.0	-0.804E-07
38500.	420.	47.5	67.6	292.7	-0.804E-07
38504.	422.	49.7	66.7	293.0	-0.151E-06
38508.	421.	48.1	65.1	293.5	-0.804E-07
38512.	419.	43.0	65.1	291.4	-0.101E-07
38516.	418.	34.4	67.1	287.7	-0.121E-06
38520.	415.	26.2	76.0	277.9	-0.301E-07
38524.	414.	16.2	87.3	267.8	-0.653E-07
38528.	414.	5.7	100.8	256.6	-0.673E-07
		Perigee In Earth Shadow			
38532.	415.	-5.0	115.2	245.0	-0.482E-07
38536.	419.	-15.6	128.8	233.8	0.100E-07
38540.	422.	-25.8	139.9	223.6	-0.804E-07
38544.	426.	-35.1	146.5	215.1	-0.201E-07
38548.	431.	-42.9	147.7	209.8	0.100E-07
38552.	432.	-48.1	146.2	207.9	-0.301E-07
38556.	433.	-49.7	145.1	208.6	-0.603E-07
38560.	432.	-47.2	146.6	209.1	-0.100E-07
38564.	429.	-41.3	151.6	206.4	0.301E-07
38568.	426.	-33.3	160.0	199.9	-0.372E-07
38572.	426.	-23.4	169.6	191.4	0.201E-07
38576.	424.	-12.9	169.7	180.8	0.201E-07

I. SAO smoothed elements

The following elements are based on 174 observations and are valid for the period April 1 through April 15, 1964.

T_0 = 38492.0 MJD

$\omega = (120^\circ\!.39 \pm 5) - 1^\circ\!.24963t + {}^\circ\!.009397t^2$

$\Omega = (40^\circ\!.112 \pm 2) - {}^\circ\!.05769t - {}^\circ\!.19 \times 10^{-4}t^2$

$i = (88^\circ\!.352 \pm 2) - {}^\circ\!.000763t$

$e = (.02732 \pm 2) + .000290t + .10 \times 10^{-5}t^2$

$M = (.7242 \pm 1) + (8.5740333 \pm 9)t - (.139 \pm 2) \times 10^{-4}t^2$
$+ (.102 \pm 3) \times 10^{-5}t^3$

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

The following elements are based on 246 observations and are valid for the period April 15 through May 1, 1964.

T_0 = 38508.0 MJD

$\omega = (102^\circ\!.79 \pm 5) - {}^\circ\!.94892t + {}^\circ\!.009397t^2$

$\Omega = (39^\circ\!.188 \pm 2) - {}^\circ\!.05830t - {}^\circ\!.19 \times 10^{-4}t^2$

$i = (88^\circ\!.337 \pm 2) - {}^\circ\!.000763t$

$e = (.03219 \pm 3) + .000322t + .10 \times 10^{-5}t^2$

$M = (.9093 \pm 1) + (8.5743224 \pm 7)t + (.2431 \pm 7) \times 10^{-4}t^2$
$+ (.35 \pm 1) \times 10^{-6}t^3$

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

The following elements are based on 317 observations and are valid for the period May 1 through May 16, 1964.

$$T_0 = 38522.0 \text{ MJD}$$

$$\omega = (90^{\circ}.15 \pm 7) - {}^{\circ}.82470t + {}^{\circ}.002652t^2$$

$$\Omega = (38^{\circ}.366 \pm 2) - {}^{\circ}.05799t - {}^{\circ}.51 \times 10^{-5}t^2$$

$$i = (88^{\circ}.339 \pm 2) + {}^{\circ}.000318t$$

$$e = (.03686 \pm 5) + .000309t - .17 \times 10^{-5}t^2$$

$$M = (.9585 \pm 2) + (8.5754725 \pm 5)t + (.395 \pm 1) \times 10^{-4}t^2 - (.91 \pm 2) \times 10^{-6}t^3$$

Standard error of one observation: $\sigma = \pm 0''.95$

The following elements are based on 254 observations and are valid for the period May 16 through June 1, 1964.

$$T_0 = 38538.0 \text{ MJD}$$

$$\omega = (77^{\circ}.69 \pm 3) - {}^{\circ}.73983t + {}^{\circ}.002652t^2$$

$$\Omega = (37^{\circ}.436 \pm 2) - {}^{\circ}.05815t - {}^{\circ}.51 \times 10^{-5}t^2$$

$$i = (88^{\circ}.345 \pm 3) + {}^{\circ}.000318t$$

$$e = (.04130 \pm 4) + .000254t - .17 \times 10^{-5}t^2$$

$$M = (.17217 \pm 7) + (8.5760268 \pm 7)t + (.500 \pm 9) \times 10^{-5}t^2 + (.34 \pm 2) \times 10^{-6}t^3$$

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

The following elements are based on 252 observations and are valid for the period June 1 through June 16, 1964.

T_0 = 38554.0 MJD

ω = $(66^\circ.37 \pm 2) - ^\circ.67056t - ^\circ.000725t^2$

Ω = $(36^\circ.5049 \pm 7) - ^\circ.05831t - ^\circ.18 \times 10^{-4}t^2$

i = $(88^\circ.358 \pm 2) - ^\circ.000236t$

e = $(.04486 \pm 4) + .000155t - .29 \times 10^{-5}t^2$

M = $(.39178 \pm 6) + (8.5764754 \pm 9)t + (.169 \pm 1) \times 10^{-4}t^2$

$- (.101 \pm 2) \times 10^{-5}t^3$

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

The following elements are based on 97 observations and are valid for the period June 16 through July 1, 1964.

T_0 = 38570.0 MJD

ω = $(55^\circ.45 \pm 3) - ^\circ.69376t - ^\circ.000725t^2$

Ω = $(35^\circ.5684 \pm 9) - ^\circ.05888t - ^\circ.18 \times 10^{-4}t^2$

i = $(88^\circ.353 \pm 2) - ^\circ.000236t$

e = $(.04652 \pm 3) + .62 \times 10^{-4}t - .29 \times 10^{-5}t^2$

M = $(.61707 \pm 9) + (8.5766432 \pm 5)t + (.43 \pm 1) \times 10^{-5}t^2$

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

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38486.0	128.24 8	40.456 2	88.359 2	.02573 4	.2793 2	8.574294 2	-.256E-4 7	9.824992	57	8	.44
38490.0	122.95 7	40.227 2	88.355 2	.02673 3	.5760 2	8.574112 1	-.192E-4 5	9.815049	89	8	.40
38494.0	118.1 1	40.000 3	88.347 3	.02783 4	.8719 3	8.574001 1	-.81E-5 5	9.803977	98	8	.43
38498.0	113.17 7	39.768 3	88.344 3	.02914 3	.1683 2	8.573986 1	.40E-5 5	9.790807	95	8	.39
38502.0	108.87 5	39.535 2	88.341 2	.03033 3	.4641 1	8.5740741 9	.174E-4 4	9.778686	123	8	.39
38506.0	104.76 5	39.302 3	88.339 3	.03158 3	.7607 1	8.574230 1	.220E-4 5	9.765974	117	8	.41
38510.0	100.9 1	39.069 4	88.336 4	.03289 5	.0582 3	8.5744278 9	.267E-4 4	9.752640	101	8	.41
38514.0	96.9 2	38.837 3	88.336 4	.03428 9	.3577 5	8.574654 1	.298E-4 4	9.738411	141	8	.41
38518.0	93.8 2	38.597 3	88.343 3	.03542 9	.6565 4	8.5751153 8	.464E-4 4	9.726662	162	8	.38
38522.0	90.2 1	38.365 3	88.341 3	.03679 7	.9584 2	8.5754615 7	.395E-4 3	9.712495	156	8	.36
38526.0	86.90 9	38.134 3	88.341 3	.03801 7	.2610 2	8.5757397 8	.295E-4 4	9.700014	152	8	.40
38530.0	83.81 5	37.899 2	88.342 3	.03910 5	.5641 1	8.5759180 7	.153E-4 4	9.688930	172	8	.40
38534.0	80.69 4	37.670 2	88.338 3	.04023 5	.8681 1	8.5759995 9	.51E-5 4	9.677484	142	8	.40
38538.0	77.69 9	37.435 3	88.348 5	.0413 1	.1722 2	8.5760302 9	.43E-5 4	9.666610	104	8	.41
38542.0	74.76 4	37.203 3	88.350 4	.04236 7	.4764 1	8.5760839 9	.99E-5 4	9.655925	117	8	.43
38546.0	71.95 4	36.971 3	88.351 4	.04329 8	.7808 1	8.576084 1	.245E-4 5	9.646509	97	8	.43
38550.0	69.07 3	36.738 2	88.354 4	.04415 5	.0861 1	8.5762843 9	.255E-4 5	9.637658	91	8	.40
38554.0	66.35 3	36.506 1	88.358 2	.04490 5	.39180 8	8.576472 1	.190E-4 5	9.629992	147	8	.46
38558.0	63.69 2	36.2722 8	88.359 2	.04545 4	.69785 7	8.5765515 8	.35E-5 4	9.624429	161	8	.41
38562.0	60.95 3	36.0377 9	88.356 2	.04583 6	.0042 1	8.576578 1	.35E-5 4	9.620524	94	8	.40
38566.0	58.25 6	35.804 1	88.356 3	.04625 9	.3105 2	8.576607 1	.37E-5 6	9.616294	56	8	.42
38570.0	55.47 3	35.569 1	88.355 2	.04655 4	.6170 1	8.576646 1	.55E-5 6	9.613225	46	8	.38
38574.0	52.61 4	35.332 1	88.351 3	.04672 3	.9239 1	8.576675 1	.44E-5 6	9.611462	42	8	.38

Table 12

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

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
		Perigee In Sunlight			
38486.	3460.	51.7	119.0	208.0	0.696E-06
38490.	3452.	57.0	114.1	203.6	0.522E-06
38494.	3442.	61.9	109.0	199.2	0.220E-06
38498.	3431.	66.8	103.5	194.5	-0.109E-06
38502.	3420.	71.1	98.3	189.6	-0.473E-06
38506.	3408.	75.1	93.0	184.2	-0.598E-06
38510.	3395.	79.0	87.9	177.9	-0.726E-06
38514.	3381.	82.9	82.6	169.0	-0.811E-06
38518.	3370.	85.9	78.1	154.9	-0.126E-05
38522.	3356.	88.3	73.3	91.2	-0.107E-05
38526.	3343.	86.5	68.8	18.4	-0.802E-06
38530.	3332.	83.6	64.8	1.0	-0.416E-06
38534.	3320.	80.5	60.9	351.9	-0.139E-06
38538.	3309.	77.6	57.5	345.2	-0.117E-06
38542.	3298.	74.7	54.5	339.4	-0.269E-06
38546.	3288.	71.9	52.1	334.1	-0.666E-06
38550.	3278.	69.0	50.2	329.0	-0.693E-06
38554.	3270.	66.3	49.0	324.1	-0.517E-06
38558.	3263.	63.6	48.6	319.3	-0.952E-07
38562.	3259.	60.9	48.7	314.6	-0.952E-07
38566.	3253.	58.2	49.6	309.9	-0.101E-06
38570.	3249.	55.4	51.1	305.2	-0.150E-06
38574.	3247.	52.6	53.3	300.6	-0.120E-06

I. SAO smoothed elements

The following elements are based on 310 observations and are valid for the period April 1 through May 1, 1964.

$T_0 = 38501.0$ MJD

$\omega = (289°.23 \pm 2) - (1°.993 \pm 2)t + °.000616t^2 + °.5085 \cos \omega$

$\Omega = (323°.889 \pm 1) - (°.9677 \pm 2)t - °.195 \times 10^{-4}t^2 + °.0069 \cos \omega$

$i = (78°.606 \pm 3) - °.0013 \sin \omega$

$e = (.11165 \pm 2) - (.53 \pm 2) \times 10^{-4}t + .1129 \times 10^{-5}t^2 + .0009740 \sin \omega$

$M = (.12682 \pm 5) + (12.445270 \pm 7)t + (.129 \pm 2) \times 10^{-4}t^2$
$+ (.721 \pm 6) \times 10^{-6}t^3 + (.196 \pm 6) \times 10^{-7}t^4 - .0013276 \cos \omega$

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

The following elements are based on 387 observations and are valid for the period May 1 through June 1, 1964.

$T_0 = 38532.0$ MJD

$\omega = (227°.603 \pm 7) - (1°.9735 \pm 7)t + °.000616t^2 + °.5085 \cos \omega$

$\Omega = (293°.8884 \pm 8) - (°.96827 \pm 9)t - °.195 \times 10^{-4}t^2 + °.0069 \cos \omega$

$i = (78°.610 \pm 2) - °.0013 \sin \omega$

$e = (.11156 \pm 2) + (.48 \pm 1) \times 10^{-4}t + .1129 \times 10^{-5}t^2$
$+ .0009740 \sin \omega$

$M = (.97559 \pm 2) + (12.449299 \pm 2)t + (.00011951 \pm 9)t^2$
$+ (.805 \pm 3) \times 10^{-6}t^3 - (.242 \pm 4) \times 10^{-7}t^4 - .0013276 \cos \omega$

Standard error of one observation: $\sigma = \pm 1'.88$

The following elements are based on 472 observations and are valid for the period June 1 through July 1, 1964.

$$T_0 = 38562.0 \text{ MJD}$$

$$\omega = (168^\circ.86 \pm 1) - (1^\circ.946 \pm 2)t + {}^\circ.000616t^2 + {}^\circ.5085 \cos\omega$$

$$\Omega = (264^\circ.813 \pm 4) - ({}^\circ.9703 \pm 2)t - {}^\circ.195 \times 10^{-4}t^2 + {}^\circ.0069 \cos\omega$$

$$i = (78^\circ.614 \pm 5) - {}^\circ.0013 \sin\omega$$

$$e = (.11254 \pm 6) + (.20 \pm 8) \times 10^{-4}t + .1129 \times 10^{-5}t^2$$
$$+ .0009740 \sin\omega$$

$$M = (.56387 \pm 5) + (12.456185 \pm 6)t + (.799 \pm 2) \times 10^{-4}t^2$$
$$- (.1527 \pm 6) \times 10^{-5}t^3 - (.111 \pm 7) \times 10^{-7}t^4 - .0013276 \cos\omega$$

Standard error of one observation: $\sigma = \pm 3'.28$

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38486.0	319.08 4	338.423 8	78.590 8	.11217 6	.4503 1	12.445037 6	.39E-4 7	6.984539	44	4	.61
38487.0	317.10 4	337.441 7	78.602 8	.11207 5	.8952 2	12.445115 5	.47E-4 4	6.985292	42	4	.50
38488.0	315.4 1	336.451 8	78.62 1	.11197 5	.3393 4	12.445196 4	.31E-4 4	6.986099	38	4	.45
38489.0	313.4 1	335.486 7	78.621 8	.11183 5	.7842 3	12.445236 3	.11E-4 2	6.987173	42	4	.37
38490.0	311.58 9	334.522 6	78.616 7	.11165 5	.2288 3	12.445251 3	.3E-5 3	6.988584	38	4	.35
38491.0	309.42 4	333.580 6	78.587 8	.11157 4	.6745 2	12.445259 4	-.1E-5 4	6.989160	37	4	.44
38492.0	307.39 3	332.614 5	78.587 6	.11150 5	.1197 1	12.445260 5	-.1E-5 4	6.989739	32	4	.46
38493.0	305.34 3	331.652 5	78.584 6	.11140 4	.5650 1	12.445268 5	.5E-5 4	6.990542	26	4	.49
38494.0	303.32 4	330.688 5	78.586 6	.11127 5	.0102 1	12.445259 9	-.5E-5 7	6.991566	23	4	.55
38495.0	301.35 4	329.725 5	78.591 6	.11118 6	.4553 1	12.44527 1	.1E-4 1	6.992280	24	4	.57
38496.0	299.36 4	328.754 5	78.589 7	.11113 6	.9004 1	12.44528 2	.1E-4 2	6.992659	23	4	.51
38497.0	297.34 4	327.788 5	78.592 7	.11107 6	.3457 1	12.44528 3	-.1E-4 2	6.993134	19	4	.50
38498.0	295.42 4	326.816 6	78.581 7	.11104 6	.7907 1	12.445315 7	.1E-4 1	6.993308	21	4	.46
38499.0	293.47 4	325.852 6	78.577 8	.11085 6	.2357 2	12.44532 1	-.5E-5 7	6.994791	23	4	.53
38500.0	291.40 4	324.872 4	78.591 6	.11075 5	.6812 1	12.44531 2	.1E-5 1	6.995614	30	4	.59
38501.0	289.45 3	323.894 3	78.600 6	.11073 4	.12625 9	12.445336 8	.15E-4 6	6.995790	44	4	.68
38502.0	287.44 2	322.927 3	78.602 5	.11066 4	.57157 7	12.445366 8	.16E-4 7	6.996289	55	4	.72
38503.0	285.47 1	321.949 1	78.616 2	.11048 2	.01677 3	12.445413 4	.17E-4 3	6.997718	52	4	.35
38504.0	283.448 9	320.983 1	78.615 2	.11043 3	.46220 3	12.445452 2	.22E-4 2	6.998054	58	4	.38
38505.0	281.44 1	320.015 1	78.612 2	.11038 3	.90762 3	12.445507 3	.29E-4 3	6.998423	59	4	.41
38506.0	279.422 9	319.047 1	78.614 2	.11033 2	.35316 3	12.445560 2	.28E-4 2	6.998828	54	4	.37
38507.0	277.41 1	318.083 2	78.613 3	.11030 3	.79875 3	12.445616 3	.25E-4 3	6.999069	46	4	.56
38508.0	275.40 1	317.113 2	78.614 3	.11027 3	.24437 3	12.445679 3	.30E-4 3	6.999238	35	4	.51
38509.0	273.38 1	316.146 2	78.614 4	.11027 2	.69010 3	12.445745 3	.34E-4 2	6.999243	28	4	.49
38510.0	271.35 2	315.181 3	78.616 6	.11025 3	.13592 5	12.445826 4	.39E-4 4	6.999328	31	4	.73
38511.0	269.36 2	314.214 3	78.619 7	.11022 3	.58175 7	12.445905 5	.45E-4 5	6.999556	26	4	.71
38512.0	267.35 2	313.248 3	78.612 7	.11020 3	.02770 7	12.446002 5	.51E-4 5	6.999684	27	4	.72
38513.0	265.33 3	312.277 3	78.608 6	.11019 2	.47378 7	12.446105 5	.56E-4 4	6.999724	26	4	.64
38514.0	263.31 2	311.309 2	78.605 4	.11017 1	.91996 5	12.446214 4	.56E-4 4	6.999835	36	4	.56
38515.0	261.26 2	310.346 2	78.603 4	.11016 1	.36634 4	12.446337 3	.64E-4 3	6.999861	41	4	.58

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38516.0	259.25 2	309.376 2	78.609 3	.11015 1	.81277 4	12.446459 3	.60E-4 3	6.999918	42	4	.54
38517.0	257.27 1	308.407 1	78.609 2	.110141 9	.25924 3	12.446591 2	.65E-4 2	6.999925	56	4	.50
38518.0	255.27 1	307.437 1	78.610 2	.110161 9	.70590 3	12.446717 3	.67E-4 2	6.999716	59	4	.55
38519.0	253.254 8	306.4689 9	78.610 2	.110180 8	.15272 2	12.446851 2	.63E-4 2	6.999520	59	4	.47
38520.0	251.235 8	305.5005 9	78.610 2	.110196 8	.59969 2	12.446985 2	.69E-4 2	6.999343	55	4	.44
38521.0	249.21 1	304.532 1	78.609 2	.11024 1	.04681 2	12.447133 3	.78E-4 3	6.998911	41	4	.44
38522.0	247.20 1	303.564 2	78.610 3	.11027 1	.49405 3	12.447286 2	.76E-4 2	6.998654	35	4	.42
38523.0	245.21 1	302.597 2	78.609 4	.11032 2	.94141 4	12.447443 3	.83E-4 3	6.998236	34	4	.52
38524.0	243.18 2	301.632 2	78.603 4	.11045 2	.38899 4	12.447613 3	.83E-4 3	6.997106	42	4	.55
38525.0	241.15 1	300.663 2	78.604 4	.11049 2	.83679 3	12.447797 3	.93E-4 3	6.996732	46	4	.53
38526.0	239.15 1	299.694 2	78.607 3	.11055 2	.28470 3	12.447998 3	.109E-3 3	6.996213	46	4	.51
38527.0	237.146 8	298.723 1	78.610 3	.11060 2	.73283 2	12.448216 2	.111E-3 2	6.995711	45	4	.40
38528.0	235.143 8	297.755 1	78.607 3	.11065 2	.18120 3	12.448427 3	.103E-3 2	6.995198	45	4	.40
38529.0	233.17 1	296.788 1	78.608 3	.11073 3	.62965 5	12.448643 3	.111E-3 3	6.994488	50	4	.44
38530.0	231.19 1	295.820 1	78.606 3	.11079 3	.07838 5	12.448868 4	.118E-3 3	6.993932	51	4	.43
38531.0	229.18 2	294.853 1	78.610 3	.11085 3	.52743 6	12.449114 3	.123E-3 3	6.993400	52	4	.45
38532.0	227.18 2	293.885 1	78.611 3	.11090 3	.97671 6	12.449370 3	.132E-3 3	6.992943	54	4	.45
38533.0	225.19 2	292.917 2	78.612 4	.11097 4	.42624 8	12.449625 5	.124E-3 4	6.992255	42	4	.45
38534.0	223.19 4	291.947 2	78.613 4	.11107 6	.8760 2	12.449857 4	.112E-3 3	6.991412	37	4	.42
38535.0	221.27 3	290.980 3	78.612 6	.11119 4	.32578 9	12.450085 4	.120E-3 4	6.990371	38	4	.48
38536.0	219.37 5	290.009 2	78.605 5	.11143 5	.7757 2	12.450325 5	.120E-3 4	6.988370	29	4	.39
38537.0	217.30 3	289.040 3	78.607 6	.11137 4	.2264 1	12.450560 4	.113E-3 3	6.988761	36	4	.40
38538.0	215.40 8	288.071 3	78.606 6	.11151 4	.6768 3	12.450802 3	.128E-3 3	6.987554	34	4	.38
38539.0	213.36 2	287.100 3	78.604 5	.11156 4	.12800 8	12.451055 4	.127E-3 4	6.987058	30	4	.36
38540.0	211.40 3	286.130 5	78.601 8	.11155 4	.57913 9	12.451320 3	.139E-3 3	6.987076	36	4	.38
38541.0	209.47 2	285.171 4	78.622 6	.11128 6	.03039 7	12.451594 6	.141E-3 6	6.989071	37	4	.63
38542.0	207.43 1	284.201 2	78.612 3	.11169 4	.48240 4	12.451874 3	.134E-3 3	6.985755	33	4	.37
38543.0	205.48 4	283.224 5	78.600 8	.11178 4	.9343 1	12.452143 3	.131E-3 2	6.984928	39	4	.35
38544.0	203.6 1	282.259 6	78.61 1	.11184 6	.3863 5	12.452399 3	.129E-3 3	6.984353	41	4	.37
38545.0	201.53 6	281.288 5	78.605 8	.11200 5	.8392 2	12.452652 3	.123E-3 2	6.983061	51	4	.38
38546.0	199.53 6	280.321 5	78.610 8	.11211 5	.2920 2	12.452893 3	.120E-3 2	6.982083	56	4	.39

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38547.0	197.67 5	279.347 4	78.603 6	.11212 6	.7447 2	12.453124 3	.113E-3 3	6.981904	57	4	.45
38548.0	195.69 6	278.378 5	78.602 7	.11220 7	.1980 2	12.453346 3	.111E-3 3	6.981192	53	4	.47
38549.0	193.67 9	277.407 6	78.601 9	.11226 9	.6516 3	12.453561 3	.104E-3 3	6.980645	54	4	.43
38550.0	191.78 3	276.434 5	78.597 8	.11225 5	.1051 1	12.453770 3	.104E-3 3	6.980643	53	4	.43
38551.0	189.8 1	275.471 7	78.61 1	.1124 1	.5589 4	12.453974 3	.104E-3 3	6.979717	61	4	.42
38552.0	187.82 3	274.499 5	78.604 7	.11246 5	.0131 1	12.454178 3	.99E-4 3	6.978854	70	4	.44
38553.0	185.88 3	273.532 6	78.606 7	.11251 6	.4673 1	12.454371 3	.95E-4 3	6.978346	60	4	.43
38554.0	183.83 7	272.565 6	78.610 8	.1127 1	.9221 3	12.454557 2	.95E-4 2	6.976603	64	4	.40
38555.0	181.97 7	271.600 6	78.617 8	.1126 1	.3764 2	12.454765 3	.113E-3 3	6.977241	62	4	.48
38556.0	180.19 6	270.630 4	78.619 5	.1125 1	.8306 2	12.455007 3	.148E-3 2	6.978145	62	4	.34
38557.0	178.10 5	269.657 3	78.615 5	.1128 1	.2863 2	12.455291 2	.139E-3 2	6.975480	78	4	.34
38558.0	176.11 4	268.684 3	78.611 4	.11295 8	.7418 2	12.455547 2	.117E-3 2	6.974495	93	4	.41
38559.0	174.17 3	267.713 3	78.609 4	.11309 7	.1975 1	12.455766 2	.99E-4 2	6.973333	90	4	.41
38560.0	172.26 3	266.742 3	78.607 4	.11307 8	.6532 1	12.455951 2	.86E-4 2	6.973412	75	4	.38
38561.0	170.33 2	265.772 3	78.607 4	.11311 6	.10915 8	12.456103 2	.72E-4 2	6.973050	66	4	.40
38562.0	168.33 6	264.802 6	78.607 6	.1134 2	.5656 2	12.456239 2	.64E-4 2	6.970676	46	4	.36
38563.0	166.42 7	263.834 9	78.61 1	.1134 2	.0217 3	12.456371 3	.68E-4 3	6.970833	45	4	.37
38564.0	164.55 6	262.866 8	78.61 1	.1131 2	.4778 3	12.456495 2	.61E-4 2	6.973293	56	4	.38
38565.0	162.63 5	261.893 8	78.61 1	.1130 2	.9342 2	12.456614 2	.54E-4 2	6.973806	54	4	.37
38566.0	160.71 2	260.923 7	78.614 9	.11296 9	.39078 8	12.456732 3	.65E-4 2	6.973975	56	4	.43
38567.0	158.72 4	259.963 7	78.626 9	.1131 2	.8477 2	12.456861 2	.70E-4 2	6.972427	55	4	.36
38568.0	156.78 2	258.981 6	78.612 7	.11310 8	.30460 6	12.456982 2	.56E-4 2	6.972752	49	4	.37
38569.0	154.84 2	258.011 6	78.614 7	.11321 9	.76164 6	12.457085 3	.39E-4 3	6.971907	44	4	.38
38570.0	152.90 3	257.051 6	78.624 7	.1132 2	.2187 1	12.457162 3	.39E-4 3	6.971798	52	4	.42
38571.0	150.94 2	256.075 5	78.616 6	.1135 2	.6760 1	12.457234 2	.28E-4 2	6.969661	52	4	.43
38572.0	149.03 2	255.097 5	78.608 6	.1132 2	.13312 9	12.457291 3	.35E-4 3	6.971695	59	4	.45
38573.0	147.09 1	254.126 5	78.604 5	.1132 2	.59044 7	12.457352 2	.18E-4 2	6.971645	62	4	.41
38574.0	145.17 1	253.155 5	78.603 6	.1133 1	.04774 6	12.457386 2	.14E-4 2	6.971160	59	4	.41
38575.0	143.24 1	252.182 5	78.599 7	.1132 2	.50508 8	12.457426 2	.20E-4 2	6.971777	58	4	.39
38576.0	141.30 1	251.215 6	78.606 8	.1133 2	.96253 8	12.457460 2	.13E-4 2	6.971161	53	4	.40

Table 13

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1963 53A

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
		Perigee In Sunlight			
38486.	615.	-39.9	58.6	318.3	-0.504E-06
38487.	616.	-41.9	61.7	315.7	-0.607E-06
38488.	618.	-43.5	64.4	313.2	-0.400E-06
38489.	620.	-45.4	67.4	310.6	-0.142E-06
38490.	622.	-47.2	70.2	307.9	-0.387E-07
38491.	623.	-49.2	73.2	305.1	0.129E-07
38492.	624.	-51.2	76.1	302.2	0.129E-07
38493.	626.	-53.1	78.9	299.3	-0.646E-07
38494.	628.	-55.0	81.7	296.2	0.646E-07
38495.	629.	-56.8	84.4	293.1	-0.129E-06
38496.	630.	-58.7	87.0	289.8	-0.129E-06
38497.	631.	-60.5	89.6	286.4	0.129E-06
38498.	632.	-62.3	92.1	282.8	-0.129E-06
38499.	634.	-64.0	94.5	279.0	0.646E-07
38500.	635.	-65.9	96.9	274.9	-0.129E-07
38501.	636.	-67.6	99.1	270.5	-0.194E-06
38502.	637.	-69.3	101.3	265.7	-0.207E-06
38503.	639.	-70.9	103.3	260.4	-0.220E-06
38504.	639.	-72.4	105.2	254.5	-0.284E-06
38505.	640.	-73.9	107.1	247.9	-0.374E-06
38506.	641.	-75.3	108.7	240.3	-0.362E-06
38507.	641.	-76.4	110.3	231.7	-0.323E-06
38508.	641.	-77.4	111.6	222.0	-0.387E-06

Table 13 (cont.)
RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1963 53A

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
38509.	641.	-78.1	112.9	211.2	-0.439E-06
38510.	642.	-78.5	113.9	199.4	-0.504E-06
		Perigee In Earth Shadow			
38511.	642.	-78.6	114.8	187.5	-0.581E-06
38512.	642.	-78.3	115.4	175.6	-0.658E-06
38513.	642.	-77.7	115.9	164.4	-0.723E-06
38514.	642.	-76.8	116.2	154.3	-0.723E-06
38515.	642.	-75.7	116.3	145.2	-0.826E-06
38516.	641.	-74.4	116.1	137.3	-0.775E-06
38517.	641.	-73.0	115.8	130.4	-0.839E-06
38518.	641.	-71.5	115.3	124.2	-0.865E-06
38519.	640.	-69.8	114.6	118.6	-0.813E-06
		Perigee In Sunlight			
38520.	639.	-68.2	113.7	113.6	-0.891E-06
38521.	639.	-66.4	112.6	109.0	-0.101E-05
38522.	638.	-64.6	111.4	104.7	-0.981E-06
38523.	637.	-62.9	110.0	100.8	-0.107E-05
38524.	635.	-61.0	108.5	97.0	-0.107E-05
38525.	634.	-59.2	106.8	93.5	-0.120E-05
38526.	633.	-57.3	105.0	90.1	-0.141E-05
38527.	632.	-55.4	103.1	86.9	-0.143E-05
38528.	631.	-53.6	101.0	83.7	-0.133E-05
38529.	629.	-51.7	98.9	80.7	-0.143E-05
38530.	628.	-49.8	96.7	77.8	-0.152E-05

Table 13 (cont.)

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1963 53A

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
38531.	627.	-47.9	94.4	74.9	-0.159E-05
38532.	626.	-46.0	92.1	72.1	-0.170E-05
38533.	624.	-44.1	89.6	69.4	-0.160E-05
38534.	623.	-42.1	87.1	66.7	-0.145E-05
38535.	621.	-40.3	84.6	64.0	-0.155E-05
38536.	618.	-38.4	82.1	61.4	-0.155E-05
38537.	618.	-36.4	79.4	58.8	-0.146E-05
38538.	616.	-34.6	76.8	56.3	-0.165E-05
38539.	615.	-32.6	74.0	53.7	-0.164E-05
38540.	614.	-30.7	71.3	51.2	-0.179E-05
38541.	616.	-28.8	68.5	48.7	-0.182E-05
38542.	612.	-26.8	65.7	46.2	-0.173E-05
38543.	610.	-24.9	62.9	43.7	-0.169E-05
38544.	609.	-23.1	60.1	41.3	-0.166E-05
38545.	607.	-21.1	57.2	38.9	-0.159E-05
38546.	606.	-19.1	54.3	36.4	-0.155E-05
38547.	605.	-17.3	51.5	34.0	-0.146E-05
38548.	604.	-15.4	48.7	31.6	-0.143E-05
38549.	603.	-13.4	45.7	29.2	-0.134E-05
38550.	603.	-11.5	42.9	26.8	-0.134E-05
38551.	602.	-9.6	40.0	24.4	-0.134E-05
38552.	601.	-7.7	37.2	22.0	-0.128E-05
38553.	600.	-5.8	34.3	19.6	-0.122E-05
38554.	598.	-3.8	31.4	17.2	-0.122E-05

Table 13 (cont.)

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1963 53A

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
38555.	599.	-1.9	28.7	14.8	-0.146E-05
38556.	600.	-0.2	26.2	12.5	-0.191E-05
38557.	597.	1.9	23.3	10.0	-0.179E-05
38558.	596.	3.8	20.7	7.6	-0.151E-05
38559.	595.	5.7	18.2	5.2	-0.128E-05
38560.	595.	7.6	15.9	2.9	-0.111E-05
38561.	595.	9.5	13.8	0.5	-0.928E-06
38562.	593.	11.4	12.1	358.0	-0.625E-06
38563.	594.	13.3	10.9	355.6	-0.877E-06
38564.	596.	15.1	10.4	353.2	-0.786E-06
38565.	597.	17.0	10.7	350.8	-0.696E-06
38566.	598.	18.9	11.7	348.4	-0.838E-06
38567.	597.	20.8	13.3	345.9	-0.902E-06
38568.	598.	22.7	15.2	343.5	-0.722E-06
38569.	597.	24.6	17.4	341.0	-0.503E-06
38570.	598.	26.5	19.7	338.5	-0.503E-06
38571.	596.	28.4	22.1	336.0	-0.361E-06
38572.	599.	30.3	24.6	333.5	-0.451E-06
38573.	599.	32.2	27.1	331.0	-0.232E-06
38574.	600.	34.0	29.6	328.4	-0.180E-06
38575.	601.	35.9	32.1	325.9	-0.258E-06
38576.	601.	37.8	34.6	323.3	-0.168E-06

I. SAO smoothed elements

The following elements are based on 208 observations and are valid for the period April 1 through April 16, 1964.

$$T_0 = 38492.0 \text{ MJD}$$

$$\omega = (315^\circ.2 \pm 4) - (2^\circ.33 \pm 4)t$$

$$\Omega = (340^\circ.634 \pm 4) - (^\circ.8160 \pm 3)t$$

$$i = (81^\circ.477 \pm 4)$$

$$e = (.02065 \pm 3) - (.325 \pm 8) \times 10^{-3}t$$

$$M = (.147 \pm 1) + (13.2365 \pm 1)t + (.378 \pm 3) \times 10^{-4}t^2 - (.37 \pm 4) \times 10^{-6}t^3$$

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

The following elements are based on 163 observations and are valid for the period April 16 through May 1, 1964.

$$T_0 = 38508.0 \text{ MJD}$$

$$\omega = (273^\circ.2 \pm 1) - (3^\circ.25 \pm 3)t$$

$$\Omega = (327^\circ.573 \pm 1) - (^\circ.8154 \pm 3)t$$

$$i = (81^\circ.505 \pm 3)$$

$$e = (.01648 \pm 5) - (.112 \pm 6) \times 10^{-3}t$$

$$M = (.9549 \pm 4) + (13.24046 \pm 7)t + (.560 \pm 2) \times 10^{-4}t^2 + (.124 \pm 3) \times 10^{-5}t^3$$

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

The following elements are based on 120 observations and are valid for the period May 1 through May 16, 1964.

$$T_0 = 38522.0 \text{ MJD}$$

$$\omega = (227^\circ.79 \pm 6) - (3^\circ.11 \pm 1)t$$

$$\Omega = (316^\circ.153 \pm 1) - (^\circ.8163 \pm 2)t$$

$$i = (81^\circ.503 \pm 2)$$

$$e = (.01602 \pm 1) + (.116 \pm 3) \times 10^{-3}t$$

$$M = (.3349 \pm 2) + (13.24214 \pm 3)t + (.767 \pm 2) \times 10^{-4}t^2$$
$$+ (.59 \pm 3) \times 10^{-6}t^3$$

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

The following elements are based on 130 observations and are valid for the period May 16 through June 1, 1964.

$$T_0 = 38538.0 \text{ MJD}$$

$$\omega = (186^\circ.69 \pm 8) - (2^\circ.15 \pm 2)t$$

$$\Omega = (303^\circ.0960 \pm 8) - (^\circ.8158 \pm 2)t$$

$$i = (81^\circ.499 \pm 2)$$

$$e = (.01966 \pm 2) + (.248 \pm 6) \times 10^{-3}t$$

$$M = (.2057 \pm 2) + (13.24216 \pm 5)t + (.1009 \pm 3) \times 10^{-3}t^2$$
$$+ (.68 \pm 4) \times 10^{-6}t^3 - (.78 \pm 4) \times 10^{-7}t^4$$

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

The following elements are based on 200 observations and are valid for the period June 1 through June 16, 1964.

$$T_0 = 38554.0 \text{ MJD}$$

$$\omega = (156^\circ.8 \pm 1) - (1^\circ.74 \pm 2)t$$

$$\Omega = (290^\circ.015 \pm 2) - (^\circ.8180 \pm 1)t$$

$$i = (81^\circ.470 \pm 4)$$

$$e = (.02210 \pm 7) + (.11 \pm 1) \times 10^{-3}t$$

$$M = (.0912 \pm 4) + (13.24379 \pm 5)t + (.783 \pm 3) \times 10^{-4}t^2$$
$$+ (.121 \pm 7) \times 10^{-5}t^3 - (.21 \pm 7) \times 10^{-7}t^4 - (.17 \pm 1) \times 10^{-7}t^5$$

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

The following elements are based on 145 observations and are valid for the period June 16 through July 1, 1964.

$$T_0 = 38568.0 \text{ MJD}$$

$$\omega = (133^\circ.27 \pm 5) - (1^\circ.66 \pm 1)t$$

$$\Omega = (278^\circ.536 \pm 4) - (^\circ.8210 \pm 2)t$$

$$i = (81^\circ.460 \pm 4)$$

$$e = (.0221 \pm 1) - (.59 \pm 16) \times 10^{-4}t$$

$$M = (.5145 \pm 2) + (13.24507 \pm 4)t + (.301 \pm 1) \times 10^{-4}t^2$$
$$- (.118 \pm 2) \times 10^{-5}t^3$$

Standard error of one observation: $\sigma = \pm\ 1'.05$

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38486.0	327.4 7	345.57 1	81.454 7	.0225 2	.735 2	13.2355 6	.484E-4 9	7.381191	47	8	.54
38487.0	325.2 7	344.75 1	81.456 7	.0221 1	.970 2	13.2353 7	.51E-4 1	7.384217	59	8	.52
38488.0	323.2 7	343.93 1	81.456 8	.0217 1	.206 2	13.2346 7	.49E-4 1	7.387193	64	8	.55
38489.0	321.0 7	343.097 9	81.465 7	.02137 8	.442 2	13.2343 6	.441E-4 8	7.389796	70	8	.60
38490.0	319.1 6	342.273 8	81.471 7	.02117 7	.677 2	13.2352 5	.371E-4 8	7.390977	78	8	.59
38491.0	317.5 6	341.457 6	81.470 5	.02092 5	.911 2	13.2360 5	.371E-4 7	7.392555	90	8	.52
38492.0	315.5 5	340.639 5	81.471 5	.02059 4	.146 1	13.2359 4	.378E-4 7	7.395081	105	8	.53
38493.0	313.3 5	339.821 4	81.472 4	.02028 3	.383 1	13.2363 5	.392E-4 6	7.397280	102	8	.43
38494.0	310.6 4	339.006 4	81.471 4	.01992 3	.620 1	13.2356 5	.387E-4 5	7.400271	103	8	.44
38495.0	308.8 4	338.189 4	81.473 4	.01956 4	.855 1	13.2353 5	.346E-4 7	7.403132	106	8	.54
38496.0	306.2 4	337.370 4	81.476 4	.01936 4	.093 1	13.2370 3	.322E-4 6	7.403985	119	8	.55
38497.0	303.7 3	336.552 3	81.477 4	.01902 4	.3304 9	13.2368 3	.299E-4 5	7.406590	133	8	.52
38498.0	301.7 3	335.739 3	81.476 3	.01864 4	.5663 8	13.2371 3	.298E-4 5	7.409411	124	8	.43
38499.0	298.7 4	334.920 4	81.480 5	.01844 6	.805 1	13.2374 4	.326E-4 6	7.410758	119	8	.52
38500.0	295.4 4	334.103 4	81.484 5	.01830 6	.045 1	13.2373 4	.374E-4 6	7.411870	118	8	.62
38501.0	292.8 4	333.286 4	81.487 5	.01802 7	.283 1	13.2370 4	.386E-4 7	7.414070	110	8	.63
38502.0	290.2 4	332.469 4	81.490 5	.01771 8	.521 1	13.2374 4	.401E-4 6	7.416261	115	8	.63
38503.0	287.7 4	331.653 4	81.492 5	.01744 9	.759 1	13.2375 4	.428E-4 6	7.418304	114	8	.61
38504.0	285.2 4	330.835 3	81.499 5	.01723 9	.997 1	13.2394 3	.443E-4 6	7.419139	109	8	.71
38505.0	282.3 3	330.019 3	81.502 5	.01698 9	.236 1	13.2395 3	.481E-4 7	7.421010	88	8	.65
38506.0	279.2 3	329.205 2	81.501 4	.01679 9	.4755 8	13.2396 3	.517E-4 8	7.422416	84	8	.68
38507.0	276.2 2	328.390 2	81.504 4	.01654 8	.7152 6	13.2399 2	.518E-4 6	7.424169	87	8	.66
38508.0	273.2 1	327.574 1	81.506 3	.01632 7	.9548 4	13.2403 2	.520E-4 6	7.425724	79	8	.61
38509.0	270.2 1	326.760 1	81.506 3	.01615 6	.1947 3	13.2408 1	.537E-4 6	7.426796	86	8	.64
38510.0	266.8 1	325.945 2	81.505 3	.01603 6	.4355 3	13.2408 2	.569E-4 8	7.427701	79	8	.72
38511.0	263.53 8	325.129 2	81.507 3	.01588 5	.6764 2	13.2408 1	.61E-4 1	7.428780	65	8	.70
38512.0	260.24 8	324.315 1	81.508 3	.01566 4	.9173 2	13.2410 1	.761E-4 7	7.430389	71	8	.75
38513.0	257.00 7	323.498 1	81.508 3	.01567 3	.1584 2	13.24128 8	.776E-4 5	7.430238	78	8	.66
38514.0	253.70 6	322.682 1	81.506 2	.01564 2	.3998 2	13.24141 7	.782E-4 6	7.430443	77	8	.60
38515.0	250.40 6	321.866 1	81.505 2	.01560 2	.6413 2	13.24161 6	.762E-4 4	7.430641	84	8	.56

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38516.0	247.09 6	321.050 1	81.504 2	.01559 1	.8830 2	13.24178 6	.754E-4 4	7.430622	97	8	.58
38517.0	243.64 6	320.234 1	81.505 2	.01552 2	.1252 2	13.24161 7	.768E-4 6	7.431272	92	8	.54
38518.0	240.44 6	319.417 1	81.503 2	.01557 1	.3669 2	13.24163 8	.763E-4 5	7.430837	93	8	.53
38519.0	237.31 6	318.600 1	81.501 2	.01564 1	.6086 2	13.24172 8	.772E-4 6	7.430273	93	8	.53
38520.0	234.18 8	317.782 1	81.502 2	.01574 1	.8504 2	13.2418 1	.729E-4 6	7.429537	82	8	.57
38521.0	231.05 8	316.967 1	81.501 2	.01586 2	.0924 2	13.2419 1	.729E-4 5	7.428539	81	8	.61
38522.0	227.96 9	316.150 2	81.501 2	.01596 2	.3344 2	13.24197 9	.721E-4 6	7.427779	72	8	.58
38523.0	224.7 1	315.337 2	81.500 3	.01614 3	.5770 3	13.2420 1	.757E-4 7	7.426404	61	8	.76
38524.0	221.7 1	314.520 2	81.503 3	.01630 3	.8193 3	13.2420 1	.775E-4 6	7.425198	49	8	.78
38525.0	218.5 1	313.707 2	81.500 3	.01654 4	.0619 3	13.2418 1	.814E-4 7	7.423451	41	8	.71
38526.0	215.6 1	312.890 2	81.500 3	.01676 3	.3041 3	13.2420 1	.822E-4 8	7.421764	41	8	.68
38527.0	212.78 7	312.073 2	81.503 3	.01695 3	.5460 2	13.24214 9	.823E-4 6	7.420223	44	8	.59
38528.0	209.95 6	311.256 2	81.503 3	.01717 3	.7882 2	13.24229 9	.839E-4 6	7.418522	46	8	.61
38529.0	207.45 7	310.437 2	81.509 4	.01737 3	.0297 2	13.24173 8	.861E-4 7	7.417259	49	8	.72
38530.0	204.92 5	309.621 2	81.506 3	.01765 2	.2714 1	13.24166 5	.867E-4 6	7.415142	60	8	.62
38531.0	202.42 4	308.805 1	81.506 2	.01792 2	.5132 1	13.24183 4	.869E-4 5	7.413057	63	8	.57
38532.0	199.92 4	307.988 1	81.507 3	.01817 2	.7552 1	13.24189 6	.856E-4 6	7.411146	63	8	.61
38533.0	197.52 4	307.174 1	81.504 3	.01842 2	.9971 1	13.24180 6	.846E-4 5	7.409289	73	8	.62
38534.0	195.17 5	306.358 2	81.504 3	.01866 2	.2389 1	13.24175 8	.871E-4 7	7.407455	75	8	.70
38535.0	192.89 5	305.541 1	81.504 3	.01890 2	.4808 2	13.24191 8	.926E-4 9	7.405627	69	8	.66
38536.0	190.65 6	304.725 1	81.505 3	.01916 2	.7227 2	13.24210 7	.949E-4 6	7.403604	74	8	.57
38537.0	188.45 8	303.909 1	81.504 3	.01941 2	.9647 2	13.24222 8	.958E-4 7	7.401645	68	8	.56
38538.0	186.2 1	303.094 2	81.504 3	.01967 3	.2071 3	13.2425 2	.957E-4 9	7.399613	58	8	.59
38539.0	183.9 2	302.278 2	81.503 4	.01994 5	.4497 5	13.2427 2	.96E-4 1	7.397437	55	8	.59
38540.0	181.6 2	301.464 2	81.502 4	.02028 6	.6927 7	13.2430 2	.1021E-3 7	7.394794	53	8	.57
38541.0	180.7 2	300.649 2	81.500 4	.02019 4	.9317 5	13.2423 2	.1046E-3 8	7.395726	49	8	.63
38542.0	178.4 2	299.832 2	81.498 4	.02047 5	.1749 7	13.2424 3	.1026E-3 8	7.393554	51	8	.68
38543.0	176.6 2	299.017 2	81.495 5	.02070 5	.4171 5	13.2428 3	.986E-4 7	7.391727	54	8	.69
38544.0	174.9 1	298.202 2	81.498 4	.02084 5	.6592 4	13.2436 5	.933E-4 6	7.390319	54	8	.61
38545.0	172.6 1	297.385 2	81.497 4	.02110 7	.9029 4	13.2440 4	.913E-4 5	7.388206	59	8	.55
38546.0	170.7 2	296.568 2	81.496 4	.02124 7	.1457 5	13.2433 3	.889E-4 6	7.387446	65	8	.55

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38547.0	168.9 2	295.751 2	81.495 4	.02137 8	.3885 5	13.2433 2	.874E-4 5	7.386433	73	8	.55
38548.0	167.2 2	294.935 3	81.495 4	.0215 1	.6313 6	13.2432 2	.848E-4 5	7.385385	71	8	.62
38549.0	165.1 3	294.111 4	81.482 7	.0217 1	.8753 9	13.2428 4	.812E-4 5	7.384335	76	8	.59
38550.0	163.7 2	293.292 4	81.478 6	.0217 1	.1173 7	13.2431 3	.767E-4 5	7.384386	77	8	.55
38551.0	162.1 2	292.472 4	81.475 6	.0217 1	.3603 6	13.2432 3	.747E-4 5	7.383777	76	8	.54
38552.0	160.4 2	291.653 3	81.472 5	.0219 1	.6035 5	13.2439 2	.737E-4 5	7.382396	81	8	.48
38553.0	158.6 2	290.835 3	81.472 5	.0220 1	.8474 5	13.2442 2	.726E-4 5	7.381007	87	8	.48
38554.0	156.9 2	290.016 4	81.470 6	.0221 1	.0910 5	13.2441 2	.790E-4 5	7.380536	98	8	.58
38555.0	155.1 2	289.198 3	81.468 5	.0222 1	.3350 5	13.2439 2	.820E-4 4	7.379744	109	8	.56
38556.0	153.3 1	288.379 3	81.467 5	.0223 1	.5791 4	13.2442 2	.820E-4 2	7.378973	122	8	.54
38557.0	151.7 1	287.561 3	81.467 5	.0223 1	.8229 4	13.2442 2	.805E-4 5	7.379090	116	8	.59
38558.0	149.9 2	286.745 4	81.470 5	.0225 1	.0675 5	13.2441 2	.757E-4 6	7.377963	110	8	.58
38559.0	147.9 2	285.924 5	81.467 7	.0227 2	.3128 5	13.2445 2	.677E-4 5	7.375671	122	8	.71
38560.0	146.2 2	285.104 5	81.466 7	.0227 2	.5572 5	13.2442 2	.573E-4 6	7.376475	114	8	.68
38561.0	144.9 2	284.285 5	81.468 7	.0222 2	.8008 5	13.2441 2	.500E-4 5	7.380008	116	8	.65
38562.0	143.3 1	283.461 5	81.462 7	.0222 2	.0452 4	13.2443 1	.443E-4 5	7.379762	115	8	.61
38563.0	141.4 1	282.644 5	81.465 7	.0227 2	.2907 4	13.2447 1	.408E-4 4	7.376073	94	8	.45
38564.0	139.8 1	281.826 9	81.47 1	.0226 3	.5352 4	13.2446 2	.407E-4 5	7.376969	81	8	.48
38565.0	138.1 1	281.006 8	81.47 1	.0225 2	.7800 3	13.2447 1	.399E-4 4	7.377775	82	8	.47
38566.0	136.7 1	280.175 8	81.456 9	.0220 2	.0242 3	13.2449 1	.369E-4 5	7.381096	90	8	.56
38567.0	134.99 7	279.363 6	81.467 8	.0222 2	.2693 2	13.2450 1	.330E-4 6	7.379619	81	8	.48
38568.0	133.26 5	278.540 6	81.464 7	.0225 2	.5147 2	13.24496 8	.299E-4 4	7.377404	79	8	.39
38569.0	131.65 5	277.716 6	81.461 7	.0223 2	.7596 2	13.24513 8	.270E-4 4	7.378696	68	8	.38
38570.0	129.92 6	276.888 5	81.454 5	.0221 2	.0049 2	13.24517 8	.254E-4 5	7.380634	66	8	.43
38571.0	128.26 7	276.071 6	81.459 6	.0219 2	.2501 2	13.24537 9	.194E-4 6	7.381486	63	8	.50
38572.0	126.59 8	275.251 6	81.460 6	.0219 2	.4954 2	13.24537 8	.153E-4 5	7.382074	68	8	.51
38573.0	124.92 8	274.431 5	81.460 5	.0217 1	.7406 2	13.24537 8	.118E-4 4	7.383112	67	8	.44
38574.0	123.22 8	273.609 4	81.458 5	.0216 1	.9860 2	13.2453 1	.93E-5 5	7.383871	59	8	.37
38575.0	121.59 9	272.789 4	81.460 5	.0215 1	.2313 2	13.2453 1	.92E-5 4	7.384531	67	8	.39
38576.0	119.9 1	271.971 5	81.463 5	.0214 1	.4766 3	13.2453 1	.93E-5 4	7.385316	66	8	.39

Table 14

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1964 4A

MJD	Z	φ	ψ	D.R.A.	$\dot{P}$
		Perigee In Sunlight			
38486.	1009.	-32.2	46.6	329.7	-0.553E-06
38487.	1013.	-34.4	49.7	327.5	-0.582E-06
38488.	1016.	-36.3	52.7	325.4	-0.560E-06
38489.	1020.	-38.5	55.8	323.1	-0.504E-06
38490.	1022.	-40.4	58.6	320.9	-0.424E-06
38491.	1024.	-41.9	61.2	318.8	-0.424E-06
38492.	1027.	-43.9	64.1	316.5	-0.432E-06
38493.	1030.	-46.0	67.1	314.1	-0.447E-06
38494.	1034.	-48.7	70.4	311.5	-0.442E-06
38495.	1037.	-50.4	73.0	309.1	-0.395E-06
38496.	1039.	-52.9	76.2	306.4	-0.368E-06
38497.	1043.	-55.4	79.2	303.6	-0.341E-06
38498.	1046.	-57.3	81.8	300.9	-0.340E-06
38499.	1049.	-60.2	85.1	297.5	-0.372E-06
38500.	1051.	-63.3	88.5	293.6	-0.427E-06
38501.	1054.	-65.7	91.3	289.7	-0.441E-06
38502.	1056.	-68.1	94.0	285.5	-0.458E-06
38503.	1059.	-70.4	96.6	280.8	-0.488E-06
38504.	1060.	-72.6	99.0	275.4	-0.505E-06
38505.	1063.	-75.1	101.6	268.0	-0.549E-06
38506.	1065.	-77.5	104.1	258.0	-0.590E-06
38507.	1067.	-79.5	106.4	245.0	-0.591E-06
38508.	1068.	-80.9	108.5	227.6	-0.593E-06

Table 14 (cont.)

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1964 4A

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
38509.	1069.	-81.5	110.4	206.5	-0.613E-06
38510.	1070.	-80.9	112.2	182.7	-0.649E-06
38511.	1071.	-79.3	113.7	164.1	-0.696E-06
38512.	1072.	-77.1	114.9	150.5	-0.868E-06
38513.	1072.	-74.5	115.8	140.7	-0.885E-06
38514.	1071.	-71.7	116.4	133.1	-0.892E-06
38515.	1071.	-68.7	116.7	127.1	-0.869E-06
38516.	1070.	-65.6	116.6	122.1	-0.860E-06
38517.	1070.	-62.4	116.2	117.6	-0.876E-06
38518.	1068.	-59.3	115.5	113.9	-0.870E-06
38519.	1067.	-56.3	114.5	110.5	-0.881E-06
38520.	1065.	-53.3	113.2	107.3	-0.832E-06
38521.	1063.	-50.3	111.7	104.3	-0.831E-06
38522.	1061.	-47.3	109.9	101.5	-0.822E-06
38523.	1058.	-44.1	107.9	98.7	-0.863E-06
38524.	1056.	-41.1	105.8	96.1	-0.884E-06
38525.	1053.	-38.0	103.4	93.5	-0.928E-06
38526.	1050.	-35.2	101.0	91.0	-0.938E-06
38527.	1048.	-32.4	98.5	88.6	-0.939E-06
38528.	1045.	-29.6	95.8	86.3	-0.957E-06
38529.	1043.	-27.1	93.3	84.0	-0.982E-06
38530.	1040.	-24.6	90.6	81.7	-0.989E-06
38531.	1038.	-22.2	87.9	79.5	-0.991E-06
38532.	1035.	-19.7	85.1	77.2	-0.976E-06

Table 14 (cont.)

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1964 4A

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
38533.	1033.	-17.3	82.4	75.0	-0.965E-06
38534.	1031.	-15.0	79.6	72.9	-0.993E-06
38535.	1028.	-12.7	76.8	70.7	-0.106E-05
38536.	1026.	-10.5	74.0	68.5	-0.108E-05
38537.	1024.	-8.4	71.3	66.4	-0.109E-05
38538.	1021.	-6.1	68.4	64.2	-0.109E-05
38539.	1019.	-3.9	65.6	62.0	-0.109E-05
38540.	1016.	-1.6	62.7	59.9	-0.116E-05
38541.	1017.	-0.7	60.6	57.9	-0.119E-05
38542.	1015.	1.6	57.7	55.8	-0.117E-05
38543.	1013.	3.4	55.1	53.7	-0.112E-05
38544.	1012.	5.0	52.6	51.6	-0.106E-05
38545.	1010.	7.3	49.7	49.4	-0.104E-05
38546.	1010.	9.2	47.1	47.3	-0.101E-05
38547.	1009.	11.0	44.5	45.2	-0.997E-06
38548.	1008.	12.7	42.0	43.1	-0.967E-06
38549.	1007.	14.7	39.4	40.9	-0.926E-06
38550.	1008.	16.1	37.1	38.8	-0.875E-06
38551.	1007.	17.7	34.7	36.7	-0.852E-06
38552.	1006.	19.4	32.4	34.6	-0.840E-06
38553.	1005.	21.2	30.0	32.4	-0.828E-06
38554.	1005.	22.8	27.8	30.3	-0.901E-06
38555.	1005.	24.6	25.7	28.1	-0.935E-06
38556.	1005.	26.4	23.7	25.9	-0.935E-06

Table 14 (cont.)

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1964 4A

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
38557.	1005.	28.0	22.0	23.8	-0.918E-06
38558.	1005.	29.7	20.4	21.6	-0.863E-06
38559.	1003.	31.7	19.1	19.3	-0.772E-06
38560.	1005.	33.4	18.1	17.1	-0.653E-06
38561.	1009.	34.7	17.3	14.9	-0.570E-06
38562.	1009.	36.2	16.9	12.7	-0.505E-06
38563.	1006.	38.1	17.2	10.4	-0.465E-06
38564.	1007.	39.7	17.7	8.2	-0.464E-06
38565.	1009.	41.3	18.6	5.9	-0.455E-06
38566.	1013.	42.7	19.5	3.6	-0.421E-06
38567.	1012.	44.4	21.0	1.3	-0.376E-06
38568.	1010.	46.1	22.6	358.9	-0.341E-06
38569.	1012.	47.6	24.4	356.5	-0.308E-06
38570.	1015.	49.3	26.3	354.1	-0.290E-06
38571.	1016.	50.9	28.3	351.6	-0.221E-06
38572.	1017.	52.6	30.4	349.1	-0.174E-06
38573.	1019.	54.2	32.5	346.6	-0.135E-06
38574.	1020.	55.8	34.6	343.9	-0.106E-06
38575.	1021.	57.4	36.7	341.3	-0.105E-06
38576.	1023.	59.0	38.9	338.5	-0.106E-06

I. SAO smoothed elements

The following elements are based on 63 observations and are valid for the period April 1 through April 15, 1964.

$$T_0 = 38493.0 \text{ MJD}$$

$$\omega = (109^\circ.84 \pm 3) + (10^\circ.158 \pm 5)t - {}^\circ.001793t^2 + {}^\circ.8312 \cos \omega$$

$$\Omega = (82^\circ.620 \pm 4) - (6^\circ.5773 \pm 7)t - {}^\circ.000277t^2 + {}^\circ.00048 \cos \omega$$

$$i = (31^\circ.460 \pm 1) - {}^\circ.000137t - {}^\circ.0017 \sin \omega$$

$$e = (.03376 \pm 1) - (.39 \pm 2) \times 10^{-4}t + .2913 \times 10^{-5}t^2 + .0005105 \sin \omega$$

$$M = (.66873 \pm 7) + (15.24106 \pm 1)t + (.000371 \pm 1)t^2 - (.19 \pm 2) \times 10^{-5}t^3$$
$$+ (.11 \pm 2) \times 10^{-6}t^4 - (.32 \pm 3) \times 10^{-7}t^5 - .0023980 \cos \omega$$

Standard error of one observation: $\sigma = \pm 2''.65$

The following elements are based on 47 observations and are valid for the period April 15 through May 1, 1964.

$$T_0 = 38508.0 \text{ MJD}$$

$$\omega = (262^\circ.43 \pm 2) + (10^\circ.192 \pm 5)t - {}^\circ.001793t^2 + {}^\circ.8312 \cos \omega$$

$$\Omega = (343^\circ.891 \pm 3) - (6^\circ.5864 \pm 6)t - {}^\circ.000277t^2 + {}^\circ.00048 \cos \omega$$

$$i = (31^\circ.4576 \pm 7) - {}^\circ.000137t - {}^\circ.0017 \sin \omega$$

$$e = (.03339 \pm 1) - (.58 \pm 19) \times 10^{-5}t + .2913 \times 10^{-5}t^2 + .0005105 \sin \omega$$

$$M = (.35495 \pm 6) + (15.24958 \pm 1)t + (.0001924 \pm 5)t^2 - (.36 \pm 1) \times 10^{-5}t^3$$
$$+ (.778 \pm 9) \times 10^{-6}t^4 + (.63 \pm 2) \times 10^{-7}t^5 - .0023980 \cos \omega$$

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

The following elements are based on 65 observations and are valid for the period May 1 through May 16, 1964.

$$T_0 = 38524.0 \text{ MJD}$$

$$\omega = (65^{\circ}.42 \pm 2) + (10^{\circ}.198 \pm 4)t - {}^{\circ}.000891t^2 + {}^{\circ}.9345 \cos \omega$$

$$\Omega = (238^{\circ}.445 \pm 3) - (6^{\circ}.5946 \pm 8)t - {}^{\circ}.000249t^2 - {}^{\circ}.00056 \cos \omega$$

$$i = (31^{\circ}.457 \pm 1) - .509 \times 10^{-4}t - .0018 \sin \omega$$

$$e = (.03310 \pm 2) - (.24 \pm 3) \times 10^{-4}t + .155 \times 10^{-5}t^2 + .0005527 \sin \omega$$

$$M = (.41432 \pm 5) + (15.25779 \pm 1)t + (.0002458 \pm 5)t^2 + (.35 \pm 1) \times 10^{-5}t^3$$

$$+ (.24 \pm 9) \times 10^{-7}t^4 - (.28 \pm 2) \times 10^{-7}t^5 - .0025886 \cos \omega$$

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

The following elements are based on 130 observations and are valid for the period May 16 through June 1, 1964.

$$T_0 = 38539.0 \text{ MJD}$$

$$\omega = (218^{\circ}.34 \pm 2) + (10^{\circ}.195 \pm 4)t - {}^{\circ}.000891t^2 + {}^{\circ}.9345 \cos \omega$$

$$\Omega = (139^{\circ}.484 \pm 4) - (6^{\circ}.6013 \pm 8)t - {}^{\circ}.000249t^2 - {}^{\circ}.00056 \cos \omega$$

$$i = (31^{\circ}.4545 \pm 9) - {}^{\circ}.509 \times 10^{-4}t - {}^{\circ}.0018 \sin \omega$$

$$e = (.03273 \pm 2) - (.20 \pm 3) \times 10^{-4}t + .155 \times 10^{-5}t^2 + .0005527 \sin \omega$$

$$M = (.33809 \pm 7) + (15.26492 \pm 1)t + (.0002158 \pm 4)t^2 + (.43 \pm 2) \times 10^{-5}t^3$$

$$- (.19 \pm 6) \times 10^{-7}t^4 - (.45 \pm 2) \times 10^{-7}t^5 - .0025886 \cos \omega$$

Standard error of one observation: $\sigma = \pm 3'.08$

The following elements are based on 83 observations and are valid for the period June 1 through June 15, 1964.

T_0 = 38554.0 MJD

$\omega = (11^\circ.58 \pm 2) + (10^\circ.216 \pm 5)t - {}^\circ.000891t^2 + {}^\circ.9345 \cos \omega$

$\Omega = (40^\circ.418 \pm 2) - (6^\circ.6068 \pm 5)t - {}^\circ.000249t^2 - {}^\circ.00056 \cos \omega$

$i = (31^\circ.4530 \pm 6) - .509 \times 10^{-4}t - .0018 \sin \omega$

$e = (.032532 \pm 8) - (.29 \pm 20) \times 10^{-5}t + .155 \times 10^{-5}t^2 + .0005527 \sin \omega$

$M = (.35822 \pm 6) + (15.27114 \pm 1)t + (.0002832 \pm 7)t^2 + (.110 \pm 2) \times 10^{-4}t^3$
$+ (.26 \pm 1) \times 10^{-6}t^4 - (.24 \pm 3) \times 10^{-7}t^5 - .0025886 \cos \omega$

Standard error of one observation: $\sigma = \pm 1''.70$

The following elements are based on 84 observations and are valid for the period June 15 through July 1, 1964.

T_0 = 38569.0 MJD

$\omega = (164^\circ.77 \pm 3) + (10^\circ.250 \pm 4)t - {}^\circ.000891t^2 + {}^\circ.9345 \cos \omega$

$\Omega = (301^\circ.238 \pm 3) - (6^\circ.6184 \pm 5)t - {}^\circ.000249t^2 - {}^\circ.00056 \cos \omega$

$i = (31^\circ.4598 \pm 6) - {}^\circ.509 \times 10^{-4}t - {}^\circ.0018 \sin \omega$

$e = (.032142 \pm 9) - (.23 \pm 2) \times 10^{-4}t + .155 \times 10^{-5}t^2 + .0005527 \sin \omega$

$M = (.50385 \pm 7) + (15.28116 \pm 1)t + (.0003118 \pm 4)t^2 - (.436 \pm 8) \times 10^{-5}t^3$
$- (.255 \pm 6) \times 10^{-6}t^4 + (.22 \pm 1) \times 10^{-7}t^5 - .0025886 \cos \omega$

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

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38486.0	39.35 4	128.644 6	31.454 2	.03421 2	.9989 1	15.234990 8	.419E-3 5	6.636512	34	4	1.82
38487.0	49.43 3	122.073 4	31.454 2	.03420 1	.23491 8	15.235829 5	.436E-3 4	6.636296	23	4	1.04
38488.0	59.57 3	115.502 3	31.455 2	.03416 4	.47162 8	15.236659 5	.407E-3 6	6.636308	12	4	.77
38489.0	69.44 5	108.923 2	31.452 3	.03460 4	.7098 1	15.23767 1	.46E-3 1	6.633019	7	4	.43
38490.0	79.54 9	102.349 5	31.452 6	.03441 4	.9484 2	15.238459 6	.40E-3 1	6.634122	6	4	.84
38491.0	89.5 1	95.775 7	31.456 8	.03437 3	.1881 3	15.23919 1	.369E-3 7	6.634126	8	6	1.20
38492.0	99.1 1	89.20 1	31.455 7	.03426 5	.4297 4	15.239945 7	.382E-3 4	6.634700	10	6	1.75
38493.0	109.28 8	82.59 2	31.447 8	.03440 4	.6704 2	15.240747 9	.365E-3 8	6.633847	13	6	1.30
38494.0	119.35 6	76.04 2	31.459 4	.03439 2	.9108 2	15.241489 5	.354E-3 2	6.633334	18	6	1.19
38495.0	129.51 8	69.47 2	31.460 5	.03424 3	.1542 2	15.242177 5	.358E-3 2	6.634156	27	6	1.43
38496.0	139.51 6	62.90 1	31.462 3	.03411 2	.3975 2	15.242892 4	.339E-3 2	6.634872	33	6	1.30
38497.0	149.62 6	56.31 1	31.462 2	.03403 2	.6412 2	15.243564 3	.334E-3 2	6.635226	41	6	1.46
38498.0	159.62 6	49.74 1	31.461 2	.03391 2	.8858 2	15.244199 3	.308E-3 2	6.635834	42	6	1.52
38499.0	169.83 5	43.150 8	31.461 1	.03375 1	.1305 1	15.244817 3	.300E-3 2	6.636755	38	6	1.12
38500.0	180.12 5	36.563 7	31.461 1	.03357 1	.3755 1	15.245391 4	.283E-3 3	6.637835	35	6	1.06
38501.0	190.24 5	29.979 8	31.461 1	.03345 1	.6216 1	15.245974 2	.288E-3 1	6.638482	37	6	1.41
38502.0	200.43 5	23.397 7	31.460 1	.03331 1	.8680 1	15.246546 2	.282E-3 1	6.639270	29	6	1.23
38503.0	210.70 5	16.817 6	31.459 1	.03320 1	.1147 1	15.247086 2	.2735E-3 9	6.639884	29	6	.91
38504.0	221.05 3	10.229 5	31.459 1	.03312 1	.36176 9	15.247635 2	.274E-3 1	6.640326	26	6	.60
38505.0	231.36 4	3.645 7	31.460 2	.03301 1	.6095 1	15.248162 2	.248E-3 1	6.640918	30	6	.89
38506.0	241.72 4	357.060 7	31.460 2	.03337 1	.8575 1	15.248659 3	.248E-3 1	6.641403	29	6	.90
38507.0	251.99 3	350.476 4	31.459 1	.03294 1	.10628 8	15.249072 2	.2047E-3 9	6.641096	22	6	.60
38508.0	262.37 3	343.891 5	31.458 2	.03288 1	.35512 7	15.249480 1	.203E-3 1	6.641390	23	6	.58
38509.0	272.71 3	337.305 6	31.456 3	.03285 1	.60444 9	15.249882 3	.199E-3 2	6.641494	15	6	.71
38510.0	283.04 3	330.720 5	31.455 3	.03285 2	.85419 9	15.25027 1	.193E-3 4	6.641353	13	6	.64
38511.0	293.41 4	324.130 5	31.457 5	.03287 2	.10425 9	15.250748 4	.227E-3 4	6.641102	8	6	.50
38512.0	303.6 2	317.53 2	31.47 2	.03300 9	.3552 4	15.25133 2	.27E-3 1	6.640042	10	6	2.49
38513.0	312.9 4	310.93 2	31.47 2	.0334 1	.609 1	15.25202 3	.29E-3 1	6.636972	8	6	1.78
38514.0	323.3 5	304.35 4	31.46 3	.0336 3	.861 2	15.25261 6	.27E-3 4	6.635772	7	6	2.42
38515.0	334.1 2	297.79 2	31.47 1	.0332 1	.1121 5	15.25322 2	.322E-3 6	6.638063	14	6	1.37

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38516.0	345.3 4	291.19 2	31.459 7	.0328 2	.363 1	15.253853 5	.307E-3 2	6.640680	16	6	.84
38517.0	355.01 3	284.598 8	31.457 4	.03318 4	.61838 9	15.254467 5	.287E-3 2	6.637872	20	6	.95
38518.0	5.10 5	278.02 1	31.463 5	.03330 5	.8734 1	15.255037 6	.263E-3 4	6.636892	25	6	1.65
38519.0	15.33 2	271.410 5	31.456 2	.03338 3	.12864 6	15.255557 3	.232E-3 2	6.636238	26	6	.82
38520.0	25.46 2	264.818 5	31.456 2	.03349 2	.38458 6	15.256021 3	.230E-3 1	6.635323	27	6	.76
38521.0	35.54 2	258.225 4	31.455 2	.03360 2	.64111 6	15.256479 2	.223E-3 1	6.634443	21	6	.62
38522.0	45.62 2	251.624 4	31.455 2	.03361 3	.89806 5	15.256932 2	.230E-3 1	6.634233	21	6	.71
38523.0	55.76 3	245.039 9	31.455 1	.03362 4	.15530 9	15.257121 2	.229E-3 1	6.634093	22	6	.82
38524.0	65.75 3	238.42 1	31.456 2	.03374 4	.41345 9	15.257599 3	.242E-3 3	6.633169	23	6	1.20
38525.0	76.00 5	231.83 2	31.458 4	.03371 8	.6712 2	15.258125 6	.281E-3 4	6.633230	28	6	2.83
38526.0	85.93 5	225.26 2	31.456 3	.03368 6	.9304 1	15.258653 7	.287E-3 4	6.633244	34	6	2.36
38527.0	95.97 6	218.66 2	31.457 4	.03361 7	.1900 1	15.259226 8	.272E-3 5	6.633538	39	6	2.98
38528.0	106.03 2	212.067 7	31.454 2	.03352 3	.45006 7	15.259763 3	.241E-3 2	6.633993	35	6	1.14
38529.0	115.95 3	205.466 8	31.455 2	.03344 3	.71102 7	15.260271 2	.242E-3 1	6.634406	36	6	1.41
38530.0	126.07 3	198.87 1	31.454 3	.03344 3	.97182 9	15.260780 3	.273E-3 1	6.634307	39	6	1.32
38531.0	136.05 2	192.274 5	31.455 1	.03332 2	.23361 5	15.261314 1	.284E-3 1	6.634942	36	6	.74
38532.0	146.12 3	185.685 7	31.453 2	.03317 2	.49567 7	15.261861 3	.274E-3 1	6.635793	28	6	.87
38533.0	156.24 4	179.06 1	31.459 2	.03309 4	.7582 1	15.262372 4	.251E-3 2	6.636244	24	6	1.33
38534.0	166.41 4	172.47 1	31.458 3	.03297 4	.0210 1	15.262863 6	.240E-3 2	6.636936	19	6	1.20
38535.0	176.69 4	165.884 6	31.456 2	.03283 3	.2840 1	15.263259 4	.196E-3 2	6.637755	18	6	.88
38536.0	186.86 6	159.283 6	31.456 2	.03278 4	.5477 2	15.263625 3	.187E-3 2	6.637979	22	6	1.18
38537.0	197.10 6	152.687 6	31.456 3	.03271 4	.8115 2	15.264005 3	.186E-3 2	6.638341	29	6	1.11
38538.0	207.23 5	146.087 5	31.456 2	.03261 3	.0759 1	15.264368 4	.210E-3 2	6.638963	32	6	.80
38539.0	217.49 5	139.490 5	31.456 2	.03249 3	.3404 1	15.264788 3	.232E-3 2	6.639627	38	6	.77
38540.0	227.91 4	132.887 4	31.456 1	.03238 2	.6049 1	15.265259 2	.252E-3 1	6.640257	40	6	.65
38541.0	238.25 2	126.286 3	31.456 1	.03229 2	.87007 7	15.265753 1	.2483E-3 8	6.640743	53	6	.65
38542.0	248.55 4	119.677 7	31.455 2	.03224 2	.1359 1	15.266230 2	.238E-3 1	6.640958	60	6	1.11
38543.0	258.97 3	113.076 6	31.455 1	.03217 2	.40188 7	15.266689 2	.215E-3 1	6.641304	62	6	.87
38544.0	269.38 2	106.465 5	31.4548 8	.03213 2	.66828 7	15.267105 2	.202E-3 1	6.641429	64	6	.81
38545.0	279.75 1	99.862 3	31.4553 6	.03214 1	.93517 4	15.267505 1	.1864E-3 8	6.641239	70	6	.62
38546.0	290.14 1	93.261 3	31.4547 6	.03214 1	.20238 4	15.2678714 9	.1832E-3 6	6.641112	82	6	.66

T (MJD)	ω	Ω	i	e	M	n	n′/2	q	N	D	σ
38547.0	300.51 1	86.654 3	31.4546 5	.032162 9	.47004 4	15.2682367 9	.1809E-3 5	6.640884	75	6	.58
38548.0	310.85 1	80.050 3	31.4542 5	.032208 8	.73809 3	15.2685984 9	.1802E-3 5	6.640465	67	6	.52
38549.0	321.18 2	73.446 3	31.4536 6	.032251 9	.00656 4	15.268966 1	.1833E-3 7	6.640060	60	6	.60
38550.0	331.47 2	66.839 4	31.4539 7	.03231 1	.27546 5	15.269353 1	.1932E-3 8	6.639523	58	6	.75
38551.0	341.79 3	60.236 5	31.453 1	.03238 1	.54469 7	15.269763 2	.205E-3 1	6.638979	46	6	.86
38552.0	352.00 2	53.632 5	31.453 1	.03245 1	.81463 7	15.270205 1	.226E-3 1	6.638307	42	6	.78
38553.0	2.21 4	47.024 7	31.453 2	.03253 2	.0850 1	15.270685 2	.245E-3 1	6.637657	39	6	1.09
38554.0	12.50 5	40.424 8	31.450 2	.03261 2	.3557 1	15.271205 3	.265E-3 2	6.636924	36	6	1.26
38555.0	22.74 6	33.81 1	31.453 4	.03270 2	.6270 2	15.271814 5	.303E-3 3	6.636132	32	6	1.49
38556.0	32.75 9	27.19 2	31.455 7	.03269 4	.8997 3	15.272534 7	.370E-3 4	6.636008	27	6	2.13
38557.0	42.78 6	20.57 1	31.458 6	.03284 3	.1730 2	15.273341 6	.405E-3 3	6.634728	23	6	1.28
38558.0	52.99 4	13.981 7	31.451 3	.03290 2	.4467 1	15.27420 1	.433E-3 3	6.634078	16	6	.69
38559.0	63.1 1	7.37 1	31.442 8	.03292 4	.7215 3	15.274931 6	.396E-3 4	6.633747	13	6	1.56
38560.0	73.2 1	0.76 1	31.44 1	.03300 4	.9971 4	15.275671 8	.361E-3 5	6.632963	10	6	1.50
38561.0	83.4 1	354.14 1	31.438 9	.03292 5	.2733 4	15.27636 2	.339E-3 8	6.633353	8	6	1.19
38562.0	93.34 9	347.526 7	31.438 6	.03284 3	.5505 3	15.276945 5	.297E-3 3	6.633741	9	6	.96
38563.0	103.2 1	340.93 2	31.45 1	.03278 4	.8287 3	15.277542 5	.295E-3 5	6.633941	13	6	1.38
38564.0	113.2 1	334.31 2	31.45 1	.03277 4	.1069 3	15.278133 8	.295E-3 5	6.633846	13	6	1.38
38565.0	123.3 2	327.70 2	31.46 2	.03257 8	.3857 4	15.27878 1	.305E-3 8	6.635035	11	6	1.78
38566.0	133.3 1	321.08 1	31.455 7	.03244 4	.6653 3	15.27937 1	.342E-3 7	6.635745	15	6	1.57
38567.0	143.4 1	314.47 1	31.458 6	.03237 4	.9452 3	15.280042 5	.332E-3 4	6.636041	20	6	1.76
38568.0	153.7 1	307.85 1	31.457 5	.03230 4	.2255 3	15.280698 5	.320E-3 3	6.636349	24	6	2.18
38569.0	164.03 5	301.227 6	31.457 2	.03224 2	.5059 1	15.281382 5	.288E-3 3	6.636556	18	6	.98
38570.0	174.28 5	294.612 7	31.457 2	.03215 2	.7874 1	15.281958 3	.284E-3 2	6.637000	29	6	1.32
38571.0	184.48 4	287.993 7	31.457 2	.03209 2	.0696 1	15.282522 2	.281E-3 1	6.637232	37	6	1.33
38572.0	194.74 4	281.385 7	31.459 2	.03195 2	.3521 1	15.283062 2	.268E-3 2	6.638017	45	6	1.37
38573.0	204.96 4	274.761 7	31.460 1	.03186 2	.6354 1	15.283585 2	.255E-3 1	6.638495	46	6	1.14
38574.0	215.31 4	268.139 6	31.461 1	.03172 3	.9187 1	15.284085 3	.226E-3 2	6.639334	49	6	1.30
38575.0	225.50 3	261.521 4	31.4623 9	.03170 2	.20300 8	15.284555 2	.227E-3 1	6.639324	50	6	.94
38576.0	235.98 4	254.901 7	31.463 1	.03168 3	.4869 1	15.284987 2	.220E-3 2	6.639313	56	6	1.41

Table 15

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1964 5A

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
		Perigee In Earth Shadow			
38486.	260.	19.3	144.5	153.2	-0.361E-05
38487.	261.	23.4	143.1	155.7	-0.376E-05
38488.	262.	26.7	142.0	158.7	-0.351E-05
38489.	260.	29.2	141.1	162.1	-0.396E-05
38490.	261.	30.9	140.8	166.1	-0.345E-05
38491.	262.	31.5	141.0	170.2	-0.318E-05
38492.	262.	31.0	141.8	174.0	-0.329E-05
38493.	261.	29.5	143.3	178.1	-0.314E-05
38494.	259.	27.1	145.4	181.7	-0.305E-05
38495.	259.	23.7	148.0	184.9	-0.308E-05
38496.	259.	19.8	151.0	187.3	-0.292E-05
38497.	258.	15.3	154.4	189.3	-0.287E-05
38498.	258.	10.5	157.8	190.8	-0.265E-05
38499.	259.	5.3	161.0	192.1	-0.258E-05
38500.	259.	-0.1	163.5	193.4	-0.244E-05
38501.	260.	-5.3	164.8	194.6	-0.248E-05
38502.	262.	-10.5	164.3	195.9	-0.243E-05
38503.	263.	-15.5	162.2	197.7	-0.235E-05
38504.	264.	-20.0	158.9	199.9	-0.236E-05
38505.	266.	-24.1	155.1	202.6	-0.213E-05
38506.	268.	-27.4	151.1	206.0	-0.213E-05
38507.	268.	-29.8	147.2	209.9	-0.176E-05

Table 15 (cont.)

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1964 5A

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
38508.	269.	-31.1	143.3	214.3	-0.175E-05
38509.	269.	-31.4	139.8	218.9	-0.171E-05
38510.	269.	-30.6	136.5	223.4	-0.166E-05
38511.	268.	-28.6	133.5	227.5	-0.195E-05
38512.	266.	-25.8	130.8	231.0	-0.232E-05
38513.	262.	-22.5	129.2	233.0	-0.249E-05
38514.	259.	-18.2	126.7	235.6	-0.232E-05
38515.	261.	-13.2	123.8	238.0	-0.277E-05
38516.	263.	-7.6	120.5	240.3	-0.264E-05
38517.	260.	-2.6	118.5	241.1	-0.247E-05
38518.	259.	2.7	115.8	242.2	-0.226E-05
38519.	258.	7.9	112.8	243.5	-0.199E-05
38520.	258.	13.0	109.6	244.8	-0.198E-05
38521.	258.	17.7	106.1	246.5	-0.192E-05
		Perigee In Sunlight			
38522.	259.	21.9	102.4	248.7	-0.198E-05
38523.	260.	25.6	98.5	251.5	-0.197E-05
38524.	260.	28.4	94.6	254.6	-0.208E-05
38525.	260.	30.4	90.5	258.6	-0.241E-05
38526.	261.	31.4	86.9	262.6	-0.247E-05
38527.	261.	31.3	83.4	266.8	-0.234E-05
38528.	261.	30.1	80.2	270.8	-0.207E-05
38529.	261.	28.0	77.7	274.3	-0.208E-05

Table 15 (cont.)

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1964 5A

MJD	Z	ϕ	ψ	D.R.A.	$\dot{P}$
38530.	260.	24.9	75.6	277.5	-0.234E-05
38531.	259.	21.2	74.2	280.0	-0.244E-05
38532.	259.	16.9	73.4	282.1	-0.235E-05
38533.	259.	12.1	73.3	283.7	-0.216E-05
38534.	259.	7.0	73.5	285.0	-0.206E-05
38535.	259.	1.7	74.1	286.3	-0.168E-05
38536.	260.	-3.6	75.1	287.3	-0.161E-05
38537.	260.	-8.8	76.0	288.6	-0.160E-05
38538.	262.	-13.8	76.9	290.0	-0.180E-05
38539.	263.	-18.5	77.4	291.9	-0.199E-05
38540.	265.	-22.8	77.4	294.4	-0.216E-05
38541.	267.	-26.3	76.9	297.5	-0.213E-05
38542.	268.	-29.1	75.8	301.1	-0.204E-05
38543.	269.	-30.8	74.0	305.3	-0.184E-05
38544.	269.	-31.5	71.6	309.9	-0.173E-05
38545.	269.	-31.0	68.5	314.4	-0.160E-05
38546.	268.	-29.3	64.9	318.6	-0.157E-05
38547.	267.	-26.7	60.9	322.4	-0.155E-05
38548.	265.	-23.2	56.5	325.5	-0.155E-05
38549.	264.	-19.1	51.9	328.0	-0.157E-05
38550.	262.	-14.4	47.2	329.9	-0.166E-05
38551.	261.	-9.4	42.4	331.5	-0.176E-05
38552.	260.	-4.2	37.8	332.7	-0.194E-05

Table 15 (cont.)

RELATIVE POSITIONS OF THE SUN AND THE PERIGEE OF SATELLITE 1964 5A

MJD	Z	φ	ψ	D.R.A.	$\dot{P}$
38553.	259.	1.2	33.4	333.8	-0.210E-05
38554.	259.	6.5	29.1	335.0	-0.227E-05
38555.	259.	11.6	25.2	336.3	-0.260E-05
38556.	259.	16.4	21.9	337.7	-0.317E-05
38557.	259.	20.8	19.0	339.6	-0.347E-05
38558.	259.	24.6	16.3	342.2	-0.371E-05
38559.	260.	27.7	14.0	345.3	-0.339E-05
38560.	260.	30.0	11.9	348.9	-0.309E-05
38561.	261.	31.2	10.0	353.0	-0.291E-05
38562.	261.	31.4	8.5	357.0	-0.255E-05
38563.	261.	30.5	7.2	0.8	-0.253E-05
38564.	260.	28.7	6.6	4.5	-0.253E-05
38565.	261.	25.9	7.5	7.8	-0.261E-05
38566.	260.	22.3	9.6	10.3	-0.293E-05
38567.	260.	18.1	12.8	12.5	-0.284E-05
38568.	259.	13.4	16.9	14.3	-0.274E-05
38569.	259.	8.3	21.4	15.8	-0.247E-05
38570.	259.	3.0	26.2	17.0	-0.243E-05
38571.	259.	-2.3	31.2	18.0	-0.241E-05
38572.	260.	-7.6	36.2	19.2	-0.229E-05
38573.	261.	-12.7	41.3	20.6	-0.218E-05
38574.	263.	-17.6	46.3	22.4	-0.193E-05
38575.	264.	-21.9	51.0	24.5	-0.194E-05
38576.	265.	-25.6	55.6	27.6	-0.188E-05

NOTICE

This series of Special Reports was instituted under the supervision of Dr. F. L. Whipple, Director of the Astrophysical Observatory of the Smithsonian Institution, shortly after the launching of the first artificial earth satellite on October 4, 1957. Contributions come from the Staff of the Observatory.

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