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Accurate Drag Determinations for Eight Artificial Satellites; Atmospheric Densities and Temperatures[1]

By Luigi G. Jacchia[2] and Jack Slowey[3]

The effect of atmospheric drag on the orbits of artificial satellites continues to be our primary source of information concerning atmospheric densities and their variations at heights above 200 km. The drag causes a secular decrease in the orbital period that can be accurately determined for satellites with perigee heights up to 1000 km or more. From the observed change in period, the density in the vicinity of perigee can be derived fairly easily. Unfortunately, determination of the change in period (acceleration) with high accuracy and high resolution is a rather laborious task. As a result, very few really good accelerations have been available in the past.

We have determined accurate anomalistic accelerations covering intervals up to several years for eight artificial satellites with perigee heights between 350 and 750 km. These accelerations have been corrected for the acceleration caused by solar-radiation pressure, and atmospheric densities and temperatures have been derived from them. These data, together with the pertinent geometric parameters, are given in table 5, at the end of this paper. A detailed explanation and a report of results so far obtained from analysis of these data are given below.

[1] Part of this work was performed under contract with the Geophysics Research Directorate, U.S. Air Force, Cambridge. The National Aeronautics and Space Administration contributed the major support.

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1. Selection of satellites

The eight satellites and the intervals covered are listed with other basic information in table 1. The quantity $\bar{z}_\pi$ tabulated for each satellite is the standard perigee height to which all of the atmospheric densities for that satellite have been reduced for the purpose of analysis. The actual perigee heights fluctuate quite rapidly because of three factors: the geometric effect of the earth's oblateness; the gravitational perturbations due to the odd harmonics in the earth's potential; and solar-radiation pressure. This fluctuation causes density fluctuations that are obviously of little interest and that are best eliminated. This procedure also facilitates the computation of atmospheric temperatures.

The eight satellites were selected primarily for their suitability for the study of upper-atmosphere variations. Optimum criteria for this purpose are spherical shape, long lifetime, well-distributed observations, and a moderately high orbital eccentricity. Unfortunately, only

TABLE 1.—*Basic data on satellites*

Satellite	z_π (km)	A/m (cm²/g)	Eccentricity	Interval	Basic resolution (days)
1958 Alpha (Explorer I)	355	0. 170	0. 14–0. 10	1958 Jan. 31–1961 Apr. 1	1. 0
1960 ξ1 (Explorer VIII)	426	0. 110	0. 12	1960 Nov. 7–1961 May 1	2. 0
1959 Eta (Vanguard III)	516	0. 173	0. 19	1959 Sept. 21–1961 May 23	2. 0
1959 α1 (Vanguard II)	563	0. 236	0. 165	1959 Mar. 7–1961 Apr. 1	2. 5
1959 α2 (Rocket)	563	0. 252	0. 18	1959 Mar. 13–1961 Mar. 30	2. 5
1958 β1 (Rocket)	655	0. 252	0. 21	1959 May 18–1961 May 1	2. 5
1958 β2 (Vanguard I)	658	0. 248	0. 19	1958 May 15–1961 Oct. 10	2. 5
1961 δ1 (Explorer IX)	*	15. 84	0. 12–0. 11	1961 Feb. 17–1961 Oct. 2	1. 0

*Five different standard heights, ranging from 660 to 740 km, were used for 1961 δ1 (Jacchia and Slowey, 1962).

three satellites (Vanguard I, Vanguard II, and Explorer IX) fulfilled all these conditions. The selection of nonspherical satellites was dictated by necessity. It is clear that for an elongated satellite we must expect to find drag oscillations caused by the variable area of presentation. In addition, the correction for solar-radiation pressure is bound to be in error if the tumbling motion of the satellite body is not sufficiently well known. The rocket casings of Vanguard I and Vanguard II were included merely to compare results with those of the spherical payloads. The other nonspherical satellites were selected because they were the best available at about their perigee heights.

A study of the oscillations in the acceleration of Satellite 1958 Alpha due to variable presentation area has already been published (Jacchia and Slowey, 1961). For present purposes, we have sometimes taken mean values of the acceleration for this satellite in order to eliminate these oscillations. The original accelerations for Satellite 1958 Alpha are given in table 6 for the sections in which they have been smoothed.

The determination of accelerations and densities is being continued for all of the satellites in table 1, with the exception of the two Vanguard rocket-casings. The additional data, which will extend to about April 1, 1962, will be published in the near future.

2. Derivation of accelerations

Atmospheric drag is only one of several perturbing forces acting on an artificial satellite. Perturbing forces also arise from the irregular shape of the earth, from the pressure of solar radiation, and from the attraction of the nearest celestial bodies. All these forces can cause both short-periodic and long-periodic perturbations, as well as secular perturbations.

In view of the different ways in which the perturbing forces act on a satellite, their effects on a specific orbital element bears very little relation to their relative intensities. This turns out to be a very fortunate circumstance for the determination of air drag. The perturbing forces arising from the departure of the earth's figure from spherical symmetry are of the order of 1 dyne, while the atmospheric drag of the Vanguard I satellite is of the order of 10^{-4} dynes at perigee height. Yet, the atmospheric drag on Vanguard I produces a very noticeable secular decrease in the semimajor axis of the orbit, while none of the gravitational perturbations have a secular effect on the semimajor axis and, therefore, on the anomalistic period. Kozai (1959a, 1959b) and Brouwer (1959) have shown that gravitational perturbations, whether arising from the earth's figure or from the attraction of the sun and moon, never produce appreciable long-periodic perturbations upon the semimajor axis of a close earth satellite. Thus, if we do not go to time intervals smaller than one revolution in the analysis of the period variations, we are left with two contending effects: atmospheric drag and solar-radiation pressure.

Solar-radiation pressure affects the orbital period when the satellite spends part of the time in the earth's shadow, which is commonly the case. For a relatively close satellite with a moderately eccentric orbit ($0.1<e<0.2$), the change in period, dP/dt, caused by solar-radiation pressure is of the order of $\pm 1 \times 10^{-7}\ A/m$, where A/m is the area/mass ratio expressed in cm²/g. By comparison, the atmospheric drag at intermediate heights gives rise to values of dP/dt^{9} of the order of $-1 \times 10^{9}\ A\rho/m$, where ρ is the atmospheric density in g/cm³. Thus, when ρ is of the order of 10^{-16} g/cm³, the effect of solar-radiation pressure may equal that of atmospheric drag. At times of sunspot maximum, this will occur at a height of 900 km; at times of low solar activity, however, when the atmosphere is appreciably contracted, it will occur as low as 500 km above the earth. If we want to determine atmospheric drag with 10-percent accuracy or better, we must take solar-radiation pressure into account whenever the perigee height of the satellite is greater than 400 km.

The contribution of solar-radiation pressure to the acceleration is easily calculated by means of a suitable computer program. For this application, the calculation should be based on on the observed orbital elements rather than on unconstrained numerical integration from initial conditions. This will save the trouble of having to deal with the accumulated errors in geometry growing out of slight errors in either the assumed physical parameters or the initial geometric parameters that might otherwise occur. We were fortunate to have available Kozai's program, which is based on his theory for the effect (Kozai, 1961). This suited our needs quite well. As was noted in an earlier paper on the drag of Satellite 1961 δ1 (Jacchia and Slowey, 1962), this program gives results that agree very well with observation. It was used to compute the anomalistic acceleration due to solar-radiation pressure for seven of the satellites in table 1; for 1958 Alpha, the calculation was not necessary. As might have been expected, the results for the satellite with the next lowest perigee, 1960 ξ1, were also essentially negligible in the interval covered. This was not, of course, the case for the other six.

The force of solar radiation on a close earth satellite, assuming a value of the solar constant of 2.00 cal cm^{-2} min^{-1}, is $4.65 \times 10^{-5} A$ (cgs), where A is the effective presentation area. For a spherical satellite and for specular reflection, A is the actual presentation area and is constant. For a nonspherical satellite, however, the effective presentation area will depend on the shape of the satellite and the type of reflection, as well as on the actual presentation area at the time. Fortunately, the satellites in table 1 for which radiation pressure is most important are all spherical. For the nonspherical satellites, we have simply taken the average cross-section in place of the effective presentation area. The error introduced should be small. The satellites affected are the two Vanguard rocket-casings, which are not themselves of primary interest, and Vanguard III (1959 Eta).

The main problem, of course, is the determination of the actual orbital accelerations of the particular satellite. This we do by accurately determining the mean anomaly as a function of time. If M is the mean anomaly, n the mean motion in revolutions/unit time, and P the anomalistic period, we clearly have

$$\dot{M}=n=1/P, \tag{1}$$

and

$$\dot{P}=-\ddot{M}/\dot{M}^2.$$

The secular acceleration $\dot{P}=dP/dt$ is always relatively small, of the order of 10^{-5} for low satellites, and 10^{-7} to 10^{-8} for higher ones. Therefore, $\dot{M}$ changes very little compared to $\ddot{M}$; and over reasonable time intervals, $\dot{P}$ is proportional to $-\ddot{M}$.

To determine $\ddot{M}$, we represent the mean anomaly with an approximate analytical function and then determine the residuals from this function. If we let $\overline{M}(t)$ be the approximating function, so that $M=\overline{M}+\Delta M$, we will have

$$\ddot{M}=\frac{d^2M}{dt^2}=\frac{d^2\overline{M}}{dt^2}+\frac{d^2}{dt^2}\Delta M. \tag{2}$$

If the motion of perigee, which is the origin of M, is not linear, we correct for this spurious contribution to the acceleration. The corrected value $\ddot{M}_c$ of the acceleration will be

$$\ddot{M}_c=\ddot{M}+\left(\frac{dM}{dv}\right)_0\ddot{\omega}, \tag{3}$$

where $\left(\frac{dM}{dv}\right)_0$ is the derivative of M with respect to the true anomaly v at perigee ($M=v=0$); this derivative is a function of the orbital eccentricity e and is given by

$$\left(\frac{dM}{dv}\right)_0=1-2e+\frac{3}{2}e^2-\ldots. \tag{4}$$

The desired value of the secular acceleration is, finally,

$$\dot{P}=dP/dt=-\ddot{M}_c/\dot{M}^2. \tag{5}$$

In practice, we begin by obtaining orbital elements for the satellite computed at intervals of from one to four days. The orbits that were used were, with the exception of those for 1958 β2, derived mainly from field-reduced Baker-Nunn observations having an accuracy of a few minutes of arc. The observations of 1958 β2 were mostly Minitrack observations, which have about the same accuracy. All the orbits were computed by the Differential Orbit Improvement (DOI) program of the Smithsonian Astrophysical Observatory (Veis and Moore, 1960). Since all of these orbits have been or will be published in separate papers, we do not give them here. It should be said, however, that the program computes mean elements in which the effect of the short-periodic gravitational perturbations is removed, but not that of long-periodic perturbations. Incidentally, it is also possible to eliminate the short-periodic perturbations due to atmospheric drag.

Analytic time functions covering intervals of 30 to 120 days are then fitted to each of the elements by least squares. Care is taken to avoid leaving systematic residuals in any of the elements except the mean anomaly. This can usually be accomplished with a fairly low-order polynomial and, very often, a sine term to account for the variations due primarily to the third harmonic in the earth's potential. Systematic residuals of up to 10^{-3} revolutions can be tolerated in the mean anomaly; the fit need only be sufficiently precise to permit accurate determination of the semimajor axis from the first derivative. However, it is usually the mean anomaly that, because of large fluctuations due to variable atmospheric drag, limits the interval over which the elements may be fitted. The fitted elements are given for all of the satellites in table 4. It will be noticed that, in adjacent sections, the elements are often exactly the same except for the mean anomaly.

After an analytical representation of all the elements has been obtained, a version of the DOI program that treats the elements as known is used to compute, for each observation of the satellite, a residual in mean anomaly ΔM. These residuals are then plotted against time and a smooth curve is drawn through them. Ordinates on the curve are read off at equal time intervals and differenced; from the differences we compute $d^2(\Delta M)/dt^2$. The secular acceleration is then computed by using equations (2) to (5).

The accelerations determined in this way appear in the second column of table 5, tabulated against time, in Modified Julian Days (MJD= JD−2400000.5), given in the first column. The accelerations due to radiation pressure and those attributed only to atmospheric drag appear in columns 3 and 4, respectively, of the same table.

3. Atmospheric densities

The rate of change dP/dt of the anomalistic period P of an artificial satellite due to drag in a rotating atmosphere is very closely given (Sterne, 1959) by the equation

$$\frac{dP}{dt}=-\frac{3}{2}C_D\frac{A}{m}\rho_\pi a\int_0^{2\pi}\frac{\rho}{\rho_\pi}\frac{(1+e\cos E)^{3/2}}{(1-e\cos E)^{1/2}}\times\left(1-d\,\frac{1-e\cos E}{1+e\cos E}\right)^2 dE, \quad (6)$$

where

$$d=P\omega_s(1-e^2)^{1/2}\cos i;$$

C_D is the drag coefficient; a the semimajor axis of its orbit; ρ_π the atmospheric density at perigee height; ρ the atmospheric density at the height corresponding to a given value of the independent variable E, the eccentric anomaly; and ω_s is the angular velocity of atmospheric rotation. A/m and e have already been defined.

TABLE 2.—*Density scale height as a function of z and ψ′*

z(km)	H_ρ(km) $\psi'=0°$	$\psi'=180°$
300	54.5	45.4
400	71.5	55.4
500	93.7	66.9
600	111.0	79.5
700	116.2	93.1
800	122.2	107.2

Relatively simple formulas have been derived by various authors from equation (6), with the assumption of a density scale height either constant or linear with height; more complicated formulas take into account the flattening of the atmosphere and the diurnal bulge. We have preferred to compute ρ_π directly from equation (6), using numerical integration. For the variation of ρ along the orbit, a modified version of Jacchia's atmospheric model (Jacchia, 1960) was used; the modification concerns the amplitude of the diurnal bulge which, if extrapolated beyond the height of 700 km (explicitly labelled in the paper as the upper limit) would become excessively large. Consequently, equation (10) in Jacchia's 1960 paper was changed to

$$\rho=\rho_0(z)F_{20}\left[1+\varphi(z)\cos^6\frac{\psi'}{2}\right], \quad (7)$$

where

$$\varphi(z)=4.6+4\tan^{-1}[0.005(z-600)],$$

and ψ' is the angular distance from the center of the bulge. Density scale heights H_ρ resulting from this model for $\psi'=0°$ and $\psi'=180°$ are given in table 2 for heights between 300 and 800 km. As can be seen, they are also in substantial agreement with Nicolet's model. For all of the satellites a lag angle $\lambda=30°$ was assumed for the position of the bulge with respect to the subsolar point. The factor F_{20} is, of course, irrelevant because it is eliminated in the ratio ρ/ρ_π.

The densities for each satellite were computed by using the area/mass ratio given in table 1. The drag coefficient C_D was taken to be 2.2 in every case. The derived values of log ρ_π are given in column 5 of table 5. The logarithms of the densities reduced to standard height are given in column 6 of the table. The reduction was made using the same model discussed above.

4. Atmospheric temperature

Nicolet (1960) has shown that the atmospheric densities derived from satellites lead to an atmospheric model in which the temperature above any given point on the globe is nearly constant at heights greater than 300 km. For such heights, then, it would appear that the temperature is a very convenient parameter to employ for a general analysis of atmospheric variations when satellites at different perigee heights are used. A good atmospheric model is needed to convert the observed densities to temperatures; Jacchia (1961b) has shown that Nicolet's 1961 model (Nicolet, 1961) yields consistent temperatures in the height interval between 350 and 700 km and should prove well suited for such purpose. Consequently, all atmospheric densities reduced to a standard perigee height were converted to temperatures by interpolation of Nicolet's table 12. The interpolation was made by least-squares fitting of a fifth-degree polynomial to the 12 asymptotic temperatures in function of log ρ. All temperatures discussed in this paper are thus Nicolet's asymptotic temperatures, which are identical with the actual perigee-height temperatures except for the lowest satellite, 1958 Alpha, for which there is a small difference when the temperatures are high (> 1500° K).

The atmospheric temperatures derived for individual satellites are given in the seventh column of table 5 and are shown synoptically in figure 1, together with the 10.7-cm solar flux and the daily geomagnetic index A_p, with which they show a close correlation (Jacchia, 1959; Priester, 1959; Jacchia, 1961a). This figure does not include the two rocket casings (1958 β1 and 1959 α2), for which the temperatures are shown in figure 2, together with those of the corresponding instrumented satellites. Figure 3, taken from an earlier paper (Jacchia and Slowey, 1962), shows the temperature variations derived from the acceleration of 1961 δ1, the 12-foot balloon satellite; the variations are presented on an expanded scale to show details that may easily be missed in figure 1. Successive passages of the satellite perigee through or near the diurnal bulge (Jacchia, 1959, 1960) appear as long-periodic waves in the temperatures of figures 1 and 2.

5. Atmospheric temperature and the solar flux; semiannual effect

A rough analysis of the nighttime temperatures T of four satellites used previously (Jacchia, 1961b) yielded a linear correlation with the 10.7-cm solar flux F_{10}, expressed in units of 10^{-22} watts/m²/cycle/sec bandwidth, in which the coefficient $dT/dF_{10}=b$ had the value 3°0. From an analysis of the temperature variations derived from 1961 δ1, we found (Jacchia and Slowey, 1962) that the characteristic "27-day" fluctuations were accounted for by $b=2.5°$ (see figs. 3 and 4). Subsequent inspection of the temperature curves in figures 1 and 2 has revealed that whenever lively temperature fluctuations in phase with the decimetric flux were present, they could be corrected to a relatively smooth curve by applying to the temperatures a correction $-2.5° \Delta F_{10}$, in which ΔF_{10} represents the difference between the observed and a standard value of the flux (see figs. 5 and 6).

If we take the atmospheric temperatures derived from satellites and reduce them all to a standard flux $F_{10}=200$ with the formula

$$T_{200}=T-2.5°(F_{10}-200), \qquad (8)$$

two important factors emerge (see figs. 7 and 8):

(1) We are left with a systematic decrease of temperature that parallels the general decrease of solar activity during the interval covered by

the observations (this is best visible in the diagram of 1958 Alpha).

The systematic decrease in temperature could be corrected taking for $b(=dT/dF_{10})$ a value around 4°.5 (all satellites; see fig, 10; a solution for 1958 Alpha alone gives 4°.2), but then the "27-day" oscillations become grossly over-corrected (see fig. 4). There is some indication that in the daytime atmosphere b may be a little larger; actually, if we assume (Jacchia, 1961b) that the temperature at the center of the diurnal bulge is 1.35 times the minimum night temperature and that 2°.5 is a mean value, we could have a nighttime b=2°.1 and a maximum daytime b=2°.9. This is not contradicted by the observations.

In any case, we are still far from the value b=4°.5 that is necessary to account for the temperature variations over a 3-year period, and we have to recognize that there is a discrepancy between the values of b as determined from oscillations of short period and from oscillations comparable in period with the solar cycle. The value b=3°.0 obtained earlier by Jacchia (1961b) turns out, in retrospect, to be the result of a compromise between the short-period and the systematic component.

(2) A semiannual oscillation appears, with maxima in early April and October. This feature had been pointed out by Paetzold and Zschörner (1960), who had called it "plasma effect," in view of its parallelism with the semiannual variation of geomagnetic activity and apparent connection with the solar wind. This semiannual oscillation can be traced with decreasing amplitude throughout the three years covered by the observations.

As has been pointed out by Nicolet (1960), the 20-cm solar-flux data published by the Heinrich-Hertz Institut in Berlin-Adlershof showed a drift, presumably of instrumental origin during the year 1958. From April to December the drift curve had, by a curious accident, almost exactly the same trend as the semiannual effect in the earth's atmosphere, with maxima in April and October and a minimum in July. This explains why some investigators (Priester, 1960; Jacchia, 1960) obtained better agreement when they used the 20-cm rather than the 10.7-cm solar flux in their analyses, which were based mainly on observations of the year 1958; their analyses, naturally, failed to reveal the semiannual effect.

TABLE 3.—*Maxima and minima of the diurnal temperature oscillation*

(a) Maxima (Day)

Satellite	Date	T'_{200}(°K)	$\overline{F}_{10}$	$\overline{T}$(°K)	$\alpha_\pi-\alpha_\odot$
1958 Alpha	1958. 7	1850°	235	1938	43°
1958 β2	1958. 9	1720	230	1795	37
1959 α1	1959. 3	1563	215	1601	29
1958 Alpha	1959. 5	1480	210	1505	35
1958 Alpha	1960. 2	1412	170	1337	22
1959 α1	1960. 6	1392	160	1292	39
1959 Eta	1960. 7	1423	155	1311	43
1958 Alpha	1961. 0	1388	140	1238	31
1958 β2	1961. 4:	1310	120	1110	--

(b) Minima (Night)

Satellite	Date	T'_{200}(°K)	$\overline{F}_{10}$	$\overline{T}$(°K)	$\alpha_\pi-\alpha_\odot$
1958 Alpha	1958. 3	1300°	235	1388°	240
1958 Alpha	1959. 1	1217	220	1267	246
1958 Alpha	1959. 9	1150	180	1100	210
1959 α1	1960. 0	1110	170	1048	185–
1958 β2	1960. 2	1105	170	1030	220–
1958 Alpha	1960. 6	1085	160	985	220
1959 α1	1961. 3	1030	115	818	--
1959 Eta	1961. 4:	1030	115	818	--

6. The diurnal bulge

The erratic ("27-day") fluctuations and the semiannual effect must be eliminated before we can obtain a clear picture of the temperature distribution around the diurnal bulge. Even so, we remain with the systematic component of the temperature variation with the solar cycle, which may cause a nonindifferent spurious asymmetry in the temperature profiles of the bulge when the perigee motion with respect to the sun is slow. Since our primary aim was the investigation of temperatures in the bulge and not their detailed profile, we have not attempted, at this stage, to apply a correction for this third effect.

The "erratic" component was corrected by means of equation (8). For the semiannual effect we assumed a sine wave with an amplitude linearly decreasing with time; the finally

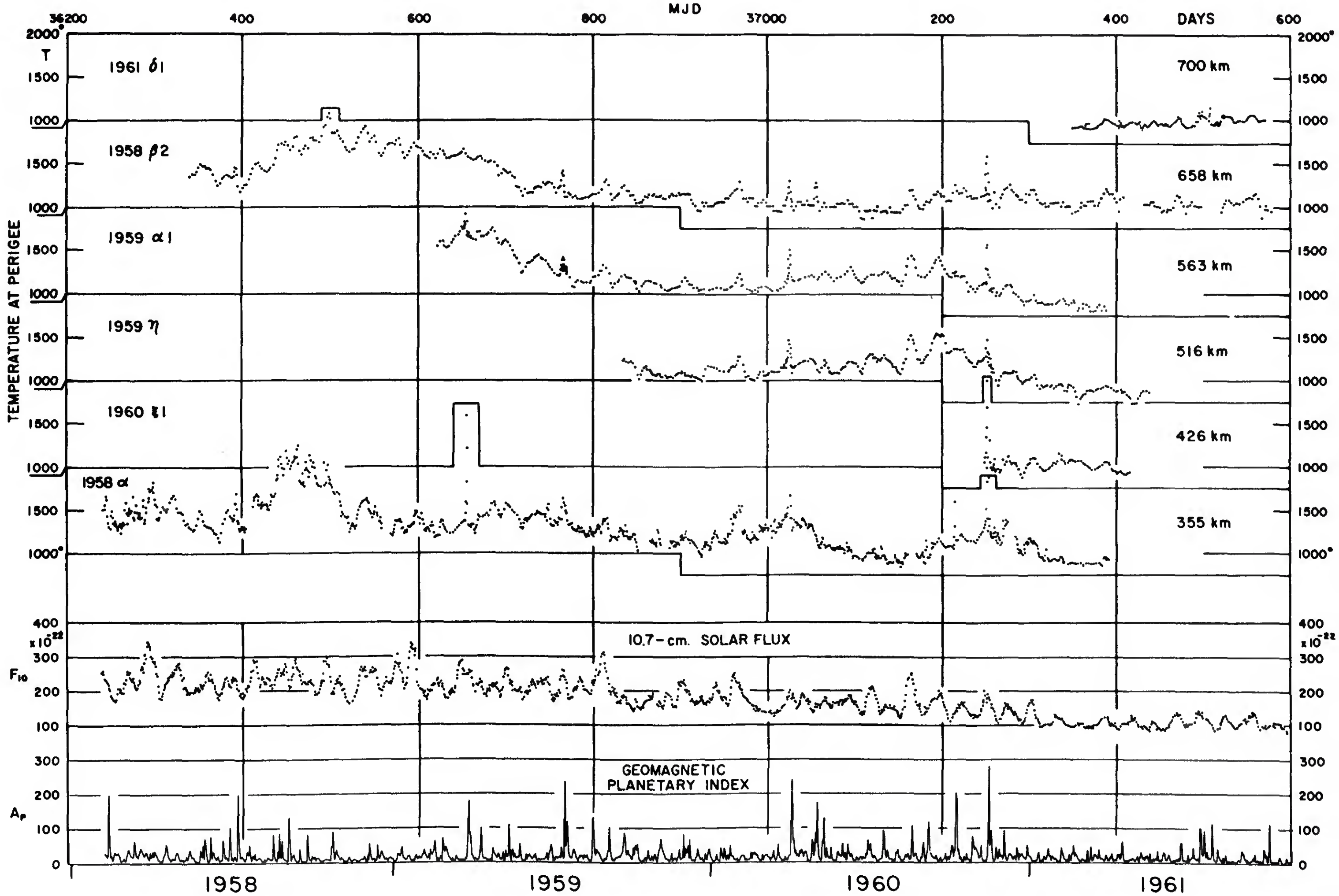


FIGURE 1.—Atmospheric temperatures (°K) derived from the drag of six satellites using Nicolet's 1961 model atmosphere. Standard perigee heights are shown at right. The 10.7-cm solar flux and the daily geomagnetic index A_p are shown for comparison.

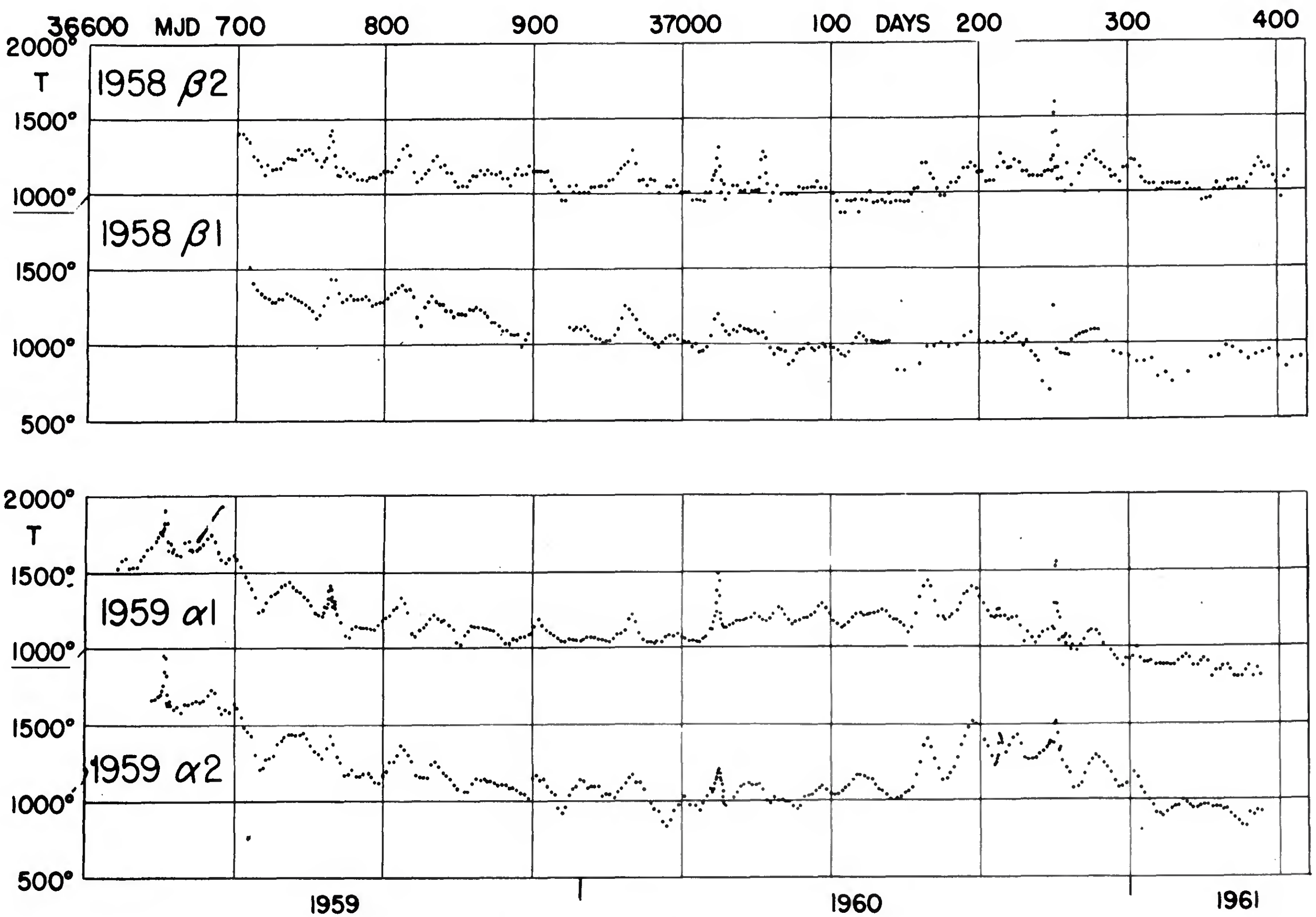


FIGURE 2.—Atmospheric temperatures (°K) derived from the drag of two rocket casings (1958 β 1 and 1959 α 2) compared with those derived from their respective spherical payloads.

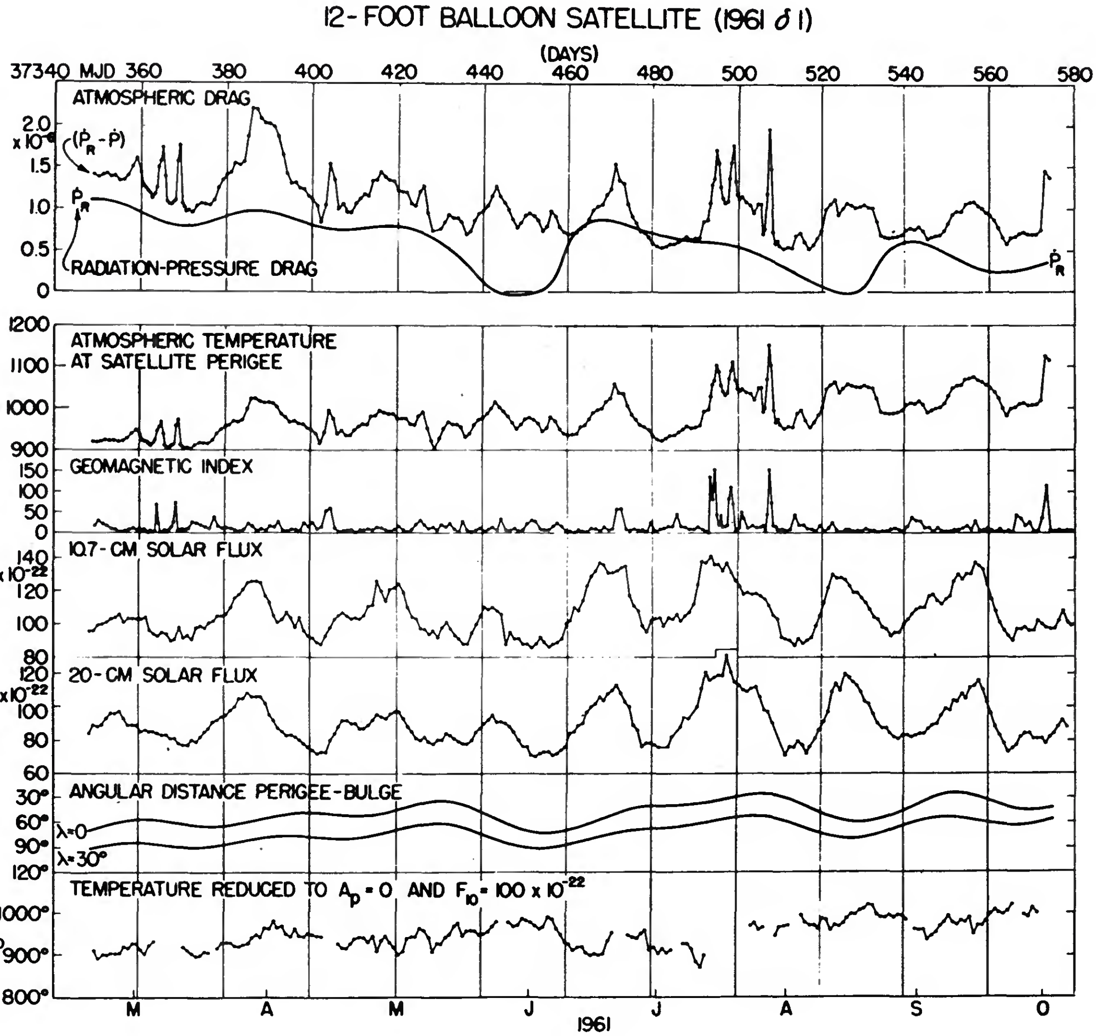


Figure 3.—Atmospheric temperature (°K) from the drag of Satellite 1961 δ1 from Jacchia and Slowey (1962). The "corrected" temperature T_{100} is computed with the formula $T_{100} = T - 2.^{\circ}5\ (F_{10} - 100) - 1.^{\circ}0\ A_p$. The angular distance ψ' of the perigee from the diurnal bulge is shown for two lag angles ($\lambda = 0^{\circ}$, and $\lambda = 30^{\circ}$).

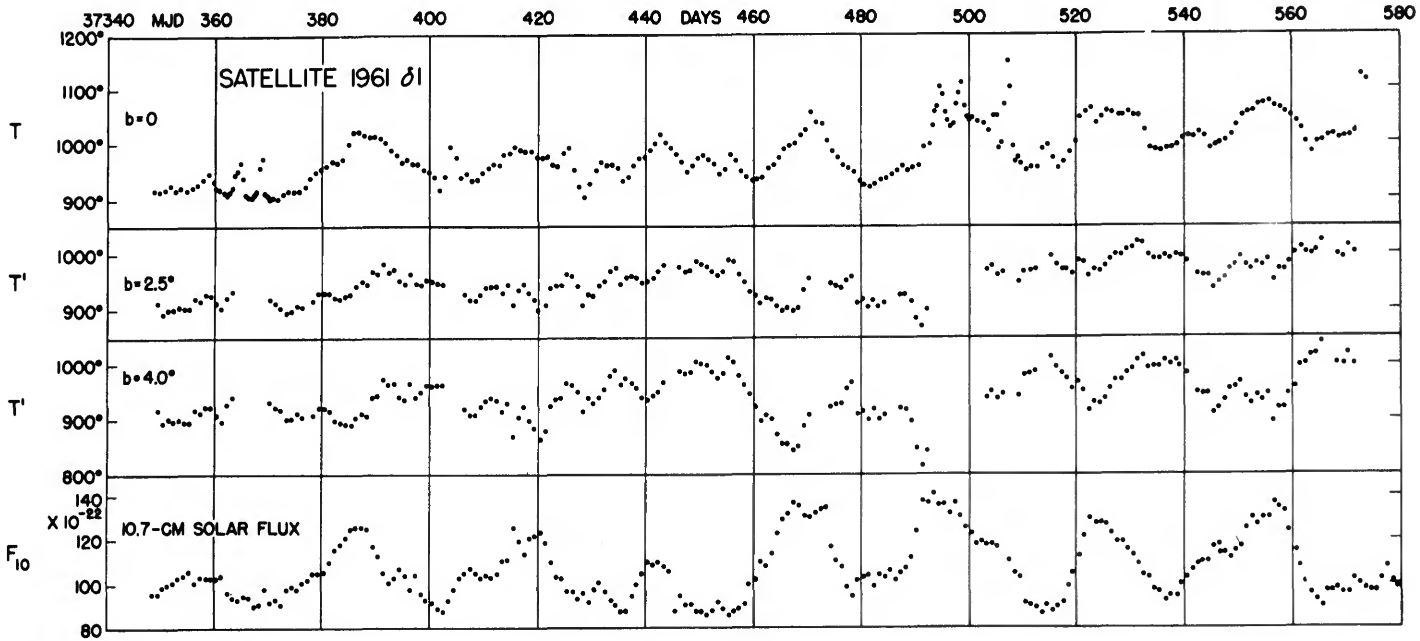


FIGURE 4.—Satellite 1961 δ 1: Atmospheric temperature (°K), uncorrected (top diagram) and corrected to a standard flux $F_{10}=100$ with b $(=dT/dF_{10})=2.^{\circ}5$ (second diagram) and $b=4.^{\circ}0$ (third diagram). With $b=4.^{\circ}0$ the "27-day" oscillations are over-corrected.

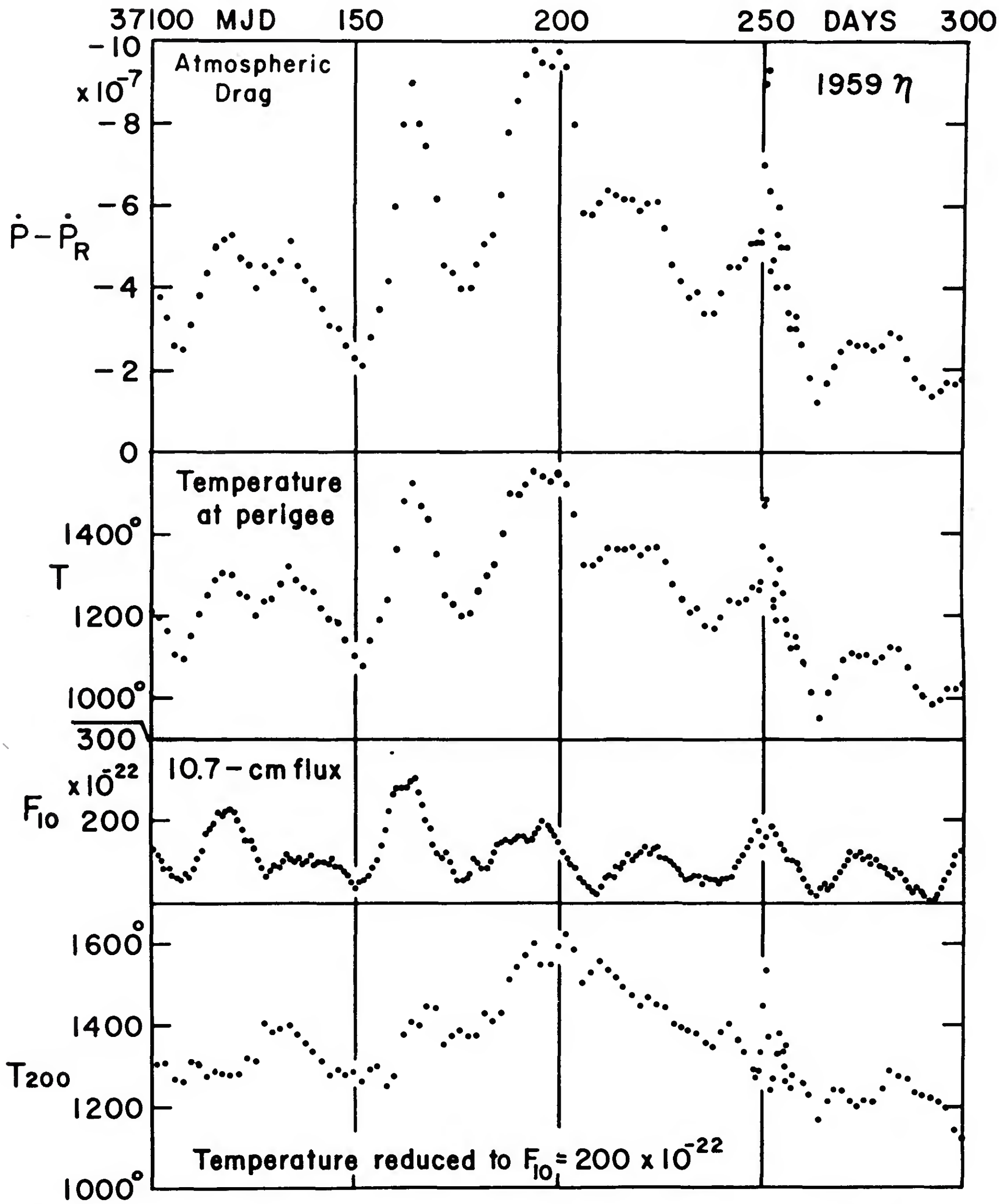


FIGURE 5.—Satellite 1959 Eta: Atmospheric drag, temperature T (°K), 10.7-cm flux F_{10} and temperature T_{200} reduced to a standard flux $F_{10}=200$ by the formula $T_{200}=T-2.^{\circ}5\ (F_{10}-200)$, during a period of lively "27-day" fluctuations. The variations after correction are mainly due to the passage of the perigee through the diurnal bulge. The perturbation at MJD 37251 corresponds to the magnetic storm of Mar. 13, 1960.

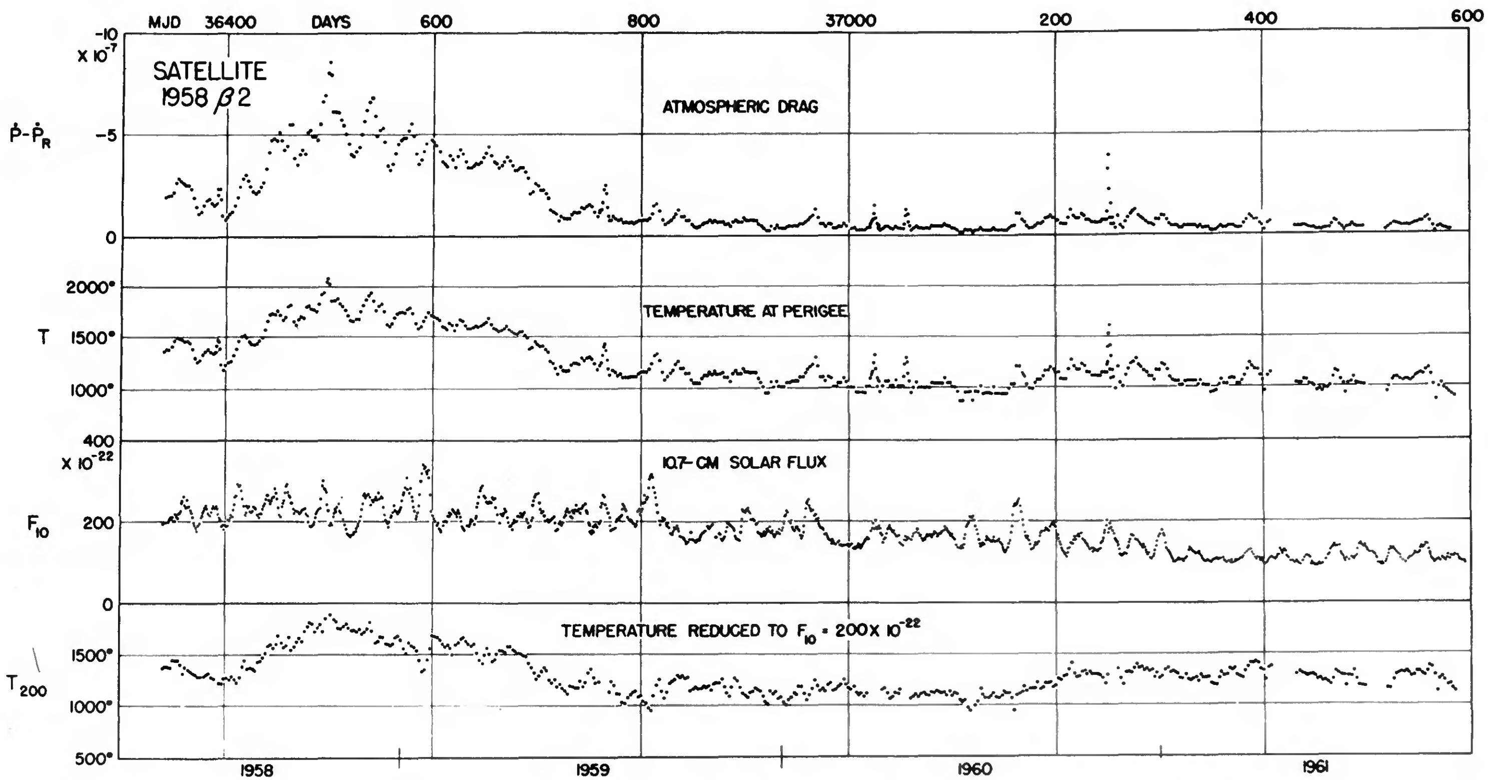


Figure 6.—Satellite 1958 β2: Atmospheric drag, temperature T (°K), 10.7-cm flux F_{10} and temperature T_{200} reduced to a standard flux $F_{10}=200$ by the formula $T_{200}=T-2.5^{\circ}(F_{10}-200)$.

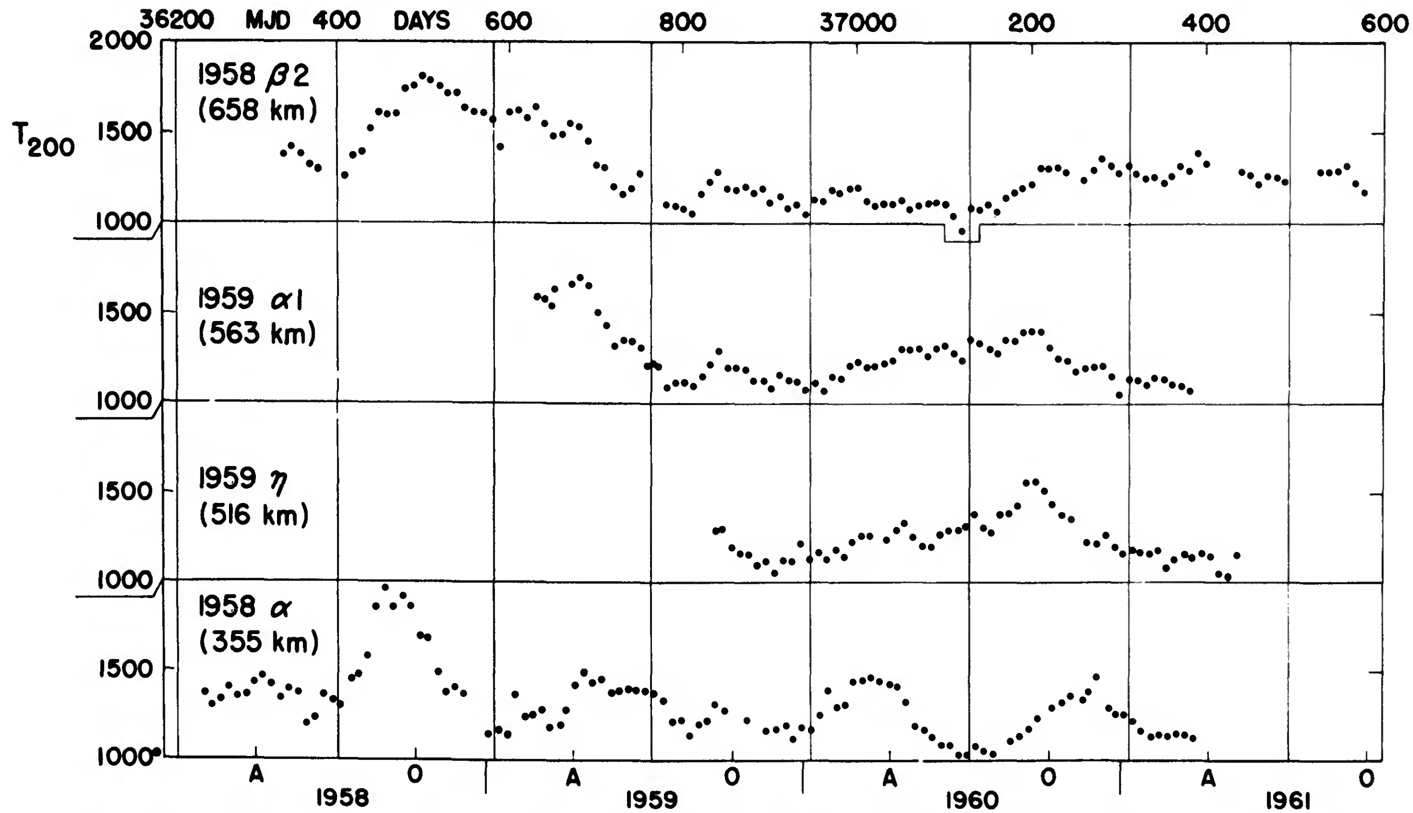


FIGURE 7.—Ten-day means of the "corrected" temperature $T_{200}=T-2{}^{\circ}\!.5\ (F_{10}-200)$ for four satellites. Notice the systematic decreasing trend, quite noticeable in 1958 Alpha. Vertical lines are drawn in correspondence with the minima (January 12 and July 13) of the semiannual oscillation.

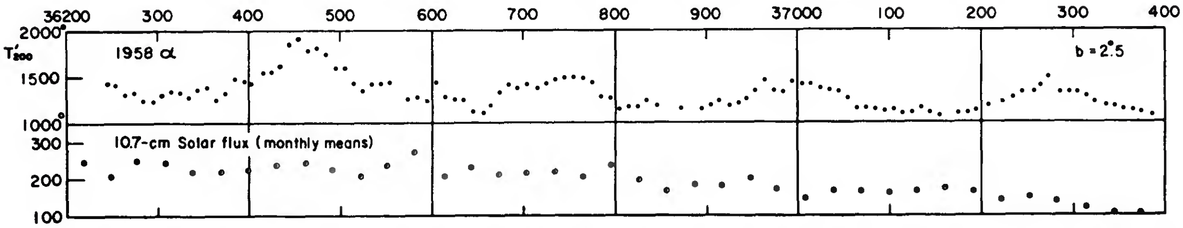
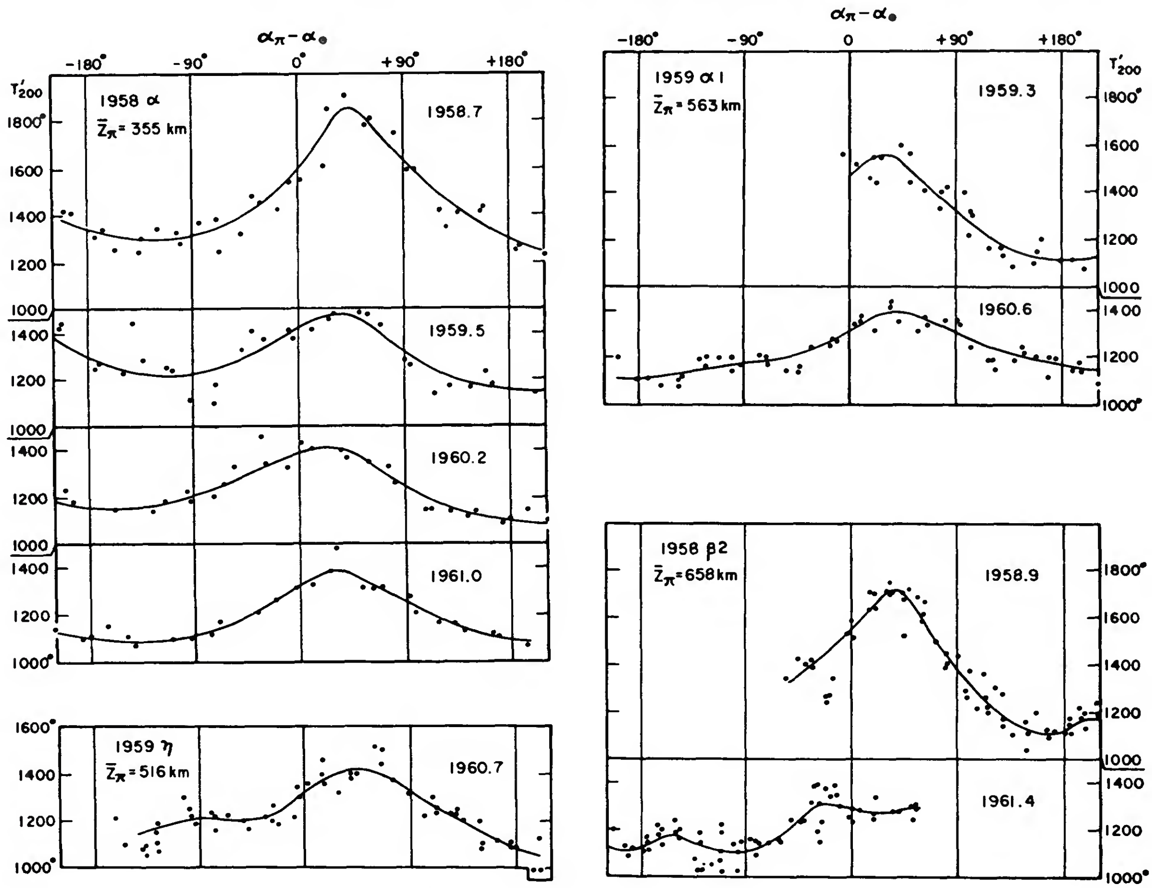


FIGURE 8.—Satellite 1958 Alpha: Atmospheric temperatures T_{200} (see legends of figs. 4, 5 and 6) corrected for the semiannual effect, compared with the monthly means of the 10.7-cm solar flux.



FIGURES 9a (left) and 9b (right).—The diurnal effect for four satellites. Temperatures T_{200}' reduced to a standard flux $F_{10}=200$ using $dT/dF=2.^{\circ}5$, and corrected for semiannual effect are plotted against the difference in R.A. between the satellite's perigee and the sun. The approximate date of the maximum of the curve is shown on the right.

corrected temperature T'_{200} was obtained from the formula

$$T'_{200}=T'_{200}-A(t)\cos[1\overset{\circ}{.}971\,(\mathrm{MJD}-36305)],\quad (9)$$

with

$$A(t)=120°-0\overset{\circ}{.}06\,(\mathrm{MJD}-36400).$$

An almost identical result could have been obtained by making the amplitude a linear function of the smoothed flux $\overline{F}_{10}$; from equation (9) and a comparison with $\overline{F}_{10}$ we find that the semiamplitude is 120° for $\overline{F}_{10}=230$, and 60° for $\overline{F}_{10}=120$.

A plot of T'_{200} against $\alpha_\pi-\alpha_\odot$, the difference in right ascension between the satellite perigee and the sun, is shown in figures 9*a* and 9*b* for four satellites. The maxima and minima of the curves of these figures are tabulated in table 3. The last column in the table gives the "reconverted" temperatures $\overline{T}$, obtained from T'_{200} by subtracting the correction to $F_{10}=200$ and using a smoothed value $\overline{F}_{10}$ of the flux ($\overline{T}=T_{200}+2\overset{\circ}{.}5\,\overline{F}_{10}$). The use of a smoothed value of F_{10} is necessary to match the smoothing that occurs in obtaining the maxima and minima from the curves of figure 9. A further cause of smoothing is the fact that T'_{200} is plotted against $\alpha_\pi-\alpha_\odot$, of which—strictly speaking—it is not a function. If the bulge approaches rotational symmetry around a vertical axis, the temperature should be a function of the angular distance ψ' from the center of the bulge. A two-dimensional mapping of isotherms around the bulge was attempted, but the material at hand proved to be insufficient, partly because of the many variables involved. The mean value of $\alpha_\pi-\alpha_\odot$ for the daytime maximum is 35°, in good agreement with previous estimates (Jacchia, 1960; Priester *et al.*, 1960). The phase angle for the nighttime minimum is harder to determine, in view of its flatness. The mean of the six values in table 3 is 220°, which differs only 5° from the antibulge meridian; no excessive significance, however, should be given to this figure. It should also be remembered that a systematic decrease in T'_{200}, such as was mentioned in section 5, would have the effect of displacing the apparent minimum toward a later hour of local time; the daytime maximum should be much less affected because of its sharpness.

7. Electromagnetic and corpuscular heating

When we plot the "reconverted" day and night temperatures of table 3 against the corresponding value of $\overline{F}_{10}$, we obtain the diagram of figure 10. A smooth curve T_N was drawn through the night temperatures (black symbols). The curve that seems to fit fairly well the daytime temperatures (open symbols) was obtained by multiplying the temperatures of the T_N curve by 1.35—the factor obtained in a previous rough analysis (Jacchia, 1961b). The scatter in the daytime temperatures is somewhat larger than in the nighttime temperatures. Part of this may be due to the fact that, because of the variations in latitude of the satellite perigee and of the bulge, the distance from the center of the bulge varies somewhat from maximum to maximum. As a consequence of this fact and of the smoothing that probably occurs in deriving atmospheric densities from these accelerations, the daytime maximum is likely to be somewhat underestimated; a value of 1.40 T_N appears to be definitely possible.

The two broken lines in figure 10 correspond to $b(=dT/dF_{10})=2\overset{\circ}{.}5$ and $5\overset{\circ}{.}0$, respectively. There seems to be little doubt that the relation between the nighttime temperatures and F_{10} is not quite linear. The average slope of the curve is $4\overset{\circ}{.}5$, or $2\overset{\circ}{.}0$ larger than the value of b that accounts for the "27-day" fluctuations.

The presence of a well-developed diurnal bulge with the base at 200 km, with a maximum temperature 35 percent higher than at night and occurring at 2 p.m. local time cannot be explained except by conduction of heat generated by the absorption of electromagnetic radiation from the sun. The height of the absorption layer points to extreme ultraviolet radiation (Hinteregger, 1961), while the stability of the wave and the magnitude of the temperature excursion indicate that this mechanism must be a dominant source of heat.

It is generally assumed that the decimetric solar flux is of thermal origin and should show a good correlation with the extreme-ultraviolet solar radiation absorbed in the upper atmosphere. The recent finding by Ward and Shapiro

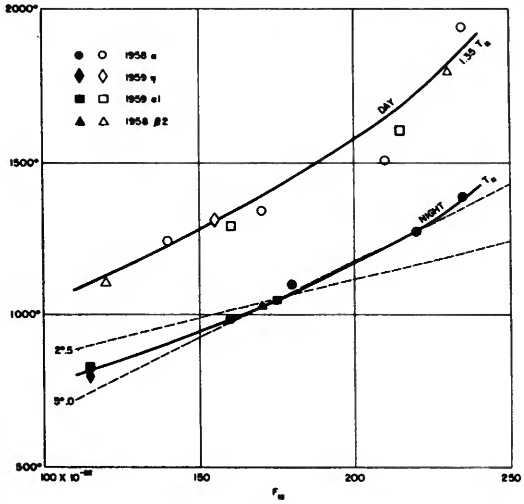


FIGURE 10.—Maxima and minima of the diurnal temperature oscillation for four satellites plotted against the 10.7-cm solar flux. The broken lines correspond to $dT/dF_{10}=2.^{\circ}5$ and $5.^{\circ}0$, respectively. The temperatures (°K) were derived from the values of T'_{200} in figure 9 by reconversion with the formula $\bar{T}=T'_{200}+2.^{\circ}5\ F_{10}$, where $\bar{F}_{10}$ is the smoothed value of F_{10} that appears in table 3.

(1962) that the correlation between F_{10} and the Greenwich sunspot areas is almost unity greatly strengthens this surmise. The fact that the coefficient b appears to be constant at around $2.^{\circ}5$ for short-period oscillations would indicate that the correlation between F_{10} and the extreme ultraviolet flux from the sun should not depart too much from linearity. The discrepancy between the value of b for short-period and long-period oscillations would then point to a supplementary source of heat, different from the ultraviolet flux that is correlated with $\bar{F}_{10}$, and variable with the general level of solar activity. Since the semiannual effect can hardly be explained in terms other than corpuscular heating, it seems natural to identify the supplementary source of heat with corpuscular radiation. The systematic decrease of temperature that is not accounted for by the factor $b=2.^{\circ}5$, and the semiannual effect with its decreasing amplitude during the years 1958–1961 are apparently two aspects of the same phenomenon—the interaction of the upper atmosphere with particles originating in a solar wind. The intensity of the solar wind apparently varies concurrently with sunspot activity, but its effect on the atmosphere is greatly smoothed out with respect to day-to-day sunspot variation; this may reflect either a more uniform corpuscular emission or a smoothing action through retention of particles in the magnetosphere.

The semiannual temperature variation in the atmosphere is in phase with the semiannual variations of several geomagnetic indices (C_i from Bartels, 1932, and Shapiro and Ward, 1960; u from Priester and Cattani, 1962; K_p from Bell and Glazer, 1958); a discussion of the theories of the effect appears in Priester and Cattani. None of these indices shows a marked variation in the mean level with the solar cycle, but this may be due to the nature of the correlation between the index and the corpuscular flux and does not constitute a disproof of the variation of the flux with the solar cycle.

That such a situation is possible is shown by the correlations between the geomagnetic index A_p and the atmospheric temperature. Values of dT/dA_p of $1.^{\circ}5$ and $1.^{\circ}0$ have been found in previous papers (Jacchia, 1961b, Jacchia and Slowey, 1962). An inspection of the several perturbations recorded in figure 1 generally confirms a value of this order of magnitude. Individual discrepancies should not be taken too seriously in view of the extreme difficulty of deriving significant satellite accelerations with a high degree of resolution. Also, it should be remembered that the interval over which the geomagnetic index is averaged should exactly match the resolution of the drag determination; this is definitely not the case of the data in figure 1, where the daily index A_p is plotted, while temperatures during magnetic storms are computed from drag with a resolution of a fraction of a day.

From Satellite 1961 δ1 we found (Jacchia and Slowey, 1962) that during moderately active days the atmospheric temperature variations could be accounted for by $\Delta T=+1.^{\circ}0A_p$. Now the index A_p, which is an exponential function of K_p, also displays the semiannual variations. The average range in the monthly means of A_p is from 13 to 21. This would correspond to a range of only 8° in the temperature, while the observed range of the semiannual effect is of the order of 100° to 250°. Clearly, this index measures the degree of magnetic *disturbance* caused by the corpuscular flux, but not the corpuscular flux itself. This seems to be the case of all geomagnetic indices.

From both the magnitude of the semiannual temperature oscillations and the systematic temperature variations with the solar cycle after corrections for the "27-day" component, it would appear that the contribution of corpuscular radiation to the heating of the upper atmosphere is quite considerable—perhaps as high as 30 percent or more.

Acknowledgments

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Abstract

Accurate accelerations during the years 1958–1961 are given for eight artificial satellites in eccentric orbits and with perigee heights between 350 and 750 km. These accelerations are obtained mainly from field-reduced Baker-Nunn observations and are corrected for the effect of solar-radiation pressure. Atmospheric densities at perigee are derived by mumerical integration of the drag equation for a rotating atmosphere by using a model atmosphere with diurnal bulge and taking account of the earth's oblateness. Atmospheric temperatures are derived from Nicolet's helium-topped, diffusion-equilibrium model with asymptotically isothermal temperature profiles (Nicolet, 1961). A preliminary analysis of these data leads to the following conclusions:

Nicolet's 1961 atmospheric model yields consistent atmospheric temperatures at all heights. The temperature at the center of the diurnal bulge is 35 to 40 percent higher than the minimum night temperature; the lag angle between the bulge and the subsolar point is about 35°.

Paetzold's semiannual effect is confirmed; it can be traced with decreasing amplitude throughout the three years covered by the observations.

The erratic ("27-day") density oscillations correspond to temperature oscillations $\Delta T = 2^{\circ}.5\ \Delta F_{10}$ where ΔF_{10} is the corresponding variation in the 10.7-cm solar flux. During magnetically disturbed days the atmospheric temperature is increased by an amount $\Delta T \approx 1^{\circ} \cdot A_p$ to $1^{\circ}.5\ A_p$ where A_p is the daily geomagnetic planetary index.

When the daily atmospheric temperatures are corrected to a standard solar flux with the relation $\Delta T = 2.5\ \Delta F_{10}$, there remains a systematic temperature decrease that roughly parallels the smoothed values of the decimetric solar flux or of the Wolf numbers. This effect could be minimized assuming that $\Delta T/\Delta F_{10} = 4.5$ instead of 2.5, but then the erratic fluctuation becomes overcorrected.

It is suggested that the systematic temperature decrease and the semiannual effect have a single underlying cause—corpuscular radiation, whose flux varies with the 11-year solar cycle. It appears that the corpuscular component in the heating of the upper atmospher is quite considerable.

TABLE 4.—*Least-squares fitting of orbital elements*

Satellite 1958 Alpha (Explorer I)

Section 1: MJD 36234 to 36320 (January 31 to April 27, 1958)

$T_o = 36240.0$

$\omega = 151^{\circ}.08 + 6^{\circ}.29510t + {}^{\circ}.0049766t^2 - {}^{\circ}.000155826t^3 + {}^{\circ}.198110 \times 10^{-5}t^4 - {}^{\circ}.85450 \times 10^{-8}t^5$

$\Omega = 322^{\circ}.62 - 4^{\circ}.22351t - {}^{\circ}.0006420t^2 + {}^{\circ}.2865 \times 10^{-5}t^3$

$i = 33^{\circ}.229 + {}^{\circ}.003238t - {}^{\circ}.00016795t^2 + {}^{\circ}.25339 \times 10^{-5}t^3 - {}^{\circ}.11388 \times 10^{-7}t^4$

$e = .13956 - .2375 \times 10^{-4}t - .1582 \times 10^{-6}t^2 + .000433 \sin (143.8 + 6.35t)$

$M = .60472 + 12.533224t + .000231164t^2 + .263064 \times 10^{-5}t^3 - .101403 \times 10^{-7}t^4$

Section 2: MJD 36300 to 36350 (April 7 to May 27, 1958)

$T_o = 36300.0$

$\omega = 172^{\circ}.09 + 6^{\circ}.36016t + {}^{\circ}.0017805t^2 + {}^{\circ}.9724 \times 10^{-5}t^3 - {}^{\circ}.142542 \times 10^{-5}t^4 + {}^{\circ}.157332 \times 10^{-7}t^5$

$\Omega = 67^{\circ}.55 - 4^{\circ}.26400t - {}^{\circ}.0006170t^2 + {}^{\circ}.3457 \times 10^{-5}t^3$

$i = 33^{\circ}.229 - {}^{\circ}.003133t + {}^{\circ}.00047432t^2 - {}^{\circ}.169582 \times 10^{-4}t^3 + {}^{\circ}.175253 \times 10^{-6}t^4$

$e = .13848 - .00016011t + .24094 \times 10^{-5}t^2 + .000525 \sin (236.4 + 6.40t)$

$M = .86317 + 12.582862t + .000289486t^2 + .522324 \times 10^{-5}t^3 - .547409 \times 10^{-7}t^4$

Section 3: MJD 36330 to 36390 (May 7 to July 6, 1958)

$T_o = 36330.0$

$\omega = 3^{\circ}.80 + 6^{\circ}.39652t + {}^{\circ}.0004396t^2 + {}^{\circ}.25 \times 10^{-7}t^3 + {}^{\circ}.160 \sin (84.0 + 6.4t)$

$\Omega = 299^{\circ}.17 - 4^{\circ}.29191t - {}^{\circ}.0002113t^2 - {}^{\circ}.432 \times 10^{-6}t^3$

$i = 33^{\circ}.230 + {}^{\circ}.008 \sin (126.0 + 6.0t)$

$e = .13630 - .335 \times 10^{-4}t - .75 \times 10^{-7}t^2 + .0004 \sin (0.0 + 6.45t)$

$M = .7058 + 12.609871t + .0003717t^2$

Section 4: MJD 36370 to 36410 (June 16 to July 26, 1958)

$T_o = 36330.0$

$\omega = 3^{\circ}.80 + 6^{\circ}.39652t + {}^{\circ}.0004396t^2 + {}^{\circ}.25 \times 10^{-7}t^3 + {}^{\circ}.160 \sin (84.0 + 6.4t)$

$\Omega = 299^{\circ}.17 - 4^{\circ}.29191t - {}^{\circ}.0002113t^2 - {}^{\circ}.432 \times 10^{-6}t^3$

$i = 33^{\circ}.230 + {}^{\circ}.008 \sin (126.0 + 6.0t)$

$e = .13630 - .335 \times 10^{-4}t - .75 \times 10^{-7}t^2 + .0004 \sin (0.0 + 6.45t)$

$M = .9008 + 12.602121t + .0004467t^2$

TABLE 4.—*Least-squares fitting of orbital elements*—Continued

Satellite 1958 Alpha

Section 5: MJD 36390 to 36460 (July 6 to September 14, 1958)

$$T_o = 36390.0$$

$$\omega = 29^\circ.35 + 6^\circ.43856t + {}^\circ.0009202t^2 - {}^\circ.3604 \times 10^{-5}t^3 + {}^\circ.140 \sin(106.2 + 6.50t)$$

$$\Omega = 40^\circ.83 - 4^\circ.32572t - {}^\circ.0001334t^2 - {}^\circ.2484 \times 10^{-5}t^3$$

$$i = 33^\circ.247 - {}^\circ.005751t + {}^\circ.00030287t^2 - {}^\circ.56559 \times 10^{-5}t^3 + {}^\circ.36060 \times 10^{-7}t^4$$

$$e = .13403 + .7959 \times 10^{-4}t - .96965 \times 10^{-5}t^2 + .222461 \times 10^{-6}t^3 - .158162 \times 10^{-8}t^4$$

$$M = .63816 + 12.655251t + .000492380t^2 - .168809 \times 10^{-5}t^3 + 285354 \times 10^{-7}t^4$$

Section 6: MJD 36440 to 36500 (August 25 to October 24, 1958)

$$T_o = 36440.0$$

$$\omega = 352^\circ.98 + 6^\circ.56021t - {}^\circ.0022617t^2 + {}^\circ.37249 \times 10^{-4}t^3 + {}^\circ.280 \sin(130.6 + 6.55t)$$

$$\Omega = 183^\circ.92 - 4^\circ.35798t - {}^\circ.0005914t^2 + {}^\circ.1207 \times 10^{-5}t^3$$

$$i = 33^\circ.235 + {}^\circ.000761t - {}^\circ.474 \times 10^{-5}t^2 - {}^\circ.5103 \times 10^{-6}t^3 + {}^\circ.5919 \times 10^{-8}t^4$$

$$e = .13173 - .84 \times 10^{-5}t - .2169 \times 10^{-5}t^2 - .1827 \times 10^{-7}t^3 + .7342 \times 10^{-9}t^4$$

$$M = .59703 + 12.705364 + .000792630t^2 + .65682 \times 10^{-6}t^3 - .171130 \times 10^{-7}t^4$$

Section 7: MJD 36480 to 36620 (October 4, 1958 to February 21, 1959)

$$T_o = 36480.0$$

$$\omega = 254^\circ.33 + 6^\circ.56013t + {}^\circ.0008934t^2 - {}^\circ.164 \times 10^{-5}t^3 + {}^\circ.250 \sin(0.0 + 6.60t)$$

$$\Omega = 8^\circ.75 - 4^\circ.40128t - {}^\circ.0004806t^2 + .587 \times 10^{-6}t^3$$

$$i = 33^\circ.225 + {}^\circ.00193t - {}^\circ.444 \times 10^{-4}t^2 + {}^\circ.281 \times 10^{-6}t^3 - {}^\circ.40 \times 10^{-9}t^4$$

$$e = .12956 - .610 \times 10^{-4}t + .113 \times 10^{-6}t^2 + .000799 \sin(213.8 + 6.65t)$$

$$M = .07420 + 12.767218t + .000787236t^2 - .223147 \times 10^{-5}t^3 + .48193 \times 10^{-8}t^4$$

Section 8: MJD 36600 to 36700 (February 1 to May 12, 1959)

$$T_o = 36602.0$$

$$\omega = 344^\circ.91 + 6^\circ.70008t + {}^\circ.0004664t^2 + {}^\circ.250 \sin(65.6 + 6.75t)$$

$$\Omega = 185^\circ.72 - 4^\circ.49884t + {}^\circ.0001513t^2 - {}^\circ.6989 \times 10^{-5}t^3 + {}^\circ.3273 \times 10^{-7}t^4$$

$$i = 33^\circ.232 - {}^\circ.002392t + {}^\circ.00026893t^2 - {}^\circ.85162 \times 10^{-5}t^3 + {}^\circ.101011 \times 10^{-6}t^4 - {}^\circ.40217 \times 10^{-9}t^5$$

$$e = .12356 - .2448 \times 10^{-4}t - .1497 \times 10^{-6}t^2 + .000538 \sin(350.4 + 6.75t)$$

$$M = .40121 + 12.896146t + .000344358t^2 + .8606 \times 10^{-7}t^3 + .54123 \times 10^{-8}t^4$$

TABLE 4.—*Least-squares fitting of orbital elements*—Continued

Satellite 1958 Alpha

Section 9: MJD 36690 to 36790 (May 2 to August 10, 1959)

$T_o = 36690.0$

$\omega = 218\overset{\circ}{.}18 + 6\overset{\circ}{.}76505t + \overset{\circ}{.}0011596t^2 - \overset{\circ}{.}3664 \times 10^{-5}t^3 + \overset{\circ}{.}258 \sin(321.6 + 6.80t)$

$\Omega = 148\overset{\circ}{.}19 - 4\overset{\circ}{.}54112t - \overset{\circ}{.}0006070t^2 + \overset{\circ}{.}2618 \times 10^{-5}t^3 - \overset{\circ}{.}1104 \times 10^{-7}t^4$

$i = 33\overset{\circ}{.}236 + \overset{\circ}{.}002482t - \overset{\circ}{.}00020991t^2 + \overset{\circ}{.}53426 \times 10^{-5}t^3 - \overset{\circ}{.}56439 \times 10^{-7}t^4 + \overset{\circ}{.}21779 \times 10^{-9}t^5$

$e = .12001 - .393 \times 10^{-4}t - .84 \times 10^{-7}t^2 + .000433 \sin(218.2 + 6.80t)$

$M = .31745 + 12.972776t + .000594211t^2 - .74597 \quad 10^{-6}t^3 + .25766 \times 10^{-8}t^4$

Section 10: MJD 36780 to 36880 (July 31 to November 8, 1959)

$T_o = 36780.0$

$\omega = 113\overset{\circ}{.}62 + 6\overset{\circ}{.}90412t + \overset{\circ}{.}0001582t^2 + \overset{\circ}{.}1694 \times 10^{-5}t^3 + \overset{\circ}{.}236 \sin(221.8 + 6.90t)$

$\Omega = 95\overset{\circ}{.}76 - 4\overset{\circ}{.}61763t - \overset{\circ}{.}0002528t^2 - \overset{\circ}{.}877 \times 10^{-6}t^3 + \overset{\circ}{.}665 \times 10^{-8}t^4$

$i = 33\overset{\circ}{.}236 + \overset{\circ}{.}00285t - \overset{\circ}{.}0001901t^2 + \overset{\circ}{.}3671 \times 10^{-5}t^3 - \overset{\circ}{.}2614 \times 10^{-7}t^4 + \overset{\circ}{.}534 \times 10^{-10}t^5$

$e = .11578 - .416 \times 10^{-4}t + .1614 \times 10^{-6}t^2 + .000408 \sin(84.9 + 6.90t)$

$M = .30816 + 13.06487t + .000421851t^2 + .2845 \times 10^{-7}t^3 - .32381 \times 10^{-8}t^4$

Section 11: MJD 36870 to 36960 (October 29, 1959 to January 27, 1960)

$T_o = 36870.0$

$\omega = 17\overset{\circ}{.}32 + 6\overset{\circ}{.}9862t - \overset{\circ}{.}0002420t^2 + \overset{\circ}{.}4189 \times 10^{-5}t^3 + \overset{\circ}{.}283 \sin(73.2 + 7.00t)$

$\Omega = 37\overset{\circ}{.}92 - 4\overset{\circ}{.}66176t - \overset{\circ}{.}000247t^2 - \overset{\circ}{.}4758 \times 10^{-5}t^3 + \overset{\circ}{.}5219 \times 10^{-7}t^4$

$i = 33\overset{\circ}{.}226 - \overset{\circ}{.}002066t + \overset{\circ}{.}00013746t^2 - \overset{\circ}{.}39438 \times 10^{-5}t^3 + \overset{\circ}{.}53225 \times 10^{-7}t^4 - \overset{\circ}{.}26398 \times 10^{-9}t^5$

$e = .11313 - .257 \times 10^{-4}t + .54 \times 10^{-8}t^2 + .000615 \sin(13.3 + 7.00t)$

$M = .69645 + 13.135149t + .000340546t^2 - .101526 \times 10^{-5}t^3 + .7283 \times 10^{-8}t^4$

Section 12: MJD 36950 to 37050 (January 17 to April 26, 1960)

$T_o = 36950.0$

$\omega = 216\overset{\circ}{.}72 + 7\overset{\circ}{.}01864t + \overset{\circ}{.}0006469t^2 - \overset{\circ}{.}969 \times 10^{-6}t^3 + \overset{\circ}{.}195 \sin(292.7 + 7.00t)$

$\Omega = 23\overset{\circ}{.}26 - 4\overset{\circ}{.}70319t - \overset{\circ}{.}0004719t^2 + \overset{\circ}{.}3200 \times 10^{-5}t^3 - \overset{\circ}{.}1966 \times 10^{-7}t^4$

$i = 33\overset{\circ}{.}235 - \overset{\circ}{.}001317t - \overset{\circ}{.}8425 \times 10^{-4}t^2 + \overset{\circ}{.}46855 \times 10^{-5}t^3 - \overset{\circ}{.}66338 \times 10^{-7}t^4 + \overset{\circ}{.}28955 \times 10^{-9}t^5$

$e = .11088 - .356 \times 10^{-4}t - .72 \times 10^{-7}t^2 + .000396 \sin(225.1 + 7.00t)$

$M = .46466 + 13.184133t + .000531970t^2 - .145739 \times 10^{-5}t^3 + .96676 \times 10^{-8}t^4$

TABLE 4.—*Least-squares fitting of orbital elements*—Continued

Satellite 1958 Alpha

Section 13: MJD 37040 to 37080 (April 16 to May 26, 1960)

$$T_o = 37040.0$$

$$\omega = 132^{\circ}.82 + 7^{\circ}.13096t + {}^{\circ}.0002731t^2 + {}^{\circ}.306 \sin(220.7 + 7.10t)$$

$$\Omega = 317^{\circ}.09 - 4^{\circ}.75707t - {}^{\circ}.0010212t^2 + {}^{\circ}.14185 \times 10^{-4}t^3 - {}^{\circ}.8054 \times 10^{-7}t^4$$

$$i = 33^{\circ}.225 - {}^{\circ}.000866t + {}^{\circ}.2237 \times 10^{-4}t^2 - {}^{\circ}.1808 \times 10^{-6}t^3$$

$$e = .10756 - .827 \times 10^{-4}t + .925 \times 10^{-6}t^2 + .000802 \sin(172.9 + 7.10t)$$

$$M = .92460 + 13.272977t + .00060704t^2 - .724944 \times 10^{-5}t^3 + .640250 \times 10^{-7}t^4$$

Section 14: MJD 37070 to 37110 (May 16 to June 25, 1960)

$$T_o = 37040.0$$

$$\omega = 132^{\circ}.82 + 7^{\circ}.13096t + {}^{\circ}.0002731t^2 + {}^{\circ}.306 \sin(220.7 + 7.10t)$$

$$\Omega = 317^{\circ}.09 - 4^{\circ}.75707t - {}^{\circ}.0010212t^2 + {}^{\circ}.14185 \times 10^{-4}t^3 - {}^{\circ}.8054 \times 10^{-7}t^4$$

$$i = 33^{\circ}.225 - {}^{\circ}.000866t + {}^{\circ}.2237 \times 10^{-4}t^2 - {}^{\circ}.1808 \times 10^{-6}t^3$$

$$e = .10756 - .827 \times 10^{-4}t + .925 \times 10^{-6}t^2 + .000802 \sin(172.9 + 7.10t)$$

$$M = .88592 + 13.278701t + .000285528t^2 + .73403 \times 10^{-6}t^3 - .89250 \times 10^{-8}t^4$$

Section 15: MJD 37100 to 37150 (June 15 to August 4, 1960)

$$T_o = 37100.0$$

$$\omega = 201^{\circ}.53 + 7^{\circ}.17009t + {}^{\circ}.0001803t^2 + {}^{\circ}.345 \sin(295.8 + 7.14t)$$

$$\Omega = 30^{\circ}.04 - 4^{\circ}.80282t - {}^{\circ}.318 \times 10^{-4}t^2 - {}^{\circ}.1530 \times 10^{-5}t^3 + {}^{\circ}.683 \times 10^{-8}t^4$$

$$i = 33^{\circ}.225 - {}^{\circ}.001153t + {}^{\circ}.2275 \times 10^{-4}t^2 - {}^{\circ}.1212 \times 10^{-6}t^3$$

$$e = .10571 - .231 \times 10^{-4}t + .12 \times 10^{-7}t^2 + .000730 \sin(183.5 + 7.14t)$$

$$M = .67936 + 13.313844t + .000105937t^2 + .350594 \times 10^{-5}t^3 - .37232 \times 10^{-7}t^4$$

Section 16: MJD 37140 to 37200 (July 25 to September 23, 1960)

$$T_o = 37100.0$$

$$\omega = 201^{\circ}.53 + 7^{\circ}.17009t + {}^{\circ}.0001803t^2 + {}^{\circ}.345 \sin(295.8 + 7.14t)$$

$$\Omega = 30^{\circ}.04 - 4^{\circ}.80282t - {}^{\circ}.318 \times 10^{-4}t^2 - {}^{\circ}.1530 \times 10^{-5}t^3 + {}^{\circ}.683 \times 10^{-8}t^4$$

$$i = 33^{\circ}.225 - {}^{\circ}.001153t + {}^{\circ}.2275 \times 10^{-4}t^2 - {}^{\circ}.1212 \times 10^{-6}t^3$$

$$e = .10571 - .231 \times 10^{-4}t + .12 \times 10^{-7}t^2 + .000730 \sin(183.5 + 7.14t)$$

$$M = .56186 + 13.319318t + .000126403t^2 - .28692 \times 10^{-6}t^3 + .54314 \times 10^{-8}t^4$$

TABLE 4.—*Least-squares fitting of orbital elements*—Continued

Satellite 1958 Alpha

Section 17: MJD 37190 to 37264 (September 13 to November 26, 1960)

$$T_o = 37190.0$$

$$\omega = 128^{\circ}.30 + 7^{\circ}.19891t + {}^{\circ}.0005327t^2 + {}^{\circ}.302 \sin(222.2 + 7.15t)$$

$$\Omega = 316^{\circ}.88 - 4^{\circ}.82576t - {}^{\circ}.0002680t^2 - {}^{\circ}.904 \times 10^{-6}t^3 + {}^{\circ}.585 \times 10^{-8}t^4$$

$$i = 33^{\circ}.219 - {}^{\circ}.94 \times 10^{-5}t - {}^{\circ}.1479 \times 10^{-4}t^2 + {}^{\circ}.2177 \times 10^{-6}t^3$$

$$e = .10400 - .357 \times 10^{-4}t - .41 \times 10^{-7}t^2 + .000517 \sin(137.4 + 7.15t)$$

$$M = .46964 + 13.351440t + .000290359t^2 + .110290 \times 10^{-5}t^3 - .3992 \times 10^{-9}t^4$$

Section 18: MJD 37250 to 37294 (November 12 to December 26, 1960)

$$T_o = 37250.0$$

$$\omega = 202^{\circ}.00 + 7^{\circ}.27135t + {}^{\circ}.0003765t^2 + {}^{\circ}.214 \sin(312.7 + 7.25t)$$

$$\Omega = 26^{\circ}.25 - 4^{\circ}.86242t - {}^{\circ}.0003337t^2 - {}^{\circ}.2417 \times 10^{-5}t^3 + {}^{\circ}.3443 \times 10^{-7}t^4$$

$$i = 33^{\circ}.212 + {}^{\circ}.0079 \sin(6.4 + 7.25t)$$

$$e = .10160 - .352 \times 10^{-4}t - .22 \times 10^{-8}t^2 + .000438 \sin(200.1 + 7.25t)$$

$$M = .82983 + 13.400477t + .000205761t^2 + .934307 \times 10^{-5}t^3 - .1058704 \times 10^{-6}t^4$$

Section 19: MJD 37284 to 37330 (December 16, 1960 to January 31, 1961)

$$T_o = 37250.0$$

$$\omega = 202^{\circ}.00 + 7^{\circ}.27135t + {}^{\circ}.0003765t^2 + {}^{\circ}.214 \sin(312.7 + 7.25t)$$

$$\Omega = 26^{\circ}.25 - 4^{\circ}.86242t - {}^{\circ}.0003337t^2 - {}^{\circ}.2417 \times 10^{-5}t^3 + {}^{\circ}.3443 \times 10^{-7}t^4$$

$$i = 33^{\circ}.212 + {}^{\circ}.0079 \sin(6.4 + 7.25t)$$

$$e = .10160 - .352 \times 10^{-4}t - .22 \times 10^{-8}t^2 + .000438 \sin(200.1 + 7.25t)$$

$$M = .85199 + 13.395097t + .000612354t^2 - .215150 \times 10^{-5}t^3 + .21260 \times 10^{-8}t^4$$

Section 20: MJD 37320 to 37360 (January 21 to March 2, 1961)

$$T_o = 37300.0$$

$$\omega = 206^{\circ}.81 + 7^{\circ}.27762t + {}^{\circ}.0012135t^2 - {}^{\circ}.7454 \times 10^{-5}t^3 + {}^{\circ}.264 \sin(292.2 + 7.35t)$$

$$\Omega = 142^{\circ}.13 - 4^{\circ}.87890t - {}^{\circ}.0009391t^2 + {}^{\circ}.11918 \times 10^{-4}t^3 - {}^{\circ}.5980 \times 10^{-7}t^4$$

$$i = 33^{\circ}.208 + {}^{\circ}.0046 \sin(313.9 + 7.35t)$$

$$e = .09951 - .34 \times 10^{-5}t - .145 \times 10^{-6}t^2 + .000451 \sin(200.9 + 7.35t)$$

$$M = .83496 + 13.448332t - .8233 \times 10^{-5}t^2 + .420221 \times 10^{-5}t^3 - .320953 \times 10^{-7}t^4$$

TABLE 4.—*Least-squares fitting of orbital elements*—Continued

Satellite 1958 Alpha

Section 21: MJD 37350 to 37390 (February 20 to April 1, 1961)

$T_o = 37300.0$

$\omega = 206^\circ.81 + 7^\circ.27762t + {}^\circ.00012135t^2 - {}^\circ.7454 \times 10^{-5}t^3 + {}^\circ.264 \sin(292.2 + 7.35t)$

$\Omega = 142^\circ.13 - 4^\circ.87890t - {}^\circ.0009391t^2 + {}^\circ.11918 \times 10^{-4}t^3 - {}^\circ.5980 \times 10^{-7}t^4$

$i = 33^\circ.208 + {}^\circ.0046 \sin(313.9 + 7.35t)$

$e = .09951 - .34 \times 10^{-5}t - .145 \times 10^{-6}t^2 + .000451 \sin(200.9 + 7.35t)$

$M = .85067 + 13.443176t + .000280796t^2 - .158737 \times 10^{-5}t^3 + .68249 \times 10^{-8}t^4$

Satellite 1958 β1 (Vanguard I Rocket)

Section 1: MJD 36706 to 36784 (May 18 to August 4, 1959)

$T_o = 36706.0$

$\omega = 95^\circ.65 + 4^\circ.15287t - {}^\circ.499 \times 10^{-4}t^2 + {}^\circ.140 \sin(155.4 + 4.148t)$

$\Omega = 24^\circ.20 - 2^\circ.840t - {}^\circ.0001490t^2 + {}^\circ.3806 \times 10^{-5}t^3 - {}^\circ.275 \times 10^{-7}t^4$

$i = 34^\circ.267 - {}^\circ.001065t + {}^\circ.0001064t^2 - {}^\circ.3040 \times 10^{-5}t^3 + {}^\circ.34497 \times 10^{-7}t^4 - {}^\circ.1414 \times 10^{-9}t^5$

$e = .20721 - .1191 \times 10^{-4}t + .178 \times 10^{-6}t^2 + .000336 \sin(81.9 + 4.15t)$

$M = .97950 + 10.397531t + .88149 \times 10^{-5}t^2$

Section 2: MJD 36766 to 36844 (July 27 to October 3, 1959)

$T_o = 36766.0$

$\omega = 344^\circ.58 + 4^\circ.15441t - {}^\circ.588 \times 10^{-4}t^2 + {}^\circ.181 \sin(82.8 + 4.15t)$

$\Omega = 213^\circ.73 - 2^\circ.84565t + {}^\circ.0002082t^2 - {}^\circ.4163 \times 10^{-5}t^3 + {}^\circ.2524 \times 10^{-7}t^4$

$i = 34^\circ.268 - {}^\circ.001260t + {}^\circ.6050 \times 10^{-4}t^2 - {}^\circ.1105 \times 10^{-5}t^3 + {}^\circ.1114 \times 10^{-7}t^4 - {}^\circ.506 \times 10^{-10}t^5$

$e = .20677 + .2339 \times 10^{-4}t - .264 \times 10^{-6}t^2 + .000449 \sin(14.8 + 4.15t)$

$M = .86303 + 10.39857t + .9822 \times 10^{-5}t^2$

Section 3: MJD 36826 to 36904 (September 15 to December 2, 1959)

$T_o = 36826.0$

$\omega = 233^\circ.67 + 4^\circ.13987t + {}^\circ.0001733t^2 + {}^\circ.213 \sin(329.0 + 4.15t)$

$\Omega = 43^\circ.16 - 2^\circ.84167t + {}^\circ.205 \times 10^{-4}t^2 - {}^\circ.2187 \times 10^{-5}t^3 + {}^\circ.2365 \times 10^{-7}t^4$

$i = 34^\circ.270 + {}^\circ.002999t - {}^\circ.0002460t^2 + {}^\circ.746 \times 10^{-5}t^3 - {}^\circ.1035 \times 10^{-6}t^4 + {}^\circ.533 \times 10^{-9}t^5$

$e = .20681 + .4426 \times 10^{-4}t - .681 \times 10^{-6}t^2 + .000719 \sin(179.2 + 4.15t)$

$M = .81233 + 10.39985t + .5953 \times 10^{-5}t^2$

TABLE 4.—*Least-squares fitting of orbital elements*—Continued

Satellite 1958 β1

Section 4: MJD 36886 to 36984 (November 14, 1959 to February 20, 1960)

$T_o = 36886.0$

$\omega = 122^{\circ}.41 + 4^{\circ}.16598t - {}^{\circ}.0001507t^2 + {}^{\circ}.066 \sin(62.0 + 4.15t)$

$\Omega = 232^{\circ}.54 - 2^{\circ}.83122t - {}^{\circ}.0004928t^2 + {}^{\circ}.6776 \times 10^{-5}t^3 - {}^{\circ}.301 \times 10^{-7}t^4$

$i = 34^{\circ}.242 - {}^{\circ}.000184t + {}^{\circ}.807 \times 10^{-4}t^2 - {}^{\circ}.2135 \times 10^{-5}t^3 + {}^{\circ}.2058 \times 10^{-7}t^4 - {}^{\circ}.6889 \times 10^{-10}$

$e = .20658 + .5211 \times 10^{-4}t - .562 \times 10^{-6}t^2 + .000870 \sin(50.2 + 4.15t)$

$M = .82587 + 10.4005t + .47756 \times 10^{-5}t^2$

Section 5: MJD 36966 to 37064 (February 2 to May 10, 1960)

$T_o = 36966.0$

$\omega = 94^{\circ}.79 + 4^{\circ}.15013t + {}^{\circ}.200 \times 10^{-4}t^2 + {}^{\circ}.114 \sin(207.3 + 4.15t)$

$\Omega = 5^{\circ}.15 - 2^{\circ}.8440t + {}^{\circ}.312 \times 10^{-4}t^2 - {}^{\circ}.516 \times 10^{-6}t^3 + {}^{\circ}.265 \times 10^{-8}t^4$

$i = 34^{\circ}.264 + {}^{\circ}.000662t - {}^{\circ}.645 \times 10^{-4}t^2 + {}^{\circ}.2097 \times 10^{-5}t^3 - {}^{\circ}.2699 \times 10^{-7}t^4 + {}^{\circ}.1188 \times 10^{-9}t^5$

$e = .20681 + .144 \times 10^{-5}t - .234 \times 10^{-7}t^2 + .000527 \sin(93.0 + 4.15t)$

$M = .89750 + 10.40129t + .272 \times 10^{-5}t^2$

Section 6: MJD 37046 to 37144 (April 22 to July 29, 1960)

$T_o = 37046.0$

$\omega = 66^{\circ}.90 + 4^{\circ}.15353t - {}^{\circ}.89 \times 10^{-5}t^2 + {}^{\circ}.080 \sin(173.8 + 4.15t)$

$\Omega = 137^{\circ}.67 - 2^{\circ}.84347t - {}^{\circ}.370 \times 10^{-4}t^2 + {}^{\circ}.1122 \times 10^{-5}t^3 - {}^{\circ}.761 \times 10^{-8}t^4$

$i = 34^{\circ}.259 + {}^{\circ}.000496t - {}^{\circ}.913 \times 10^{-5}t^2 + {}^{\circ}.385 \times 10^{-6}t^3 - {}^{\circ}.741 \times 10^{-8}t^4 + {}^{\circ}.396 \times 10^{-10}t^5$

$e = .20694 - .814 \times 10^{-5}t + .876 \times 10^{-7}t^2 + .000416 \sin(73.4 + 4.15t)$

$M = .01813 + 10.40177t + .1153 \times 10^{-5}t^2$

Section 7: MJD 37126 to 37224 (July 11 to October 17, 1960)

$T_o = 37126.0$

$\omega = 39^{\circ}.13 + 4^{\circ}.14903t + {}^{\circ}.328 \times 10^{-4}t^2 + {}^{\circ}.114 \sin(139.8 + 4.15t)$

$\Omega = 270^{\circ}.23 - 2^{\circ}.8460t + {}^{\circ}.897 \times 10^{-4}t^2 - {}^{\circ}.1286 \times 10^{-5}t^3 + {}^{\circ}.616 \times 10^{-8}t^4$

$i = 34^{\circ}.262 - {}^{\circ}.000624t + {}^{\circ}.317 \times 10^{-4}t^2 - {}^{\circ}.3968 \times 10^{-6}t^3 + {}^{\circ}.1436 \times 10^{-8}t^4$

$e = .20704 - .1226 \times 10^{-4}t + .1400 \times 10^{-6}t^2 + .000411 \sin(23.2 + 4.15t)$

$M = .16753 + 10.40194t + .4942 \times 10^{-6}t^2$

TABLE 4.—*Least-squares fitting of orbital elements*—Continued

Satellite 1958 β1

Section 8: MJD 37206 to 37288 (September 29 to December 20, 1960)

$T_o = 37206.0$

$\omega = 11^{\circ}.26 + 4^{\circ}.15212t - {}^{\circ}.76 \times 10^{-5}t^2 + {}^{\circ}.134 \sin(100.3 + 4.15t)$

$\Omega = 42^{\circ}.72 - 2^{\circ}.84336t - {}^{\circ}.795 \times 10^{-4}t^2 + {}^{\circ}.2009 \times 10^{-5}t^3 - {}^{\circ}.1378 \times 10^{-7}t^4$

$i = 34^{\circ}.269 + {}^{\circ}.000106t - {}^{\circ}.4325 \times 10^{-4}t^2 + {}^{\circ}.18605 \times 10^{-5}t^3 - {}^{\circ}.26193 \times 10^{-7}t^4 + {}^{\circ}.1177 \times 10^{-9}t^5$

$e = .20721 - .1474 \times 10^{-4}t + .1820 \times 10^{-6}t^2 + .000505 \sin(345.9 + 4.15t)$

$M = .32575 + 10.40208t + .200 \times 10^{-7}t^2$

Section 9: MJD 37268 to 37360 (November 30, 1960 to March 2, 1961)

$T_o = 37268.0$

$\omega = 268^{\circ}.69 + 4^{\circ}.14983t + {}^{\circ}.260 \times 10^{-4}t^2 + {}^{\circ}.126 \sin(339.4 + 4.18t)$

$\Omega = 226^{\circ}.39 - 2^{\circ}.84056t - {}^{\circ}.0001850t^2 + {}^{\circ}.2972 \times 10^{-5}t^3 - {}^{\circ}.1458 \times 10^{-7}t^4$

$i = 34^{\circ}.272 - {}^{\circ}.000282t + {}^{\circ}.365 \times 10^{-5}t^2 + {}^{\circ}.0067 \sin(128.5 + 4.15t)$

$e = .20700 - .20 \times 10^{-5}t + .19 \times 10^{-7}t^2 + .000478 \sin(261.5 + 4.15t)$

$M = .25405 + 10.402171t - .535 \times 10^{-6}t^2$

Section 10: MJD 37340 to 37420 (February 10 to May 1, 1961)

$T_o = 37340.0$

$\omega = 207^{\circ}.69 + 4^{\circ}.14491t + {}^{\circ}.813 \times 10^{-4}t^2 + {}^{\circ}.170 \sin(289.6 + 4.18t)$

$\Omega = 21^{\circ}.65 - 2^{\circ}.84628t + {}^{\circ}.0001726t^2 - {}^{\circ}.3477 \times 10^{-5}t^3 + {}^{\circ}.2101 \times 10^{-7}t^4$

$i = 34^{\circ}.273 - {}^{\circ}.000331t + {}^{\circ}.332 \times 10^{-5}t^2 + {}^{\circ}.0116 \sin(31.2 + 4.15t)$

$e = .20743 - .348 \times 10^{-4}t + .388 \times 10^{-6}t^2 + .000602 \sin(233.4 + 4.15t)$

$M = .20771 + 10.402025t - .292 \times 10^{-6}t^2$

Satellite 1958 β2 (Vanguard I)

Section 1: MJD 36338 to 36450 (May 15 to September 4, 1958)

$T_o = 36338.0$

$\omega = 25^{\circ}.73 + 4^{\circ}.401592t + {}^{\circ}.233 \times 10^{-5}t^2 + {}^{\circ}.1462 \sin(119.4 + 4.41t)$

$\Omega = 337^{\circ}.70 - 3^{\circ}.013460t + {}^{\circ}.501 \times 10^{-5}t^2 + {}^{\circ}.1937 \times 10^{-6}t^3 - {}^{\circ}.2248 \times 10^{-8}t^4$

$i = 34^{\circ}.242 - {}^{\circ}.001748t + {}^{\circ}.8181 \times 10^{-4}t^2 - {}^{\circ}.11257 \times 10^{-5}t^3 + {}^{\circ}.4787 \times 10^{-8}t^4$

$e = .19031 - .661 \times 10^{-5}t + .311 \times 10^{-7}t^2 + .000475 \sin(32.5 + 4.41t)$

$M = .15127 + 10.724511t + .10197 \times 10^{-4}t^2$

TABLE 4.—*Least-squares fitting of orbital elements*—Continued

Satellite 1958 $\beta 2$

Section 2: MJD 36430 to 36600 (August 15, 1958 to February 1, 1959)

$T_o = 36430.0$

$\omega = 70^\circ.72 + 4^\circ.401259t + {}^\circ.2924 \times 10^{-4}t^2 + {}^\circ.1244 \sin(176.5 + 4.41t)$

$\Omega = 60^\circ.48 - 3^\circ.013786t + {}^\circ.2723 \times 10^{-4}t^2 - {}^\circ.4610 \times 10^{-6}t^3 + {}^\circ.1383 \times 10^{-8}t^4$

$i = 34^\circ.254 - {}^\circ.003237t + {}^\circ.00017840t^2 - {}^\circ.34329 \times 10^{-5}t^3 + {}^\circ.28194 \times 10^{-7}t^4 - {}^\circ.9692 \times 10^{-10}t^5$
$+ {}^\circ.1012 \times 10^{-12}t^6$

$e = .19008 - .864 \times 10^{-5}t + .479 \times 10^{-7}t^2 + .000418 \sin(67.6 + 4.41t)$

$M = .89441 + 10.725962t + .30401 \times 10^{-4}t^2$

Section 3: MJD 36580 to 36770 (January 12 to July 21, 1959)

$T_o = 36580.0$

$\omega = 11^\circ.54 + 4^\circ.410607t + {}^\circ.846 \times 10^{-5}t^2 + {}^\circ.1436 \sin(104.1 + 4.41t)$

$\Omega = 328^\circ.20 - 3^\circ.021232t + {}^\circ.4059 \times 10^{-4}t^2 - {}^\circ.4299 \times 10^{-6}t^3 + {}^\circ.1143 \times 10^{-8}t^4$

$i = 34^\circ.248 - {}^\circ.000585t + {}^\circ.3550 \times 10^{-4}t^2 - {}^\circ.5974 \times 10^{-6}t^3 + {}^\circ.3853 \times 10^{-8}t^4 - {}^\circ.859 \times 10^{-11}t^5$

$e = .18986 + .73 \times 10^{-6}t - .44 \times 10^{-8}t^2 + .000422 \sin(12.9 + 4.41t)$

$M = .47652 + 10.734724t + .31332 \times 10^{-4}t^2 - .4820 \times 10^{-7}t^3$

Section 4: MJD 36750 to 36920 (July 1 to December 18, 1959)

$T_o = 36750.0$

$\omega = 41^\circ.54 + 4^\circ.415910t - {}^\circ.342 \times 10^{-6}t^2 + {}^\circ.1417 \sin(135.2 + 4.41t)$

$\Omega = 174^\circ.61 - 3^\circ.019931t - {}^\circ.8363 \times 10^{-4}t^2 + {}^\circ.8283 \times 10^{-6}t^3 - {}^\circ.2618 \times 10^{-8}t^4$

$i = 34^\circ.249 - {}^\circ.004581t + {}^\circ.00021120t^2 - {}^\circ.33295 \times 10^{-5}t^3 + {}^\circ.21697 \times 10^{-7}t^4 - {}^\circ.5007 \times 10^{-10}t^5$

$e = .18971 - .119 \times 10^{-5}t + .103 \times 10^{-7}t^2 + .000543 \sin(43.5 + 4.41t)$

$M = .04624 + 10.741281t + .4751 \times 10^{-5}t^2$

Section 5: MJD 36900 to 37050 (November 28, 1959 to April 26, 1960)

$T_o = 36900.0$

$\omega = 343^\circ.91 + 4^\circ.415918t - {}^\circ.159 \times 10^{-5}t^2 + {}^\circ.1182 \sin(91.4 + 4.41t)$

$\Omega = 81^\circ.25 - 3^\circ.030302t + {}^\circ.00020248t^2 - {}^\circ.20063 \times 10^{-5}t^3 + {}^\circ.6323 \times 10^{-8}t^4$

$i = 34^\circ.262 - {}^\circ.002214t + {}^\circ.00010472t^2 - {}^\circ.18020 \times 10^{-5}t^3 + {}^\circ.12488 \times 10^{-7}t^4 - {}^\circ.2974 \times 10^{-10}t^5$

$e = .18969 + .154 \times 10^{-5}t - .104 \times 10^{-7}t^2 + .000384 \sin(346.9 + 4.41t)$

$M = .34471 + 10.742689t + .2167 \times 10^{-5}t^2$

TABLE 4.—*Least-squares fitting of orbital elements*—Continued

Satellite 1958 β2

Section 6: MJD 37030 to 37144 (April 6 to July 29, 1960)

$$T_o = 37030.0$$

$$\omega = 197^{\circ}.97 + 4^{\circ}.415768t + {}^{\circ}.213 \times 10^{-5}t^2 + {}^{\circ}.1147 \sin(291.8 + 4.416t)$$

$$\Omega = 48^{\circ}.14 - 3^{\circ}.021893t - {}^{\circ}.3754 \times 10^{-4}t^2 + {}^{\circ}.1254 \times 10^{-6}t^3 + {}^{\circ}.795 \times 10^{-9}t^4$$

$$i = 34^{\circ}.250 + {}^{\circ}.000836t - {}^{\circ}.170 \times 10^{-5}t^2 - {}^{\circ}.9312 \times 10^{-6}t^3 + {}^{\circ}.15973 \times 10^{-7}t^4 - {}^{\circ}.7218 \times 10^{-10}t^5$$

$$e = .18976 + .210 \times 10^{-5}t - .258 \times 10^{-7}t^2 + .000446 \sin(204.9 + 4.416t)$$

$$M = .93072 + 10.743220t + .728 \times 10^{-6}t^2$$

Section 7: MJD 37120 to 37221 (July 5 to October 14, 1960)

$$T_o = 37120.0$$

$$\omega = 235^{\circ}.42 + 4^{\circ}.415738t + {}^{\circ}.242 \times 10^{-5}t^2 + {}^{\circ}.1348 \sin(328.7 + 4.416t)$$

$$\Omega = 136^{\circ}.02 - 3^{\circ}.022241t - {}^{\circ}.2623 \times 10^{-4}t^2 + {}^{\circ}.328 \times 10^{-7}t^3 + {}^{\circ}.1236 \times 10^{-8}t^4$$

$$i = 34^{\circ}.255 + {}^{\circ}.001274t - {}^{\circ}.9869 \times 10^{-4}t^2 + {}^{\circ}.23426 \times 10^{-5}t^3 - {}^{\circ}.23075 \times 10^{-7}t^4 + {}^{\circ}.8237 \times 10^{-10}t^5$$

$$e = .18972 + .7 \times 10^{-7}t - .328 \times 10^{-7}t^2 + .000441 \sin(237.0 + 4.416t)$$

$$M = .82703 + 10.743282t + .1503 \times 10^{-5}t^2$$

Section 8: MJD 37201 to 37299 (September 24 to December 31, 1960)

$$T_o = 37201.0$$

$$\omega = 233^{\circ}.10 + 4^{\circ}.417346t - {}^{\circ}.1539 \times 10^{-4}t^2 + {}^{\circ}.1135 \sin(330.5 + 4.416t)$$

$$\Omega = 251^{\circ}.11 - 3^{\circ}.022492t - {}^{\circ}.1177 \times 10^{-4}t^2 - {}^{\circ}.1800 \times 10^{-6}t^3 + {}^{\circ}.2819 \times 10^{-8}t^4$$

$$i = 34^{\circ}.237 + {}^{\circ}.002636t - {}^{\circ}.00012029t^2 + {}^{\circ}.16861 \times 10^{-5}t^3 - {}^{\circ}.5601 \times 10^{-8}t^4 - {}^{\circ}.1538 \times 10^{-10}t^5$$

$$e = .18962 - .902 \times 10^{-5}t + .551 \times 10^{-7}t^2 + .000518 \sin(228.7 + 4.416t)$$

$$M = .04224 + 10.743532t + .3865 \times 10^{-5}t^2$$

Section 9: MJD 37281 to 37411 (December 13, 1960 to April 22, 1961)

$$T_o = 37281.0$$

$$\omega = 226^{\circ}.37 + 4^{\circ}.417650t - {}^{\circ}.209 \times 10^{-5}t^2 + {}^{\circ}.1357 \sin(316.0 + 4.416t)$$

$$\Omega = 9^{\circ}.28 - 3^{\circ}.022799t - {}^{\circ}.272 \times 10^{-5}t^2 - {}^{\circ}.295 \times 10^{-7}t^3 + {}^{\circ}.237 \times 10^{-9}t^4$$

$$i = 34^{\circ}.258 - {}^{\circ}.000274t + {}^{\circ}.189 \times 10^{-5}t^2 + {}^{\circ}.01155 \sin(34.9 + 4.416t)$$

$$e = .18926 - .355 \times 10^{-5}t + .234 \times 10^{-7}t^2 + .000470 \sin(222.9 + 4.416t)$$

$$M = .54927 + 10.744189t + .2352 \times 10^{-5}t^2$$

TABLE 4.—*Least-squares fitting of orbital elements*—Continued

Satellite 1958 β2

Section 10: MJD 37407 to 37510 (April 18 to July 31, 1961)

$T_o = 37407.0$

$\omega = 62^\circ.95 + 4^\circ.417077t + {}^\circ.194 \times 10^{-5}t^2 + {}^\circ.1259 \sin(150.7 + 4.42t)$

$\Omega = 348^\circ.23 - 3^\circ.015952t - {}^\circ.00014044t^2 + {}^\circ.9886 \times 10^{-6}t^3 - {}^\circ.2491 \times 10^{-8}t^4$

$i = 34^\circ.252 - {}^\circ.0001631t + {}^\circ.1052 \times 10^{-5}t^2 + {}^\circ.01015 \sin(252.9 + 4.42t)$

$e = .18913 + .3310 \times 10^{-5}t - .297 \times 10^{-8}t^2 + .0004033 \sin(59.5 + 4.42t)$

$M = .35497 + 10.744871t + .256043 \times 10^{-5}t^2$

Section 11: MJD 37510 to 37582 (July 31 to October 10, 1961)

$T_o = 37407.0$

$\omega = 62^\circ.95 + 4^\circ.417077t + {}^\circ.194 \times 10^{-5}t^2 + {}^\circ.1259 \sin(150.7 + 4.42t)$

$\Omega = 348^\circ.23 - 3^\circ.015952t - {}^\circ.00014044t^2 + {}^\circ.9886 \times 10^{-6}t^3 - {}^\circ.2491 \times 10^{-8}t^4$

$i = 34^\circ.252 - {}^\circ.0001631t + {}^\circ.1052 \times 10^{-5}t^2 + {}^\circ.01015 \sin(252.9 + 4.42t)$

$e = .18913 + .3310 \times 10^{-5}t - .297 \times 10^{-8}t^2 + .0004033 \sin(59.5 + 4.42t)$

$M = .37743 + 10.74629t + .385384 \times 10^{-5}t^2$

Satellite 1959 α1 (Vanguard II)

Section 1: MJD 36618 to 36720 (February 19 to June 1, 1959)

$T_o = 36618.0$

$\omega = 142^\circ.36 + 5^\circ.26407t + {}^\circ.144 \sin(256.2 + 5.272t)$

$\Omega = 177^\circ.732 - 3^\circ.493869t - {}^\circ.7811 \times 10^{-4}t^2 + {}^\circ.101 \times 10^{-6}t^3$

$i = 32^\circ.887 - {}^\circ.000147t + {}^\circ.0157 \sin(324.0 + 4.500t)$

$e = .16575 - .358 \times 10^{-5}t + .000397 \sin(137.4 + 5.272t)$

$M = .21337 + 11.441937t + .33838 \times 10^{-4}t^2 + .51769 \times 10^{-6}t^3 - .26054 \times 10^{-8}t^4$

Section 2: MJD 36700 to 36800 (May 12 to August 20, 1959)

$T_o = 36700.0$

$\omega = 214^\circ.03 + 5^\circ.26982t + {}^\circ.168 \sin(297.8 + 5.272t)$

$\Omega = 250^\circ.777 - 3^\circ.506923t + {}^\circ.5450 \times 10^{-4}t^2 - {}^\circ.4778 \times 10^{-6}t^3$

$i = 32^\circ.878 - {}^\circ.000380t + {}^\circ.2308 \times 10^{-4}t^2 - {}^\circ.2083 \times 10^{-6}t^3$

$e = .16548 - .171 \times 10^{-5}t + .000472 \sin(207.2 + 5.272t)$

$M = .84661 + 11.45253t + .28040 \times 10^{-4}t^2 + .16811 \times 10^{-6}t^3 - .13759 \times 10^{-8}t^4$

TABLE 4.—*Least-squares fitting of orbital elements*—Continued

Satellite 1959 α1

Section 3: MJD 36780 to 36930 (July 31 to December 28, 1959)

$T_o = 36780.0$

$\omega = 275^\circ\!.575 + 5^\circ\!.274537t + ^\circ\!.1558 \sin (5.9 + 5.272t)$

$\Omega = 330^\circ\!.342 - 3^\circ\!.510501t + ^\circ\!.5252 \times 10^{-4}t^2 - ^\circ\!.2943 \times 10^{-6}t^3$

$i = 32^\circ\!.8773 + ^\circ\!.283 \times 10^{-4}t + ^\circ\!.01144 \sin (165.9 + 3.83t)$

$e = .165310 - .1326 \times 10^{-5}t + .0004695 \sin (275.2 + 5.272t)$

$M = .25669 + 11.457393t + .18896 \times 10^{-4}t^2 - .3825 \times 10^{-8}t^3 - .1190 \times 10^{-9}t^4$

Section 4: MJD 36900 to 37024 (November 28, 1959 to March 31, 1960)

$T_o = 36902.0$

$\omega = 199^\circ\!.11 + 5^\circ\!.27517t + ^\circ\!.174 \sin (276.3 + 5.272t)$

$\Omega = 262^\circ\!.313 - 3^\circ\!.513402t + ^\circ\!.9241 \times 10^{-4}t^2 - ^\circ\!.5572 \times 10^{-6}t^3$

$i = 32^\circ\!.871 - ^\circ\!.000254t + ^\circ\!.3289 \times 10^{-4}t^2 - ^\circ\!.5257 \times 10^{-6}t^3 + ^\circ\!.2166 \times 10^{-8}t^4$

$e = .16513 - .63 \times 10^{-6}t + .000490 \sin (204.1 + 5.272t)$

$M = .30511 + 11.461069t + .5293 \times 10^{-5}t^2 + .4998 \times 10^{-7}t^3 - .1914 \times 10^{-9}t^4$

Section 5: MJD 37000 to 37046 (March 7 to April 22, 1960)

$T_o = 37000.0$

$\omega = 356^\circ\!.24 + 5^\circ\!.27248t - ^\circ\!.0005024t^2 + ^\circ\!.14569 \times 10^{-4}t^3 - ^\circ\!.5971 \times 10^{-7}t^4$

$\Omega = 278^\circ\!.376 - 3^\circ\!.51550t + ^\circ\!.0001318t^2 - ^\circ\!.2348 \times 10^{-5}t^3 + ^\circ\!.2808 \times 10^{-7}t^4$

$i = 32^\circ\!.869 - ^\circ\!.003820t + ^\circ\!.00024293t^2 - ^\circ\!.45433 \times 10^{-5}t^3 + ^\circ\!.30035 \times 10^{-7}t^4$

$e = .16491 + .230 \times 10^{-5}t + .000619 \sin (10.1 + 5.28t)$

$M = .56980 + 11.462838t + .6759 \times 10^{-5}t^2 + .12134 \times 10^{-6}t^3$

Section 6: MJD 37024 to 37170 (March 31 to August 24, 1960)

$T_o = 37024.0$

$\omega = 122^\circ\!.80 + 5^\circ\!.27496t + ^\circ\!.420 \times 10^{-4}t^2 + ^\circ\!.143 \sin (233.2 + 5.272t)$

$\Omega = 194^\circ\!.021 - 3^\circ\!.505911t - ^\circ\!.7331 \times 10^{-4}t^2 + ^\circ\!.2499 \times 10^{-6}t^3$

$i = 32^\circ\!.856 + ^\circ\!.004115t - ^\circ\!.00012432t^2 + ^\circ\!.12317 \times 10^{-5}t^3 - ^\circ\!.3862 \times 10^{-8}t^4$

$e = .16487 - .180 \times 10^{-5}t + .000455 \sin (124.4 + 5.272t)$

$M = .68284 + 11.463429t + .15679 \times 10^{-4}t^2 + .3183 \times 10^{-7}t^3 - .948 \times 10^{-10}t^4$

TABLE 4.—*Least-squares fitting of orbital elements*—Continued

Satellite 1959 α1

Section 7: MJD 37150 to 37270 (August 4 to December 2, 1960)

$T_o = 37150.0$

$\omega = 68^{\circ}.02 + 5^{\circ}.28115t + {}^{\circ}.314 \times 10^{-4}t^2 + {}^{\circ}.137 \sin (149.8 + 5.272t)$

$\Omega = 111^{\circ}.609 - 3^{\circ}.510485t - {}^{\circ}.7936 \times 10^{-4}t^2 + {}^{\circ}.3261 \times 10^{-6}t^3$

$i = 32^{\circ}.884 + {}^{\circ}.001484t - {}^{\circ}.7546 \times 10^{-4}t^2 + {}^{\circ}.10153 \times 10^{-5}t^3 - {}^{\circ}.4032 \times 10^{-8}t^4$

$e = .16477 - .166 \times 10^{-5}t + .000432 \sin (71.8 + 5.272t)$

$M = .36352 + 11.468037t + .263916 \times 10^{-4}t^2 + .5936 \times 10^{-7}t^3 - .5653 \times 10^{-9}t^4$

Section 8: MJD 37250 to 37390 (November 12, 1960 to April 1, 1961)

$T_o = 37250.$

$\omega = 236^{\circ}.43 + 5^{\circ}.28657t + {}^{\circ}.63 \times 10^{-5}t^2 + {}^{\circ}.170 \sin (323.6 + 5.29t)$

$\Omega = 120^{\circ}.104 - 3^{\circ}.516578t + {}^{\circ}.1461 \times 10^{-4}t^2 - {}^{\circ}.2428 \times 10^{-6}t^3 + {}^{\circ}.880 \times 10^{-9}t^4$

$i = 32^{\circ}.883 + {}^{\circ}.002562t - {}^{\circ}.00018268t^2 + {}^{\circ}.43081 \times 10^{-5}t^3 - {}^{\circ}.44099 \times 10^{-7}t^4 + {}^{\circ}.19476 \times 10^{-9}t^5$
$- {}^{\circ}.2802 \times 10^{-12}t^6$

$e = .16464 - .444 \times 10^{-5}t + .497 \times 10^{-7}t^2 - .180 \times 10^{-9}t^3 + .000442 \sin (231.6 + 5.29t)$

$M = .43388 + 11.472537t + .31138 \times 10^{-4}t^2 - .40977 \times 10^{-6}t^3 + .28836 \times 10^{-8}t^4$
$- .7734 \times 10^{-11}t^5$

Satellite 1959 α 2 (Vanguard II Rocket)

Section 1: MJD 36640 to 36720 (March 13 to June 1, 1959)

$T_o = 36640.0$

$\omega = 251^{\circ}.18 + 4^{\circ}.95100t - {}^{\circ}.0008309t^2 + {}^{\circ}.7407 \times 10^{-5}t^3$

$\Omega = 105^{\circ}.90 - 3^{\circ}.27338t - {}^{\circ}.0001762t^2 + {}^{\circ}.924 \times 10^{-6}t^3$

$i = 32^{\circ}.943 + {}^{\circ}.001798t - {}^{\circ}.00016512t^2 + {}^{\circ}.31549 \times 10^{-5}t^3 - {}^{\circ}.17681 \times 10^{-7}t^4$

$e = .18406 - .3419 \times 10^{-5}t + .000400 \sin (250.4 + 4.94t)$

$M = .21176 + 11.069261t + .56243 \times 10^{-4}t^2 + .25077 \times 10^{-6}t^3 - .20151 \times 10^{-8}t^4$

Section 2: MJD 36700 to 36800 (May 12 to August 20, 1959)

$T_o = 36700.0$

$\omega = 186^{\circ}.80 + 4^{\circ}.94457t + {}^{\circ}.0002705t^2 - {}^{\circ}.11126 \times 10^{-4}t^3 + {}^{\circ}.7863 \times 10^{-7}t^4$

$\Omega = 269^{\circ}.07 - 3^{\circ}.28606t + {}^{\circ}.448 \times 10^{-4}t^2 - {}^{\circ}.376 \times 10^{-6}t^3$

$i = 32^{\circ}.908 + {}^{\circ}.001616t - {}^{\circ}.643 \times 10^{-4}t^2 + {}^{\circ}.1088 \times 10^{-5}t^3 - {}^{\circ}.6017 \times 10^{-8}t^4$

$e = .18394 - .153 \times 10^{-5}t - .000505 \sin (186.5 + 4.940t)$

$M = .5977 + 11.07721t + .386 \times 10^{-4}t^2 - .4480 \times 10^{-7}t^3$

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TABLE 4.—*Least-squares fitting of orbital elements*—Continued

Satellite 1959 $\alpha 2$

Section 3: MJD 36780 to 36900 (July 31 to November 28, 1959)

$T_o = 36780.0$

$\omega = 221^{\circ}.51 + 4^{\circ}.97880t - {}^{\circ}.00014446t^2 + {}^{\circ}.17920 \times 10^{-4}t^3 - {}^{\circ}.7000 \times 10^{-7}t^4$

$\Omega = 6^{\circ}.31 - 3^{\circ}.2893t + {}^{\circ}.417 \times 10^{-5}t^2 - {}^{\circ}.18 \times 10^{-7}t^3$

$i = 32^{\circ}.946 - {}^{\circ}.002218t + {}^{\circ}.2442 \times 10^{-4}t^2 + {}^{\circ}.1948 \times 10^{-6}t^3 - {}^{\circ}.2252 \times 10^{-8}t^4$

$e = .18377 - .154 \times 10^{-5}t + .000445 \sin (222.3 + 4.94t)$

$M = .99630 + 11.08271t + .2572 \times 10^{-4}t^2 - .4880 \times 10^{-7}t^3$

Section 4: MJD 36880 to 37024 (November 8, 1959 to March 31, 1960)

$T_o = 36880.0$

$\omega = 355^{\circ}.77 + 4^{\circ}.94107t + {}^{\circ}.156 \sin (80.3 + 4.94t)$

$\Omega = 37^{\circ}.42 - 3^{\circ}.28999t + {}^{\circ}.15 \times 10^{-5}t^2$

$i = 32^{\circ}.939 - {}^{\circ}.001918t + {}^{\circ}.3857 \times 10^{-4}t^2 - {}^{\circ}.2477 \times 10^{-6}t^3 + {}^{\circ}.444 \times 10^{-9}t^4$

$e = .18359 - .96 \times 10^{-6}t + .000458 \sin (354.5 + 4.94t)$

$M = .47329 + 11.08649t + .917 \times 10^{-5}t^2$

Section 5: MJD 37000 to 37120 (March 7 to July 5, 1960)

$T_o = 37000.0$

$\omega = 228^{\circ}.69 + 4^{\circ}.94269t + {}^{\circ}.44 \times 10^{-5}t^2 + {}^{\circ}.075 \sin (309.2 + 4.95t)$

$\Omega = 2^{\circ}.61 - 3^{\circ}.281809t - {}^{\circ}.0004089t^2 + {}^{\circ}.5640 \times 10^{-5}t^3 - {}^{\circ}.2387 \times 10^{-7}t^4$

$i = 32^{\circ}.909 + {}^{\circ}.000259t - {}^{\circ}.125 \times 10^{-5}t^2 + {}^{\circ}.0224 \sin (57.5 + 4.95t)$

$e = .18358 - .54 \times 10^{-6}t - .296 \times 10^{-7}t^2 + .000470 \sin (228.0 + 4.95t)$

$M = .98708 + 11.08829t + .1228 \times 10^{-4}t^2 - .438 \times 10^{-7}t^3 + .153 \times 10^{-9}t^4$

Section 6: MJD 37100 to 37200 (June 15 to September 23, 1960)

$T_o = 37100.0$

$\omega = 2^{\circ}.95 + 4^{\circ}.94552t + {}^{\circ}.59 \times 10^{-5}t^2 + {}^{\circ}.171 \sin (102.4 + 4.95t)$

$\Omega = 33^{\circ}.53 - 3^{\circ}.28947t - {}^{\circ}.335 \times 10^{-4}t^2 + {}^{\circ}.170 \times 10^{-6}t^3$

$i = 32^{\circ}.924 - {}^{\circ}.001827t + {}^{\circ}.2866 \times 10^{-4}t^2 + {}^{\circ}.464 \times 10^{-7}t^3 - {}^{\circ}.1559 \times 10^{-8}t^4$

$e = .18324 - .718 \times 10^{-5}t + .380 \times 10^{-7}t^2 + .000432 \sin (358.1 + 4.95t)$

$M = .90993 + 11.0900t + .1626 \times 10^{-4}t^2 - .1378 \times 10^{-6}t^3 + .1155 \times 10^{-8}t^4$

TABLE 4.—*Least-squares fitting of orbital elements*—Continued

Satellite 1959 $\alpha 2$

Section 7: MJD 37180 to 37280 (September 3 to December 12, 1960)

$T_o = 37180.0$

$\omega = 38^\circ.61 + 4^\circ.94622t + {}^\circ.283 \times 10^{-4}t^2 + {}^\circ.154 \sin (125.6 + 4.95t)$

$\Omega = 130^\circ.25 - 3^\circ.29186t - {}^\circ.68 \times 10^{-5}t^2 - {}^\circ.158 \times 10^{-6}t^3$

$i = 32^\circ.926 - {}^\circ.000691t + {}^\circ.363 \times 10^{-4}t^2 - {}^\circ.6653 \times 10^{-6}t^3 + {}^\circ.3549 \times 10^{-8}t^4$

$e = .18278 + .317 \times 10^{-5}t - .224 \times 10^{-7}t^2 + .000549 \sin (41.7 + 4.95t)$

$M = .19182 + 11.09228t + .35779 \times 10^{-4}t^2 - .29872 \times 10^{-7}t^3 - .6024 \times 10^{-10}t^4$

Section 8: MJD 37260 to 37388 (November 22, 1960 to March 30, 1961)

$T_o = 37260.0$

$\omega = 74^\circ.48 + 4^\circ.95119t + {}^\circ.41 \times 10^{-5}t^2 + .131 \sin (167.2 + 4.95t)$

$\Omega = 226^\circ.77 - 3^\circ.29583t - {}^\circ.53 \times 10^{-5}t^2 - {}^\circ.9 \times 10^{-8}t^3$

$i = 32^\circ.912 + {}^\circ.77 \times 10^{-4}t + {}^\circ.83 \times 10^{-6}t^2 - {}^\circ.96 \times 10^{-8}t^3 + {}^\circ.0082 \sin (244.2 + 4.95t)$

$e = .18293 - .59 \times 10^{-6}t + .113 \times 10^{-7}t^2 + .000489 \sin (75.8 + 4.95t)$

$M = .78642 + 11.09726t + .26705 \times 10^{-4}t^2 - .13198 \times 10^{-6}t^3 + .2995 \times 10^{-9}t^4$

Satellite 1959 Eta (Vanguard III)

Section 1: MJD 36832 to 36950 (September 21, 1959 to January 17, 1960)

$T_o = 36832.0$

$\omega = 147^\circ.09 + 4^\circ.87103t + {}^\circ.61 \times 10^{-5}t^2 + {}^\circ.145 \sin (240.9 + 4.883t)$

$\Omega = 223^\circ.980 - 3^\circ.270292t - {}^\circ.4071 \times 10^{-4}t^2 + {}^\circ.1676 \times 10^{-6}t^3$

$i = 33^\circ.339 + {}^\circ.001580t - {}^\circ.3931 \times 10^{-4}t^2 + {}^\circ.3232 \times 10^{-6}t^3 - {}^\circ.811 \times 10^{-9}t^4$

$e = .19008 - .96 \times 10^{-6}t + .000446 \sin (149.5 + 4.883t)$

$M = .64733 + 11.061390t + .12115 \times 10^{-4}t^2$

Section 2: MJD 36930 to 37044 (December 28, 1959 to April 20, 1960)

$T_o = 36930.0$

$\omega = 264^\circ.55 + 4^\circ.87246t + {}^\circ.108 \times 10^{-4}t^2 + {}^\circ.120 \sin (340.6 + 4.887t)$

$\Omega = 263^\circ.269 - 3^\circ.275542t + {}^\circ.3912 \times 10^{-4}t^2 - {}^\circ.2379 \times 10^{-6}t^3$

$i = 33^\circ.363 - {}^\circ.002404t + {}^\circ.8016 \times 10^{-4}t^2 - {}^\circ.7888 \times 10^{-6}t^3 + {}^\circ.2002 \times 10^{-8}t^4$

$e = .18998 - .338 \times 10^{-5}t + .000447 \sin (270.0 + 4.887t)$

$M = .77874 + 11.063792t + .15479 \times 10^{-4}t^2$

TABLE 4.—*Least-squares fitting of orbital elements*—Continued

Satellite 1959 Eta

Section 3: MJD 37025 to 37130 (April 1 to July 16, 1960)

$T_o = 37025.0$

$\omega = 7^{\circ}.54 + 4^{\circ}.87814t - {}^{\circ}.79 \times 10^{-5}t^2 + {}^{\circ}.094 \sin (109.4 + 4.89t)$

$\Omega = 312^{\circ}.295 - 3^{\circ}.282613t + {}^{\circ}.00014199t^2 - {}^{\circ}.7899 \times 10^{-6}t^3$

$i = 33^{\circ}.346 - {}^{\circ}.004586t + {}^{\circ}.00021659t^2 - {}^{\circ}.29454 \times 10^{-5}t^3 + {}^{\circ}.12364 \times 10^{-7}t^4$

$e = .18963 - .36 \times 10^{-5}t + .000425 \sin (8.2 + 4.89t)$

$M = .97618 + 11.067015t + .20357 \times 10^{-4}t^2$

Section 4: MJD 37110 to 37196 (June 25 to September 19, 1960)

$T_o = 37110.0$

$\omega = 61^{\circ}.96 + 4^{\circ}.88880t - {}^{\circ}.763 \times 10^{-4}t^2 + {}^{\circ}.150 \sin (128.9 + 4.893t)$

$\Omega = 33^{\circ}.816 - 3^{\circ}.274982t - {}^{\circ}.00010506t^2 + {}^{\circ}.8244 \times 10^{-6}t^3$

$i = 33^{\circ}.353 + {}^{\circ}.31 \times 10^{-4}t - {}^{\circ}.4411 \times 10^{-4}t^2 + {}^{\circ}.10582 \times 10^{-5}t^3 - {}^{\circ}.6192 \times 10^{-8}t^4$

$e = .18928 + .82 \times 10^{-6}t + .000438 \sin (58.7 + 4.893t)$

$M = .82087 + 11.070264t + .29195 \times 10^{-4}t^2$

Section 5: MJD 37183 to 37300 (September 6, 1960 to January 1, 1961)

$T_o = 37183.0$

$\omega = 58^{\circ}.54 + 4^{\circ}.87789t + {}^{\circ}.623 \times 10^{-4}t^2 + {}^{\circ}.187 \sin (172.8 + 4.89t)$

$\Omega = 154^{\circ}.516 - 3^{\circ}.279448t - {}^{\circ}.2712 \times 10^{-4}t^2 + {}^{\circ}.358 \times 10^{-7}t^3$

$i = 33^{\circ}.359 + {}^{\circ}.000209t + {}^{\circ}.207 \times 10^{-5}t^2 - {}^{\circ}.1463 \times 10^{-6}t^3 + {}^{\circ}.979 \times 10^{-9}t^4$

$e = .18918 + .6 \times 10^{-7}t + .000493 \sin (56.9 + 4.89t)$

$M = .10453 + 11.074634t + .56185 \times 10^{-4}t^2 - .18075 \times 10^{-6}t^3 + .1768 \times 10^{-9}t^4$

Section 6: MJD 37280 to 37370 (December 12, 1960 to March 12, 1961)

$T_o = 37280.0$

$\omega = 172^{\circ}.32 + 4^{\circ}.88710t + {}^{\circ}.119 \times 10^{-4}t^2 + {}^{\circ}.136 \sin (265.6 + 4.89t)$

$\Omega = 196^{\circ}.187 - 3^{\circ}.283470t + {}^{\circ}.496 \times 10^{-5}t^2 - {}^{\circ}.1204 \times 10^{-6}t^3 + {}^{\circ}.454 \times 10^{-9}t^4$

$i = 33^{\circ}.351 + {}^{\circ}.000129t - {}^{\circ}.81 \times 10^{-6}t^2 + {}^{\circ}.0076 \sin (354.9 + 4.89t)$

$e = .18914 - .177 \times 10^{-5}t + .31 \times 10^{-8}t^2 + .000438 \sin (170.9 + 4.89t)$

$M = .72330 + 11.081058t + .13982 \times 10^{-4}t^2 - .4167 \times 10^{-7}t^3$

TABLE 4.—*Least-squares fitting of orbital elements*—Continued

Satellite 1959 Eta

Section 7: MJD 37350 to 37442 (February 20 to May 23, 1961)

$T_o = 37280.0$

$\omega = 172\overset{\circ}{.}32 + 4\overset{\circ}{.}88710t + \overset{\circ}{.}119 \times 10^{-4}t^2 + \overset{\circ}{.}136 \sin (265.6 + 4.89t)$

$\Omega = 196\overset{\circ}{.}187 - 3\overset{\circ}{.}283470t + \overset{\circ}{.}496 \times 10^{-5}t^2 - \overset{\circ}{.}1204 \times 10^{-6}t^3 + \overset{\circ}{.}454 \times 10^{-9}t^4$

$i = 33\overset{\circ}{.}351 + \overset{\circ}{.}000129t - \overset{\circ}{.}81 \times 10^{-6}t^2 + \overset{\circ}{.}0076 \sin (354.9 + 4.89t)$

$e = .18914 - .177 \times 10^{-5}t + .31 \times 10^{-8}t^2 + .000438 \sin (170.9 + 4.89t)$

$M = .69857 + 11.081978t + .24941 \times 10^{-5}t^2 + .5927 \times 10^{-8}t^3$

Satellite 1960 ξ1 (Explorer VIII)

Section 1: MJD 37245 to 37350 (November 7, 1960 to February 20, 1961)

$T_o = 37245.0$

$\omega = 62\overset{\circ}{.}03 + 2\overset{\circ}{.}79876t + \overset{\circ}{.}141 \times 10^{-4}t^2 + \overset{\circ}{.}298 \sin (153.0 + 2.80t)$

$\Omega = 4\overset{\circ}{.}301 - 3\overset{\circ}{.}370558t + \overset{\circ}{.}3047 \times 10^{-4}t^2 - \overset{\circ}{.}3756 \times 10^{-6}t^3 + \overset{\circ}{.}797 \times 10^{-9}t^4$

$i = 49\overset{\circ}{.}955 - \overset{\circ}{.}38 \times 10^{-4}t + \overset{\circ}{.}0031 \sin (143.9 + 2.80t)$

$e = .12060 - .130 \times 10^{-5}t - .83 \times 10^{-8}t^2 + .000772 \sin (62.8 \times 2.80t)$

$M = .14695 + 12.772427t + .42626 \times 10^{-4}t^2 - .5063 \times 10^{-7}t^3 + .2595 \times 10^{-9}t^4$

Section 2: MJD 37330 to 37420 (January 31 to May 1, 1961)

$T_o = 37245.0$

$\omega = 62\overset{\circ}{.}03 + 2\overset{\circ}{.}79876t + \overset{\circ}{.}141 \times 10^{-4}t^2 + \overset{\circ}{.}298 \sin (153.0 + 2.80t)$

$\Omega = 4\overset{\circ}{.}301 - 3\overset{\circ}{.}370558t + \overset{\circ}{.}3047 \times 10^{-4}t^2 - \overset{\circ}{.}3756 \times 10^{-6}t^3 + \overset{\circ}{.}797 \times 10^{-9}t^4$

$i = 49\overset{\circ}{.}955 - \overset{\circ}{.}38 \times 10^{-4}t + \overset{\circ}{.}0031 \sin (143.9 + 2.80t)$

$e = .12060 - .130 \times 10^{-5}t - .83 \times 10^{-8}t^2 + .000772 \sin (62.8 + 2.80t)$

$M = .21411 + 12.771222t + .36636 \times 10^{-4}t^2 + .13426 \times 10^{-6}t^3 - .4576 \times 10^{-9}t^4$

TABLE 4.—*Least-squares fitting of orbital elements*—Continued

Satellite 1961 δ1 (Explorer IX)

Section 1: MJD 37347 to 37400 (February 17 to April 11, 1961)

$$T_o = 37347.0$$

$$\omega = 101\overset{\circ}{.}81 + 4\overset{\circ}{.}73772t + \overset{\circ}{.}0010967t^2 - \overset{\circ}{.}8276 \times 10^{-5}t^3 - \overset{\circ}{.}2048 \times 10^{-7}t^4$$

$$\Omega = 169\overset{\circ}{.}36 - 3\overset{\circ}{.}63979t + \overset{\circ}{.}888 \times 10^{-4}t^2 - \overset{\circ}{.}163 \times 10^{-6}t^3$$

$$i = 38\overset{\circ}{.}860 + \overset{\circ}{.}001111t - \overset{\circ}{.}4102 \times 10^{-4}t^2 + \overset{\circ}{.}3393 \times 10^{-6}t^3$$

$$e = .12236 - .00015089t + .5853 \times 10^{-6}t^2 + .4248 \times 10^{-8}t^3$$

$$M = .46926 + 12.160213t + .5115 \times 10^{-5}t^2 + .45946 \times 10^{-6}t^3 - .14966 \times 10^{-8}t^4$$

Section 2: MJD 37390 to 37435 (April 1 to May 16, 1961)

$$T_o = 37390.0$$

$$\omega = 306\overset{\circ}{.}83 + 4\overset{\circ}{.}78292t - \overset{\circ}{.}00004489t^2 - \overset{\circ}{.}15060 \times 10^{-4}t^3 + \overset{\circ}{.}24632 \times 10^{-6}t^4 + \overset{\circ}{.}15786 \times 10^{-8}t^5$$

$$\Omega = 13\overset{\circ}{.}01 - 3\overset{\circ}{.}63357t - \overset{\circ}{.}175 \times 10^{-4}t^2 + \overset{\circ}{.}496 \times 10^{-6}t^3$$

$$i = 38\overset{\circ}{.}856 + \overset{\circ}{.}000826t - \overset{\circ}{.}7554 \times 10^{-4}t^2 + \overset{\circ}{.}12195 \times 10^{-5}t^3$$

$$e = .11729 - .9748 \times 10^{-4}t + .65547 \times 10^{-5}t^2 - .241674 \times 10^{-6}t^3 + .253918 \times 10^{-8}t^4$$

$$M = .39776 + 12.163319t + .11407 \times 10^{-4}t^2 + .67063 \times 10^{-6}t^3 - .73615 \times 10^{-8}t^4$$

Section 3: MJD 37415 to 37468 (April 26 to June 18, 1961)

$$T_o = 37415.0$$

$$\omega = 65\overset{\circ}{.}94 + 4\overset{\circ}{.}76574t + \overset{\circ}{.}216 \times 10^{-4}t^2 + \overset{\circ}{.}175 \sin (166.4 + 4.77t)$$

$$\Omega = 282\overset{\circ}{.}16 - 3\overset{\circ}{.}63275t - \overset{\circ}{.}35 \times 10^{-5}t^2 + \overset{\circ}{.}364 \times 10^{-6}t^3 - \overset{\circ}{.}125 \times 10^{-8}t^4$$

$$i = 38\overset{\circ}{.}849 - \overset{\circ}{.}000565t + \overset{\circ}{.}3535 \times 10^{-4}t^2 - \overset{\circ}{.}7080 \times 10^{-6}t^3 + \overset{\circ}{.}4029 \times 10^{-8}t^4$$

$$e = .11617 - .8476 \times 10^{-4}t + .3420 \times 10^{-6}t^2 - .2002 \times 10^{-7}t^3 + .4695 \times 10^{-9}t^4 - .2896 \times 10^{-11}t^5$$

$$M = .49293 + 12.165635t - .55835 \times 10^{-4}t^2 + .254554 \times 10^{-5}t^3 - .204109 \times 10^{-7}t^4$$

TABLE 4.—*Least-squares fitting of orbital elements*—Continued

Satellite 1961 δ1

Section 4: MJD 37458 to 37510 (June 8 to July 30, 1961)

$T_o = 37415.0$

$\omega = 65^{\circ}.94 + 4^{\circ}.76574t + {}^{\circ}.216 \times 10^{-4}t^2 + {}^{\circ}.175 \sin (166.4 + 4.77t)$

$\Omega = 282^{\circ}.16 - 3^{\circ}.63275t - {}^{\circ}.35 \times 10^{-5}t^2 + {}^{\circ}.364 \times 10^{-6}t^3 - {}^{\circ}.125 \times 10^{-8}t^4$

$i = 38^{\circ}.849 - {}^{\circ}.000565t + {}^{\circ}.3535 \times 10^{-4}t^2 - {}^{\circ}.7080 \times 10^{-6}t^3 - {}^{\circ}.4029 \times 10^{-8}t^4$

$e = .11617 - .8476 \times 10^{-4}t + .3420 \times 10^{-6}t^2 - .2002 \times 10^{-7}t^3 + .4695 \times 10^{-9}t^4$

$\quad - .2896 \times 10^{-11}t^5$

$M = .64170 + 12.152901t + .000365370t^2 - .371741 \times 10^{-5}t^3 + .144022 \times 10^{-7}t^4$

Section 5: MJD 37500 to 37542 (July 20 to September 1, 1961)

$T_o = 37500.0$

$\omega = 110^{\circ}.99 + 4^{\circ}.78744t - {}^{\circ}.0001479t^2 + {}^{\circ}.197 \sin (172.2 + 4.77t)$

$\Omega = 333^{\circ}.51 - 3^{\circ}.62680t - {}^{\circ}.936 \times 10^{-4}t^2 + {}^{\circ}.1834 \times 10^{-5}t^3 - {}^{\circ}.1074 \times 10^{-7}t^4$

$i = 38^{\circ}.832 + {}^{\circ}.000761t - {}^{\circ}.3867 \times 10^{-4}t^2 + {}^{\circ}.6480 \times 10^{-6}t^3 - {}^{\circ}.4111 \times 10^{-8}t^4$

$e = .11080 - .00011186t + .44356 \times 10^{-5}t^2 - .19309 \times 10^{-6}t^3 + .3612 \times 10^{-8}t^4$

$\quad - .2229 \times 10^{-10}t^5$

$M = .74612 + 12.170484t - .24171 \times 10^{-4}t^2 + .230385 \times 10^{-5}t^3 - .233256 \times 10^{-7}t^4$

Section 6: MJD 37532 to 37574 (August 21 to October 2, 1961)

$T_o = 37500.0$

$\omega = 110^{\circ}.99 + 4^{\circ}.78744t - {}^{\circ}.0001479t^2 + {}^{\circ}.197 \sin (172.2 + 4.77t)$

$\Omega = 333^{\circ}.51 - 3^{\circ}.62680t - {}^{\circ}.936 \times 10^{-4}t^2 + {}^{\circ}.1834 \times 10^{-5}t^3 - {}^{\circ}.1074 \times 10^{-7}t^4$

$i = 38^{\circ}.832 + {}^{\circ}.000761t - {}^{\circ}.3867 \times 10^{-4}t^2 + {}^{\circ}.6480 \times 10^{-6}t^3 - {}^{\circ}.4111 \times 10^{-8}t^4$

$e = .11080 - .00011186t + .44356 \times 10^{-5}t^2 - .19309 \times 10^{-6}t^3 + .3612 \times 10^{-8}t^4$

$\quad - .2229 \times 10^{-10}t^5$

$M = .53811 + 12.185659t - .000380871t^2 + .489570 \times 10^{-5}t^3 - .210151 \times 10^{-7}t^4$

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*

Satellite 1958 Alpha

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_v$	$\log \rho_s$	T_v (°K)	z (km)	$a_v - a_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36242.0	6.03		6.0	-13.69	-13.69	1506	355.7	159.3	158.8	130.1
43.0	6.03		6.0	.69	.68	1507	355.8	159.4	157.7	129.4
44.0	6.29		6.3	.67	.66	1556	356.0	159.5	156.2	128.6
45.0	6.79		6.8	.64	.63	1642	356.3	159.6	154.4	127.7
46.0	6.60		6.6	.65	.63	1619	356.9	159.7	152.4	126.6
47.0	5.27		5.3	.75	.72	1430	357.5	159.8	150.3	125.6
48.0	4.70		4.7	.80	.77	1354	358.3	160.1	148.2	124.6
49.0	4.25		4.3	.84	.80	1307	359.2	160.5	146.1	123.6
50.0	4.06		4.1	.86	.82	1288	360.2	161.1	144.1	122.8
51.0	5.02		5.0	.78	.72	1431	361.2	161.9	142.3	122.2
52.0	5.27		5.3	.75	.69	1492	362.2	162.9	140.7	121.8
53.0	4.70		4.7	.81	.74	1408	363.2	164.1	139.3	121.6
54.0	4.19		4.2	.86	.78	1341	364.1	165.7	138.2	121.7
55.0	4.13		4.1	.87	.78	1333	364.8	167.5	137.3	122.1
56.0	4.25		4.3	.85	.76	1372	365.5	169.5	136.9	122.8
57.0	4.06		4.1	.87	.78	1345	365.9	171.7	136.6	123.8
58.0	3.81		3.8	.90	.81	1301	366.2	174.0	136.8	125.2
59.0	3.62		3.6	.93	.83	1271	366.3	176.5	137.3	126.8
60.0	3.94		3.9	.89	.80	1318	366.1	178.8	138.1	128.7
61.0	4.06		4.1	.87	.78	1347	365.8	181.2	139.3	130.9
62.0	3.36		3.4	.95	.86	1234	365.3	183.3	140.8	133.3
63.0	3.87		3.9	.89	.80	1305	364.6	185.2	142.6	135.9
64.0	4.13		4.1	.86	.79	1328	363.8	186.9	144.7	138.7
65.0	4.32		4.3	.84	.77	1350	362.9	188.3	147.0	141.6
66.0	4.32		4.3	.84	.78	1340	362.0	189.4	149.6	144.7
67.0	5.40		5.4	.74	.69	1500	361.0	190.3	152.3	147.7
68.0	6.03		6.0	.69	.65	1584	360.0	191.0	155.1	150.8
69.0	5.27		5.3	.74	.71	1458	359.1	191.5	158.0	153.7
70.0	4.57		4.6	.80	.78	1345	358.2	191.9	160.8	156.5
71.0	5.33		5.3	.74	.72	1438	357.5	192.2	163.4	158.9
72.0	5.90		5.9	.69	.68	1519	356.8	192.3	165.6	160.8
73.0	5.65		5.6	.72	.70	1467	356.4	192.5	167.0	162.1
74.0	5.84		5.8	.70	.69	1492	356.1	192.6	167.4	162.6
75.0	6.86		6.9	.63	.62	1660	355.9	192.8	166.6	162.4
76.0	6.92		6.9	.63	.62	1659	355.9	193.0	164.9	161.4
77.0	5.33		5.3	.74	.73	1416	356.0	193.4	162.4	160.0
78.0	5.14		5.1	.76	.75	1390	356.2	194.0	159.6	158.2
79.0	5.71		5.7	.71	.70	1479	356.5	194.7	156.6	156.3
80.0	6.22		6.2	.68	.66	1560	356.9	195.7	153.6	154.3
81.0	5.65		5.6	.72	.70	1474	357.3	196.9	150.6	152.4
82.0	5.21		5.2	.75	.73	1419	357.6	198.3	147.6	150.6
83.0	5.33		5.3	.75	.72	1437	358.0	200.0	144.9	149.0
84.0	5.52		5.5	.73	.70	1471	358.3	202.0	142.3	147.7
85.0	5.14		5.1	.76	.73	1413	358.5	204.1	139.9	146.6
86.0	5.08		5.1	.76	.73	1414	358.6	206.4	137.8	145.8
87.0	6.41		6.4	.67	.64	1616	358.6	208.8	135.9	145.2
88.0	6.03		6.0	.69	.66	1549	358.4	211.2	134.3	145.0
89.0	4.70		4.7	.80	.77	1352	358.2	213.6	133.0	145.1
90.0	5.02		5.0	.77	.75	1391	357.9	215.8	131.9	145.6
91.0	5.59		5.6	.72	.70	1473	357.4	217.7	131.2	146.3
92.0	6.03		6.0	.69	.68	1527	356.9	219.5	130.7	147.3
93.0	6.48		6.5	.66	.64	1596	356.4	221.0	130.5	148.5
94.0	6.86		6.9	.63	.62	1652	355.9	222.2	130.5	150.0
95.0	7.49		7.5	.59	.59	1742	355.4	223.2	130.7	151.7
96.0	7.49		7.5	.59	.59	1734	355.0	224.0	131.0	153.5
97.0	7.56		7.6	.58	.59	1744	354.6	224.6	131.5	155.4
98.0	7.81		7.8	.57	.58	1774	354.4	225.0	132.1	157.4
99.0	8.06		8.1	.56	.56	1824	354.3	225.3	132.7	159.3
36300.0	7.36		7.4	.60	.60	1709	354.4	225.5	133.3	161.1
01.0	6.79		6.8	.63	.63	1618	354.6	225.7	133.8	162.5

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 Alpha

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_π	log ρ_B	T_π (°K)	z (km)	$\alpha_\pi-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36302.0	6.41		6.4	-13.66	-13.66	1564	355.0	225.8	134.2	163.6
03.0	6.22		6.2	.67	.67	1543	355.6	226.0	134.3	164.0
04.0	5.14		5.1	.76	.75	1392	356.3	226.2	134.3	163.9
05.0	5.07		5.0	.77	.75	1388	357.2	226.6	134.0	163.1
36306.0	5.1		5.1	-13.76	-13.73	1418	358.4	227.1	133.5	161.8
08.0	5.3		5.3	.75	.70	1484	361.0	228.7	131.7	158.1
10.0	5.4		5.4	.74	.67	1534	363.3	231.3	129.0	153.9
12.0	5.1		5.1	.77	.68	1507	365.0	234.8	125.7	149.6
14.0	4.9		4.9	.79	.70	1484	365.9	239.3	122.0	145.8
16.0	5.1		5.1	.77	.68	1518	365.9	244.1	118.2	142.5
18.0	5.6		5.6	.73	.65	1592	365.0	248.8	114.7	139.9
20.0	6.0		6.0	.70	.63	1635	363.5	252.6	111.5	137.8
22.0	6.4		6.4	.67	.62	1666	361.5	255.5	108.7	136.1
24.0	6.4		6.4	.67	.63	1624	359.3	257.4	106.3	134.6
26.0	6.0		6.0	.70	.68	1525	357.3	258.4	104.1	132.9
28.0	5.8		5.8	.71	.70	1470	355.8	258.8	102.1	130.8
30.0	5.9		5.9	.70	.70	1468	354.9	259.0	99.9	128.1
32.0	5.9		5.9	.71	.71	1460	354.7	259.3	97.3	124.6
34.0	5.3		5.3	.76	.76	1378	355.0	260.0	94.4	120.4
36.0	5.0		5.0	.79	.78	1342	355.8	261.4	90.9	115.8
38.0	5.0		5.0	.79	.78	1346	356.7	263.8	87.0	110.8
40.0	4.7		4.7	.82	.80	1309	357.4	267.1	82.8	106.0
42.0	4.5		4.5	.84	.82	1283	357.7	271.3	78.5	101.5
44.0	4.4		4.4	.85	.83	1266	357.4	275.9	74.4	97.7
46.0	4.6		4.6	.83	.82	1282	356.5	280.4	70.9	94.8
48.0	5.1		5.1	.79	.79	1329	354.9	284.1	68.3	93.1
50.0	5.56		5.6	.74	.74	1409	355.9	286.9	66.7	92.6
52.0	6.25		6.3	.69	.69	1497	355.0	288.6	66.5	93.3
54.0	6.00		6.0	.71	.71	1454	354.5	289.5	67.6	95.0
56.0	5.35		5.4	.75	.76	1379	354.4	289.9	69.6	97.3
58.0	4.88		4.9	.79	.79	1324	355.0	290.0	72.3	99.9
60.0	4.69		4.7	.81	.80	1312	356.2	290.2	75.1	102.4
62.0	4.53		4.5	.83	.81	1303	358.0	290.7	77.7	104.2
64.0	4.35		4.3	.85	.81	1294	360.0	292.0	79.7	105.1
66.0	4.02		4.0	.89	.83	1269	362.0	294.2	80.6	104.9
68.0	3.68		3.7	.93	.86	1238	363.6	297.5	80.4	103.5
70.0	3.58		3.6	.95	.87	1228	364.7	301.8	78.9	101.0
72.0	3.31		3.3	.99	.91	1183	365.0	306.4	76.2	97.6
74.0	3.02		3.0	-14.03	.96	1134	364.5	310.9	72.4	93.5
76.0	3.87		3.9	-13.92	.85	1241	363.4	314.7	67.9	89.2
78.0	4.84		4.8	.83	.78	1342	361.7	317.5	62.9	84.8
80.0	5.41		5.4	.78	.74	1400	359.9	319.2	57.7	80.7
82.0	6.15		6.1	.73	.70	1473	358.2	320.2	52.6	76.9
84.0	6.40		6.4	.70	.69	1496	356.9	320.5	47.8	73.4
86.0	6.04		6.0	.73	.72	1434	356.2	320.6	43.6	70.3
36388.0	5.80		5.8	-13.75	-13.74	1406	356.1	320.8	40.1	67.5
89.0	5.58		5.6	.76	.76	1378	355.9	321.0	38.5	66.1
90.0	5.71		5.7	.76	.75	1393	356.2	321.4	37.1	64.7
91.0	6.02		6.0	.73	.72	1434	356.5	321.9	35.7	63.2
92.0	7.03		7.0	.67	.65	1574	357.0	322.7	34.5	61.8
93.0	7.65		7.7	.63	.61	1682	357.5	323.7	33.3	60.3
94.0	6.47		6.5	.70	.68	1514	358.0	325.0	32.0	58.7
95.0	5.52		5.5	.78	.75	1385	358.4	326.5	30.8	57.0
96.0	5.22		5.2	.80	.77	1350	358.8	328.3	29.5	55.3
97.0	4.66		4.7	.85	.82	1290	359.2	330.4	28.1	53.5
98.0	4.47		4.5	.87	.83	1266	359.4	332.6	26.6	51.6
99.0	4.60		4.6	.86	.82	1279	359.5	334.9	25.0	49.7
36400.0	4.86		4.9	.83	.80	1310	358.9	337.4	23.2	47.7

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 Alpha

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_v$	$\log \rho_s$	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36401.0	4.86		4.9	-13.83	-13.80	1310	358.9	339.7	21.3	45.8
02.0	4.74		4.7	.85	.82	1284	358.7	341.8	19.3	44.0
03.0	4.55		4.5	.87	.84	1259	358.5	343.8	17.2	42.3
04.0	4.80		4.8	.84	.81	1294	358.2	345.6	15.1	40.8
36412.0	6.73		6.7	-13.68	-13.67	1539	356.4	351.5	16.6	40.2
13.0	7.23		7.2	.65	.64	1616	356.6	351.6	19.5	41.6
14.0	7.35		7.4	.63	.62	1655	357.0	351.7	22.5	43.1
15.0	7.41		7.4	.63	.62	1666	357.5	351.8	25.6	44.8
16.0	7.35		7.4	.63	.61	1679	358.2	352.0	28.6	46.5
17.0	7.16		7.2	.65	.62	1662	359.0	352.4	31.6	48.2
18.0	6.79		6.8	.67	.64	1614	359.9	352.8	34.4	49.7
19.0	6.42		6.4	.70	.66	1567	360.8	353.5	37.1	51.2
20.0	6.23		6.2	.71	.66	1550	361.7	354.4	39.6	52.4
21.0	6.04		6.0	.73	.67	1532	362.7	355.6	41.8	53.4
22.0	6.17		6.2	.72	.65	1576	363.5	357.0	43.8	54.2
23.0	5.98		6.0	.73	.66	1554	364.3	358.6	45.5	54.6
24.0	5.98		6.0	.73	.66	1562	364.9	0.6	46.9	54.7
25.0	6.04		6.0	.73	.66	1568	365.4	2.8	47.9	54.5
26.0	5.98		6.0	.73	.66	1570	365.7	5.1	48.6	53.9
27.0	5.98		6.0	.74	.66	1569	365.8	7.6	49.0	52.9
28.0	5.85		5.8	.75	.67	1533	365.7	10.1	48.9	51.6
29.0	5.73		5.7	.76	.68	1511	365.4	12.5	48.6	50.0
30.0	5.71		5.7	.76	.69	1502	364.9	14.8	47.8	48.0
31.0	6.14		6.1	.73	.66	1553	364.3	16.9	46.8	45.6
32.0	6.52		6.5	.70	.64	1603	363.5	18.7	45.4	43.0
33.0	6.95		7.0	.67	.62	1668	362.6	20.2	43.7	40.2
34.0	6.95		7.0	.67	.62	1651	361.6	21.5	41.9	37.1
35.0	6.45		6.5	.70	.66	1559	360.6	22.6	39.8	33.8
36.0	6.58		6.6	.69	.66	1560	359.6	23.4	37.6	30.3
37.0	7.51		7.5	.64	.61	1681	358.6	24.0	35.3	26.8
38.0	8.56		8.6	.58	.56	1842	357.8	24.4	33.0	23.1
39.0	8.75		8.8	.56	.55	1861	357.0	24.7	30.8	19.3
40.0	9.12		9.1	.55	.54	1898	356.4	24.9	28.8	15.6
41.0	9.81		9.8	.52	.51	2007	355.9	25.1	27.2	11.8
42.0	10.30		10.3	.49	.49	2088	355.6	25.3	26.0	8.3
43.0	10.36		10.4	.49	.49	2101	355.5	25.5	25.4	5.4
44.0	9.99		10.0	.51	.50	2030	355.5	25.8	25.4	4.2
45.0	9.68		9.7	.52	.52	1980	355.6	26.2	26.1	5.8
46.0	9.25		9.2	.55	.54	1900	355.9	26.8	27.3	8.7
47.0	9.18		9.2	.55	.54	1906	356.3	27.6	29.0	11.8
48.0	9.50		9.5	.53	.52	1965	356.7	28.6	31.1	14.8
49.0	10.67		10.7	.48	.47	2191	357.2	29.8	33.5	17.7
50.0	10.60		10.6	.49	.47	2183	357.6	31.4	36.0	20.4
51.0	10.07		10.1	.51	.49	2104	358.2	33.2	38.6	22.8
52.0	9.70		9.7	.53	.50	2041	358.6	35.3	41.1	25.0
53.0	9.76		9.8	.52	.50	2067	358.9	37.5	43.6	27.0
54.0	9.33		9.3	.55	.52	1982	359.1	39.9	45.9	28.6
55.0	9.33		9.3	.55	.52	1984	359.2	42.4	48.1	30.0
56.0	9.46		9.5	.54	.51	2020	359.1	44.9	50.1	31.0
57.0	9.70		9.7	.53	.50	2053	358.9	47.3	51.9	31.8
58.0	9.83		9.8	.52	.50	2065	358.6	49.5	53.5	32.2
59.0	10.01		10.0	.51	.49	2093	358.2	51.5	54.8	32.4
60.0	10.25		10.2	.50	.48	2118	357.7	53.2	55.9	32.4
61.0	10.28		10.2	.50	.49	2106	357.2	54.7	56.8	32.1
62.0	10.82		10.8	.48	.46	2204	356.7	55.9	57.5	31.7
63.0	11.19		11.1	.46	.46	2247	356.2	56.9	58.0	31.2
64.0	10.07		10.0	.51	.50	2035	355.7	57.6	58.4	30.6
65.0	8.92		8.9	.56	.56	1843	355.4	58.2	58.6	30.0
66.0	8.71		8.7	.57	.57	1806	355.2	58.6	58.8	29.6

Table 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 Alpha

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_r$	$\log \rho_s$	T_r (°K)	z (km)	$a_r - a_\odot$ (deg.)	ψ_0' (deg.)	ψ_{30}' (deg.)
36467.0	8.71		8.7	−13.57	−13.57	1804	355.1	58.9	58.9	29.2
68.0	9.44		9.4	.54	.53	1918	355.2	59.1	59.1	29.1
69.0	8.84		8.8	.57	.56	1824	355.5	59.3	59.3	29.3
70.0	8.40		8.4	.59	.58	1767	355.9	59.5	59.6	29.8
71.0	9.52		9.5	.53	.52	1956	356.5	59.8	60.0	30.6
72.0	10.07		10.0	.51	.50	2057	357.3	60.1	60.6	31.8
73.0	9.52		9.5	.54	.52	1986	358.1	60.6	61.3	33.2
74.0	9.21		9.2	.55	.52	1952	359.1	61.3	62.3	34.9
75.0	8.73		8.7	.58	.54	1884	360.1	62.2	63.4	36.7
76.0	8.90		8.9	.57	.53	1938	361.1	63.4	64.7	38.8
77.0	9.83		9.8	.53	.48	2128	362.0	64.8	66.2	40.9
78.0	9.41		9.4	.55	.49	2073	362.9	66.5	67.9	43.0
79.0	8.90		8.9	.58	.51	1997	363.7	68.5	69.6	45.1
80.0	8.83		8.8	.58	.51	1994	364.3	70.7	71.5	47.2
81.0	9.01		9.0	.57	.50	2045	364.7	73.1	73.4	49.2
82.0	8.64		8.6	.59	.52	1976	364.9	75.7	75.4	51.0
83.0	8.09		8.1	.62	.54	1885	364.9	78.2	77.3	52.8
84.0	7.97		8.0	.62	.55	1865	364.7	80.7	79.2	54.3
85.0	7.72		7.7	.64	.57	1805	364.3	83.1	81.0	55.7
86.0	7.54		7.5	.65	.58	1761	363.6	85.3	82.7	56.9
87.0	7.66		7.7	.63	.58	1782	362.8	87.2	84.4	58.0
88.0	7.66		7.7	.63	.58	1765	361.9	88.8	85.8	58.9
89.0	7.85		7.8	.63	.58	1763	360.8	90.2	87.2	59.7
90.0	8.02		8.0	.61	.58	1767	359.3	91.3	88.4	60.4
91.0	8.14		8.1	.61	.58	1766	358.3	92.1	89.5	61.0
92.0	8.32		8.3	.59	.58	1780	357.4	92.7	90.5	61.6
93.0	9.98		10.0	.51	.50	2044	356.5	93.2	91.4	62.1
94.0	8.63		8.6	.58	.57	1790	355.6	93.4	92.2	62.7
95.0	8.75		8.8	.57	.57	1804	354.9	93.6	93.0	63.4
96.0	9.85		9.9	.52	.52	1962	354.2	93.8	93.7	64.2
97.0	10.28		10.3	.50	.51	2011	353.7	94.0	94.5	65.2
98.0	9.06		9.1	.55	.57	1807	353.3	94.2	95.4	66.3
99.0	9.61		9.6	.53	.55	1873	353.0	94.4	96.3	67.6
36500.0	9.55		9.5	.54	.55	1850	352.8	94.8	97.3	69.1
01.0	9.14		9.1	.56	.57	1785	352.7	95.4	98.5	70.8
02.0	9.01		9.0	.56	.58	1768	352.7	96.1	99.8	72.7
03.0	8.77		8.8	.57	.59	1737	352.7	97.1	101.3	74.7
04.0	8.47		8.5	.59	.61	1694	352.7	98.4	103.0	76.9
05.0	8.40		8.4	.59	.61	1681	352.6	99.9	104.8	79.1
06.0	8.40		8.4	.59	.61	1681	352.6	101.7	106.7	81.5
07.0	8.47		8.5	.58	.61	1695	352.4	103.7	108.8	83.8
08.0	8.47		8.5	.58	.61	1695	352.2	106.0	110.9	86.2
09.0	8.53		8.5	.58	.61	1693	351.9	108.4	113.1	88.5
10.0	8.40		8.4	.58	.61	1676	351.5	110.8	115.3	90.6
11.0	7.84		7.8	.61	.65	1591	350.9	113.2	117.5	92.7
12.0	7.48		7.5	.63	.67	1547	350.3	115.6	119.6	94.5
13.0	6.63		6.6	.68	.72	1432	349.6	117.7	121.6	96.0
14.0	6.93		6.9	.66	.71	1461	348.9	119.6	123.3	97.3
15.0	6.81		6.8	.66	.72	1443	348.1	121.2	124.8	98.4
16.0	6.69		6.7	.66	.73	1425	347.4	122.6	126.0	99.0
17.0	6.69		6.7	.66	.73	1419	346.7	123.6	126.9	99.4
18.0	6.75		6.7	.66	.73	1414	346.2	124.5	127.4	99.5
19.0	6.81		6.8	.65	.73	1422	345.8	125.1	127.4	99.2
20.0	6.75		6.7	.66	.74	1409	345.5	125.5	127.2	98.8
21.0	5.96		6.0	.71	.78	1334	345.4	125.7	126.5	98.0
22.0	5.23		5.2	.77	.85	1252	345.6	125.9	125.6	97.1
23.0	5.35		5.4	.75	.83	1276	346.0	126.0	124.3	96.1
24.0	5.72		5.7	.73	.80	1314	346.6	126.1	122.9	95.0
25.0	5.84		5.8	.72	.79	1332	347.4	126.2	121.4	93.9
26.0	5.72		5.7	.73	.79	1331	348.4	126.4	119.8	92.8

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 Alpha

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_π	log ρ_s	T_π (°K)	z (km)	$\alpha_\pi-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36527.0	5.35		5.3	-13.77	-13.81	1297	349.6	126.7	118.2	91.8
28.0	5.11		5.1	.79	.82	1286	351.0	127.1	116.7	91.0
29.0	5.29		5.3	.77	.79	1321	352.4	127.8	115.4	90.4
30.0	5.84		5.8	.74	.74	1396	353.8	128.7	114.2	90.0
31.0	6.02		6.0	.72	.72	1437	355.3	129.9	113.3	89.8
32.0	6.32		6.3	.70	.69	1495	356.7	131.3	112.6	90.0
33.0	6.38		6.4	.70	.68	1526	358.0	133.0	112.3	90.5
34.0	6.38		6.4	.70	.67	1543	359.2	135.0	112.3	91.2
35.0	6.51		6.5	.70	.65	1573	360.2	137.2	112.6	92.3
36.0	6.51		6.5	.70	.65	1586	361.0	139.6	113.3	93.6
37.0	6.51		6.5	.70	.64	1596	361.5	142.1	114.4	95.2
38.0	6.44		6.4	.70	.65	1587	361.8	144.5	115.7	97.0
39.0	6.46		6.5	.70	.64	1607	361.9	146.8	117.4	99.0
40.0	6.44		6.4	.70	.65	1592	361.7	149.0	119.4	101.2
41.0	6.63		6.6	.69	.63	1622	361.4	150.9	121.6	103.4
42.0	6.63		6.6	.68	.64	1616	360.3	152.5	124.1	105.8
43.0	6.44		6.4	.70	.65	1577	360.1	153.8	126.7	108.1
44.0	5.90		5.9	.73	.69	1493	359.3	154.9	129.5	110.4
45.0	5.84		5.8	.73	.70	1470	358.4	155.6	132.3	112.7
46.0	5.59		5.6	.74	.72	1433	357.6	156.2	135.3	115.0
47.0	5.53		5.5	.75	.74	1411	356.7	156.6	138.2	117.1
48.0	5.65		5.6	.74	.73	1417	355.9	156.8	141.2	119.1
49.0	5.96		5.9	.72	.71	1449	355.1	156.8	144.0	121.1
50.0	6.09		6.1	.70	.70	1470	354.5	156.9	146.8	122.9
51.0	6.48		6.5	.67	.68	1518	354.0	156.9	149.4	124.6
52.0	6.06		6.1	.70	.71	1459	353.6	156.9	151.8	126.1
53.0	6.00		6.0	.70	.72	1443	353.3	157.0	154.0	127.6
54.0	5.88		5.9	.71	.73	1428	353.2	157.2	156.0	129.1
55.0	5.76		5.8	.72	.73	1414	353.1	157.6	157.8	130.4
56.0	5.39		5.4	.75	.77	1363	353.1	158.2	159.3	131.8
57.0	5.27		5.2	.77	.78	1339	353.2	159.0	160.6	133.2
58.0	4.67		4.7	.81	.82	1278	353.2	160.0	161.7	134.7
36569.0	4.45		4.4	-13.83	-13.88	1212	349.3	181.8	175.7	154.2
70.0	4.45		4.4	.83	.88	1206	348.5	183.0	176.8	155.3
71.0	4.76		4.8	.79	.85	1245	347.9	184.1	176.1	156.0
72.0	5.13		5.1	.76	.83	1273	347.3	184.8	174.0	156.2
73.0	5.61		5.6	.72	.79	1325	346.9	185.4	171.2	155.7
74.0	6.03		6.0	.69	.76	1368	346.6	185.8	168.2	154.7
75.0	6.03		6.0	.69	.76	1368	346.6	186.0	165.1	153.1
76.0	6.03		6.0	.69	.76	1370	346.7	186.1	161.8	151.2
77.0	6.03		6.0	.69	.76	1375	347.1	186.1	158.4	148.8
78.0	5.97		6.0	.69	.75	1382	347.7	186.2	155.0	146.4
79.0	5.85		5.8	.71	.76	1369	348.5	186.2	151.5	143.7
80.0	5.61		5.6	.72	.77	1357	349.5	186.4	148.1	141.1
81.0	4.88		4.9	.78	.82	1286	350.7	186.6	144.8	138.5
82.0	4.82		4.8	.79	.82	1287	352.0	187.1	141.6	136.0
83.0	4.16		4.2	.85	.87	1228	353.4	187.7	138.5	133.8
84.0	4.10		4.1	.86	.87	1228	354.9	188.6	135.6	131.7
85.0	4.22		4.2	.86	.84	1254	356.3	189.8	132.9	129.9
86.0	4.04		4.0	.88	.86	1240	357.8	191.2	130.5	128.4
87.0	4.10		4.1	.87	.84	1265	359.1	193.0	128.3	127.2
88.0	4.34		4.3	.85	.81	1304	360.2	195.0	126.5	126.5
89.0	4.22		4.2	.86	.81	1299	361.2	197.3	125.0	126.1
90.0	4.22		4.2	.86	.80	1307	361.9	199.7	123.8	126.2
91.0	4.16		4.2	.86	.80	1313	362.5	202.2	123.0	126.6
92.0	4.28		4.3	.85	.79	1331	362.7	204.6	122.7	127.5
93.0	4.34		4.3	.85	.79	1332	362.8	207.0	122.6	128.7
94.0	4.40		4.4	.84	.78	1345	362.6	209.2	123.0	130.4
95.0	5.00		5.0	.79	.72	1432	362.2	211.1	123.7	132.4

Table 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—**Continued**

Satellite 1958 Alpha

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_\pi$	$\log \rho_s$	T_π (°K)	z (km)	$\alpha_\pi-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36596.0	5.13		5.1	-13.78	-13.72	1441	361.6	212.8	124.8	134.8
97.0	5.37		5.4	.75	.70	1479	360.9	214.2	126.1	137.5
98.0	5.43		5.4	.75	.70	1468	360.0	215.3	127.7	140.4
99.0	5.54		5.5	.74	.70	1472	359.1	216.1	129.5	143.6
36600.0	5.09		5.1	.77	.74	1401	358.2	216.7	131.4	147.0
01.0	4.74		4.7	.80	.78	1336	357.3	217.1	133.4	150.5
02.0	5.19		5.2	.76	.75	1395	356.5	217.4	135.5	154.1
03.0	5.73		5.7	.72	.71	1455	355.7	217.6	137.4	157.8
04.0	5.83		5.8	.71	.71	1460	355.1	217.7	139.1	161.4
05.0	5.29		5.3	.75	.75	1384	354.5	217.8	140.6	164.9
06.0	4.87		4.9	.78	.79	1326	354.1	217.9	141.8	168.1
07.0	4.45		4.4	.83	.84	1260	353.8	218.2	142.5	170.5
08.0	4.45		4.4	.83	.84	1257	353.6	218.5	142.7	171.6
09.0	4.57		4.6	.81	.82	1280	353.6	219.0	142.4	171.0
10.0	4.67		4.7	.80	.82	1291	353.5	219.8	141.6	169.0
11.0	4.85		4.8	.79	.82	1286	352.1	220.7	140.5	166.4
12.0	4.55		4.6	.81	.83	1266	352.5	222.0	138.9	163.6
13.0	4.35		4.4	.83	.85	1245	352.9	223.5	137.0	160.7
14.0	4.86		4.9	.79	.80	1309	353.3	225.4	134.9	157.9
15.0	5.23		5.2	.76	.77	1349	353.7	227.4	132.6	155.3
16.0	4.94		4.9	.79	.80	1314	353.9	229.8	130.3	152.9
17.0	4.30		4.3	.85	.85	1241	354.1	232.2	128.0	150.7
18.0	3.85		3.8	.90	.91	1181	354.2	234.7	125.7	148.7
19.0	3.86		3.9	.89	.90	1192	354.1	237.2	123.5	147.0
20.0	3.89		3.9	.89	.90	1191	353.9	239.6	121.4	145.6
21.0	3.97		4.0	.88	.89	1201	353.6	241.8	119.5	144.4
22.0	4.06		4.1	.87	.88	1210	353.3	243.8	117.8	143.4
23.0	4.07		4.1	.87	.88	1207	352.9	245.4	116.3	142.6
24.0	4.82		4.8	.80	.82	1286	352.5	246.8	114.9	142.0
25.0	5.44		5.4	.75	.77	1356	352.1	247.9	113.8	141.6
26.0	5.59		5.6	.73	.76	1377	351.8	248.8	112.8	141.2
27.0	5.55		5.6	.73	.76	1375	351.5	249.4	111.9	140.9
28.0	5.17		5.2	.76	.79	1325	351.4	249.9	111.1	140.5
29.0	4.95		5.0	.78	.81	1302	351.5	250.2	110.5	140.1
36630.0	4.7		4.7	-13.80	-13.83	1269	351.7	250.5	109.8	139.6
32.0	4.5		4.5	.82	.84	1253	352.6	250.9	108.6	138.0
34.0	4.3		4.3	.85	.85	1242	354.1	251.4	107.1	135.7
36.0	4.1		4.1	.87	.86	1232	356.1	252.6	105.0	132.4
38.0	4.0		4.0	.89	.86	1235	358.3	254.6	102.4	128.6
40.0	4.1		4.1	.88	.84	1262	360.2	257.7	99.2	124.3
42.0	4.2		4.2	.88	.82	1284	361.5	262.0	95.4	120.0
44.0	4.3		4.3	.87	.81	1299	362.1	267.1	91.5	116.0
46.0	4.5		4.5	.85	.79	1320	361.7	272.4	87.5	112.4
48.0	4.8		4.8	.82	.78	1345	360.4	277.1	83.8	109.6
36650.0	5.10		5.1	-13.79	-13.77	1363	358.5	280.8	80.6	107.5
51.0	5.18		5.2	.78	.76	1364	357.4	282.2	79.2	106.8
52.0	5.39		5.4	.77	.76	1377	356.2	283.3	78.0	106.2
36653.0	5.54		5.5	-13.76	-13.76	1376	355.1	284.2	77.0	105.7
53.2	6.22		6.2	.71	.71	1463	354.8	284.4	76.8	105.6
53.5	6.22		6.2	.70	.71	1460	354.5	284.5	76.6	105.5
53.7	7.17		7.2	.64	.65	1592	354.3	284.7	76.4	105.4
54.0	8.13		8.1	.59	.60	1719	354.0	284.8	76.2	105.3
54.2	12.97		13.0	.38	.39	2587	353.7	285.0	76.0	105.2
54.5	11.06		11.1	.45	.46	2208	353.5	285.1	75.8	105.1
54.7	7.23		7.2	.64	.65	1575	353.2	285.2	75.6	105.0
36655.0	7.23		7.2	-13.64	-13.65	1571	353.0	285.3	75.4	104.9

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 Alpha

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_r$	$\log \rho_s$	T_r (°K)	z (km)	$\alpha_r-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36656.0	5.44		5.4	-13.76	-13.79	1332	352.1	285.6	74.8	104.6
57.0	5.38		5.4	.76	.79	1324	351.4	285.9	74.3	104.2
58.0	5.38		5.4	.76	.80	1317	350.9	286.1	73.8	103.8
59.0	5.38		5.4	.76	.80	1312	350.6	286.4	73.4	103.2
60.0	5.56		5.6	.75	.79	1332	350.4	286.6	72.9	102.5
61.0	5.62		5.6	.75	.79	1330	350.4	287.0	72.4	101.6
62.0	5.56		5.6	.75	.79	1329	350.6	287.6	71.7	100.5
63.0	4.96		5.0	.80	.84	1263	350.9	288.3	70.9	99.2
64.0	4.66		4.7	.83	.86	1231	351.3	289.2	69.9	97.7
65.0	5.26		5.3	.78	.81	1298	351.7	290.5	68.7	95.9
66.0	5.44		5.4	.78	.80	1311	352.2	292.0	67.3	94.0
67.0	6.04		6.0	.73	.75	1382	352.7	293.8	65.8	91.9
36668.0	6.4		6.4	-13.71	-13.72	1430	353.1	295.8	64.0	89.7
70.0	6.3		6.3	.72	.73	1419	353.6	300.6	59.9	85.0
72.0	6.3		6.3	.72	.73	1416	353.7	305.8	55.3	80.3
74.0	6.4		6.4	.72	.73	1423	353.4	310.6	50.4	76.0
76.0	6.6		6.6	.70	.72	1441	352.7	314.5	45.9	72.4
78.0	6.7		6.7	.69	.72	1448	351.9	317.3	42.2	69.9
80.0	6.6		6.6	.69	.72	1435	351.2	319.0	40.0	68.7
82.0	7.0		7.0	.66	.69	1487	351.0	319.9	39.5	68.8
84.0	7.6		7.6	.63	.65	1575	351.4	320.4	40.9	69.8
86.0	7.5		7.5	.63	.65	1583	352.5	320.8	43.6	71.5
88.0	7.1		7.1	.66	.66	1557	354.2	321.5	47.0	73.2
90.0	6.5		6.5	.70	.69	1504	356.2	322.8	50.4	74.6
92.0	5.9		5.9	.74	.72	1447	358.3	325.2	53.3	75.3
94.0	5.6		5.6	.77	.73	1422	360.0	328.7	55.1	74.9
96.0	5.8		5.8	.76	.71	1456	361.0	333.3	55.6	73.3
98.0	6.2		6.2	.73	.69	1506	361.1	338.5	54.6	70.5
36700.0	6.8		6.8	.69	.65	1573	360.2	343.6	52.1	66.7
02.0	6.9		6.9	.69	.66	1556	358.5	347.8	48.3	62.1
04.0	7.0		7.0	.68	.67	1536	356.3	350.9	43.3	57.0
06.0	7.1		7.1	.67	.68	1517	353.9	352.9	37.4	51.8
08.0	7.0		7.0	.67	.70	1478	351.6	353.9	30.9	46.7
10.0	7.0		7.0	.67	.71	1460	349.8	354.4	24.0	42.0
12.0	6.9		6.9	.67	.72	1439	348.8	354.7	17.1	38.0
36714.0	6.80		6.8	-13.68	-13.73	1425	348.4	355.2	10.5	34.6
15.0	6.27		6.3	.72	.74	1396	350.9	355.4	7.5	33.4
16.0	5.85		5.8	.75	.78	1343	351.2	356.0	4.8	32.0
17.0	5.30		5.3	.79	.82	1290	351.6	356.9	2.9	30.8
18.0	5.23		5.2	.80	.82	1283	352.1	358.0	3.2	29.6
19.0	5.34		5.3	.79	.81	1297	352.5	359.4	5.0	28.3
20.0	5.68		5.7	.76	.73	1346	353.0	1.1	7.1	27.0
21.0	5.97		6.0	.74	.75	1383	353.4	3.0	9.1	25.6
22.0	6.13		6.1	.73	.74	1398	353.6	5.2	10.9	24.1
23.0	6.13		6.1	.73	.74	1399	353.8	7.6	12.6	22.4
24.0	5.76		5.8	.76	.76	1364	353.9	10.2	14.0	20.5
25.0	5.87		5.9	.75	.76	1375	353.8	12.7	15.3	18.5
26.0	6.10		6.1	.73	.74	1397	353.6	15.1	16.5	16.3
27.0	6.26		6.3	.72	.73	1418	353.3	17.4	17.5	14.0
28.0	6.38		6.4	.71	.73	1427	352.9	19.4	18.6	11.5
29.0	6.49		6.5	.70	.72	1435	352.4	21.1	19.6	9.1
30.0	6.71		6.7	.69	.71	1455	351.9	22.6	20.7	7.0
31.0	6.71		6.7	.69	.71	1450	351.3	23.7	21.9	5.9
32.0	6.64		6.6	.69	.72	1435	350.9	24.6	23.4	6.6
33.0	6.75		6.7	.69	.72	1444	350.5	25.3	25.0	8.8
34.0	6.74		6.7	.69	.72	1442	350.3	25.7	26.9	11.9
35.0	6.91		6.9	.67	.71	1466	350.1	26.0	29.0	15.3
36.0	7.13		7.1	.66	.69	1491	350.2	26.2	31.4	18.9

Table 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 Alpha

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_v	log ρ_s	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36737.0	6.94		6.9	-13.67	-13.70	1470	350.4	26.3	33.9	22.6
38.0	6.93		6.9	.67	.70	1475	350.9	26.4	36.7	26.3
39.0	6.68		6.7	.69	.71	1458	351.5	26.6	39.6	30.0
40.0	6.61		6.6	.69	.71	1454	352.3	26.8	42.6	33.7
41.0	6.54		6.5	.70	.71	1452	353.2	27.2	45.7	37.2
42.0	6.41		6.4	.71	.71	1451	354.2	27.8	48.8	40.6
43.0	6.28		6.3	.72	.71	1451	355.2	28.6	51.8	43.8
44.0	6.21		6.2	.72	.71	1451	356.3	29.6	54.8	46.7
45.0	5.90		5.9	.75	.73	1424	357.3	31.0	57.4	49.4
46.0	5.43		5.4	.78	.76	1371	358.3	32.6	60.5	51.7
47.0	6.42		6.4	.71	.68	1516	359.1	34.6	63.0	53.8
48.0	6.69		6.7	.69	.66	1570	359.8	36.8	65.3	55.4
49.0	6.15		6.2	.72	.69	1505	360.2	39.2	67.3	56.6
50.0	5.37		5.4	.78	.74	1398	360.4	41.8	69.0	57.5
51.0	4.96		5.0	.82	.78	1346	360.4	44.4	70.4	57.9
52.0	4.94		4.9	.83	.79	1331	360.2	47.0	71.4	57.8
53.0	4.94		4.9	.82	.79	1327	359.8	49.3	72.0	57.4
54.0	4.99		5.0	.82	.78	1334	359.1	51.5	72.2	56.5
55.0	4.99		5.0	.81	.79	1327	358.3	53.4	72.1	55.3
56.0	5.45		5.5	.77	.75	1380	357.4	54.9	71.6	53.7
57.0	5.44		5.4	.78	.77	1358	356.4	56.2	70.9	51.8
58.0	5.32		5.3	.79	.78	1335	355.4	57.2	69.8	49.6
59.0	5.61		5.6	.76	.77	1361	354.4	57.9	68.5	47.2
60.0	6.12		6.1	.72	.74	1412	353.5	58.4	67.1	44.7
61.0	6.11		6.1	.72	.74	1402	352.6	58.8	65.5	42.0
62.0	6.11		6.1	.72	.75	1394	352.0	59.0	63.9	39.4
63.0	6.23		6.2	.72	.74	1399	351.4	59.2	62.3	36.9
64.0	7.29		7.3	.65	.67	1528	351.1	59.3	60.8	34.5
65.0	8.23		8.2	.60	.63	1640	350.9	59.4	59.5	32.5
66.0	7.76		7.8	.62	.65	1585	351.0	59.7	58.4	30.9
67.0	7.48		7.5	.64	.67	1546	351.2	60.0	57.6	29.8
68.0	7.13		7.1	.66	.69	1497	351.5	60.6	57.2	29.2
69.0	6.78		6.8	.69	.71	1463	351.9	61.3	57.1	29.3
70.0	6.14		6.1	.73	.75	1383	352.4	62.3	57.5	30.0
71.0	5.62		5.6	.77	.79	1329	353.0	63.6	58.2	31.2
72.0	5.63		5.6	.78	.79	1332	353.5	65.2	59.3	32.9
73.0	5.63		5.6	.78	.78	1334	354.0	67.1	60.8	34.8
74.0	5.64		5.6	.78	.78	1337	354.4	69.2	62.5	37.0
75.0	5.71		5.7	.77	.77	1350	354.7	71.6	64.4	39.2
76.0	5.25		5.3	.80	.80	1306	354.9	74.1	66.6	41.5
77.0	5.08		5.1	.82	.82	1283	354.9	76.7	68.8	43.8
78.0	4.98		5.0	.83	.83	1272	354.8	79.3	71.1	46.0
79.0	4.99		5.0	.83	.83	1270	354.6	81.7	73.4	48.0
80.0	4.82		4.8	.85	.85	1246	354.3	83.9	75.7	50.0
81.0	5.08		5.1	.82	.83	1277	353.9	85.8	77.9	51.8
82.0	5.44		5.4	.79	.80	1307	353.4	87.5	80.1	53.5
83.0	5.27		5.3	.80	.81	1293	353.0	88.8	82.1	55.0
84.0	4.99		5.0	.82	.84	1257	352.5	89.9	84.0	56.4
85.0	5.00		5.0	.82	.84	1255	352.2	90.7	85.7	57.8
86.0	5.14		5.1	.81	.84	1257	351.1	91.3	87.3	59.0
87.0	5.49		5.5	.78	.81	1297	350.8	91.8	88.8	60.3
88.0	5.19		5.2	.80	.84	1264	350.7	92.1	90.2	61.5
89.0	4.89		4.9	.83	.86	1233	350.8	92.3	91.5	62.8
90.0	4.89		4.9	.83	.86	1234	351.1	92.5	92.8	64.1
91.0	4.70		4.7	.85	.88	1216	351.6	92.8	94.0	65.5
92.0	4.29		4.3	.89	.91	1179	352.3	93.1	95.2	67.0
93.0	4.40		4.4	.88	.90	1194	353.1	93.5	96.5	68.6
94.0	4.68		4.7	.85	.86	1233	354.1	94.1	97.8	70.3
95.0	4.84		4.8	.85	.85	1252	355.2	94.9	99.2	72.2
96.0	5.07		5.1	.82	.81	1295	356.3	96.0	100.7	74.2

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 Alpha

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_\pi$	$\log \rho_s$	T_π (°K)	z (km)	$\alpha_\pi-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36797.0	4.89		4.9	-13.84	-13.82	1282	357.5	97.4	102.4	76.3
98.0	4.46		4.5	.88	.85	1245	358.5	99.1	104.1	78.5
99.0	4.16		4.2	.91	.87	1219	359.5	101.1	105.9	80.7
36800.0	3.97		4.0	.93	.89	1203	360.3	103.3	107.9	82.9
01.0	4.18		4.2	.91	.86	1234	360.9	105.8	109.9	85.1
02.0	4.30		4.3	.90	.85	1252	361.3	108.5	112.0	87.2
03.0	4.46		4.5	.88	.82	1281	361.5	111.3	114.1	89.3
04.0	4.74		4.7	.85	.80	1310	361.5	114.0	116.2	91.2
05.0	4.78		4.8	.84	.79	1324	361.2	116.5	118.3	92.9
06.0	4.76		4.8	.84	.79	1322	360.7	118.9	120.3	94.4
07.0	4.51		4.5	.86	.82	1281	360.1	121.0	122.1	95.7
08.0	4.44		4.4	.87	.84	1264	359.3	122.7	123.7	96.8
09.0	4.48		4.5	.86	.83	1271	358.4	124.2	125.1	97.6
10.0	5.11		5.1	.80	.78	1338	357.5	125.4	126.3	98.2
11.0	5.39		5.4	.77	.76	1368	356.5	126.2	127.2	98.5
12.0	5.66		5.7	.75	.74	1397	355.7	126.9	127.8	98.7
13.0	5.71		5.7	.75	.75	1389	354.8	127.4	128.1	98.6
14.0	5.86		5.9	.73	.74	1406	354.2	127.8	128.2	98.5
15.0	6.03		6.0	.72	.74	1412	353.6	128.0	128.0	98.3
16.0	5.49		5.5	.76	.78	1346	353.2	128.3	127.7	98.0
17.0	4.96		5.0	.80	.82	1284	353.0	128.6	127.3	97.8
18.0	4.30		4.3	.87	.89	1204	352.9	128.9	126.8	97.7
19.0	3.94		3.9	.91	.93	1159	353.0	129.3	126.3	97.7
20.0	3.99		4.0	.90	.92	1171	353.2	130.0	125.9	97.9
21.0	4.15		4.2	.88	.90	1194	353.5	130.8	125.6	98.3
22.0	4.19		4.2	.89	.90	1195	353.8	131.8	125.6	99.0
23.0	4.06		4.1	.90	.90	1186	354.2	133.2	125.7	99.9
24.0	4.06		4.1	.90	.90	1188	354.5	134.9	126.1	101.1
25.0	4.09		4.1	.90	.90	1190	354.8	136.8	126.8	102.6
26.0	4.02		4.0	.91	.91	1180	355.0	139.1	127.8	104.4
27.0	3.89		3.9	.92	.92	1170	355.1	141.6	129.2	106.4
28.0	4.23		4.2	.89	.89	1204	355.0	144.2	130.8	108.6
29.0	4.62		4.6	.85	.85	1249	354.8	146.9	132.8	110.9
30.0	5.01		5.0	.81	.81	1294	354.4	149.6	135.0	113.4
31.0	4.93		4.9	.81	.82	1280	353.9	152.1	137.6	116.0
32.0	4.86		4.9	.81	.83	1276	353.3	154.5	140.3	118.6
33.0	4.55		4.5	.85	.87	1227	352.6	156.5	143.3	121.2
34.0	4.41		4.4	.85	.88	1212	351.8	158.3	146.4	123.7
35.0	4.91		4.9	.80	.84	1263	351.0	159.8	149.6	126.0
36.0	5.59		5.6	.74	.78	1337	350.3	160.9	152.8	128.1
37.0	4.93		4.9	.80	.84	1254	349.7	161.8	155.9	130.0
38.0	4.38		4.4	.84	.89	1198	349.1	162.5	158.8	131.4
39.0	4.24		4.2	.86	.91	1175	348.7	163.0	161.2	132.6
40.0	4.21		4.2	.86	.92	1174	348.5	163.4	162.9	133.4
41.0	4.24		4.2	.86	.91	1175	348.6	163.7	163.7	133.7
42.0	4.26		4.3	.85	.90	1188	348.8	164.0	163.4	133.8
43.0	4.29		4.3	.85	.90	1192	349.2	164.2	162.2	133.5
44.0	4.32		4.3	.85	.89	1197	349.8	164.6	160.2	133.0
45.0	4.47		4.5	.83	.87	1225	350.6	165.1	157.8	132.4
46.0	4.44		4.4	.84	.87	1221	351.5	165.7	155.2	131.7
47.0	3.93		3.9	.90	.92	1173	352.5	166.6	152.5	130.9
48.0	3.44		3.4	.96	.97	1122	353.6	167.7	149.9	130.3
49.0	2.93		2.9	-14.03	-14.03	1070	354.6	169.1	147.4	129.7
50.0	2.55		2.5	.09	.09	1027	355.6	170.8	145.2	129.4
36865.0	3.70		3.7	-13.91	-13.95	1144	351.1	199.0	151.9	156.6
66.0	3.66		3.7	.91	.95	1140	350.4	199.4	154.1	159.7
67.0	3.87		3.9	.89	.93	1158	349.8	199.6	156.1	162.7
68.0	3.77		3.8	.90	.95	1144	349.4	199.8	157.8	165.5
69.0	3.57		3.6	.92	.97	1120	349.2	200.0	159.1	168.0

Table 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 Alpha

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_T	log ρ_B	T_T (°K)	z (km)	$\alpha_T-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36870.0	3.48		3.5	-13.93	-13.98	1108	349.1	200.3	159.8	169.9
71.0	3.45		3.4	.95	-14.00	1098	349.2	200.8	159.8	171.0
72.0	3.70		3.7	.91	-13.96	1131	349.4	201.4	159.2	171.2
73.0	5.02		5.0	.78	.83	1275	349.7	202.2	158.0	170.5
74.0	4.76		4.8	.80	.84	1255	350.0	203.3	156.4	169.3
75.0	4.10		4.1	.87	.91	1177	350.0	204.7	154.4	167.9
76.0	3.63		3.6	.93	.97	1124	350.3	206.4	152.3	166.5
77.0	3.37		3.4	.95	.99	1104	350.6	208.4	150.1	165.2
36887.0	3.09		3.1	-13.99	-14.04	1060	348.8	230.2	133.0	160.7
88.0	3.88		3.9	.89	-13.95	1144	348.5	231.1	131.8	160.0
89.0	3.70		3.7	.91	.97	1121	348.2	231.8	130.6	159.0
90.0	3.86		3.9	.89	.95	1142	348.0	232.3	129.4	157.6
91.0	3.86		3.9	.89	.95	1142	348.1	232.6	128.1	155.7
92.0	3.32		3.3	.96	-14.02	1080	348.3	232.8	126.7	153.5
93.0	3.38		3.4	.95	.00	1093	348.7	232.9	125.1	151.0
94.0	3.32		3.3	.96	.01	1085	349.3	233.0	123.3	148.1
95.0	3.66		3.7	.91	-13.96	1134	350.0	233.2	121.4	145.1
96.0	3.41		3.4	.95	.99	1106	351.0	233.4	119.3	141.9
97.0	3.52		3.5	.94	.97	1124	352.1	233.8	117.1	138.6
98.0	3.29		3.3	.97	.99	1108	353.2	234.3	114.6	135.2
99.0	3.63		3.6	.94	.94	1149	354.4	235.1	112.1	131.9
36900.0	4.02		4.0	.89	.89	1204	355.7	236.1	109.5	128.7
01.0	4.07		4.1	.88	.87	1225	356.8	237.5	106.8	125.6
02.0	3.66		3.7	.93	.91	1183	357.9	239.1	104.2	122.7
03.0	3.48		3.5	.96	.93	1164	358.8	241.1	101.6	120.0
04.0	3.60		3.6	.95	.91	1181	359.5	243.3	99.1	117.6
05.0	4.00		4.0	.90	.86	1234	359.9	245.8	96.7	115.4
06.0	4.23		4.2	.88	.84	1262	360.1	248.4	94.6	113.7
07.0	3.70		3.7	.94	.89	1197	360.1	251.0	92.7	112.3
08.0	3.53		3.5	.96	.92	1170	359.8	253.5	91.0	111.3
09.0	3.52		3.5	.96	.92	1166	359.2	255.8	89.8	110.7
10.0	3.24		3.2	-14.00	.97	1124	358.5	257.9	88.8	110.5
11.0	3.45		3.5	-13.96	.93	1155	357.5	259.7	88.3	110.8
12.0	3.57		3.6	.94	.93	1160	356.4	261.2	88.1	111.4
13.0	3.58		3.6	.94	.94	1153	355.3	262.3	88.3	112.3
14.0	3.58		3.6	.94	.94	1145	354.1	263.2	88.8	113.5
15.0	3.36		3.4	.96	.98	1115	352.9	263.8	89.6	115.0
16.0	3.41		3.4	.96	.98	1109	351.8	264.2	90.7	116.7
17.0	3.25		3.2	.98	-14.02	1081	350.8	264.5	92.0	118.4
18.0	3.19		3.2	.98	.02	1076	349.9	264.6	93.4	120.2
19.0	3.09		3.1	.99	.04	1061	349.3	264.7	94.8	122.0
20.0	2.81		2.8	-14.04	.09	1025	348.8	264.8	96.3	123.7
21.0	2.60		2.6	.07	.13	1002	348.5	264.9	97.7	125.1
22.0	2.61		2.6	.07	.13	1001	348.3	265.1	98.9	126.3
23.0	2.23		2.2	.14	.20	957	348.4	265.4	99.9	127.2
24.0	2.42		2.4	.11	.16	978	348.6	266.0	100.7	127.7
25.0	3.02		3.0	.01	.06	1044	348.9	266.8	101.1	127.8
26.0	3.39		3.4	-13.96	.01	1087	349.2	267.9	101.2	127.4
27.0	3.41		3.4	.96	.01	1088	349.6	269.3	101.0	126.7
28.0	3.61		3.6	.94	-13.98	1110	349.9	271.0	100.4	125.6
29.0	3.81		3.8	.92	.96	1132	350.2	273.0	99.4	124.2
30.0	3.84		3.8	.92	.96	1131	350.4	275.2	98.1	122.4
31.0	3.47		3.5	.96	-14.00	1099	350.5	277.7	96.5	120.5
32.0	3.04		3.0	-14.03	.06	1044	350.5	280.2	94.6	118.5
33.0	3.07		3.1	.01	.05	1052	350.4	282.7	92.5	116.3
34.0	3.40		3.4	-13.98	.02	1081	350.1	285.1	90.3	114.1
35.0	4.01		4.0	.91	-13.95	1140	349.8	287.3	87.9	111.9
36.0	4.39		4.4	.87	.91	1176	349.4	289.2	85.5	109.8
37.0	4.60		4.6	.85	.90	1192	348.9	290.9	83.1	107.7

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TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 Alpha

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_π	log ρ_s	T_π (°K)	z (km)	$\alpha_\pi-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36938.0	4.70		4.7	-13.84	-13.89	1198	348.4	292.2	80.6	105.7
39.0	5.21		5.2	.79	.85	1244	348.0	293.2	78.3	103.8
40.0	5.43		5.4	.78	.84	1260	347.6	294.0	76.0	102.0
41.0	5.01		5.0	.81	.87	1218	347.4	294.5	73.8	100.3
42.0	4.70		4.7	.84	.90	1188	347.3	294.9	71.8	98.7
43.0	4.23		4.2	.89	.95	1139	347.3	295.1	69.8	97.1
44.0	4.22		4.2	.89	.95	1141	347.6	295.2	68.0	95.6
45.0	4.14		4.1	.90	.96	1134	348.0	295.3	66.3	94.1
46.0	3.95		4.0	.91	.96	1127	348.7	295.4	64.7	92.6
47.0	3.88		3.9	.92	.97	1122	349.5	295.5	63.2	91.0
48.0	3.93		3.9	.93	.96	1127	350.5	295.8	61.8	89.4
49.0	3.86		3.9	.93	.96	1133	351.6	296.3	60.3	87.7
50.0	3.73		3.7	.96	.97	1118	352.7	297.0	58.8	86.0
51.0	4.23		4.2	.90	.91	1178	353.9	298.0	57.3	84.1
52.0	3.82		3.8	.95	.95	1141	355.0	299.2	55.7	82.1
53.0	3.58		3.6	.98	.97	1124	356.0	300.8	54.0	80.0
54.0	4.26		4.3	.90	.89	1206	356.9	302.8	52.3	77.9
55.0	4.46		4.5	.88	.86	1232	357.6	305.0	50.4	75.7
56.0	4.36		4.4	.89	.87	1228	358.6	307.4	48.4	73.5
57.0	4.36		4.4	.90	.87	1228	358.8	310.0	46.4	71.4
58.0	5.92		5.9	.77	.74	1405	358.7	312.7	44.3	69.3
59.0	4.84		4.8	.86	.83	1270	358.3	315.3	42.1	67.3
60.0	5.49		5.5	.80	.78	1347	357.8	317.8	40.0	65.5
61.0	6.36		6.4	.73	.71	1450	357.0	320.1	38.0	63.9
62.0	6.33		6.3	.73	.73	1429	356.1	322.0	36.1	62.5
63.0	6.46		6.5	.72	.72	1444	355.1	323.7	34.4	61.4
64.0	6.42		6.4	.72	.73	1422	354.0	325.0	33.1	60.7
65.0	7.01		7.0	.68	.70	1484	352.8	326.1	32.2	60.3
66.0	7.09		7.1	.67	.70	1485	351.7	326.9	31.7	60.2
67.0	7.69		7.7	.63	.67	1548	350.7	327.4	31.7	60.4
68.0	7.54		7.5	.64	.68	1514	349.8	327.8	32.2	60.9
69.0	7.34		7.3	.65	.70	1483	349.1	328.1	33.2	61.6
70.0	7.94		7.9	.62	.66	1549	348.5	328.3	34.5	62.5
71.0	5.18		5.2	.80	.85	1249	348.2	328.5	36.1	63.5
72.0	4.99		5.0	.81	.87	1228	348.0	328.7	37.9	64.5
73.0	5.37		5.4	.78	.83	1269	348.0	329.0	39.7	65.5
74.0	5.18		5.2	.80	.85	1250	348.3	329.4	41.5	66.4
75.0	4.77		4.8	.83	.88	1212	348.6	330.1	43.3	67.1
76.0	4.47		4.5	.86	.91	1184	349.1	330.9	44.9	67.6
77.0	4.34		4.3	.88	.92	1166	349.6	332.1	46.2	67.8
78.0	4.33		4.3	.88	.92	1169	350.2	333.6	47.3	67.7
79.0	4.14		4.1	.91	.94	1150	350.8	335.3	48.0	67.3
80.0	3.84		3.8	.94	.97	1121	351.3	337.4	48.4	66.5
81.0	4.24		4.2	.90	.93	1163	351.7	339.8	48.4	65.4
82.0	4.87		4.9	.84	.86	1236	351.9	342.3	48.0	63.9
83.0	4.75		4.8	.85	.87	1225	352.1	345.0	47.1	62.0
84.0	4.41		4.4	.88	.91	1182	352.1	347.7	45.8	59.9
85.0	4.52		4.5	.88	.90	1191	351.9	350.4	44.2	57.5
86.0	4.59		4.6	.87	.89	1198	351.6	352.8	42.1	54.8
87.0	4.42		4.4	.89	.91	1175	351.2	355.0	39.7	51.9
88.0	4.31		4.3	.90	.93	1162	350.8	356.9	36.9	48.9
89.0	4.37		4.4	.88	.92	1170	350.3	358.4	33.9	45.8
90.0	5.18		5.2	.81	.85	1248	349.8	359.7	30.5	42.6
91.0	5.99		6.0	.75	.79	1329	349.3	0.7	26.9	39.5
92.0	5.88		5.9	.75	.80	1317	349.0	1.4	23.1	36.6
93.0	5.77		5.8	.76	.80	1307	348.7	2.0	19.2	33.8
94.0	5.50		5.5	.78	.83	1277	348.7	2.4	15.2	31.4
95.0	5.34		5.3	.80	.84	1260	348.8	2.6	11.1	29.4
96.0	5.52		5.5	.78	.82	1284	349.1	2.9	7.1	27.8
97.0	5.63		5.6	.77	.81	1300	349.5	3.2	3.9	26.8

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 Alpha

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_\pi$	$\log \rho_s$	T_π (°K)	z (km)	$\alpha_\pi-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36998.0	5.87		5.9	-13.75	-13.78	1338	350.2	3.5	3.9	26.4
99.0	5.37		5.4	.79	.81	1292	351.0	3.9	7.2	26.5
37000.0	5.10		5.1	.81	.83	1267	352.0	4.5	11.0	27.0
01.0	5.23		5.2	.80	.82	1286	353.0	5.3	14.8	27.8
02.0	5.19		5.2	.81	.81	1294	354.0	6.4	18.5	28.7
03.0	5.44		5.4	.79	.79	1326	355.1	7.8	22.0	29.7
04.0	5.00		5.0	.83	.82	1288	356.0	9.5	25.4	30.7
05.0	4.74		4.7	.85	.84	1259	356.8	11.6	28.4	31.5
06.0	4.70		4.7	.85	.84	1264	357.5	13.9	31.2	32.1
07.0	5.57		5.6	.78	.76	1375	358.0	16.5	33.7	32.4
08.0	5.71		5.7	.77	.75	1390	358.2	19.3	35.8	32.5
09.0	4.54		4.5	.87	.85	1245	358.2	22.1	37.6	32.2
10.0	4.62		4.6	.86	.84	1255	358.0	24.9	39.0	31.6
11.0	5.05		5.0	.83	.81	1298	357.5	27.6	40.2	30.6
12.0	5.51		5.1	.82	.81	1304	356.8	30.0	40.9	29.4
13.0	5.48		5.5	.78	.78	1344	356.0	32.1	41.4	27.8
14.0	5.48		5.5	.78	.78	1336	355.0	33.9	41.6	25.9
15.0	5.34		5.3	.80	.81	1304	354.0	35.4	41.5	23.7
16.0	5.60		5.6	.77	.79	1330	352.9	36.6	41.2	21.4
17.0	6.14		6.1	.73	.76	1377	351.8	37.5	40.9	18.9
18.0	6.24		6.2	.73	.75	1380	350.9	38.1	40.4	16.3
19.0	6.56		6.6	.70	.73	1417	350.0	38.6	40.0	13.8
20.0	6.71		6.7	.69	.73	1421	349.3	39.0	39.7	11.7
21.0	7.04		7.0	.67	.71	1449	348.8	39.3	39.5	10.1
22.0	6.92		6.9	.68	.72	1433	348.5	39.6	39.5	09.6
23.0	7.24		7.2	.66	.71	1465	348.4	39.9	39.9	10.3
24.0	7.87		7.9	.62	.67	1546	348.4	40.3	40.5	12.1
25.0	8.94		8.9	.57	.61	1671	348.7	40.9	41.4	14.5
26.0	7.91		7.9	.62	.66	1549	349.0	41.7	42.7	17.2
27.0	6.60		6.6	.70	.74	1402	349.5	42.7	44.2	20.0
28.0	5.33		5.3	.80	.83	1266	350.1	43.9	46.0	22.7
29.0	5.56		5.6	.78	.81	1301	350.6	45.5	48.0	25.4
30.0	6.30		6.3	.73	.75	1380	351.1	47.4	50.1	27.9
31.0	6.08		6.1	.74	.77	1361	351.6	49.7	52.2	30.3
32.0	6.09		6.1	.74	.76	1364	351.9	52.1	54.4	32.4
33.0	5.97		6.0	.75	.77	1355	352.1	54.8	56.6	34.3
34.0	5.81		5.8	.76	.79	1333	352.2	57.6	58.7	36.0
35.0	5.88		5.9	.76	.78	1343	352.1	60.4	60.7	37.4
36.0	5.72		5.7	.77	.79	1320	351.8	63.0	62.6	38.5
37.0	5.51		5.5	.79	.81	1296	351.5	65.5	64.4	39.5
38.0	5.74		5.7	.77	.80	1313	351.0	67.6	66.0	40.2
39.0	6.33		6.3	.73	.76	1374	350.4	69.5	67.4	40.9
40.0	6.46		6.5	.71	.75	1390	349.8	71.0	68.7	41.4
41.0	6.48		6.5	.71	.75	1385	349.3	72.2	69.9	41.8
42.0	6.38		6.4	.72	.76	1369	348.8	73.2	70.9	42.3
43.0	6.17		6.2	.73	.78	1344	348.4	73.9	71.9	42.9
44.0	5.96		6.0	.74	.79	1320	348.1	74.4	72.9	43.6
45.0	5.75		5.7	.77	.81	1297	349.1	74.6	73.7	44.3
46.0	5.68		5.7	.77	.81	1301	349.7	74.9	74.7	45.5
47.0	5.89		5.9	.76	.79	1327	350.4	75.2	75.8	46.9
48.0	5.82		5.8	.77	.79	1323	351.3	75.4	77.1	48.6
49.0	5.88		5.9	.76	.78	1341	352.3	75.8	78.4	50.6
50.0	5.77		5.8	.77	.78	1338	353.4	76.3	80.0	52.9
51.0	5.55		5.6	.79	.79	1324	354.6	77.0	81.8	55.3
52.0	5.17		5.2	.82	.82	1288	355.7	77.9	83.7	58.0
53.0	4.86		4.9	.85	.84	1263	356.8	79.1	85.8	60.8
54.0	4.44		4.4	.90	.88	1215	357.8	80.6	88.1	63.7
55.0	4.32		4.3	.91	.88	1210	358.6	82.4	90.6	66.6
56.0	3.86		3.9	.95	.92	1170	359.2	84.5	93.1	69.5
57.0	3.58		3.6	.99	.95	1140	359.6	87.0	95.7	72.3

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 Alpha

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_v	log ρ_s	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37058.0	3.08		3.1	-14.05	-14.01	1086	359.8	89.6	98.2	74.9
59.0	2.88		2.9	.08	.04	1063	359.6	92.4	100.8	77.4
60.0	2.90		2.9	.07	.04	1063	359.2	95.3	103.2	79.5
61.0	3.28		3.3	.01	-13.99	1107	358.5	98.0	105.5	81.4
62.0	3.56		3.6	-13.97	.95	1138	357.6	100.6	107.5	83.0
63.0	3.95		4.0	.92	.91	1177	356.4	102.8	109.3	84.2
64.0	3.96		4.0	.92	.92	1170	355.1	104.8	110.7	85.0
65.0	3.41		3.4	.99	-14.00	1097	353.7	106.4	111.8	85.5
66.0	3.21		3.2	-14.01	.03	1068	352.2	107.7	112.4	85.6
67.0	3.41		3.4	-13.98	.02	1082	350.7	108.7	112.7	85.4
68.0	3.51		3.5	.97	.01	1084	349.3	109.4	112.6	84.9
69.0	3.57		3.6	.95	.01	1087	348.0	110.0	112.2	84.1
70.0	3.68		3.7	.94	.01	1091	346.9	110.3	111.4	83.2
71.0	3.82		3.8	.93	.00	1095	346.0	110.6	110.4	82.1
72.0	3.79		3.8	.93	.01	1090	345.3	110.8	109.2	81.0
73.0	3.49		3.5	.96	.05	1059	344.9	111.0	107.9	79.9
74.0	3.36		3.4	.98	.06	1047	344.7	111.3	106.6	78.9
75.0	3.20		3.2	-14.01	.05	1055	350.0	111.6	105.3	78.0
76.0	3.01		3.0	.04	.08	1035	350.6	112.2	104.2	77.4
77.0	3.25		3.2	.02	.05	1058	351.3	113.0	103.2	77.0
78.0	3.09		3.1	.03	.06	1050	352.0	114.0	102.5	77.0
79.0	3.25		3.2	.02	.04	1062	352.6	115.4	102.0	77.2
80.0	3.23		3.2	.02	.04	1064	353.3	117.0	101.9	77.8
81.0	3.10		3.1	.04	.05	1055	353.8	119.0	102.2	78.8
82.0	2.97		3.0	.06	.06	1046	354.2	121.3	102.8	80.0
83.0	3.29		3.3	.02	.02	1078	354.4	123.8	103.7	81.6
84.0	2.98		3.0	.06	.06	1046	354.4	126.4	105.0	83.4
85.0	3.02		3.0	.06	.06	1045	354.2	129.1	106.7	85.4
86.0	3.10		3.1	.04	.05	1054	353.8	131.8	108.6	87.6
87.0	3.08		3.1	.04	.05	1051	353.2	134.2	110.8	89.9
88.0	2.66		2.7	.10	.12	1006	352.4	136.4	113.3	92.3
89.0	2.97		3.0	.05	.08	1034	351.5	138.3	115.9	94.7
90.0	3.79		3.8	-13.94	-13.98	1112	350.5	139.9	118.7	97.1
91.0	3.36		3.4	.99	-14.03	1067	349.4	141.2	121.6	99.5
92.0	3.05		3.0	-14.04	.09	1022	348.3	142.1	124.4	101.8
93.0	3.24		3.2	.01	.07	1039	347.3	142.8	127.3	104.1
94.0	3.37		3.4	-13.98	.05	1055	346.4	143.3	130.2	106.2
95.0	3.16		3.2	-14.00	.08	1032	345.7	143.7	132.9	108.2
96.0	3.01		3.0	.03	.11	1010	345.1	143.9	135.6	110.1
97.0	2.40		2.4	.12	.21	951	344.6	144.0	138.1	112.0
98.0	2.41		2.4	.12	.21	950	344.4	144.2	140.4	113.7
99.0	2.65		2.6	.09	.18	970	344.3	144.4	142.5	115.5
37100.0	2.06		2.1	.18	.27	922	344.4	144.8	144.5	117.2
01.0	2.39		2.4	.12	.19	964	347.6	145.2	146.2	118.7
02.0	2.27		2.3	.14	.19	961	349.0	145.9	147.9	120.5
03.0	2.20		2.2	.16	.20	956	350.6	146.9	149.5	122.3
04.0	1.96		2.0	.20	.23	941	352.0	148.2	151.0	124.1
05.0	1.82		1.8	.25	.26	924	353.4	149.9	152.6	126.1
06.0	1.90		1.9	.23	.23	940	354.7	151.9	154.2	128.2
07.0	1.92		1.9	.23	.22	945	355.8	154.2	155.8	130.3
08.0	1.83		1.8	.25	.24	937	356.6	156.7	157.6	132.6
09.0	1.84		1.8	.25	.23	939	357.2	159.4	159.5	134.8
10.0	1.56		1.6	.30	.28	916	357.4	162.2	161.6	137.2
11.0	1.90		1.9	.23	.20	954	357.4	164.9	163.8	139.4
12.0	2.01		2.0	.20	.18	966	357.1	167.5	166.3	141.6
13.0	2.17		2.2	.16	.14	990	356.6	169.8	168.6	143.6
14.0	2.33		2.3	.14	.13	999	355.8	171.8	171.4	145.4
15.0	2.37		2.4	.12	.12	1007	354.9	173.5	173.8	146.7
16.0	2.40		2.4	.11	.12	1002	353.8	174.8	175.1	147.6
17.0	2.37		2.4	.11	.13	998	352.7	175.9	174.3	147.9

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 Alpha

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_\pi$	$\log \rho_S$	T_π (°K)	z (km)	$a_\pi - a_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37118.0	2.51		2.5	-14.09	-14.12	1004	351.6	176.6	171.8	147.7
19.0	2.65		2.6	.07	.11	1010	350.5	177.2	168.5	146.8
20.0	3.00		3.0	.01	.06	1049	349.5	177.5	165.0	145.5
21.0	3.13		3.1	.00	.05	1055	348.6	177.8	161.2	143.7
22.0	2.58		2.6	.07	.13	997	347.9	178.0	157.5	141.6
23.0	2.30		2.3	.12	.19	962	347.3	178.1	153.7	139.3
24.0	2.19		2.2	.14	.21	950	346.9	178.4	149.9	136.8
25.0	2.41		2.4	.11	.18	970	346.7	178.7	146.3	134.4
26.0	2.41		2.4	.11	.18	969	346.7	179.2	142.8	132.1
27.0	2.40		2.4	.11	.18	968	346.7	179.9	139.4	129.9
28.0	2.16		2.2	.15	.22	948	346.9	180.9	136.3	127.9
29.0	2.25		2.2	.15	.22	948	347.1	182.1	133.5	126.2
30.0	3.47		3.5	-13.95	.01	1083	347.3	183.7	131.0	124.9
31.0	3.21		3.2	.99	.05	1053	347.5	185.6	128.8	123.9
32.0	2.39		2.4	-14.11	.18	970	347.6	187.9	127.0	123.4
33.0	2.36		2.4	.12	.18	970	347.7	190.3	125.6	123.3
34.0	2.31		2.3	.13	.20	958	347.6	193.0	124.6	123.6
35.0	2.04		2.0	.19	.26	926	347.4	195.7	124.1	124.4
36.0	1.99		2.0	.19	.26	925	347.2	198.4	124.0	125.7
37.0	1.59		1.6	.29	.36	884	346.8	200.9	124.3	127.4
38.0	1.64		1.6	.29	.36	882	346.3	203.2	125.1	129.4
39.0	1.69		1.7	.26	.34	891	345.8	205.2	126.3	131.9
40.0	1.73		1.7	.26	.34	890	345.3	206.9	127.8	134.8
41.0	1.76		1.8	.23	.32	899	344.8	208.3	129.7	137.9
42.0	1.68		1.7	.26	.35	888	344.4	209.4	131.8	141.4
43.0	1.70		1.7	.26	.35	888	344.1	210.2	134.1	145.0
44.0	1.83		1.8	.23	.32	898	344.0	210.8	136.5	148.8
45.0	2.28		2.3	.12	.22	948	344.1	211.2	139.0	152.8
46.0	2.61		2.6	.07	.16	981	344.5	211.5	141.3	156.9
47.0	2.01		2.0	.18	.27	922	345.0	211.8	143.5	161.1
48.0	1.76		1.8	.23	.31	905	345.8	212.0	145.4	165.2
49.0	1.73		1.7	.25	.32	898	346.8	212.3	146.8	169.3
50.0	1.75		1.8	.23	.29	912	348.0	212.7	147.7	173.1
51.0	1.55		1.6	.28	.33	894	349.3	213.2	148.0	176.0
52.0	1.06		1.1	.45	.48	844	350.7	214.0	147.6	175.9
53.0	1.54		1.5	.31	.34	892	352.2	215.1	146.5	173.1
54.0	1.50		1.5	.32	.33	896	353.7	216.4	145.0	169.8
55.0	1.31		1.3	.38	.38	877	355.1	218.1	143.0	166.5
56.0	1.78		1.8	.24	.23	941	356.4	220.2	140.7	163.4
57.0	2.03		2.0	.20	.18	970	357.5	222.5	138.2	160.5
58.0	2.16		2.2	.16	.13	1000	358.3	225.1	135.6	157.9
59.0	2.13		2.1	.18	.14	989	358.9	227.9	133.0	155.5
37170.0	2.42		2.4	-14.11	-14.14	991	351.6	247.5	113.5	142.9
71.0	2.29		2.3	.13	.17	975	350.7	247.9	112.5	142.0
72.0	2.16		2.2	.15	.19	961	349.9	248.2	111.5	140.8
73.0	2.21		2.2	.15	.20	958	349.4	248.5	110.5	139.4
74.0	2.31		2.3	.13	.18	966	349.0	248.8	109.4	137.7
75.0	2.64		2.6	.08	.13	997	348.7	249.2	108.1	135.9
76.0	2.57		2.6	.08	.14	995	348.6	249.8	106.6	133.8
77.0	2.79		2.8	.05	.10	1015	348.7	250.6	105.3	131.6
78.0	2.28		2.3	.14	.19	961	348.8	251.7	103.6	129.3
79.0	1.66		1.7	.27	.32	898	349.0	253.1	101.8	126.9
80.0	1.55		1.6	.30	.35	887	349.1	254.7	99.9	124.4
81.0	3.07		3.1	.02	.06	1044	349.3	256.8	97.8	122.0
82.0	4.19		4.2	-13.89	-13.93	1155	349.3	259.1	95.7	119.6
83.0	3.46		3.5	.97	-14.01	1083	349.3	261.6	93.5	117.4
84.0	2.34		2.3	-14.15	.20	957	349.2	264.4	91.3	115.3
85.0	2.29		2.3	.15	.20	955	348.9	267.2	89.2	113.3
86.0	2.69		2.7	.08	.14	995	348.5	270.0	87.1	111.6

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 Alpha

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_r	log ρ_s	T_r (°K)	z (km)	$\alpha_r-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37187.0	3.43		3.4	-13.98	-14.04	1062	348.0	272.6	85.1	110.1
88.0	3.54		3.5	.97	.03	1069	347.4	275.1	83.3	108.8
89.0	4.05		4.0	.91	-13.98	1114	346.8	277.2	81.7	107.8
37190.0	4.0		4.0	-13.91	-13.98	1110	346.1	279.0	80.2	107.1
92.0	4.0		4.0	.91	.98	1110	345.9	281.7	78.0	106.1
94.0	4.3		4.3	.87	.95	1138	345.5	283.3	76.5	105.8
96.0	4.6		4.6	.84	.92	1169	345.8	284.2	75.8	105.6
98.0	4.3		4.3	.87	.94	1147	346.8	284.8	75.3	105.2
37200.0	3.8		3.8	.93	.99	1107	348.5	285.6	74.7	104.1
02.0	3.5		3.5	.97	-14.01	1087	350.7	287.1	73.5	102.0
04.0	3.3		3.3	-14.01	.02	1076	353.0	289.6	71.6	98.8
06.0	3.3		3.3	.01	.01	1083	355.0	293.4	68.5	94.6
08.0	3.3		3.3	.02	.01	1087	356.3	298.5	64.5	89.6
10.0	3.2		3.2	.04	.03	1074	356.6	304.3	59.5	84.3
37212.0	3.20		3.2	-14.04	-14.03	1069	355.8	309.9	54.1	79.2
12.5	3.38		3.4	.01	.01	1088	355.5	311.2	52.7	78.0
13.0	2.95		3.0	.07	.07	1044	355.1	312.4	51.3	76.8
13.5	4.54		4.5	-13.89	-13.89	1199	354.7	313.5	49.9	75.7
14.0	8.13		8.1	.63	.64	1607	354.2	314.5	48.6	74.6
14.5	5.68		5.7	.78	.80	1319	353.7	315.5	47.3	73.6
15.0	4.14		4.1	.93	.94	1148	353.1	316.4	46.0	72.7
15.5	4.15		4.2	.91	.93	1156	352.6	317.2	44.8	71.9
37216.0	4.2		4.2	-13.91	-13.94	1153	352.0	317.9	43.7	71.2
18.0	4.3		4.3	.90	.94	1151	349.7	319.9	40.2	69.0
20.0	5.0		5.0	.83	.88	1209	347.6	321.1	38.5	68.2
22.0	5.2		5.2	.80	.87	1221	346.3	321.7	39.0	68.5
24.0	5.0		5.0	.82	.89	1200	345.8	322.4	41.1	69.4
26.0	4.8		4.8	.84	.91	1182	346.0	323.4	44.1	70.6
28.0	4.5		4.5	.87	.93	1158	346.9	325.3	47.1	71.3
30.0	4.4		4.4	.88	.94	1153	348.0	328.3	49.4	71.2
32.0	4.4		4.4	.89	.93	1156	348.9	332.7	50.7	70.0
34.0	4.4		4.4	.89	.93	1157	349.4	338.0	50.4	67.5
36.0	4.3		4.3	.90	.94	1145	349.4	343.5	48.6	63.9
38.0	4.2		4.2	.91	.96	1131	348.9	348.4	45.2	59.4
40.0	4.6		4.6	.87	.92	1164	348.0	352.1	40.5	54.2
42.0	5.0		5.0	.83	.89	1199	347.2	354.5	34.6	48.8
44.0	5.3		5.3	.81	.87	1227	346.7	355.9	27.9	43.6
46.0	5.6		5.6	.78	.83	1261	346.8	356.5	20.7	38.9
48.0	5.9		5.9	.76	.81	1302	347.7	357.0	13.4	34.9
37250.0	6.09		6.1	-13.74	-13.78	1339	349.4	357.6	6.3	31.8
50.5	6.54		6.5	.71	.75	1387	349.9	357.9	4.6	31.1
51.0	7.67		7.7	.64	.67	1530	350.4	358.2	3.0	30.5
51.5	9.92		9.9	.53	.56	1826	351.0	358.6	1.6	29.9
52.0	6.59		6.6	.71	.73	1415	351.6	359.0	1.2	29.4
52.5	5.27		5.3	.81	.83	1278	352.1	359.5	2.4	28.8
53.0	5.28		5.3	.81	.82	1282	352.7	0.1	3.8	28.3
53.5	5.74		5.7	.77	.79	1330	353.2	0.7	5.2	27.7
54.0	6.43		6.4	.73	.73	1415	353.8	1.5	6.6	27.2
54.5	5.55		5.6	.78	.79	1328	354.3	2.3	8.0	26.6
55.0	4.90		4.9	.84	.84	1254	354.8	3.2	9.3	26.1
55.5	4.68		4.7	.86	.86	1235	355.2	4.2	10.6	25.5
56.0	4.48		4.5	.88	.88	1216	355.6	5.3	11.8	24.8
56.5	4.26		4.3	.90	.89	1197	356.0	6.4	12.9	24.2
57.0	4.28		4.3	.90	.89	1198	356.3	7.7	14.0	23.5
57.5	4.07		4.1	.92	.91	1178	356.5	8.9	15.0	22.7
58.0	4.30		4.3	.90	.89	1201	356.7	10.3	15.9	21.9

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 Alpha

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_r$	$\log \rho_s$	T_r (°K)	z (km)	$\alpha_r-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37258.5	4.32		4.3	-13.90	-13.89	1202	356.8	11.6	16.8	21.0
59.0	4.56		4.6	.87	.86	1235	356.9	13.0	17.7	20.1
59.5	5.23		5.2	.82	.81	1303	356.9	14.5	18.5	19.1
60.0	4.80		4.8	.85	.84	1257	356.8	15.9	19.2	18.1
60.5	4.81		4.8	.85	.84	1256	356.6	17.2	19.9	17.0
61.0	4.38		4.4	.89	.88	1210	356.4	18.6	20.5	15.8
61.5	4.16		4.2	.91	.90	1187	356.1	19.9	21.1	14.6
62.0	3.96		4.0	.93	.93	1163	355.8	21.1	21.7	13.2
62.5	3.75		3.8	.95	.95	1139	355.4	22.3	22.3	11.9
63.0	3.54		3.5	.99	.99	1105	355.0	23.4	22.8	10.4
63.5	4.67		4.7	.86	.86	1231	354.5	24.4	23.4	9.0
37264.0	4.90		4.9	-13.84	-13.85	1249	354.0	25.4	23.9	7.4
65.0	4.36		4.4	.89	.90	1192	353.2	26.9	25.0	4.3
66.0	4.12		4.1	.92	.94	1154	352.0	28.1	26.2	1.8
67.0	3.72		3.7	.96	.99	1107	350.9	29.0	27.6	3.7
68.0	3.96		4.0	.92	.96	1132	349.7	29.7	29.1	7.3
69.0	4.86		4.9	.83	.88	1215	348.7	30.2	31.0	11.2
70.0	6.62		6.6	.70	.75	1383	347.8	30.4	33.1	15.3
71.0	5.88		5.9	.75	.81	1303	347.1	30.6	35.5	19.4
72.0	6.18		6.2	.73	.79	1328	346.5	30.7	38.1	23.5
73.0	6.41		6.4	.72	.78	1344	346.2	30.9	40.9	27.6
74.0	6.91		6.9	.68	.75	1393	346.1	31.1	43.9	31.6
75.0	6.67		6.7	.70	.76	1372	346.1	31.4	47.0	35.6
37284.0	4.84		4.8	-13.84	-13.89	1202	348.9	46.5	71.8	58.7
85.0	4.45		4.4	.88	.93	1163	348.8	49.2	73.2	59.2
86.0	3.82		3.8	.94	.99	1103	348.6	51.7	74.3	59.2
87.0	3.34		3.3	-14.00	-14.05	1052	348.2	54.1	74.9	58.8
88.0	2.91		2.9	.06	.11	1010	347.8	56.2	75.1	57.9
89.0	3.24		3.2	.02	.07	1038	347.3	57.9	74.9	56.6
90.0	3.06		3.1	.03	.09	1027	346.9	59.4	74.3	54.9
91.0	2.98		3.0	.04	.11	1015	346.4	60.4	73.4	52.9
92.0	2.70		2.7	.09	.15	984	346.0	61.2	72.2	50.6
93.0	3.03		3.0	.04	.11	1012	345.6	61.8	70.7	48.1
94.0	3.47		3.5	-13.97	.04	1060	345.5	62.2	69.1	45.5
95.0	4.01		4.0	.92	-13.98	1108	345.5	62.4	67.4	42.8
96.0	4.06		4.1	.91	.97	1119	345.8	62.5	65.6	40.3
97.0	4.22		4.2	.90	.96	1131	346.3	62.6	64.0	37.8
98.0	3.96		4.0	.92	.98	1115	347.0	62.8	62.5	35.7
99.0	4.10		4.1	.91	.96	1128	347.8	63.0	61.3	34.0
37300.0	4.48		4.5	.87	.92	1172	348.8	63.5	60.4	32.9
01.0	4.53		4.5	.88	.91	1178	350.0	64.1	59.9	32.3
02.0	4.20		4.2	.91	.94	1153	351.2	65.0	59.8	32.4
03.0	3.97		4.0	.93	.95	1138	352.4	66.2	60.2	33.2
04.0	3.85		3.8	.96	.97	1122	353.5	67.8	60.9	34.4
05.0	3.95		4.0	.94	.94	1148	354.5	69.7	62.1	36.1
06.0	3.78		3.8	.96	.96	1130	355.4	71.9	63.7	38.2
07.0	3.61		3.6	.99	.98	1112	356.0	74.4	65.6	40.4
08.0	3.50		3.5	-14.00	.99	1103	356.5	77.1	67.7	42.8
09.0	3.21		3.2	.04	-14.03	1071	356.6	79.9	70.0	45.1
10.0	2.65		2.6	.13	.12	1005	356.5	82.6	72.4	47.5
11.0	2.48		2.5	.15	.14	993	356.2	85.2	74.9	49.8
12.0	2.32		2.3	.18	.18	969	355.6	87.5	77.4	52.0
13.0	2.20		2.2	.20	.20	955	354.8	89.6	79.9	54.0
14.0	2.26		2.3	.18	.19	963	353.9	91.3	82.2	56.0
15.0	2.14		2.1	.22	.23	939	353.0	92.6	84.5	57.8
16.0	1.98		2.0	.24	.26	925	352.0	93.6	86.6	59.5
17.0	2.03		2.0	.24	.27	922	351.0	94.4	88.6	61.1
18.0	2.65		2.6	.12	.16	981	350.1	94.9	90.5	62.6

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 Alpha

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_v$	$\log \rho_s$	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37319.0	3.26		3.3	-14.02	-14.06	1047	349.4	95.2	92.2	64.2
20.0	2.43		2.4	.16	.20	955	348.8	95.5	93.8	65.7
21.0	2.16		2.2	.19	.24	934	348.4	95.7	95.4	67.3
22.0	2.11		2.1	.21	.27	923	348.2	95.8	96.9	68.9
23.0	2.01		2.0	.24	.29	912	348.3	96.1	98.4	70.6
24.0	2.06		2.1	.22	.27	922	348.5	96.5	99.9	72.5
25.0	2.16		2.2	.20	.25	933	348.9	97.0	101.5	74.4
26.0	2.34		2.3	.18	.24	933	346.4	97.8	103.0	76.5
27.0	2.32		2.3	.18	.24	934	346.8	98.8	104.8	78.6
28.0	2.40		2.4	.16	.22	945	347.2	100.2	106.6	80.9
29.0	2.31		2.3	.18	.24	937	347.7	101.9	108.5	83.2
30.0	2.16		2.2	.20	.25	929	348.1	104.0	110.5	85.6
31.0	2.12		2.1	.22	.27	921	348.4	106.4	112.6	87.9
32.0	2.02		2.0	.24	.29	913	348.6	109.0	114.8	90.2
33.0	1.97		2.0	.23	.29	914	348.6	111.7	117.0	92.4
34.0	2.20		2.2	.19	.24	934	348.5	114.5	119.2	94.4
35.0	2.53		2.5	.13	.19	964	348.3	117.2	121.3	96.2
36.0	2.52		2.5	.13	.19	964	347.9	119.8	123.3	97.8
37.0	2.29		2.3	.16	.23	943	347.4	122.0	125.2	99.2
38.0	2.00		2.0	.22	.29	913	346.9	123.9	126.8	100.2
39.0	1.82		1.8	.26	.34	893	346.3	125.5	128.1	100.9
40.0	1.90		1.9	.24	.31	902	345.7	126.8	129.1	101.4
41.0	1.76		1.8	.26	.34	892	345.3	127.8	129.8	101.5
42.0	1.78		1.8	.26	.34	891	344.9	128.5	130.1	101.4
43.0	1.58		1.6	.31	.39	872	344.7	129.0	130.1	101.0
44.0	1.64		1.6	.31	.39	873	344.7	129.4	129.7	100.5
45.0	1.60		1.6	.31	.39	873	344.9	129.7	129.1	100.0
46.0	1.70		1.7	.28	.36	884	345.3	129.9	128.3	99.3
47.0	1.81		1.8	.26	.33	895	346.0	130.2	127.4	98.7
48.0	1.86		1.9	.23	.30	906	346.8	130.6	126.4	98.2
49.0	1.73		1.7	.29	.34	889	347.8	131.2	125.5	97.9
50.0	1.77		1.8	.26	.31	902	348.9	131.9	124.7	97.9
51.0	1.69		1.7	.29	.33	895	350.1	132.9	124.1	98.1
52.0	1.54		1.5	.35	.38	877	351.3	134.2	123.8	98.6
53.0	1.62		1.6	.32	.34	890	352.5	135.9	123.7	99.4
54.0	1.47		1.5	.35	.36	882	353.6	137.9	124.0	100.6
55.0	1.48		1.5	.35	.36	884	354.5	140.3	124.7	102.2
37356.0	1.5		1.5	-14.35	-14.35	886	355.2	142.9	125.8	104.1
58.0	1.6		1.6	.33	.37	900	355.7	148.7	129.1	108.7
60.0	1.5		1.5	.35	.35	889	355.3	154.4	133.9	114.2
62.0	1.4		1.4	.37	.38	876	353.9	159.2	140.0	120.0
64.0	1.5		1.5	.34	.36	883	352.0	162.6	147.0	125.7
66.0	1.6		1.6	.30	.34	889	349.9	164.8	154.4	130.7
68.0	1.6		1.6	.30	.35	886	348.1	166.0	161.4	134.4
70.0	1.6		1.6	.29	.36	883	347.0	166.7	166.2	136.5
72.0	1.6		1.6	.29	.36	883	346.7	167.3	166.4	137.2
74.0	1.6		1.6	.29	.36	884	347.2	168.5	162.3	136.9
76.0	1.6		1.6	.30	.35	886	348.2	170.5	156.9	136.2
78.0	1.7		1.7	.27	.32	899	349.4	173.8	151.9	135.8
37380.0	1.60		1.6	-14.30	-14.34	891	350.3	178.4	147.9	136.2
81.0	1.50		1.5	.33	.37	882	350.7	181.1	146.5	136.8
82.0	1.42		1.4	.36	.39	872	350.9	183.9	145.4	137.7
83.0	1.23		1.2	.43	.46	851	350.9	186.8	144.7	139.0
84.0	2.03		2.0	.20	.24	936	350.8	189.6	144.4	140.6
85.0	2.12		2.1	.18	.22	946	350.5	192.2	144.6	142.5
86.0	2.25		2.2	.16	.20	956	350.2	194.5	145.0	144.7
87.0	2.06		2.1	.18	.22	944	349.8	196.5	145.9	147.2
88.0	2.15		2.2	.16	.21	954	349.3	198.2	147.0	149.9
37389.0	2.24		2.2	-14.15	-14.21	953	348.9	199.5	148.4	152.8
90.0	2.10		2.1	.17	.23	941	348.5	200.6	149.9	155.9

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 β1

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_v	log ρ_s	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36710.0	3.27	-0.30	3.0	-15.31	-15.31	1518	653.6	71.2	64.0	38.5
12.5	2.53	-0.30	2.2	.44	.45	1417	652.9	73.0	65.9	39.7
15.0	2.20	-0.30	1.9	.50	.52	1373	652.1	74.0	67.5	40.6
17.5	1.99	-0.30	1.7	.55	.57	1341	651.4	74.4	68.9	41.4
20.0	1.86	-0.30	1.6	.58	.60	1324	650.8	74.1	70.2	42.4
22.5	1.76	-0.30	1.5	.61	.63	1306	650.6	73.4	71.3	43.7
25.0	1.73	-0.30	1.4	.64	.66	1288	650.7	72.4	72.5	45.4
27.5	1.67	-0.31	1.4	.64	.66	1288	651.3	71.2	73.9	47.6
30.0	1.80	-0.32	1.5	.62	.63	1305	652.3	70.2	75.5	50.4
32.5	1.79	-0.32	1.5	.62	.63	1306	653.7	69.4	77.4	53.6
35.0	1.98	-0.32	1.7	.57	.57	1340	655.3	69.1	79.7	57.2
37.5	1.97	-0.32	1.6	.60	.59	1327	657.0	69.3	82.3	60.9
40.0	1.78	-0.32	1.5	.63	.61	1313	658.6	70.3	85.1	64.5
42.5	1.73	-0.31	1.4	.66	.64	1299	660.0	72.0	87.9	67.8
45.0	1.57	-0.30	1.3	.69	.67	1284	660.9	74.3	90.6	70.7
47.5	1.46	-0.29	1.2	.72	.70	1267	661.3	77.1	93.0	72.9
50.0	1.41	-0.27	1.1	.76	.73	1249	661.2	79.9	94.9	74.2
52.5	1.30	-0.25	1.0	.79	.77	1228	660.6	82.5	96.1	74.6
55.0	1.07	-0.22	0.8	.89	.37	1180	659.4	84.5	96.5	74.0
57.5	1.05	-0.18	0.9	.83	.82	1203	657.9	85.8	96.1	72.5
60.0	1.29	-0.12	1.2	.70	.70	1266	656.3	86.4	94.8	70.1
62.5	1.52	-0.05	1.5	.60	.61	1317	654.6	86.3	92.7	67.1
65.0	2.28	0.00	2.3	.42	.43	1433	653.0	85.8	90.1	63.6
67.5	2.28	0.00	2.3	.42	.43	1430	651.7	84.9	87.1	59.8
70.0	1.66	0.00	1.7	.55	.57	1342	650.8	83.9	84.0	56.2
72.5	1.44	0.00	1.4	.63	.65	1291	650.1	82.9	81.1	53.0
75.0	1.56	-0.02	1.5	.61	.63	1306	649.8	82.2	78.6	50.5
77.5	1.63	-0.07	1.6	.58	.60	1321	650.0	81.8	76.8	49.0
80.0	1.66	-0.17	1.5	.61	.63	1304	650.5	81.9	75.8	48.6
82.5	1.72	-0.24	1.5	.62	.63	1304	651.2	82.8	75.8	49.3
85.0	1.77	-0.27	1.5	.62	.63	1303	652.0	84.4	76.7	51.0
87.5	1.95	-0.30	1.6	.60	.60	1319	652.6	86.6	78.4	53.3
90.0	1.86	-0.31	1.5	.63	.63	1302	653.0	89.5	80.8	56.1
92.5	1.66	-0.32	1.3	.69	.70	1266	653.2	92.5	83.6	59.0
95.0	1.68	-0.32	1.4	.66	.67	1283	653.0	95.4	86.6	61.7
97.5	1.69	-0.32	1.4	.66	.67	1282	652.6	97.8	89.6	64.2
36800.0	1.78	-0.31	1.4	.66	.67	1281	652.0	99.6	92.4	66.2
02.5	1.95	-0.31	1.6	.60	.61	1313	651.3	100.6	94.8	67.6
05.0	2.08	-0.30	1.8	.55	.57	1342	650.8	101.0	96.7	68.6
07.5	2.19	-0.30	1.9	.52	.54	1356	650.4	100.8	98.1	69.2
10.0	2.35	-0.29	2.1	.48	.50	1383	650.3	100.3	98.8	69.4
12.5	2.49	-0.28	2.2	.46	.48	1397	650.6	99.5	99.2	69.5
15.0	2.22	-0.27	2.0	.50	.52	1371	651.4	98.7	99.2	69.6
17.5	2.25	-0.27	2.0	.51	.52	1372	652.5	98.1	99.1	69.8
20.0	1.86	-0.27	1.6	.61	.61	1315	653.9	97.8	99.0	70.4
22.5	1.16	-0.27	0.9	.86	.86	1185	655.4	97.9	99.1	71.3
25.0	1.00	-0.28	0.7	.97	.97	1136	657.0	98.7	99.5	72.6
27.5	1.43	-0.28	1.2	.74	.73	1250	658.4	100.3	100.4	74.3
30.0	1.72	-0.29	1.4	.68	.66	1287	659.5	102.5	101.6	76.3
32.5	1.89	-0.29	1.6	.62	.60	1321	660.1	105.4	103.3	78.4
35.0	1.69	-0.29	1.4	.68	.66	1288	660.2	108.6	105.2	80.5
37.5	1.59	-0.29	1.3	.71	.69	1271	660.3	111.7	107.4	82.5
40.0	1.57	-0.28	1.3	.71	.69	1271	659.7	114.5	109.5	84.2
42.5	1.32	-0.26	1.1	.78	.76	1231	658.7	116.6	111.6	85.6
45.0	1.27	-0.20	1.1	.78	.77	1230	657.4	118.0	113.4	86.5
47.5	1.05	-0.11	0.9	.86	.86	1185	655.9	118.6	114.8	87.0
50.0	1.04	-0.04	1.0	.81	.82	1205	654.4	118.6	115.8	87.2
52.5	0.95	0.00	1.0	.81	.82	1203	653.1	118.2	116.4	87.2
55.0	1.00	0.00	1.0	.81	.83	1200	652.0	117.5	116.6	87.0
57.5	1.16	0.00	1.2	.74	.75	1238	651.2	116.6	116.7	87.0

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 β1

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_v	log ρ_s	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36860.0	1.18	0.00	1.2	-15.74	-15.76	1236	650.8	115.8	116.7	87.3
62.5	1.31	0.00	1.3	.71	.72	1252	650.7	115.3	116.8	88.0
65.0	1.22	-0.01	1.2	.74	.76	1232	650.9	115.1	117.2	89.2
67.5	1.21	-0.06	1.1	.79	.80	1212	651.2	115.5	118.1	90.9
70.0	1.10	-0.12	1.0	.83	.84	1192	651.5	116.6	119.4	93.2
72.5	1.06	-0.21	0.8	.93	.94	1147	651.8	118.4	121.3	95.8
75.0	1.04	-0.23	0.8	.93	.94	1147	651.9	120.8	123.6	98.7
77.5	0.90	-0.23	0.7	.98	-16.00	1123	651.7	123.6	126.3	101.6
80.0	0.87	-0.22	0.6	-16.04	.06	1096	651.3	126.5	129.1	104.3
82.5	0.84	-0.21	0.6	.04	.06	1097	650.7	129.2	131.8	106.6
85.0	0.73	-0.20	0.5	.11	.13	1067	649.9	131.2	134.1	108.1
87.5	0.67	-0.18	0.5	.10	.13	1068	649.2	132.5	135.6	108.8
90.0	0.63	-0.17	0.5	.10	.12	1070	648.7	133.1	136.1	108.6
92.5	0.47	-0.15	0.3	.31	.34	991	648.5	133.0	135.4	107.4
95.0	0.48	-0.13	0.4	.19	.21	1036	648.8	132.4	133.5	105.4
97.5	0.66	-0.12	0.5	.09	.11	1075	649.7	131.5	130.6	102.6
36925.0	0.85	-0.20	0.65	-16.01	-16.01	1118	656.2	138.8	111.2	91.8
27.5	0.75	-0.15	0.60	.05	.04	1104	656.4	140.8	114.1	94.4
30.0	0.76	-0.10	0.66	.01	.00	1121	656.2	142.2	117.5	97.2
32.5	0.79	-0.16	0.63	.02	.02	1112	655.7	142.8	121.2	99.9
35.0	0.89	-0.22	0.67	.00	.00	1123	655.0	142.7	124.9	102.4
37.5	0.81	-0.22	0.59	.05	.05	1099	654.3	142.1	128.4	104.5
40.0	0.69	-0.22	0.47	.14	.15	1060	653.8	141.1	131.6	106.3
42.5	0.63	-0.21	0.42	.19	.20	1042	653.4	139.9	134.2	107.7
45.0	0.60	-0.19	0.41	.20	.21	1038	653.3	138.6	136.3	108.9
47.5	0.55	-0.19	0.36	.26	.26	1018	653.5	137.6	137.7	109.9
50.0	0.56	-0.18	0.38	.23	.24	1027	653.8	136.8	138.7	110.8
52.5	0.58	-0.18	0.40	.21	.21	1036	654.3	136.5	139.4	111.9
55.0	0.65	-0.17	0.48	.13	.13	1067	654.9	136.9	140.0	113.1
57.5	0.79	-0.17	0.62	.02	.02	1113	655.3	138.0	140.7	114.6
60.0	1.02	-0.16	0.86	-15.88	-15.87	1178	655.5	139.8	141.6	116.3
62.5	1.37	-0.16	1.21	.72	.72	1253	655.4	142.3	143.0	118.2
65.0	1.27	-0.16	1.11	.76	.76	1234	655.0	145.1	144.6	120.2
67.5	1.09	-0.15	0.94	.83	.83	1199	654.3	147.9	146.7	122.2
70.0	0.95	-0.15	0.80	.89	.90	1166	653.4	150.4	148.9	124.0
72.5	0.70	-0.14	0.56	-16.04	-16.05	1098	652.4	152.2	151.1	125.3
75.0	0.63	-0.13	0.50	.09	.10	1078	651.4	153.4	153.0	126.0
77.5	0.55	-0.11	0.44	.14	.15	1058	651.6	153.8	154.2	126.1
80.0	0.48	-0.10	0.38	.20	.22	1035	651.2	153.7	154.4	125.5
82.5	0.39	-0.09	0.30	.30	.32	999	651.1	153.2	153.5	124.2
85.0	0.35	-0.08	0.27	.35	.36	985	651.4	152.4	151.6	122.4
87.5	0.40	-0.07	0.33	.26	.27	1015	652.2	151.5	149.0	120.4
90.0	0.48	-0.07	0.41	.17	.18	1050	653.4	150.6	146.1	118.4
92.5	0.50	-0.07	0.43	.15	.15	1060	654.9	150.1	143.1	116.6
95.0	0.50	-0.07	0.43	.15	.15	1062	656.7	150.0	140.5	115.3
97.5	0.44	-0.07	0.37	.22	.21	1039	658.6	150.4	138.4	114.6
37000.0	0.41	-0.07	0.34	.26	.24	1027	660.4	151.6	137.0	114.7
02.5	0.39	-0.08	0.31	.31	.27	1015	661.8	153.6	136.5	115.6
05.0	0.40	-0.09	0.31	.31	.27	1016	662.9	156.2	137.0	117.4
07.5	0.34	-0.10	0.24	.42	.38	980	663.4	159.2	138.5	119.9
10.0	0.37	-0.10	0.27	.37	.33	997	663.3	162.4	141.0	123.0
12.5	0.28	-0.10	0.18	.54	.50	943	662.6	165.3	144.3	126.6
15.0	0.31	-0.10	0.21	.47	.43	963	661.4	167.6	148.5	130.2
17.5	0.34	-0.09	0.25	.38	.36	986	659.8	169.2	153.4	133.8
20.0	0.48	-0.08	0.40	.17	.16	1057	658.1	170.2	158.6	136.8
22.5	0.79	-0.07	0.72	-15.91	-15.91	1162	656.3	170.4	163.8	139.0
25.0	0.97	-0.05	0.92	.80	.80	1211	654.6	170.1	168.1	140.0
27.5	0.65	-0.04	0.61	.98	.99	1126	653.2	169.5	169.6	139.7
30.0	0.52	-0.02	0.50	-16.06	-16.08	1089	652.2	168.7	166.9	138.3

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 β1

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_T$	$\log \rho_S$	T_T (°K)	z (km)	$\alpha_T-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37032.5	0.47	-0.01	0.46	-16.10	-16.12	1073	651.6	167.9	161.9	135.9
35.0	0.53	0.00	0.53	.04	.06	1097	651.5	167.3	156.3	133.1
37.5	0.49	0.01	0.50	.07	.08	1086	651.7	167.1	150.7	130.0
40.0	0.61	0.01	0.62	-15.98	-15.99	1126	652.2	167.3	145.5	127.2
42.5	0.55	0.01	0.56	-16.02	-16.03	1107	652.9	168.2	140.9	124.8
45.0	0.53	0.01	0.54	.04	.05	1100	653.6	169.8	137.0	123.1
47.5	0.50	0.00	0.50	.08	.08	1087	654.1	172.2	134.2	122.1
50.0	0.51	-0.01	0.50	.08	.08	1087	654.5	175.0	132.3	122.0
52.5	0.48	-0.02	0.46	.12	.12	1072	654.5	178.0	131.6	122.8
55.0	0.51	-0.03	0.48	.10	.10	1079	654.3	180.9	131.9	124.5
57.5	0.41	-0.04	0.37	.21	.22	1036	654.0	183.4	133.3	126.9
60.0	0.30	-0.05	0.25	.38	.39	978	653.5	185.1	135.8	129.9
62.5	0.24	-0.06	0.18	.52	.53	936	652.9	186.1	139.1	133.3
65.0	0.30	-0.06	0.24	.39	.40	973	652.3	186.4	143.2	136.9
67.5	0.28	-0.06	0.22	.42	.44	962	652.0	186.1	147.8	140.6
70.0	0.26	-0.05	0.21	.44	.46	956	652.0	185.4	152.9	144.0
72.5	0.13	-0.03	0.10	.76	.77	872	652.4	184.5	158.2	147.1
75.0	0.14	-0.02	0.12	.68	.69	893	653.2	183.5	163.6	149.6
77.5	0.19	-0.01	0.18	.50	.51	942	654.4	182.6	168.9	151.5
80.0	0.23	-0.01	0.22	.42	.41	970	655.9	182.0	174.0	152.8
82.5	0.22	0.00	0.22	.42	.40	972	657.6	181.8	178.0	153.7
85.0	0.26	0.01	0.27	.33	.31	1003	659.3	182.3	176.2	154.4
87.5	0.19	0.02	0.21	.44	.41	970	660.8	183.5	172.6	155.2
90.0	0.17	0.03	0.20	.46	.43	966	662.0	185.4	169.5	156.2
92.5	0.18	0.04	0.22	.42	.38	979	662.7	187.9	167.1	157.7
95.0	0.20	0.05	0.25	.36	.32	998	662.9	190.7	165.4	159.7
97.5	0.18	0.05	0.23	.40	.36	986	662.5	193.5	164.2	162.2
37100.0	0.17	0.05	0.22	.42	.38	978	661.6	195.9	163.6	165.0
02.5	0.16	0.06	0.22	.41	.39	977	660.2	197.8	163.2	167.8
05.0	0.13	0.07	0.20	.45	.44	962	658.5	198.8	162.8	169.7
07.5	0.07	0.08	0.15	.58	.57	924	656.7	199.2	161.9	169.4
10.0	0.05	0.10	0.15	.58	.58	922	654.9	198.9	160.2	166.6
12.5	0.09	0.10	0.19	.47	.48	949	653.4	198.2	157.7	162.1
15.0	0.17	0.11	0.28	.30	.32	1000	652.1	197.2	154.3	156.9
17.5	0.27	0.13	0.40	.15	.17	1053	651.3	196.1	150.3	151.4
20.0	0.30	0.14	0.44	.11	.13	1068	651.0	195.1	145.8	145.9
22.5	0.26	0.15	0.41	.14	.16	1056	651.0	194.3	141.2	140.7
25.0	0.19	0.15	0.34	.22	.24	1026	651.4	193.9	136.7	136.0
27.5	0.18	0.15	0.33	.24	.25	1021	652.0	194.2	132.4	131.9
30.0	0.18	0.14	0.32	.26	.27	1017	652.7	195.1	128.6	128.6
32.5	0.18	0.13	0.31	.27	.28	1013	653.3	196.7	125.4	126.3
35.0	0.19	0.12	0.31	.27	.28	1013	653.8	199.1	123.1	125.1
37.5	0.21	0.11	0.32	.26	.26	1018	653.9	201.9	121.7	125.0
37140.0	0.23	0.10	0.33	-16.25	-16.25	1023	654.2	204.8	121.4	126.1
45.0	0.00	0.07	0.07	.92	.93	834	653.2	209.6	123.8	131.6
50.0	0.01	0.06	0.07	.91	.93	834	651.6	211.8	130.0	140.8
55.0	-0.04	0.05	0.01	-17.75	-17.77	241	650.6	211.6	138.4	152.6
60.0	0.02	0.08	0.10	-16.75	-16.77	873	651.1	210.0	147.0	165.6
65.0	0.15	0.10	0.25	.35	.36	986	653.4	208.6	152.1	178.1
70.0	0.12	0.13	0.25	.36	.35	990	656.8	208.6	150.6	169.1
75.0	0.12	0.16	0.28	.31	.28	1011	660.2	211.2	144.4	159.4
80.0	0.06	0.18	0.24	.38	.34	991	662.2	216.6	137.3	153.0
85.0	0.06	0.18	0.24	.38	.35	991	662.0	222.8	131.8	150.2
90.0	0.18	0.17	0.35	.21	.19	1045	659.7	227.4	129.1	151.1
95.0	0.28	0.17	0.45	.10	.09	1082	656.4	229.1	129.2	155.0
37200.0	0.15	0.17	0.32	.25	.26	1021	653.2	228.6	131.0	160.0
05.0	0.12	0.18	0.30	.27	.29	1008	651.3	227.1	133.0	162.8
10.0	0.11	0.20	0.31	.26	.28	1012	650.9	226.0	133.3	160.5

Table 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 $\beta1$

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_v	log ρ_s	T_v (°K)	z (km)	$\alpha_v - \alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37215.0	0.22	0.21	0.43	-16.12	-16.14	1064	651.5	226.8	131.2	154.9
17.5	0.08	0.22	0.30	.28	.30	1007	652.1	228.2	129.5	152.0
20.0	0.13	0.23	0.36	.20	.22	1035	652.7	230.3	127.4	149.3
22.5	0.15	0.24	0.39	.17	.18	1048	653.0	233.0	125.3	147.2
25.0	0.19	0.24	0.43	.13	.14	1064	652.9	236.1	123.3	145.6
27.5	0.07	0.24	0.31	.27	.28	1011	652.6	239.1	121.4	144.7
30.0	0.04	0.24	0.28	.32	.33	996	652.0	241.7	119.9	144.4
32.5	0.08	0.25	0.33	.24	.26	1019	651.1	243.7	118.8	144.5
35.0	-0.05	0.25	0.20	.46	.48	948	650.2	245.0	118.0	145.0
37.5	-0.10	0.25	0.15	.58	.61	913	649.4	245.5	117.5	145.6
40.0	-0.13	0.25	0.12	.68	.71	888	648.8	245.4	117.1	145.8
42.5	-0.21	0.25	0.04	-17.16	-17.19	753	648.5	244.8	116.7	145.6
45.0	-0.24	0.26	0.02	.46	.49	581	648.6	243.9	116.1	144.5
47.5	-0.23	0.26	0.03	.29	.31	697	649.3	242.9	115.2	142.5
50.0	0.88	0.27	1.15	-15.71	-15.73	1250	650.4	241.9	113.8	139.6
52.5	-0.05	0.28	0.23	-16.41	-15.43	965	651.9	241.1	111.9	135.9
55.0	-0.10	0.28	0.18	.52	.53	935	653.7	240.7	109.5	131.8
57.5	-0.12	0.29	0.17	.55	.55	930	655.6	240.9	106.7	127.5
60.0	-0.14	0.30	0.16	.58	.57	924	657.5	241.8	103.6	123.3
62.5	0.03	0.30	0.33	.27	.25	1022	659.1	243.3	100.4	119.4
65.0	0.08	0.30	0.38	.21	.19	1046	660.3	245.5	97.3	116.0
67.5	0.13	0.29	0.42	.17	.14	1064	660.9	248.2	94.6	113.5
70.0	0.16	0.27	0.43	.16	.13	1068	661.0	251.0	92.4	111.8
72.5	0.23	0.22	0.45	.13	.11	1077	660.5	253.5	91.0	111.3
75.0	0.30	0.17	0.47	.11	.09	1084	659.4	255.4	90.6	111.8
77.5	0.40	0.10	0.50	.08	.06	1094	658.0	256.6	91.1	113.3
37280.0	0.44	0.05	0.49	-16.08	-16.08	1089	656.2	257.1	92.6	115.8
85.0	0.30	0.00	0.30	.29	.30	1007	653.2	256.1	97.9	123.0
90.0	0.06	0.13	0.19	.48	.50	943	651.0	253.8	104.9	131.5
95.0	-0.01	0.18	0.17	.53	.55	929	650.3	251.4	111.5	139.0
37300.0	-0.04	0.19	0.15	.59	.61	915	651.1	250.4	115.6	142.8
05.0	-0.12	0.23	0.11	.73	.74	881	652.4	252.0	116.0	141.8
10.0	-0.15	0.26	0.11	.73	.74	880	653.2	256.4	112.9	137.7
15.0	-0.17	0.30	0.13	.67	.68	896	652.8	261.6	108.0	132.9
20.0	-0.25	0.30	0.05	-17.09	-17.10	784	651.5	265.3	103.1	129.2
25.0	-0.24	0.30	0.06	.01	.03	806	650.0	266.3	99.3	127.0
30.0	-0.26	0.30	0.04	.18	.21	745	649.5	265.0	97.0	125.6
35.0	-0.31	0.31	0.00				650.6	263.0	95.7	124.0
40.0	-0.37	0.31	-0.06				653.5	261.5	94.2	121.2
45.0	-0.31	0.31	0.00				657.1	261.9	91.8	116.9
50.0	-0.30	0.32	0.02	-17.51	-17.49	584	660.4	265.2	88.2	112.0
55.0	-0.18	0.32	0.14	-16.67	-16.64	906	661.8	270.9	84.1	107.8
60.0	-0.15	0.31	0.16	.61	.58	921	660.8	276.6	80.5	105.4
65.0	-0.03	0.29	0.26	.39	.38	980	657.8	280.2	78.5	105.4
70.0	-0.02	0.26	0.24	.42	.42	966	654.2	280.9	78.5	107.4
75.0	-0.05	0.24	0.19	.52	.54	934	651.3	279.9	80.1	110.0
80.0	-0.11	0.25	0.14	.65	.68	896	650.2	278.3	81.7	111.4
85.0	-0.10	0.28	0.18	.55	.57	924	650.8	277.7	81.9	110.2
90.0	-0.10	0.30	0.20	.52	.53	935	652.5	279.3	79.7	106.1
95.0	-0.08	0.31	0.23	.46	.47	952	654.1	283.7	75.1	100.0
37400.0	-0.15	0.31	0.16	.62	.62	910	654.7	289.8	69.1	93.8
05.0	-0.21	0.30	0.09	.87	.87	849	654.1	295.0	63.5	89.3
10.0	-0.12	0.26	0.14	.66	.67	897	652.7	297.5	60.3	87.9
15.0	0.00	0.16	0.16	.60	.61	913	651.5	297.4	61.0	89.8

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 β1 (5-day)

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_T	log ρ_B	T_T (°K)	z (km)	$\alpha_T-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36875.0	1.01	-0.23	0.78	-15.94	-15.95	1142	651.9	120.8	123.6	98.7
80.0	0.87	-0.22	0.65	-16.01	-16.02	1110	651.3	126.5	129.1	104.3
85.0	0.75	-0.20	0.55	.07	.09	1084	649.9	131.2	134.1	108.1
90.0	0.60	-0.17	0.43	.16	.19	1045	648.7	133.1	136.1	108.6
95.0	0.53	-0.13	0.40	.19	.21	1036	648.8	132.4	133.5	105.4
36930.0	0.77	-0.10	0.67	-16.00	-15.99	1123	656.2	142.2	117.5	97.2
35.0	0.85	-0.22	0.63	.02	-16.02	1111	655.0	142.7	124.9	102.4
40.0	0.71	-0.22	0.49	.13	.13	1067	653.8	141.1	131.6	106.3
45.0	0.59	-0.19	0.40	.21	.22	1034	653.3	138.6	136.3	108.9
50.0	0.56	-0.18	0.38	.23	.24	1027	653.8	136.8	138.7	110.8
55.0	0.67	-0.17	0.50	.11	.11	1074	654.9	136.9	140.0	113.1
60.0	1.04	-0.16	0.88	-15.87	-15.86	1183	655.5	139.8	141.6	116.3
65.0	1.25	-0.16	1.09	.77	.77	1230	655.0	145.1	144.6	120.2
70.0	0.92	-0.15	0.77	.91	.92	1158	653.4	150.4	148.9	124.0
75.0	0.64	-0.13	0.51	-16.08	-16.09	1082	651.4	153.4	153.0	126.0
80.0	0.47	-0.10	0.37	.21	.23	1031	651.2	153.7	154.4	125.5
85.0	0.37	-0.08	0.29	.31	.33	995	651.4	152.4	151.6	122.4
90.0	0.46	-0.07	0.39	.19	.20	1042	653.4	150.6	146.1	118.4
95.0	0.48	-0.07	0.41	.17	.17	1054	656.7	150.0	140.5	115.3
37000.0	0.42	-0.07	0.35	.25	.23	1032	660.4	151.6	137.0	114.7
05.0	0.38	-0.09	0.29	.34	.30	1006	662.9	156.2	137.0	117.4
10.0	0.34	-0.10	0.24	.42	.38	981	663.3	162.4	141.0	123.0
15.0	0.31	-0.10	0.21	.47	.43	963	661.4	167.6	148.5	130.2
20.0	0.52	-0.08	0.44	.13	.12	1073	658.1	170.2	158.6	136.8
25.0	0.72	-0.05	0.67	-15.94	-15.94	1146	654.6	170.1	168.1	140.0
30.0	0.54	-0.02	0.52	-16.05	-16.06	1096	652.2	168.7	166.9	138.3
35.0	0.50	0.00	0.50	.06	.08	1087	651.5	167.3	156.3	133.1
40.0	0.56	0.01	0.57	.01	.03	1110	652.2	167.3	145.5	127.2
45.0	0.53	0.01	0.54	.04	.05	1100	653.6	169.8	137.0	123.1
50.0	0.50	-0.01	0.49	.09	.09	1083	654.5	175.0	132.3	122.0
55.0	0.47	-0.03	0.44	.14	.14	1064	654.3	180.9	131.9	124.5
60.0	0.31	-0.05	0.26	.36	.37	983	653.5	185.1	135.8	129.9
65.0	0.29	-0.06	0.23	.41	.42	967	652.3	186.4	143.2	136.9
70.0	0.23	-0.05	0.18	.51	.52	937	652.0	185.4	152.9	144.0
75.0	0.15	-0.02	0.13	.65	.65	902	653.2	183.5	163.6	149.6
80.0	0.22	-0.01	0.21	.44	.43	964	655.9	182.0	174.0	152.8
85.0	0.23	0.01	0.24	.38	.36	986	659.3	182.3	176.2	154.4
90.0	0.18	0.03	0.21	.44	.40	972	662.0	185.4	169.5	156.2
95.0	0.18	0.05	0.23	.40	.36	986	662.9	190.7	165.4	159.7
37100.0	0.17	0.05	0.22	.42	.38	978	661.6	195.9	163.6	165.0
05.0	0.12	0.07	0.19	.48	.46	955	658.5	198.8	162.8	169.7
10.0	0.06	0.10	0.16	.55	.55	930	654.9	198.9	160.2	166.6
15.0	0.18	0.11	0.29	.29	.30	1005	652.1	197.2	154.3	156.9
20.0	0.28	0.14	0.42	.13	.15	1060	651.0	195.1	145.8	145.9
25.0	0.20	0.15	0.35	.21	.23	1030	651.4	193.9	136.7	136.0
30.0	0.18	0.14	0.32	.26	.27	1017	652.7	195.1	128.6	128.6

Table 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 $\beta 2$

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_v	log ρ_s	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36340.0	1.69	0.20	1.9	−15.53	−15.55	1359	653.0	308.1	48.9	76.6
42.5	1.74	0.21	2.0	.51	.53	1375	653.9	308.6	47.7	74.7
45.0	1.82	0.21	2.0	.51	.52	1378	654.8	309.8	46.2	72.3
47.5	1.94	0.21	2.2	.47	.48	1408	655.7	311.8	44.2	69.7
50.0	2.40	0.20	2.6	.39	.40	1462	656.4	314.5	41.9	66.8
52.5	2.56	0.20	2.8	.36	.36	1489	656.8	317.6	39.2	63.9
55.0	2.52	0.19	2.7	.37	.37	1480	656.8	320.8	36.4	61.3
57.5	2.41	0.17	2.6	.38	.39	1470	656.6	323.5	33.7	59.2
60.0	2.38	0.15	2.5	.39	.40	1460	656.1	325.5	31.6	57.9
62.5	2.36	0.13	2.5	.39	.40	1462	655.4	326.7	30.5	57.6
65.0	2.17	0.11	2.3	.42	.43	1437	654.9	327.1	30.9	58.4
67.5	1.79	0.09	1.9	.50	.51	1383	654.6	326.8	32.8	60.3
70.0	1.34	0.06	1.4	.63	.64	1304	654.7	326.1	36.1	63.0
72.5	1.03	0.04	1.1	.74	.75	1248	655.2	325.2	40.3	66.4
75.0	1.15	0.01	1.2	.70	.71	1270	656.1	324.2	44.9	70.0
77.5	1.49	0.00	1.5	.60	.60	1328	657.6	323.3	49.6	73.6
80.0	1.68	0.00	1.7	.55	.54	1364	659.3	322.8	54.0	76.8
82.5	1.83	0.00	1.8	.53	.52	1382	661.2	323.0	57.8	79.3
85.0	1.63	0.00	1.6	.58	.56	1352	663.0	323.8	60.8	81.0
87.5	1.50	0.00	1.5	.62	.59	1336	664.5	325.5	62.7	81.6
36390.0	1.60	0.00	1.6	−15.60	−15.56	1352	665.7	328.0	63.5	81.2
91.0	2.00	0.00	2.0	.50	.47	1414	665.9	329.2	63.4	80.7
92.0	2.30	0.00	2.3	.44	.41	1455	666.1	330.4	63.2	80.0
93.0	2.30	0.00	2.3	.44	.41	1454	666.2	331.7	62.7	79.2
94.0	1.80	0.00	1.8	.55	.52	1381	666.2	333.0	62.1	78.3
36395.0	1.00	0.00	1.0	−15.81	−15.78	1234	666.1	334.3	61.3	77.2
97.5	0.73	0.04	0.8	.91	.88	1183	665.3	337.3	58.5	74.1
36400.0	0.86	0.09	1.0	.81	.79	1228	664.0	339.6	54.7	70.4
02.5	0.93	0.14	1.1	.77	.75	1247	662.3	341.2	50.2	66.5
05.0	1.06	0.16	1.2	.72	.71	1265	660.4	342.0	45.1	62.6
07.5	1.31	0.16	1.5	.62	.62	1318	658.5	342.1	39.7	59.0
10.0	1.76	0.15	1.9	.52	.52	1380	656.9	341.6	34.3	55.9
12.5	2.22	0.14	2.4	.41	.42	1448	655.6	340.8	29.4	53.3
15.0	2.66	0.13	2.8	.34	.35	1498	654.8	340.0	25.2	51.4
17.5	2.87	0.12	3.0	.31	.32	1522	654.5	339.2	22.1	50.1
20.0	2.56	0.10	2.7	.35	.36	1488	654.7	338.8	20.6	49.2
22.5	2.28	0.09	2.4	.40	.41	1453	655.3	338.8	20.4	48.5
25.0	2.16	0.08	2.2	.44	.45	1428	656.1	339.6	21.2	47.9
27.5	2.02	0.07	2.1	.46	.46	1416	656.9	341.1	22.4	47.0
30.0	2.13	0.06	2.2	.44	.44	1432	657.7	343.5	23.3	45.8
32.5	2.35	0.05	2.4	.40	.40	1460	658.2	346.6	23.7	44.2
35.0	2.60	0.05	2.6	.37	.37	1487	658.3	350.0	23.4	42.2
37.0	3.26	0.04	3.3	.26	.26	1571	658.2	353.2	22.2	39.7
40.0	4.06	0.04	4.1	.17	.17	1657	657.5	356.1	20.1	37.1
42.5	4.70	0.03	4.7	.10	.11	1717	656.8	358.1	17.2	34.5
45.0	4.66	0.02	4.7	.10	.11	1717	656.0	359.4	13.5	32.2
47.5	4.72	0.01	4.7	.10	.11	1717	655.4	359.9	9.2	30.7
50.0	5.12	0.00	5.1	.06	.07	1757	655.0	359.8	4.4	30.0
52.5	4.73	−0.01	4.7	.10	.11	1720	655.1	359.4	0.9	30.4
55.0	4.23	−0.02	4.2	.14	.15	1673	655.6	358.7	6.1	31.8
57.5	4.46	−0.03	4.4	.12	.13	1698	656.7	358.1	11.3	33.7
60.0	5.54	−0.04	5.5	.03	.03	1814	658.1	357.7	16.4	36.0
62.5	5.56	−0.05	5.5	.03	.02	1821	659.9	357.8	21.0	38.0
65.0	3.90	−0.06	3.8	.19	.17	1652	661.8	358.4	25.2	39.7
67.5	3.59	−0.06	3.5	.23	.20	1623	663.6	359.9	28.5	40.6
70.0	4.06	−0.06	4.0	.17	.14	1684	665.1	2.1	31.0	40.7
72.5	4.28	−0.06	4.2	.15	.12	1709	666.1	5.1	32.6	39.8
75.0	4.06	−0.05	4.0	.17	.14	1688	666.6	8.6	33.1	37.8

Table 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 $\beta 2$

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_τ	log ρ_s	T_τ (°K)	z (km)	$\alpha_\tau-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36477.5	5.15	-0.04	5.1	-15.06	-15.03	1805	666.4	12.1	32.6	34.8
80.0	5.23	-0.04	5.2	.06	.03	1812	665.6	15.2	31.1	31.0
82.5	4.91	-0.05	4.9	.08	.06	1778	664.3	17.6	28.9	26.3
85.0	4.98	-0.06	4.9	.08	.06	1773	662.6	19.2	26.0	21.1
87.5	4.80	-0.07	4.7	.09	.08	1747	660.8	19.9	23.0	15.8
90.0	5.57	-0.08	5.5	.02	.02	1822	659.1	20.0	20.5	11.4
92.5	6.66	-0.09	6.6	-14.94	-14.94	1920	657.7	19.6	19.4	10.3
95.0	7.01	-0.11	6.9	.92	.93	1943	656.6	18.9	20.4	13.7
97.5	8.15	-0.13	8.0	.86	.87	2036	656.0	18.1	23.6	19.2
36499.0	8.65	-0.15	8.5	-14.83	-14.84	2077	655.9	17.7	26.2	22.9
36500.0	8.00	-0.15	7.9	-14.86	-14.87	2025	655.9	17.5	28.1	25.4
02.5	6.28	-0.16	6.1	.98	.99	1864	656.2	17.2	33.4	31.4
05.0	6.23	-0.16	6.1	.98	.98	1865	656.8	17.4	38.9	37.0
07.5	6.23	-0.15	6.1	.98	.98	1867	657.5	18.4	44.2	41.9
10.0	5.79	-0.13	5.7	-15.01	-15.01	1832	658.3	20.1	48.9	45.9
12.5	5.46	-0.09	5.4	.04	.03	1804	658.8	22.6	53.0	48.9
15.0	5.00	-0.03	5.0	.07	.07	1766	659.1	25.6	56.1	50.6
17.5	4.49	0.00	4.5	.12	.11	1714	659.0	28.9	58.0	51.1
20.0	4.00	0.00	4.0	.17	.17	1660	658.5	31.8	58.8	50.4
22.5	3.90	0.00	3.9	.18	.18	1647	657.8	34.2	58.4	48.4
25.0	4.13	0.00	4.1	.16	.16	1665	656.8	35.7	56.8	45.3
27.5	4.28	0.00	4.3	.13	.14	1684	655.9	36.4	54.2	41.3
30.0	5.00	0.00	5.0	.07	.08	1753	655.2	36.4	50.8	36.6
32.5	5.62	0.00	5.6	.02	.03	1810	654.8	35.8	46.7	31.2
35.0	6.26	-0.02	6.2	-14.97	-14.98	1868	654.8	34.9	42.4	25.5
37.5	6.69	-0.05	6.6	.94	.95	1908	655.3	33.8	38.1	19.7
40.0	6.89	-0.08	6.8	.93	.94	1932	656.4	32.8	34.3	13.8
42.5	5.96	-0.10	5.9	.99	.99	1856	657.8	32.0	31.3	8.2
45.0	4.98	-0.12	4.9	-15.07	-15.07	1765	659.4	31.7	29.6	3.2
47.5	5.31	-0.14	5.2	.05	.04	1801	661.1	32.1	29.4	2.7
50.0	5.48	-0.16	5.3	.04	.02	1817	662.7	33.3	30.4	6.6
52.5	4.77	-0.17	4.6	.10	.08	1749	663.9	35.4	32.4	9.9
55.0	3.62	-0.19	3.4	.23	.21	1617	664.6	38.0	34.8	12.6
57.5	3.52	-0.20	3.3	.25	.22	1605	664.6	41.0	37.3	14.5
60.0	3.69	-0.20	3.5	.22	.20	1627	664.1	43.9	39.6	15.6
62.5	4.25	-0.21	4.0	.16	.15	1680	662.9	46.3	41.6	16.3
65.0	4.68	-0.21	4.5	.11	.10	1728	661.3	48.0	43.3	16.7
67.5	4.95	-0.22	4.7	.09	.09	1742	659.4	48.8	44.7	17.3
70.0	4.98	-0.22	4.8	.08	.09	1744	657.5	48.9	46.0	18.5
72.5	5.06	-0.22	4.8	.08	.09	1736	655.6	48.3	47.2	20.6
75.0	5.38	-0.23	5.2	.05	.06	1768	654.1	47.4	48.6	23.7
77.5	5.70	-0.23	5.5	.03	.05	1789	653.0	46.2	50.4	27.5
80.0	5.15	-0.24	4.9	.08	.10	1727	652.4	45.1	52.5	32.0
82.5	4.23	-0.25	4.0	.17	.19	1635	652.3	44.2	55.1	36.7
85.0	3.79	-0.26	3.5	.23	.25	1580	652.5	43.8	58.1	41.4
87.5	4.00	-0.26	3.7	.21	.23	1603	653.4	44.0	61.3	45.8
90.0	4.40	-0.26	4.1	.16	.18	1646	654.2	45.0	64.5	49.8
92.5	4.79	-0.25	4.5	.12	.14	1689	654.8	46.9	67.6	53.0
95.0	5.26	-0.24	5.0	.08	.09	1741	655.3	49.4	70.2	55.3
97.5	4.92	-0.21	4.7	.10	.11	1714	655.5	52.5	72.3	56.5
36600.0	4.72	-0.17	4.6	.11	.12	1705	655.3	55.6	73.6	56.6
02.5	4.53	-0.11	4.4	.13	.14	1685	654.8	58.4	74.0	55.6
05.0	4.10	-0.01	4.1	.16	.17	1653	654.0	60.6	73.5	53.4
07.5	3.56	0.00	3.6	.21	.23	1598	653.1	61.9	72.2	50.3
10.0	3.52	0.00	3.5	.22	.24	1586	652.3	62.5	70.1	46.5
12.5	3.43	0.00	3.4	.23	.26	1574	651.7	62.4	67.6	42.2
15.0	3.88	-0.02	3.9	.17	.20	1628	651.5	61.8	64.8	37.8
17.5	3.82	-0.08	3.7	.20	.22	1608	651.7	61.1	62.2	33.7

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 $\beta 2$

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_v	log ρ_s	T_v (°K)	z (km)	$a_v - a_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36620.0	3.40	-0.13	3.3	-15.25	-15.27	1565	652.4	60.2	60.0	30.6
22.5	4.03	-0.18	3.8	.19	.20	1622	653.6	59.6	58.6	29.1
25.0	4.40	-0.21	4.2	.15	.16	1667	655.2	59.3	58.2	29.5
27.5	4.28	-0.24	4.0	.17	.18	1650	656.9	59.6	58.9	31.6
30.0	3.89	-0.25	3.6	.22	.22	1609	658.6	60.7	60.6	34.9
32.5	3.55	-0.26	3.3	.26	.25	1578	660.1	62.6	63.3	38.9
35.0	3.60	-0.27	3.3	.26	.25	1579	661.2	65.4	66.5	42.9
37.5	3.69	-0.28	3.4	.25	.24	1592	661.7	68.6	70.0	46.6
40.0	3.77	-0.28	3.5	.24	.23	1602	661.6	72.2	73.4	49.8
42.5	3.74	-0.27	3.5	.24	.23	1600	660.9	75.4	76.5	52.2
45.0	3.80	-0.26	3.6	.23	.22	1608	659.6	78.1	79.0	53.7
47.5	4.00	-0.25	3.8	.20	.20	1626	657.9	79.9	80.8	54.4
50.0	4.24	-0.24	4.0	.18	.18	1642	656.1	81.0	81.8	54.3
52.5	4.58	-0.23	4.4	.13	.15	1677	654.2	81.3	82.1	53.5
55.0	4.16	-0.22	3.9	.18	.21	1621	652.6	81.1	81.6	52.3
57.5	3.82	-0.22	3.6	.22	.25	1585	651.3	80.5	80.8	51.0
60.0	3.71	-0.22	3.5	.23	.26	1570	650.5	79.8	79.6	49.7
62.5	3.54	-0.22	3.3	.26	.29	1546	650.3	79.2	78.5	48.9
65.0	3.64	-0.23	3.4	.25	.28	1555	650.4	78.8	77.6	48.6
67.5	3.84	-0.24	3.6	.23	.26	1576	651.0	79.0	77.2	49.1
70.0	4.08	-0.25	3.8	.21	.23	1596	651.7	79.8	77.3	50.2
72.5	3.89	-0.26	3.6	.24	.26	1575	652.5	81.5	78.1	52.0
75.0	3.64	-0.27	3.4	.26	.28	1553	653.2	83.9	79.5	54.2
77.5	3.47	-0.28	3.2	.29	.31	1531	653.6	87.0	81.4	56.6
80.0	3.44	-0.28	3.2	.29	.31	1530	653.7	90.4	83.7	59.0
82.5	3.59	-0.29	3.3	.28	.30	1540	653.4	93.7	86.1	61.2
85.0	3.56	-0.29	3.3	.28	.30	1538	652.8	96.4	88.5	63.0
87.5	3.40	-0.29	3.1	.31	.33	1514	652.0	98.4	90.8	64.5
90.0	3.08	-0.28	2.8	.35	.38	1477	651.2	99.6	92.8	65.7
92.5	2.27	-0.28	2.0	.50	.53	1375	650.5	100.0	94.4	66.7
95.0	2.41	-0.28	2.1	.48	.51	1387	650.0	99.8	95.8	67.5
97.5	2.74	-0.27	2.5	.40	.43	1436	650.0	99.1	97.0	68.4
36700.0	2.71	-0.27	2.4	.42	.45	1423	650.5	98.3	98.0	69.5
02.5	2.50	-0.27	2.2	.46	.49	1398	651.4	97.4	99.1	71.0
05.0	2.43	-0.26	2.2	.47	.49	1398	652.8	96.8	100.4	73.1
07.5	2.26	-0.26	2.0	.52	.53	1373	654.5	96.6	102.0	75.6
10.0	2.02	-0.27	1.8	.57	.57	1346	656.3	97.0	104.1	78.6
12.5	1.43	-0.27	1.2	.75	.75	1249	658.0	98.2	106.5	81.8
15.0	1.32	-0.26	1.1	.78	.78	1232	659.4	100.3	109.2	85.3
17.5	1.11	-0.20	0.9	.87	.86	1192	660.3	103.0	112.1	88.6
20.0	0.80	-0.11	0.7	.98	.96	1144	660.6	106.2	115.1	91.5
22.5	0.99	-0.12	0.9	.86	.85	1196	660.3	109.4	117.7	93.9
25.0	0.92	-0.14	0.8	.90	.90	1173	659.4	112.2	119.9	95.4
27.5	0.96	-0.18	0.8	.90	.90	1174	658.1	114.3	121.2	95.9
30.0	1.02	-0.19	0.8	.89	.90	1173	656.3	115.5	121.4	95.4
32.5	1.20	-0.17	1.0	.79	.80	1219	654.5	115.9	120.6	93.8
35.0	1.21	-0.12	1.1	.74	.77	1238	652.8	115.7	118.7	91.5
37.5	1.20	-0.08	1.1	.74	.77	1236	651.3	115.0	115.9	88.4
40.0	1.17	-0.07	1.1	.74	.77	1234	650.2	114.0	112.5	85.1
42.5	1.43	-0.08	1.4	.64	.67	1289	649.7	113.0	108.9	81.7
45.0	1.35	-0.06	1.3	.67	.71	1270	649.6	112.2	105.4	78.6
47.5	1.41	-0.03	1.4	.64	.68	1287	650.0	111.7	102.2	76.1
50.0	1.55	-0.04	1.5	.62	.65	1303	650.6	111.8	99.7	74.4
52.5	1.46	-0.09	1.4	.65	.68	1285	651.5	112.6	98.2	73.7
55.0	1.27	-0.15	1.1	.76	.79	1228	652.3	114.3	97.6	74.1
57.5	1.09	-0.19	0.9	.85	.88	1184	652.9	116.7	98.1	75.4
36760.0	1.34	-0.22	1.1	-15.77	-15.79	1225	653.5	119.7	99.7	77.5
61.0	1.43	-0.23	1.2	.74	.76	1244	653.5	121.0	100.6	78.6
62.0	1.47	-0.24	1.2	.74	.76	1243	653.5	122.3	101.6	79.7

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 $\beta 2$

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_r$	$\log \rho_s$	T_r (°K)	z (km)	$\alpha_r-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36763.0	1.82	-0.24	1.6	-15.61	-15.63	1310	653.4	123.6	102.7	80.9
64.0	2.43	-0.24	2.2	.48	.50	1394	653.3	124.8	104.0	82.1
65.0	2.60	-0.24	2.4	.44	.46	1418	653.2	125.9	105.3	83.3
66.0	2.25	-0.23	2.0	.52	.54	1366	653.0	126.9	106.7	84.6
67.0	1.56	-0.22	1.3	.71	.73	1257	652.7	127.8	108.2	85.8
68.0	1.13	-0.21	0.9	.87	.89	1177	652.5	128.6	109.7	87.1
69.0	0.87	-0.19	0.7	.98	-16.00	1127	652.2	129.2	111.2	88.3
36770.0	0.87	-0.17	0.7	-15.98	-16.00	1126	652.0	129.8	112.8	89.5
72.5	1.01	-0.15	0.9	.87	-15.90	1174	651.3	130.5	116.6	92.2
75.0	0.93	-0.15	0.8	.92	.95	1151	650.9	130.6	120.1	94.5
77.5	0.90	-0.18	0.7	.97	-16.00	1126	650.8	130.2	123.2	96.3
80.0	0.87	-0.21	0.7	.97	.00	1127	651.2	129.4	125.6	97.8
82.5	0.85	-0.21	0.6	-16.04	.07	1100	652.1	128.6	127.4	99.0
85.0	0.81	-0.20	0.6	.04	.06	1102	653.4	127.8	128.7	100.0
87.5	0.83	-0.19	0.6	.04	.05	1105	655.2	127.4	129.5	101.1
90.0	0.75	-0.18	0.6	.04	.05	1108	657.1	127.6	130.1	102.3
92.5	0.73	-0.18	0.6	.04	.04	1111	659.0	128.4	130.8	103.8
95.0	0.80	-0.18	0.6	.05	.03	1114	660.7	130.1	131.7	105.6
97.5	0.84	-0.18	0.7	-15.98	-15.96	1146	662.1	132.6	133.0	107.7
36800.0	0.83	-0.17	0.7	.98	.95	1148	662.8	135.7	134.7	110.0
02.5	0.86	-0.17	0.7	.97	.95	1150	662.9	139.2	136.8	112.5
05.0	0.89	-0.16	0.7	.97	.95	1152	662.3	142.6	139.3	114.9
07.5	0.99	-0.15	0.8	.90	.89	1179	661.2	145.4	142.0	117.0
10.0	1.17	-0.14	1.0	.80	.79	1225	659.5	147.5	144.7	118.7
12.5	1.53	-0.14	1.4	.65	.65	1302	657.6	148.8	147.0	119.7
15.0	1.62	-0.12	1.5	.61	.62	1316	655.6	149.2	148.6	120.1
17.5	1.25	-0.10	1.2	.70	.73	1260	653.7	149.2	149.2	119.8
20.0	0.82	-0.10	0.7	.94	.96	1143	652.2	148.7	148.8	119.0
22.5	0.62	-0.10	0.5	-16.08	-16.12	1080	651.1	148.0	147.5	117.8
25.0	0.68	-0.09	0.6	.00	.04	1111	650.5	147.4	145.6	116.6
27.5	0.79	-0.09	0.7	-15.94	-15.98	1138	650.4	147.0	143.6	115.5
30.0	0.94	-0.09	0.8	.88	.92	1164	650.7	147.1	141.6	114.8
32.5	1.10	-0.09	1.0	.79	.82	1210	651.3	147.8	140.1	114.8
35.0	1.31	-0.09	1.2	.71	.74	1251	652.0	149.3	139.4	115.6
37.5	0.97	-0.09	0.9	.84	.87	1189	652.7	151.6	139.5	117.2
40.0	0.96	-0.10	0.9	.84	.86	1190	653.1	154.6	140.6	119.5
42.5	0.78	-0.09	0.7	.95	.97	1141	653.3	158.1	142.7	122.6
45.0	0.81	-0.09	0.7	.94	.97	1143	653.1	161.5	145.8	126.1
47.5	0.55	-0.09	0.5	-16.08	-16.11	1083	652.6	164.5	149.8	129.8
50.0	0.46	-0.09	0.4	.17	.20	1046	652.0	166.8	154.5	133.4
52.5	0.42	-0.07	0.4	.17	.20	1047	651.3	168.2	159.6	136.5
55.0	0.50	-0.06	0.4	.16	.20	1048	650.7	168.9	164.6	138.6
57.5	0.55	-0.05	0.5	.06	.10	1087	650.3	168.9	168.2	139.4
60.0	0.63	-0.04	0.6	-15.98	.02	1121	650.4	168.4	168.3	138.8
62.5	0.62	-0.03	0.6	.98	.01	1122	650.9	167.7	164.5	136.9
65.0	0.75	-0.02	0.7	.91	-15.94	1154	651.9	166.9	158.9	134.0
67.5	0.55	0.00	0.6	.98	-16.00	1126	653.4	166.3	152.8	130.6
70.0	0.68	0.01	0.7	.92	-15.93	1159	655.2	166.1	146.9	127.2
72.5	0.62	0.00	0.6	.99	.99	1131	657.1	166.4	141.4	124.0
75.0	0.57	0.00	0.6	.99	.99	1134	659.0	167.5	136.6	121.4
77.5	0.64	0.02	0.6	-16.00	.98	1135	660.5	169.4	132.8	119.6
80.0	0.49	0.02	0.5	.08	-16.06	1102	661.6	172.0	130.1	118.8
82.5	0.50	0.00	0.5	.08	.06	1102	662.1	175.2	128.6	119.0
85.0	0.42	-0.04	0.4	.18	.16	1062	661.9	178.4	128.4	120.3
87.5	0.65	-0.08	0.6	.00	-15.99	1133	661.1	181.4	129.4	122.5
90.0	0.71	-0.05	0.7	-15.93	.93	1161	659.6	183.7	131.6	125.5
92.5	0.66	-0.04	0.6	-16.00	-16.00	1129	657.8	185.1	135.0	129.1
95.0	0.59	-0.04	0.6	-15.99	.00	1127	655.8	185.7	139.2	133.1
97.5	0.87	-0.04	0.8	.86	-15.88	1181	653.8	185.5	144.1	137.2

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TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 β2

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_v	log ρ_s	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36900.0	0.72	-0.07	0.7	-15.92	-15.94	1152	652.0	184.9	149.6	141.1
02.5	0.75	-0.06	0.7	.91	.95	1151	650.6	183.8	155.4	144.7
05.0	0.76	-0.04	0.7	.91	.95	1150	649.7	182.7	161.3	147.7
07.5	0.72	-0.02	0.7	.91	.95	1150	649.3	181.7	167.2	150.0
10.0	0.77	-0.01	0.7	.91	.95	1150	649.3	181.0	172.8	151.7
12.5	0.49	0.00	0.5	-16.05	-16.09	1091	651.2	180.8	177.8	152.8
15.0	0.40	0.02	0.4	.15	.18	1055	652.0	181.2	177.2	153.7
17.5	0.27	0.02	0.3	.28	.30	1011	652.9	182.5	173.3	154.7
20.0	0.19	0.02	0.2	.45	.47	956	653.6	184.6	170.1	155.9
22.5	0.16	0.03	0.2	.45	.47	957	654.0	187.3	167.6	157.6
25.0	0.32	0.04	0.4	.15	.17	1059	654.0	190.3	166.0	159.8
27.5	0.29	0.04	0.3	.27	.30	1013	653.7	193.1	165.1	162.4
30.0	0.31	0.05	0.4	.15	.17	1058	653.1	195.4	164.6	165.2
32.5	0.23	0.06	0.3	.27	.30	1012	652.3	196.8	164.4	167.6
35.0	0.27	0.07	0.3	.27	.30	1011	651.4	197.5	163.8	168.4
37.5	0.24	0.08	0.3	.27	.30	1010	650.7	197.5	162.5	166.7
40.0	0.26	0.09	0.4	.14	.18	1054	650.2	196.8	160.1	162.9
42.5	0.29	0.10	0.4	.14	.18	1055	650.2	195.9	156.8	157.9
45.0	0.29	0.10	0.4	.14	.18	1055	650.7	194.7	152.6	152.4
47.5	0.37	0.12	0.4	.14	.18	1056	651.7	193.7	148.0	146.9
50.0	0.37	0.13	0.4	.15	.17	1058	653.1	192.9	143.2	141.6
52.5	0.37	0.13	0.5	.05	.07	1099	654.7	192.6	138.5	136.8
55.0	0.41	0.12	0.5	.06	.06	1101	656.5	193.0	134.1	132.9
57.5	0.52	0.12	0.6	-15.98	-15.98	1137	658.1	194.2	130.2	129.8
60.0	0.54	0.12	0.7	.91	.91	1169	659.4	196.3	127.2	127.9
62.5	0.65	0.12	0.8	.86	.85	1198	660.2	199.1	125.1	127.2
65.0	0.94	0.11	0.9	.81	.79	1224	660.4	202.3	124.1	127.8
67.5	1.11	0.09	1.2	.68	.67	1289	660.0	205.5	124.3	129.7
70.0	0.73	0.08	0.8	.86	.85	1196	659.0	208.2	125.6	132.8
72.5	0.48	0.06	0.5	-16.06	-16.06	1103	657.6	210.2	128.0	137.0
75.0	0.42	0.06	0.5	.05	.06	1100	655.9	211.4	131.3	142.2
77.5	0.32	0.06	0.4	.15	.17	1060	654.1	211.9	135.3	148.1
80.0	0.40	0.07	0.5	.05	.08	1096	652.4	211.7	139.6	154.6
82.5	0.38	0.08	0.5	.05	.08	1094	651.1	211.1	144.0	161.6
85.0	0.23	0.09	0.3	.27	.31	1010	650.1	210.3	147.8	168.6
87.5	0.24	0.10	0.3	.27	.31	1009	649.7	209.5	150.5	175.7
90.0	0.26	0.11	0.4	.14	.18	1054	649.8	208.9	151.4	177.1
92.5	0.25	0.12	0.4	.14	.18	1054	650.3	208.8	150.5	170.6
95.0	0.34	0.14	0.5	.05	.08	1093	651.1	209.2	147.9	164.5
97.5	0.29	0.15	0.4	.15	.18	1056	652.0	210.4	144.3	159.1
37000.0	0.17	0.15	0.3	.27	.30	1012	652.8	212.5	140.3	154.4
02.5	0.13	0.17	0.3	.27	.30	1013	653.4	215.3	136.3	150.8
05.0	0.12	0.18	0.3	.28	.30	1013	653.7	218.6	132.7	148.2
07.5	0.03	0.18	0.2	.45	.47	956	653.7	222.1	129.8	146.6
10.0	0.04	0.18	0.2	.45	.47	956	653.3	225.2	127.6	146.2
12.5	0.06	0.17	0.2	.45	.48	955	652.6	227.6	126.4	146.9
15.0	0.05	0.16	0.2	.45	.48	955	651.7	229.3	126.0	148.4
17.5	0.10	0.16	0.3	.27	.31	1010	650.9	230.1	126.4	150.8
37020.0	0.18	0.16	0.3	-16.27	-16.31	1009	650.4	230.3	127.4	153.7
21.0	0.34	0.16	0.5	.05	.09	1092	650.2	230.2	127.9	154.9
22.0	0.42	0.16	0.6	-15.97	.01	1125	650.1	230.1	128.4	156.1
23.0	0.51	0.16	0.7	.90	-15.94	1155	650.1	229.9	129.0	157.3
24.0	1.03	0.16	1.2	.67	.71	1268	650.2	229.6	129.6	158.4
25.0	1.20	0.16	1.4	.60	.64	1308	650.3	229.4	130.2	159.5
26.0	0.59	0.16	0.8	.84	.88	1182	650.6	229.1	130.7	160.3
27.0	0.33	0.16	0.5	-16.05	-16.08	1093	650.9	228.8	131.2	161.0
28.0	0.15	0.16	0.3	.27	.30	1011	651.2	228.6	131.7	161.5
29.0	0.14	0.17	0.3	.27	.30	1012	651.7	228.3	132.0	161.8

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 β2

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_\pi$	$\log \rho_s$	T_π (°K)	z (km)	$\alpha_\pi - \alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37030.0	0.00	0.17	0.2	-16.45	-16.47	956	652.2	228.1	132.3	161.7
32.5	0.09	0.18	0.3	.27	.29	1014	653.8	227.9	132.4	160.6
35.0	0.17	0.19	0.4	.15	.16	1062	655.5	228.2	131.8	158.2
37.5	0.16	0.20	0.4	.15	.16	1064	657.3	229.3	130.5	155.2
40.0	0.12	0.21	0.3	.28	.28	1020	658.8	231.1	128.5	152.1
42.5	0.12	0.22	0.3	.28	.27	1021	659.9	233.8	126.2	149.2
45.0	0.13	0.23	0.4	.16	.15	1068	660.4	237.0	123.8	146.8
47.5	0.11	0.23	0.3	.29	.27	1071	660.3	240.5	121.4	145.0
37050.0	0.09	0.23	0.3	-16.29	-16.28	1020	659.6	243.7	119.2	143.7
52.0	0.07	0.23	0.3	.29	.28	1018	658.6	245.9	117.7	143.1
53.0	0.31	0.23	0.5	.06	.06	1101	658.0	246.8	117.0	142.9
54.0	0.67	0.23	0.9	-15.81	-15.81	1216	657.3	247.6	116.4	142.8
55.0	0.92	0.23	1.2	.68	.69	1279	656.6	248.2	115.8	142.7
56.0	0.74	0.23	1.0	.76	.77	1236	655.9	248.7	115.4	142.6
57.0	0.39	0.23	0.6	.98	-16.00	1129	655.1	249.1	114.9	142.6
58.0	0.12	0.23	0.4	-16.16	.18	1056	654.4	249.3	114.5	142.5
37060.0	0.00	0.24	0.2	-16.46	-16.48	953	652.8	249.4	113.7	142.2
62.5	0.10	0.24	0.3	.28	.32	1006	651.1	249.1	112.8	141.5
65.0	0.13	0.24	0.4	.16	.20	1047	649.8	248.4	111.8	140.0
67.5	0.07	0.25	0.3	.29	.33	1001	649.0	247.5	110.6	137.8
70.0	0.03	0.26	0.3	.29	.34	999	648.7	246.7	108.9	134.7
72.5	0.05	0.26	0.3	.30	.34	998	648.9	246.1	106.7	131.0
75.0	0.02	0.27	0.3	.30	.34	997	649.4	246.0	104.1	126.8
77.5	0.04	0.28	0.3	.31	.35	996	650.3	246.6	101.0	122.4
80.0	0.10	0.28	0.4	.19	.22	1040	651.1	248.0	97.7	118.1
82.5	0.16	0.28	0.4	.19	.22	1040	651.9	250.1	94.3	114.2
85.0	0.14	0.27	0.4	.19	.22	1041	652.5	253.0	91.1	111.0
87.5	0.14	0.25	0.4	.19	.21	1042	652.7	256.1	88.3	108.5
90.0	0.20	0.23	0.4	.19	.21	1043	652.6	259.2	86.2	107.1
92.5	0.28	0.20	0.5	.08	.11	1081	652.1	261.8	85.0	106.8
95.0	0.29	0.14	0.4	.18	.21	1045	651.5	263.6	84.8	107.7
97.5	0.28	0.08	0.4	.17	.21	1045	650.8	264.6	85.7	109.6
37100.0	0.23	0.02	0.3	.29	.33	1002	650.2	264.9	87.5	112.4
02.5	0.30	0.00	0.3	.29	.33	1002	649.8	264.5	90.1	115.9
05.0	0.19	0.00	0.2	.46	.50	948	649.9	263.7	93.3	119.8
07.5	0.10	0.01	0.1	.76	.80	870	650.4	262.7	96.7	123.8
10.0	0.07	0.05	0.1	.76	.79	871	651.5	261.7	100.0	127.4
12.5	0.09	0.11	0.2	.46	.49	953	652.9	261.0	103.0	130.5
15.0	0.08	0.15	0.2	.46	.48	954	654.6	260.6	105.3	132.5
17.5	0.04	0.18	0.2	.47	.47	956	656.5	260.9	106.7	133.4
20.0	-0.07	0.21	0.1	.77	.77	876	658.2	262.0	107.0	133.0
22.5	-0.02	0.23	0.2	.48	.47	957	659.7	263.9	106.4	131.6
25.0	-0.02	0.25	0.2	.49	.47	957	660.6	266.6	104.7	129.3
27.5	-0.02	0.26	0.3	.32	.30	1012	661.0	269.8	102.3	126.6
30.0	-0.03	0.27	0.2	.50	.48	953	660.8	273.0	99.4	123.7
32.5	-0.02	0.27	0.2	.50	.49	951	659.9	275.9	96.2	120.9
35.0	0.07	0.28	0.3	.33	.33	1001	658.6	278.1	93.0	118.4
37.5	0.04	0.28	0.3	.33	.34	997	656.8	279.5	90.1	116.2
40.0	0.02	0.29	0.3	.33	.34	997	655.0	280.1	87.5	114.4
42.5	-0.05	0.29	0.2	.50	.53	941	653.2	280.1	85.3	113.0
45.0	-0.05	0.29	0.2	.50	.53	939	651.8	279.5	83.6	111.8
47.5	-0.05	0.29	0.2	.50	.54	937	650.7	278.7	82.2	110.7
50.0	-0.03	0.28	0.2	.51	.54	936	650.1	277.9	81.1	109.6
52.5	-0.03	0.28	0.2	.51	.55	935	650.0	277.2	80.2	108.2
55.0	0.04	0.28	0.3	.34	.37	988	650.4	276.9	79.1	106.5
57.5	0.14	0.28	0.4	.21	.25	1030	651.1	277.2	77.9	104.5
60.0	0.14	0.28	0.4	.22	.25	1031	651.9	278.2	76.4	102.2
62.5	0.72	0.28	1.0	-15.82	-15.85	1198	652.8	280.1	74.6	99.6

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 β2

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_r$	$\log \rho_s$	T_r (°K)	z (km)	$\alpha_r-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37165.0	0.68	0.28	1.0	-15.82	-15.84	1199	653.5	282.8	72.4	97.0
67.5	0.45	0.27	0.7	.98	-16.00	1129	653.9	286.0	70.1	94.5
70.0	0.30	0.27	0.6	-16.04	.06	1102	653.9	289.4	67.7	92.3
72.5	0.14	0.26	0.4	.22	.24	1034	653.7	292.6	65.4	90.6
75.0	0.07	0.26	0.3	.34	.36	992	653.1	295.3	63.4	89.4
77.5	0.05	0.25	0.3	.33	.36	992	652.4	297.1	62.0	88.9
80.0	0.20	0.24	0.4	.21	.23	1035	651.7	298.1	61.1	89.0
82.5	0.31	0.22	0.5	.11	.13	1072	651.2	298.4	60.9	89.7
85.0	0.28	0.21	0.5	.10	.13	1073	651.0	298.2	61.3	90.8
87.5	0.43	0.19	0.6	.02	.05	1106	651.3	297.7	62.1	92.0
90.0	0.58	0.18	0.8	-15.90	-15.92	1161	652.1	297.0	63.3	93.2
92.5	0.63	0.18	0.8	.90	.92	1163	653.4	296.4	64.4	94.0
95.0	0.75	0.18	0.9	.85	.87	1189	655.0	296.2	65.3	94.2
97.5	0.65	0.19	0.8	.91	.91	1166	656.9	296.4	65.7	93.7
37200.0	0.49	0.20	0.7	.97	.97	1142	658.8	297.3	65.4	92.4
02.5	0.44	0.22	0.7	.98	.97	1143	660.6	299.1	64.4	90.4
05.0	0.29	0.23	0.5	-16.13	-16.11	1082	662.0	301.6	62.5	87.6
07.5	0.27	0.24	0.5	.13	.11	1083	662.9	304.8	59.9	84.4
10.0	0.23	0.24	0.5	.13	.10	1084	663.1	308.4	56.6	80.9
12.5	0.61	0.24	0.8	-15.92	-15.90	1173	662.8	311.8	53.0	77.5
15.0	0.93	0.23	1.2	.74	.72	1261	661.9	314.7	49.2	74.4
17.5	0.68	0.22	0.9	.86	.85	1198	660.5	316.8	45.8	72.0
20.0	0.62	0.21	0.8	.90	.90	1173	658.9	318.0	43.0	70.5
22.5	0.63	0.19	0.8	.90	.90	1173	657.1	318.5	41.3	69.8
25.0	0.86	0.17	1.0	.79	.80	1219	655.5	318.3	41.0	70.3
27.5	0.78	0.14	0.9	.84	.85	1195	654.1	317.8	42.1	71.6
30.0	0.64	0.10	0.7	.94	.96	1144	653.2	317.0	44.4	73.5
32.5	0.61	0.05	0.7	.94	.96	1144	652.7	316.2	47.5	75.8
35.0	0.55	0.02	0.6	-16.01	-16.03	1114	652.8	315.7	51.0	78.1
37.5	0.59	0.00	0.6	.01	.03	1114	653.2	315.6	54.5	80.2
40.0	0.62	0.00	0.6	.02	.03	1114	653.8	316.0	57.6	81.8
42.5	0.57	0.00	0.6	.02	.03	1113	654.6	317.3	60.0	82.7
45.0	0.72	0.00	0.7	-15.96	-15.97	1141	655.3	319.3	61.5	82.8
47.5	0.68	0.00	0.7	.96	.97	1140	655.8	322.0	62.0	82.0
37249.0	0.69	0.01	0.7	-15.96	-15.97	1140	656.0	323.9	61.9	81.2
49.5	1.02	0.02	1.0	.81	.82	1212	656.0	324.6	61.7	80.9
50.0	1.04	0.03	1.1	.77	.78	1232	656.0	325.2	61.6	80.5
50.5	2.08	0.04	2.1	.49	.50	1394	656.0	325.8	61.3	80.1
51.0	3.12	0.05	3.2	.31	.32	1526	656.0	326.5	61.1	79.7
51.5	3.81	0.06	3.9	.22	.23	1598	655.9	327.1	60.8	79.3
52.0	2.08	0.07	2.2	.47	.48	1406	655.9	327.8	60.4	78.8
52.5	0.69	0.08	0.8	.91	.92	1164	655.8	328.4	60.0	78.4
53.0	0.69	0.09	0.8	.91	.92	1163	655.8	329.0	59.6	77.9
53.5	0.35	0.10	0.5	-16.12	-16.12	1076	655.7	329.5	59.2	77.4
54.0	1.39	0.11	1.5	-15.64	-15.65	1302	655.6	330.1	58.7	76.8
54.5	0.69	0.12	0.8	.91	.92	1163	655.5	330.6	58.2	76.3
55.0	0.35	0.13	0.5	-16.12	-16.13	1076	655.4	331.1	57.6	75.7
55.5	0.35	0.14	0.5	.12	.13	1075	655.3	331.6	57.0	75.2
56.0	0.35	0.15	0.5	.12	.13	1075	655.1	332.0	56.4	74.6
37257.5	0.16	0.17	0.3	-16.34	-16.35	995	654.7	333.1	54.5	72.9
60.0	0.71	0.19	0.9	-15.86	-15.87	1185	654.0	334.2	50.8	70.0
62.5	0.19	0.20	0.4	-16.21	-16.22	1038	653.4	334.6	46.8	67.2
65.0	0.12	0.20	0.3	.33	.35	996	653.0	334.3	42.8	64.7
67.5	0.38	0.19	0.6	.02	.04	1110	653.0	333.5	38.9	62.5
70.0	0.62	0.18	0.8	-15.89	-15.91	1168	653.5	332.4	35.5	60.7
72.5	0.82	0.18	1.0	.79	.81	1217	654.6	331.3	32.7	59.2
75.0	0.97	0.17	1.1	.75	.76	1242	656.1	330.4	30.6	57.9
77.5	1.06	0.16	1.2	.71	.71	1267	657.9	329.8	29.0	56.6

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 β2

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_\tau$	$\log \rho_s$	T_τ (°K)	z (km)	$a_\tau - a_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37280.0	0.78	0.15	0.9	-15.84	-15.83	1207	659.9	329.7	27.9	55.2
82.5	0.69	0.14	0.8	.89	.87	1186	661.8	330.5	26.9	53.6
85.0	0.52	0.13	0.7	.95	.92	1162	663.4	332.0	25.9	51.7
87.5	0.47	0.12	0.6	-16.01	.99	1134	664.6	334.3	24.5	49.4
90.0	0.36	0.11	0.5	.09	-16.06	1102	665.0	337.2	22.6	47.0
92.5	0.41	0.10	0.5	.09	.06	1102	665.1	340.2	20.2	44.5
95.0	0.29	0.09	0.4	.18	.16	1064	664.4	343.0	17.5	42.2
97.5	0.62	0.08	0.7	-15.94	-15.92	1165	663.3	345.1	14.7	40.5
37300.0	0.60	0.07	0.7	.93	.92	1164	661.7	346.4	12.6	39.6
02.5	0.81	0.05	0.9	.82	.81	1214	659.9	346.9	12.4	40.0
05.0	0.89	0.04	0.9	.82	.82	1212	658.1	346.7	14.6	41.5
07.5	0.64	0.02	0.7	.92	.93	1159	656.5	346.0	18.8	44.2
10.0	0.50	0.01	0.5	-16.07	-16.08	1094	655.3	345.0	23.9	47.6
12.5	0.39	0.00	0.4	.17	.18	1055	654.6	343.8	29.3	51.5
15.0	0.35	0.00	0.4	.17	.18	1054	654.4	342.8	34.7	55.4
17.5	0.38	0.00	0.4	.17	.18	1054	654.6	342.2	39.8	59.0
20.0	0.33	0.00	0.3	.30	.31	1009	655.1	342.0	44.3	62.1
22.5	0.30	0.00	0.3	.30	.31	1009	655.9	342.6	48.0	64.3
25.0	0.42	0.00	0.4	.18	.18	1054	656.6	344.0	50.6	65.5
27.5	0.45	0.00	0.4	.18	.18	1054	657.2	346.3	52.2	65.6
30.0	0.42	0.00	0.4	.18	.18	1053	657.6	349.2	52.5	64.5
32.5	0.40	0.00	0.4	.19	.19	1052	657.6	352.4	51.5	62.3
35.0	0.42	0.00	0.4	.19	.19	1052	657.3	355.4	49.2	59.1
37.5	0.30	0.02	0.3	.31	.32	1006	656.7	358.0	45.7	55.1
40.0	0.32	0.04	0.4	.18	.19	1050	655.9	359.8	41.2	50.6
42.5	0.27	0.05	0.3	.31	.32	1006	655.1	0.8	35.8	45.9
45.0	0.27	0.06	0.3	.30	.32	1006	654.5	1.0	29.7	41.2
47.5	0.25	0.06	0.3	.30	.31	1007	654.2	0.8	23.1	37.1
50.0	0.17	0.05	0.2	.47	.49	953	654.3	0.1	16.1	33.8
52.5	0.14	0.03	0.2	.47	.48	954	654.9	359.8	9.0	31.8
55.0	0.22	0.01	0.2	.47	.47	956	656.0	358.6	2.4	31.2
57.5	0.35	0.00	0.3	.29	.29	1014	657.6	358.1	5.4	31.7
60.0	0.42	-0.02	0.4	.17	.16	1062	659.4	358.1	11.7	33.1
62.5	0.34	-0.03	0.3	.29	.28	1019	661.3	358.8	17.6	34.7
65.0	0.38	-0.04	0.3	.29	.27	1021	663.1	0.3	22.8	36.3
67.5	0.41	-0.04	0.4	.17	.14	1069	664.5	2.6	27.2	37.3
70.0	0.42	-0.04	0.4	.17	.14	1070	665.5	5.7	30.6	37.7
72.5	0.41	-0.04	0.4	.17	.14	1070	665.8	9.2	32.9	37.2
75.0	0.38	-0.04	0.3	.30	.27	1023	665.5	12.6	34.1	35.9
77.5	0.36	-0.04	0.3	.29	.27	1022	664.5	15.6	34.1	33.6
80.0	0.36	-0.04	0.3	.29	.27	1021	663.1	17.9	33.2	30.6
82.5	0.57	-0.04	0.5	.07	.06	1104	661.3	19.4	31.3	27.0
85.0	0.77	-0.04	0.7	-15.92	-15.92	1165	659.4	20.0	28.7	23.0
87.5	0.96	-0.05	0.9	.81	.81	1215	657.6	20.1	25.6	18.9
90.0	0.87	-0.06	0.8	.86	.87	1188	656.1	19.6	22.5	15.2
92.5	0.81	-0.07	0.7	.92	.93	1160	655.0	19.0	19.8	12.5
95.0	0.80	-0.08	0.7	.92	.93	1159	654.4	18.3	18.2	11.6
97.5	0.61	-0.09	0.5	-16.06	-16.08	1096	654.2	17.8	18.1	12.8
37400.0	0.49	-0.10	0.4	.16	.17	1058	654.6	17.7	19.6	15.2
02.5	0.27	-0.11	0.2	.46	.47	956	655.1	18.2	22.1	17.7
05.0	0.59	-0.12	0.5	.06	.07	1097	655.8	19.4	25.1	19.9
07.5	0.75	-0.12	0.6	-15.99	-15.99	1131	656.4	21.5	28.1	21.4
37432.5	0.54	-0.20	0.34	-16.23	-16.25	1030	653.6	37.4	39.9	17.4
35.0	0.55	-0.20	0.35	.22	.23	1035	654.2	36.5	42.5	23.6
37.5	0.55	-0.21	0.34	.24	.25	1031	655.4	35.8	45.9	29.9
40.0	0.62	-0.22	0.40	.17	.17	1058	656.9	35.3	49.8	36.1
42.5	0.62	-0.23	0.39	.18	.18	1056	658.6	35.4	54.2	42.0
45.0	0.55	-0.23	0.32	.27	.26	1026	660.3	36.2	58.6	47.3
47.5	0.50	-0.21	0.29	.31	.30	1013	661.9	37.8	62.8	51.8

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 β2

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_v	log ρ_s	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37450.0	0.46	-0.20	0.26	-16.36	-16.34	998	663.0	40.2	66.6	55.3
52.5	0.35	-0.15	0.20	.47	.45	963	663.6	43.3	69.7	57.6
55.0	0.29	-0.08	0.21	.45	.43	970	663.6	46.5	71.8	58.7
57.5	0.21	-0.03	0.18	.52	.50	950	663.0	49.5	72.9	58.6
60.0	0.23	0.00	0.23	.41	.39	981	661.8	52.0	72.8	57.1
62.5	0.23	0.01	0.24	.39	.38	985	660.2	53.6	71.6	54.4
65.0	0.26	0.02	0.28	.32	.32	1006	658.4	54.4	69.4	50.8
67.5	0.42	0.03	0.45	.11	.12	1079	656.6	54.5	66.3	46.3
70.0	0.62	0.02	0.64	-15.96	-15.97	1141	655.0	54.0	62.7	41.2
72.5	0.60	0.01	0.61	.98	.99	1130	653.7	53.1	58.7	35.7
75.0	0.43	-0.01	0.42	-16.14	-16.16	1063	652.8	52.1	54.8	30.3
77.5	0.36	-0.04	0.32	.26	.28	1019	652.5	51.2	51.2	25.4
80.0	0.26	-0.09	0.17	.53	.55	933	652.6	50.5	48.5	21.4
82.5	0.46	-0.14	0.32	.26	.28	1019	653.1	50.3	46.8	19.2
85.0	0.51	-0.17	0.34	.24	.25	1029	653.8	50.8	46.3	19.1
87.5	0.67	-0.20	0.47	.10	.11	1082	654.5	52.1	47.0	20.8
90.0	0.56	-0.21	0.35	.23	.24	1034	655.2	54.2	48.7	23.5
92.5	0.55	-0.23	0.32	.27	.28	1020	655.5	57.0	51.1	26.5
95.0	0.54	-0.24	0.30	.30	.30	1010	655.6	60.2	53.9	29.4
97.5	0.55	-0.25	0.30	.30	.31	1009	655.2	63.4	56.8	31.8
37520.0	0.47	-0.28	0.19	-16.50	-16.52	942	653.0	66.5	71.5	45.8
22.5	0.56	-0.28	0.28	.34	.35	994	654.6	66.4	73.3	48.8
25.0	0.68	-0.28	0.40	.19	.19	1049	656.3	66.9	75.4	52.1
27.5	0.76	-0.28	0.48	.11	.11	1081	658.0	68.2	77.8	55.4
30.0	0.75	-0.28	0.47	.12	.12	1079	659.4	70.3	80.4	58.6
32.5	0.71	-0.28	0.43	.16	.15	1065	660.4	73.2	83.1	61.3
35.0	0.65	-0.28	0.37	.23	.22	1042	660.8	76.6	85.6	63.5
37.5	0.65	-0.27	0.38	.21	.20	1046	660.5	80.1	87.7	64.9
40.0	0.65	-0.26	0.39	.20	.19	1050	659.7	83.3	89.4	65.6
42.5	0.62	-0.25	0.37	.22	.22	1041	658.3	85.7	90.4	65.4
45.0	0.65	-0.24	0.41	.17	.18	1056	656.6	87.4	90.8	64.5
47.5	0.74	-0.23	0.51	.07	.09	1091	654.8	88.2	90.6	63.0
50.0	0.74	-0.21	0.53	.06	.08	1096	653.0	88.3	89.8	61.2
52.5	0.77	-0.20	0.57	.02	.05	1106	651.5	88.0	88.7	59.3
55.0	0.78	-0.21	0.57	.03	.06	1104	650.4	87.4	87.5	57.7
57.5	0.93	-0.22	0.71	-15.93	-15.96	1143	649.8	86.8	86.5	56.6
60.0	1.03	-0.23	0.80	.88	.92	1165	649.6	86.2	85.9	56.4
62.5	0.81	-0.24	0.57	-16.04	-16.07	1099	649.9	86.1	85.9	57.3
65.0	0.57	-0.25	0.32	.29	.32	1004	650.5	86.5	86.7	59.1
67.5	0.37	-0.27	0.10	.80	.83	862	651.3	87.6	88.3	61.8
70.0	0.55	-0.28	0.27	.38	.40	979	652.0	89.6	90.6	65.0
72.5	0.61	-0.28	0.33	.29	.31	1007	652.6	92.3	93.4	68.7
75.0	0.53	-0.28	0.25	.41	.44	968	652.8	95.6	96.7	72.3
77.5	0.50	-0.28	0.22	.47	.49	951	652.7	99.1	100.2	75.6
80.0	0.46	-0.27	0.19	.53	.55	933	652.2	102.3	103.4	78.4
82.5	0.42	-0.26	0.16	.60	.63	913	651.5	104.9	106.2	80.4
85.0	0.38	-0.24	0.14	.65	.69	898	650.6	106.7	108.3	81.5
87.5	0.22	-0.22	0.00				649.6	107.6	109.5	81.7
90.0	0.23	-0.22	0.01	-17.79	-17.83	176	648.9	107.9	109.6	81.1
92.5	0.23	-0.20	0.03	.31	.35	684	648.5	107.6	108.9	79.8
95.0	0.25	-0.19	0.06	.01	.05	804	648.6	106.9	107.3	77.9

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 β2 (5-day)

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_r	log ρ_s	T_r (°K)	z (km)	$\alpha_r-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36905.0	0.76	-0.04	0.72	-15.90	-15.93	1157	650.4	182.7	161.3	147.7
10.0	0.55	-0.01	0.54	-16.02	-16.06	1104	650.5	181.0	172.7	151.7
15.0	0.39	0.02	0.41	.14	.17	1059	652.0	181.2	177.2	153.7
20.0	0.21	0.02	0.23	.39	.41	974	653.6	184.6	170.1	155.9
25.0	0.28	0.04	0.32	.25	.27	1023	654.0	190.3	166.0	159.8
30.0	0.29	0.05	0.34	.22	.24	1032	653.1	195.4	164.6	165.2
35.0	0.28	0.07	0.35	.20	.24	1034	651.4	197.5	163.8	168.4
40.0	0.35	0.09	0.44	.10	.14	1070	650.2	196.8	160.1	162.9
45.0	0.38	0.10	0.48	.06	.10	1086	650.7	194.7	152.6	152.4
50.0	0.37	0.13	0.50	.05	.07	1096	653.1	192.9	143.2	141.6
55.0	0.43	0.12	0.55	.01	.02	1118	656.5	193.0	134.1	132.9
60.0	0.56	0.12	0.68	-15.93	-15.92	1164	659.4	196.3	127.2	127.9
65.0	0.91	0.11	1.02	.75	.74	1252	660.4	202.3	124.1	127.8
70.0	0.76	0.08	0.84	.83	.83	1206	659.0	208.2	125.6	132.8
75.0	0.42	0.06	0.48	-16.07	-16.08	1093	655.9	211.4	131.3	142.2
80.0	0.37	0.07	0.44	.10	.13	1074	652.4	211.7	139.6	154.6
85.0	0.27	0.09	0.36	.19	.23	1038	650.1	210.3	147.8	168.6
90.0	0.25	0.11	0.36	.19	.23	1037	649.8	208.9	151.4	177.1
95.0	0.31	0.14	0.45	.09	.13	1075	651.1	209.2	147.9	164.5
37000.0	0.20	0.16	0.36	.19	.22	1040	652.8	212.5	140.3	154.4
05.0	0.11	0.18	0.29	.29	.31	1008	653.7	218.6	132.7	148.2
10.0	0.04	0.18	0.22	.41	.43	968	653.3	225.2	127.6	146.2
15.0	0.07	0.16	0.23	.39	.42	973	651.7	229.3	126.0	148.4
20.0	0.75	0.16	0.91	-15.79	-15.83	1208	650.4	230.3	127.4	153.7
25.0	0.53	0.16	0.69	.91	.94	1152	650.3	229.4	130.2	159.5
30.0	0.09	0.17	0.26	-16.33	-16.36	991	652.2	228.1	132.3	161.7
35.0	0.15	0.19	0.34	.22	.23	1036	655.5	228.2	131.8	158.2
40.0	0.15	0.21	0.36	.20	.20	1049	658.8	231.1	128.5	152.1
45.0	0.12	0.23	0.35	.22	.20	1046	660.4	237.0	123.8	146.8
50.0	0.13	0.23	0.36	.21	.20	1048	659.6	243.7	119.2	143.7
55.0	0.48	0.23	0.71	-15.91	-15.92	1165	656.6	248.2	115.8	142.7
60.0	0.08	0.24	0.32	-16.25	-16.28	1018	652.8	249.4	113.7	142.2
65.0	0.10	0.24	0.34	.23	.27	1022	649.8	248.4	111.8	140.0
70.0	0.04	0.26	0.30	.29	.34	999	648.7	246.7	108.9	134.7
75.0	0.03	0.27	0.30	.30	.34	997	649.4	246.0	104.1	126.8
80.0	0.10	0.28	0.38	.21	.24	1031	651.1	248.0	97.7	118.1
85.0	0.15	0.27	0.42	.17	.20	1049	652.5	253.0	91.1	111.0
90.0	0.20	0.23	0.43	.15	.18	1055	652.6	259.2	86.2	107.1
95.0	0.29	0.14	0.43	.15	.18	1056	651.5	263.6	84.8	107.7
37100.0	0.26	0.02	0.28	.32	.36	992	650.2	264.9	87.5	112.4
05.0	0.20	0.00	0.20	.46	.50	948	649.9	263.7	93.3	119.8
10.0	0.08	0.05	0.13	.65	.68	900	651.5	261.7	100.0	127.4
15.0	0.08	0.15	0.23	.40	.42	973	654.6	260.6	105.3	132.5
20.0	-0.03	0.21	0.18	.52	.52	944	658.2	262.0	107.0	133.0
25.0	-0.02	0.25	0.23	.42	.41	975	660.6	266.6	104.7	129.3
30.0	-0.02	0.27	0.25	.40	.39	983	660.8	273.0	99.4	123.7
35.0	0.03	0.28	0.31	.31	.31	1008	658.6	278.1	93.0	118.4
40.0	0.01	0.29	0.30	.33	.34	997	655.0	280.1	87.5	114.4
45.0	-0.05	0.29	0.24	.42	.45	962	651.8	279.5	83.6	111.8
50.0	-0.04	0.28	0.24	.43	.46	959	650.1	277.9	81.1	109.6
55.0	0.05	0.28	0.33	.29	.33	1002	650.4	276.9	79.1	106.5
60.0	0.29	0.28	0.57	.06	.09	1089	651.9	278.2	76.4	102.2
65.0	0.63	0.28	0.91	-15.86	-15.89	1180	653.5	282.8	72.4	97.0
70.0	0.30	0.27	0.57	-16.07	-16.08	1092	653.9	289.4	67.7	92.3
75.0	0.09	0.26	0.35	.27	.29	1014	653.1	295.3	63.4	89.4
80.0	0.19	0.24	0.43	.17	.20	1047	651.7	298.1	61.1	89.0
85.0	0.33	0.21	0.54	.07	.10	1086	651.0	298.2	61.3	90.8
90.0	0.56	0.18	0.64	.00	.02	1119	652.1	297.0	63.3	93.2
95.0	0.69	0.18	0.87	-15.87	-15.88	1182	655.0	296.2	65.3	94.2
37200.0	0.52	0.20	0.72	.96	.96	1147	658.8	297.3	65.4	92.4

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1958 β2 (5-day)

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_v	log ρ_s	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37205.0	0.33	0.23	0.56	-16.08	-16.06	1102	662.0	301.6	62.5	87.6
10.0	0.31	0.24	0.55	.09	.06	1101	663.1	308.4	56.6	80.9
15.0	0.80	0.23	1.03	-15.80	-15.79	1227	661.9	314.7	49.2	74.4
20.0	0.63	0.21	0.84	.88	.88	1183	658.9	318.0	43.0	70.5
25.0	0.78	0.17	0.95	.82	.83	1208	655.5	318.3	41.0	70.3
30.0	0.66	0.10	0.76	.91	.93	1160	653.2	317.0	44.4	73.5
35.0	0.57	0.02	0.59	-16.02	-16.04	1111	652.8	315.7	51.0	78.1
40.0	0.60	0.00	0.60	.02	.03	1114	653.8	316.0	57.6	81.8
45.0	0.67	0.00	0.67	-15.98	-15.99	1133	655.3	319.3	61.5	82.8
50.0	1.34	0.03	1.37	.67	.68	1283	656.0	325.2	61.6	80.5
55.0	0.66	0.13	0.79	.92	.93	1160	655.4	331.1	57.6	75.7
60.0	0.44	0.19	0.63	-16.01	-16.03	1116	654.0	334.2	50.8	70.0
65.0	0.21	0.20	0.41	.19	.21	1043	653.0	334.3	42.8	64.7
70.0	0.62	0.18	0.80	-15.89	-15.91	1168	653.5	332.4	35.5	60.7
75.0	0.95	0.17	1.12	.74	.75	1246	656.1	330.4	30.6	57.9
80.0	0.82	0.15	0.97	.80	.80	1223	659.9	329.7	27.9	55.2
85.0	0.55	0.13	0.68	.96	.94	1156	663.4	332.0	25.9	51.7
90.0	0.36	0.11	0.47	-16.12	-16.09	1091	665.3	337.2	22.6	47.0
95.0	0.40	0.09	0.49	.09	.07	1099	664.4	343.0	17.5	42.2
37300.0	0.65	0.07	0.72	-15.92	-15.91	1170	661.7	346.4	12.6	39.6
05.0	0.81	0.04	0.85	.84	.84	1200	658.1	346.7	14.6	41.5
10.0	0.50	0.01	0.51	-16.06	-16.07	1098	655.3	345.0	23.9	47.6
15.0	0.36	0.00	0.36	.21	.23	1038	654.4	342.8	34.7	55.4
20.0	0.34	0.00	0.34	.24	.25	1028	655.1	342.0	44.3	62.1
25.0	0.40	0.00	0.40	.18	.18	1054	656.6	344.0	50.6	65.5
30.0	0.42	0.00	0.42	.16	.16	1061	657.6	349.2	52.5	64.5
35.0	0.39	0.00	0.39	.20	.20	1047	657.3	355.4	49.2	59.1
40.0	0.30	0.04	0.34	.25	.26	1025	655.9	359.8	41.2	50.6
45.0	0.27	0.06	0.33	.26	.27	1020	654.5	1.0	29.7	41.2
50.0	0.19	0.05	0.24	.39	.41	977	654.3	0.1	16.1	33.8
55.0	0.23	0.01	0.24	.39	.40	980	656.0	358.6	2.4	31.2
60.0	0.39	-0.02	0.37	.20	.19	1050	659.4	358.1	11.7	33.1
65.0	0.38	-0.04	0.34	.24	.22	1040	663.1	0.3	22.8	36.3
70.0	0.42	-0.04	0.38	.19	.16	1061	665.5	5.7	30.6	37.7
75.0	0.39	-0.04	0.35	.23	.20	1048	665.5	12.6	34.1	35.9
80.0	0.42	-0.04	0.38	.19	.17	1058	663.1	17.9	33.2	30.6
85.0	0.77	-0.04	0.73	-15.90	-15.90	1174	659.4	20.0	28.7	23.0
90.0	0.87	-0.06	0.81	.85	.86	1191	656.1	19.6	22.5	15.2
95.0	0.74	-0.08	0.66	.94	.96	1147	654.4	18.3	18.2	11.6
37400.0	0.46	-0.10	0.36	-16.21	-16.22	1040	654.5	17.7	19.6	15.2
05.0	0.55	-0.12	0.43	.13	.14	1071	655.8	19.4	25.1	19.9

Table 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 $\alpha 1$

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_v$	$\log \rho_s$	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36622.5	8.05	0.06	8.1	-14.83	-14.85	1543	559.8	354.1	18.6	39.9
25.0	8.87	0.04	8.9	.79	.80	1591	560.2	354.1	11.2	37.0
27.5	8.99	0.03	9.0	.78	.79	1604	561.2	354.1	6.0	35.6
30.0	7.82	0.01	7.8	.84	.84	1546	562.8	354.5	8.3	35.5
32.5	7.66	-0.01	7.6	.85	.85	1543	564.7	355.5	14.3	36.2
35.0	7.65	-0.02	7.6	.85	.84	1550	566.7	357.4	20.2	37.0
37.5	8.23	-0.03	8.2	.82	.80	1592	568.4	0.5	25.2	37.6
40.0	8.69	-0.03	8.7	.80	.77	1625	569.6	4.5	29.1	37.4
42.5	9.31	-0.04	9.3	.77	.74	1660	569.9	9.1	31.7	36.3
45.0	9.65	-0.04	9.6	.76	.73	1674	569.4	13.6	33.0	34.1
47.5	10.52	-0.04	10.5	.72	.69	1718	568.2	17.5	32.9	30.8
36650.0	11.18	-0.04	11.1	-14.69	-14.68	1743	566.4	20.3	31.7	26.6
51.0	11.84	-0.04	11.8	.66	.65	1776	565.6	21.1	31.0	24.7
36652.0	11.94	-0.04	11.9	-14.66	-14.65	1778	564.8	21.8	30.1	22.7
52.5	11.54	-0.04	11.5	.67	.67	1756	564.4	22.1	29.6	21.6
53.0	12.54	-0.04	12.5	.63	.63	1805	564.0	22.3	29.2	20.6
53.5	13.14	-0.04	13.1	.61	.61	1833	563.6	22.5	28.7	19.5
54.0	15.05	-0.05	15.0	.55	.55	1925	563.2	22.7	28.2	18.5
54.5	15.05	-0.05	15.0	.55	.55	1923	562.8	22.8	27.6	17.4
55.0	13.25	-0.05	13.2	.61	.61	1834	562.4	22.9	27.1	16.3
55.5	10.85	-0.05	10.8	.70	.70	1711	562.1	23.0	26.6	15.2
56.0	10.25	-0.05	10.2	.72	.73	1678	561.8	23.1	26.2	14.2
56.5	9.76	-0.06	9.7	.74	.75	1651	561.4	23.2	25.7	13.1
36657.0	9.96	-0.06	9.9	-14.73	-14.74	1660	561.2	23.2	25.2	12.1
58.0	10.66	-0.06	10.6	.70	.71	1695	560.6	23.3	24.4	10.1
59.0	9.77	-0.07	9.7	.74	.75	1646	560.2	23.3	23.8	8.4
36660.0	10.08	-0.07	10.0	-14.73	-14.74	1661	559.9	23.3	23.4	7.2
62.5	9.44	-0.09	9.4	.75	.77	1628	559.6	23.4	23.5	7.4
65.0	9.42	-0.10	9.3	.76	.77	1623	559.9	24.0	25.2	11.0
67.5	10.99	-0.12	10.9	.69	.70	1708	560.5	25.2	28.2	15.0
70.0	11.09	-0.13	11.0	.69	.70	1716	561.3	27.5	31.9	18.6
72.5	9.96	-0.14	9.8	.74	.74	1656	562.0	30.8	35.7	21.3
75.0	9.97	-0.14	9.8	.74	.74	1657	562.4	34.9	39.2	22.9
77.5	10.45	-0.15	10.3	.72	.72	1683	562.3	39.5	42.2	23.4
80.0	10.77	-0.16	10.6	.71	.71	1696	561.7	43.7	44.6	22.9
82.5	11.53	-0.16	11.4	.67	.68	1733	560.8	47.2	46.4	21.8
85.0	12.21	-0.16	12.0	.65	.66	1758	559.8	49.5	47.7	20.6
87.5	11.34	-0.16	11.2	.68	.70	1714	558.9	50.9	49.0	20.2
90.0	10.05	-0.17	9.9	.73	.75	1644	558.4	51.4	50.4	21.5
92.5	8.96	-0.18	8.8	.79	.81	1585	558.5	51.5	52.2	24.7
95.0	8.75	-0.19	8.6	.80	.82	1575	559.2	51.4	54.8	29.6
97.5	9.29	-0.20	9.1	.78	.79	1604	560.6	51.5	58.2	35.4
36700.0	9.50	-0.21	9.3	.77	.78	1618	562.4	52.1	62.4	41.7
02.5	9.01	-0.22	8.8	.80	.79	1598	564.4	53.6	67.0	47.9
05.0	7.99	-0.22	7.8	.86	.84	1548	566.3	56.1	71.9	53.6
07.5	6.92	-0.22	6.7	.92	.90	1490	567.6	59.6	76.6	58.4
10.0	6.12	-0.21	5.9	.98	.95	1445	568.5	63.8	80.7	62.1
12.5	5.44	-0.19	5.2	-15.03	-15.00	1401	568.4	68.2	84.0	64.4
15.0	4.57	-0.17	4.4	.10	.08	1344	567.4	72.1	86.1	65.2
17.5	3.36	-0.12	3.2	.23	.22	1248	565.8	75.1	86.8	64.5
20.0	3.50	-0.07	3.4	.20	.20	1250	563.8	76.9	86.3	62.5
22.5	4.07	-0.01	4.1	.12	.12	1310	561.7	77.8	84.5	59.5
25.0	4.82	0.00	4.8	.05	.06	1354	559.9	78.0	82.0	55.8
27.5	5.14	0.00	5.1	.02	.04	1370	558.7	77.8	79.0	52.0
30.0	5.29	0.00	5.3	.01	.03	1379	558.0	77.6	76.0	48.5
32.5	5.95	-0.05	5.9	-14.97	-14.99	1414	558.0	77.6	73.5	46.0

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 α1

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_v	log ρ_s	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36735.0	6.35	-0.12	6.2	-14.95	-14.97	1431	559.4	78.3	72.0	44.9
37.5	6.70	-0.16	6.5	.93	.95	1447	559.1	79.9	71.7	45.3
40.0	6.19	-0.19	6.0	.97	.98	1416	559.8	82.6	72.6	47.1
42.5	5.90	-0.21	5.7	-15.00	-15.01	1396	560.3	86.2	74.8	50.0
45.0	5.61	-0.22	5.4	.02	.04	1376	560.3	90.4	77.9	53.4
47.5	5.25	-0.23	5.0	.06	.07	1347	560.0	94.6	81.6	57.1
50.0	4.87	-0.23	4.6	.10	.11	1318	559.1	98.1	85.6	60.6
52.5	4.31	-0.23	4.1	.15	.17	1280	558.2	100.6	89.6	63.9
55.0	3.79	-0.22	3.6	.20	.23	1241	557.3	102.0	93.3	66.8
57.5	3.58	-0.22	3.4	.23	.26	1224	556.8	102.6	96.6	69.4
36760.0	3.56	-0.22	3.3	-15.24	-15.27	1215	556.8	102.6	99.5	71.9
61.0	3.81	-0.22	3.6	.21	.23	1238	557.0	102.5	100.6	72.9
62.0	4.34	-0.22	4.1	.15	.18	1274	557.3	102.4	101.6	73.9
36763.0	4.34	-0.22	4.1	-15.15	-15.18	1274	557.7	102.3	102.6	74.9
63.5	4.64	-0.22	4.4	.12	.15	1295	558.0	102.3	103.1	75.4
64.0	5.18	-0.22	5.0	.07	.09	1334	558.2	102.3	103.6	76.0
64.5	6.09	-0.22	5.9	.00	.02	1389	558.5	102.3	104.1	76.5
65.0	6.62	-0.22	6.4	-14.96	-14.98	1418	558.8	102.3	104.6	77.1
65.5	6.24	-0.22	6.0	.99	-15.01	1396	559.2	102.3	105.0	77.6
66.0	5.33	-0.22	5.1	-15.06	.08	1343	559.6	102.3	105.5	78.2
66.5	4.95	-0.21	4.7	.10	.11	1318	559.9	102.4	106.0	78.8
67.0	4.26	-0.21	4.1	.16	.17	1278	560.3	102.5	106.5	79.4
67.5	4.87	-0.21	4.6	.11	.12	1313	560.7	102.6	107.0	80.1
36768.0	4.49	-0.21	4.3	-15.14	-15.15	1294	561.2	102.7	107.5	80.7
69.0	3.96	-0.20	3.8	.19	.20	1260	562.0	103.1	108.5	82.0
36770.0	3.55	-0.19	3.4	-15.24	-15.24	1232	562.9	103.7	109.6	83.4
72.5	2.78	-0.10	2.7	.35	.34	1179	565.0	105.8	112.5	87.1
75.0	1.82	-0.08	1.7	.55	.53	1082	566.6	109.0	115.8	90.9
77.5	1.69	-0.14	1.6	.57	.54	1074	567.7	113.0	119.2	94.6
80.0	2.25	-0.17	2.1	.45	.42	1134	567.8	117.5	122.7	97.9
82.5	2.38	-0.16	2.2	.42	.40	1147	567.1	121.8	126.0	100.6
85.0	2.22	-0.16	2.1	.43	.42	1136	565.7	125.2	128.7	102.3
87.5	2.22	-0.15	2.1	.42	.42	1135	563.9	127.5	130.4	103.0
90.0	2.33	-0.14	2.1	.42	.42	1132	561.8	128.9	131.0	102.7
92.5	2.22	-0.12	2.1	.41	.43	1128	559.7	129.4	130.5	101.6
95.0	2.26	-0.12	2.1	.41	.44	1125	558.3	129.6	128.9	99.9
97.5	2.56	-0.11	2.4	.36	.39	1152	557.5	129.5	126.8	98.2
36800.0	2.98	-0.11	2.9	.28	.31	1195	557.3	129.7	124.6	96.8
02.5	3.16	-0.11	3.0	.27	.30	1202	557.7	130.5	122.8	96.1
05.0	3.31	-0.12	3.2	.24	.27	1217	558.4	132.1	121.7	96.4
07.5	3.89	-0.12	3.8	.17	.19	1263	559.2	134.7	121.7	97.8
10.0	4.07	-0.13	3.9	.17	.18	1271	559.9	138.4	123.0	100.4
12.5	4.99	-0.13	4.9	.07	.08	1340	560.2	142.8	125.6	104.0
15.0	4.41	-0.13	4.3	.12	.14	1302	560.1	147.4	129.4	108.4
17.5	3.48	-0.12	3.4	.22	.24	1238	559.5	151.4	134.3	113.1
20.0	2.06	-0.12	1.9	.46	.48	1102	558.7	154.6	140.0	117.7
22.5	1.80	-0.12	1.7	.50	.53	1081	557.9	156.7	145.9	121.9
25.0	2.05	-0.10	2.0	.42	.45	1117	557.3	157.9	151.5	125.2
27.5	2.18	-0.08	2.1	.39	.43	1130	557.1	158.4	156.0	127.4
30.0	2.52	-0.07	2.4	.33	.36	1164	557.6	158.5	158.4	128.4
32.5	2.80	-0.06	2.7	.28	.30	1196	558.8	158.6	157.9	128.4
35.0	2.89	-0.04	2.8	.27	.28	1211	560.6	159.0	155.2	127.7
37.5	2.64	-0.03	2.6	.30	.30	1198	562.6	160.1	151.4	126.9
40.0	2.40	-0.02	2.4	.34	.33	1184	564.7	162.2	147.7	126.2
42.5	2.41	-0.02	2.4	.34	.32	1188	566.4	165.3	144.6	126.3
45.0	2.12	-0.02	2.1	.40	.37	1159	567.6	169.3	142.5	127.2

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 $\alpha 1$

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_v	log ρ_s	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36847.5	1.80	-0.03	1.8	-15.46	-15.44	1126	567.9	174.0	141.8	129.0
50.0	1.28	-0.04	1.2	.64	.61	1044	567.4	178.5	142.4	131.9
52.5	1.13	-0.03	1.1	.67	.65	1027	566.1	182.3	144.4	135.6
55.0	1.49	-0.02	1.5	.53	.52	1083	564.2	185.1	147.7	139.9
57.5	1.83	-0.02	1.8	.45	.45	1118	562.1	186.8	152.1	144.5
60.0	2.10	-0.02	2.1	.38	.39	1148	560.1	187.6	157.2	149.1
62.5	2.08	-0.01	2.1	.37	.40	1145	558.5	187.9	162.7	153.1
65.0	2.09	0.00	2.1	.37	.40	1143	557.5	187.8	168.0	156.2
67.5	1.96	0.02	2.0	.39	.43	1131	557.2	187.8	171.7	158.0
70.0	1.92	0.03	2.0	.39	.42	1132	557.4	188.3	171.5	158.8
72.5	1.89	0.04	1.9	.41	.44	1122	558.1	189.5	167.9	158.9
75.0	1.74	0.06	1.8	.44	.46	1112	558.9	191.7	163.6	159.0
77.5	1.51	0.06	1.6	.49	.51	1090	559.7	194.9	159.7	159.5
80.0	1.33	0.06	1.4	.55	.57	1064	560.1	198.9	156.4	160.8
82.5	1.11	0.07	1.2	.62	.63	1036	560.1	203.2	153.8	163.2
85.0	1.13	0.08	1.2	.62	.63	1035	559.7	207.3	152.0	166.7
87.5	1.32	0.08	1.4	.55	.57	1062	558.9	210.4	150.7	171.1
90.0	1.33	0.09	1.4	.55	.57	1061	558.1	212.5	149.4	176.0
92.5	1.40	0.10	1.5	.51	.55	1073	557.4	213.6	147.9	175.3
95.0	1.35	0.12	1.5	.51	.55	1073	557.1	213.9	145.7	168.9
97.5	1.45	0.13	1.6	.49	.52	1086	557.5	213.6	142.6	161.6
36900.0	1.59	0.14	1.7	.46	.49	1100	558.5	213.3	138.5	154.1
02.5	1.95	0.15	2.1	.37	.39	1150	560.1	213.2	133.6	146.8
05.0	2.32	0.16	2.5	.30	.31	1195	562.1	213.6	128.2	139.9
07.5	1.96	0.16	2.1	.38	.37	1158	564.2	214.8	122.8	133.7
10.0	1.63	0.16	1.8	.45	.43	1126	566.1	217.1	117.7	128.5
12.5	1.42	0.16	1.6	.51	.48	1105	567.8	220.4	113.2	124.7
15.0	1.27	0.15	1.4	.56	.53	1078	568.3	224.5	109.8	122.4
17.5	1.15	0.14	1.3	.60	.57	1063	567.9	228.6	107.7	121.8
20.0	1.13	0.12	1.2	.63	.61	1047	566.8	232.2	107.0	122.8
22.5	1.13	0.10	1.2	.62	.61	1044	564.9	234.9	107.7	125.4
25.0	1.21	0.08	1.3	.59	.59	1055	562.8	236.4	109.8	129.3
27.5	1.21	0.08	1.3	.58	.60	1051	560.6	237.1	112.9	134.3
30.0	1.23	0.08	1.3	.58	.60	1048	558.8	237.0	116.6	139.8
32.5	1.25	0.09	1.3	.58	.61	1046	557.6	236.6	120.4	145.3
35.0	1.35	0.10	1.4	.54	.58	1058	557.0	236.2	123.8	150.3
37.5	1.38	0.11	1.5	.52	.55	1071	557.0	236.2	126.3	153.7
40.0	1.37	0.13	1.5	.52	.55	1072	557.6	236.8	127.4	155.0
42.5	1.35	0.15	1.5	.52	.55	1073	558.5	238.4	127.0	153.9
45.0	1.19	0.16	1.4	.55	.58	1060	559.3	241.0	125.1	151.1
47.5	1.21	0.18	1.4	.56	.58	1060	559.9	244.6	122.2	147.4
50.0	1.13	0.19	1.3	.59	.61	1046	560.1	248.8	118.6	143.7
52.5	1.09	0.20	1.3	.60	.61	1044	559.9	252.8	114.8	140.3
55.0	1.32	0.20	1.5	.53	.56	1069	559.3	256.1	111.1	137.3
57.5	1.51	0.21	1.7	.48	.51	1091	558.6	258.5	107.8	134.9
60.0	1.61	0.22	1.8	.46	.49	1101	557.9	259.8	105.0	132.9
62.5	1.83	0.22	2.0	.41	.44	1121	557.5	260.3	102.7	131.1
65.0	2.50	0.22	2.7	.29	.32	1190	557.7	260.3	100.7	129.2
67.5	2.88	0.22	3.1	.23	.26	1225	558.5	260.0	98.8	127.0
70.0	2.29	0.22	2.5	.33	.35	1173	559.9	259.9	96.9	124.4
72.5	1.62	0.23	1.8	.48	.48	1102	561.8	260.3	94.7	121.2
75.0	1.22	0.23	1.4	.59	.59	1054	563.9	261.5	92.2	117.6
77.5	1.16	0.23	1.3	.63	.62	1042	565.9	263.8	89.2	113.8
80.0	1.13	0.23	1.3	.64	.62	1042	567.3	267.1	86.0	110.0
82.5	1.00	0.23	1.2	.68	.65	1028	568.1	271.3	82.5	106.5
85.0	1.08	0.23	1.3	.64	.62	1042	568.0	275.8	79.2	103.6
87.5	1.10	0.22	1.3	.64	.62	1040	567.0	280.1	76.3	101.5
90.0	1.39	0.21	1.6	.55	.54	1077	565.4	283.4	74.0	100.3
92.5	1.48	0.20	1.7	.52	.52	1086	563.3	285.7	72.4	100.0
95.0	1.52	0.19	1.7	.51	.53	1083	561.1	287.0	71.7	100.4

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 α1

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_\pi$	$\log \rho_s$	T_π (°K)	z (km)	$\alpha_\pi-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36997.5	1.58	0.19	1.8	-15.49	-15.51	1091	559.1	287.6	71.7	101.2
37000.0	1.51	0.19	1.7	.51	.54	1077	557.7	287.7	72.2	102.1
02.5	1.38	0.19	1.6	.54	.57	1063	556.9	287.7	72.8	102.6
05.0	1.35	0.18	1.5	.57	.60	1049	556.8	288.0	73.2	102.5
07.5	1.31	0.18	1.5	.57	.60	1047	557.2	288.8	73.0	101.4
10.0	1.32	0.18	1.5	.58	.61	1046	557.8	290.5	72.0	99.3
12.5	1.34	0.18	1.5	.59	.61	1045	558.7	293.2	70.0	96.2
15.0	1.49	0.19	1.7	.54	.56	1068	559.4	297.0	66.9	92.2
17.5	1.61	0.20	1.8	.52	.53	1078	559.9	301.5	63.1	87.9
37020.0	2.06	0.20	2.3	-15.41	-15.43	1130	559.9	306.0	58.6	83.6
21.0	2.13	0.20	2.3	.41	.43	1130	559.9	307.7	56.7	81.9
22.0	2.51	0.20	2.7	.34	.36	1167	559.7	309.3	54.9	80.3
37023.0	2.97	0.20	3.2	-15.27	-15.28	1209	559.6	310.7	53.0	78.8
23.5	3.35	0.20	3.6	.21	.23	1240	559.5	311.4	52.1	78.2
24.0	4.26	0.20	4.5	.12	.13	1304	559.4	312.0	51.3	77.5
24.5	5.56	0.20	5.8	.00	.02	1385	559.2	312.5	50.4	76.9
25.0	7.69	0.20	7.9	-14.87	-14.89	1502	559.1	313.0	49.6	76.3
25.5	6.77	0.20	7.0	.92	.94	1454	559.0	313.5	48.8	75.8
26.0	5.02	0.20	5.2	-15.05	-15.07	1350	558.9	314.0	48.0	75.3
26.5	3.20	0.20	3.4	.23	.25	1227	558.8	314.4	47.3	74.8
37027.0	2.66	0.20	2.9	-15.30	-15.32	1187	558.7	314.7	46.6	74.4
28.0	2.28	0.20	2.5	.36	.38	1153	558.5	315.3	45.5	73.7
29.0	2.13	0.20	2.3	.40	.42	1135	558.4	315.7	44.5	73.2
37030.0	2.13	0.20	2.3	-15.39	-15.42	1136	558.4	316.1	43.8	72.9
32.5	2.29	0.13	2.4	.37	.39	1149	558.8	316.4	43.2	72.9
35.0	2.37	0.11	2.5	.35	.37	1162	559.3	316.5	44.2	73.7
37.5	2.46	0.09	2.6	.33	.34	1175	560.6	316.6	46.3	75.0
40.0	2.56	0.06	2.6	.33	.34	1179	562.3	317.0	49.1	76.3
42.5	2.62	0.03	2.6	.33	.33	1183	564.4	318.2	51.8	77.3
45.0	2.66	0.00	2.7	.32	.31	1196	566.4	320.3	54.0	77.6
47.5	2.75	-0.01	2.7	.33	.30	1198	568.1	323.4	55.3	76.9
50.0	3.07	0.02	3.1	.27	.24	1233	569.1	327.5	55.3	75.2
52.5	2.79	0.06	2.8	.32	.29	1205	569.3	332.1	54.1	72.6
55.0	2.51	0.09	2.6	.35	.33	1184	568.6	336.4	51.6	69.2
57.5	2.39	0.10	2.5	.37	.35	1172	567.2	340.0	48.0	65.3
60.0	2.66	0.12	2.8	.32	.31	1196	565.3	342.6	43.4	61.2
62.5	3.20	0.12	3.3	.24	.24	1235	563.2	344.1	38.2	57.0
65.0	3.71	0.11	3.8	.17	.18	1272	561.2	344.7	32.6	53.3
67.5	3.52	0.10	3.6	.19	.21	1255	559.7	344.8	27.1	49.9
70.0	3.05	0.09	3.1	.25	.27	1215	558.8	344.6	22.0	47.1
72.5	2.70	0.08	2.8	.30	.31	1191	558.6	344.6	17.7	44.8
75.0	2.39	0.06	2.4	.36	.38	1156	558.9	345.0	14.6	42.7
77.5	2.59	0.05	2.6	.33	.34	1176	559.6	346.2	13.0	40.6
80.0	2.72	0.04	2.7	.31	.32	1188	560.5	348.4	12.3	38.2
82.5	2.31	0.03	2.8	.29	.30	1199	561.3	351.7	12.0	35.4
85.0	2.82	0.02	2.8	.29	.30	1200	561.7	355.8	11.5	32.1
87.5	3.06	0.00	3.1	.25	.25	1227	561.7	0.1	10.3	28.4
90.0	3.21	-0.01	3.2	.23	.24	1235	561.2	4.0	8.7	24.5
92.5	3.70	-0.02	3.7	.17	.18	1275	560.4	7.0	7.5	21.2
95.0	4.18	-0.04	4.1	.12	.13	1304	559.6	9.0	8.4	19.5
97.5	3.69	-0.05	3.6	.17	.19	1266	558.9	10.0	12.2	20.4
37100.0	3.26	-0.07	3.2	.22	.24	1234	558.7	10.2	17.6	23.9
02.5	2.68	-0.09	2.6	.31	.33	1183	559.1	10.0	23.8	29.1
05.0	2.37	-0.10	2.3	.37	.38	1156	560.1	9.8	30.5	35.1
07.5	2.15	-0.10	2.0	.43	.43	1128	561.7	9.8	37.2	41.0
10.0	2.29	-0.10	2.2	.39	.38	1153	563.7	10.4	43.5	46.4

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 α1

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_π	log ρ_S	T_π (°K)	z (km)	$\alpha_\pi-\alpha_\odot$ (deg.)	ψ_0' (deg.)	ψ_{30}' (deg.)
37112.5	2.40	-0.07	2.3	-15.37	-15.36	1167	565.8	12.0	49.2	51.0
15.0	2.76	-0.04	2.7	.30	.28	1210	567.6	14.6	54.0	54.2
17.5	2.95	-0.01	2.9	.27	.25	1231	568.8	18.2	57.6	56.0
20.0	2.91	0.00	2.9	.27	.24	1232	569.3	22.5	60.0	56.1
22.5	2.85	0.00	2.8	.29	.26	1221	568.8	26.8	60.2	54.6
25.0	2.92	0.00	2.9	.27	.25	1227	567.6	30.5	59.2	51.4
27.5	2.99	0.00	3.0	.26	.24	1232	565.8	33.2	56.8	46.9
30.0	3.10	0.00	3.1	.24	.24	1236	563.8	34.8	53.2	41.1
32.5	3.26	0.00	3.3	.21	.22	1249	561.7	35.6	48.8	34.5
35.0	3.48	-0.02	3.5	.18	.20	1262	560.1	35.7	44.0	27.2
37.5	3.32	-0.05	3.3	.21	.22	1244	559.0	35.5	39.6	19.8
40.0	2.97	-0.08	2.9	.26	.28	1209	558.6	35.4	36.1	12.6
42.5	2.84	-0.10	2.7	.30	.31	1191	558.8	35.8	34.4	6.9
45.0	2.86	-0.13	2.7	.30	.31	1192	559.4	36.8	34.6	6.9
47.5	2.52	-0.15	2.4	.35	.36	1164	560.3	38.8	36.8	11.8
50.0	2.39	-0.17	2.2	.39	.40	1145	561.1	42.0	40.3	16.9
52.5	2.01	-0.18	1.8	.48	.48	1102	561.6	46.0	44.4	21.5
55.0	2.29	-0.19	2.1	.41	.42	1135	561.7	50.5	48.5	25.1
57.5	3.29	-0.19	3.1	.24	.25	1228	561.3	54.8	52.3	27.7
60.0	4.74	-0.19	4.5	.08	.09	1334	560.6	58.3	55.5	29.5
62.5	5.89	-0.19	5.7	-14.98	-14.99	1408	558.9	60.7	58.0	30.6
65.0	6.48	-0.19	6.3	.93	.95	1442	558.1	62.2	60.0	31.4
67.5	6.06	-0.19	5.9	.96	.98	1416	557.7	62.9	61.5	32.2
70.0	4.47	-0.20	4.3	-15.10	-15.12	1311	557.8	63.0	62.9	33.6
72.5	3.22	-0.20	3.0	.26	.28	1211	558.7	63.1	64.3	35.8
75.0	3.11	-0.21	2.9	.28	.29	1204	560.1	63.3	66.1	38.7
77.5	2.90	-0.22	2.7	.31	.32	1188	561.9	64.0	68.3	42.4
80.0	3.06	-0.22	2.8	.30	.30	1200	563.9	65.6	71.1	46.5
82.5	3.28	-0.22	3.1	.26	.25	1228	565.7	68.3	74.3	50.6
85.0	3.61	-0.22	3.4	.22	.21	1256	567.1	72.0	77.8	54.5
87.5	4.10	-0.22	3.9	.16	.14	1296	567.7	76.5	81.3	57.9
90.0	5.02	-0.22	4.8	.07	.05	1361	567.4	81.2	84.6	60.5
92.5	5.29	-0.22	5.1	.05	.03	1380	566.4	85.4	87.5	62.3
95.0	5.91	-0.22	5.7	-14.99	-14.99	1414	564.7	88.7	89.7	63.2
97.5	5.74	-0.22	5.5	-15.01	-15.01	1396	562.6	90.9	91.2	63.4
37200.0	4.92	-0.21	4.7	.07	.09	1337	560.5	92.1	92.1	63.1
02.5	4.35	-0.20	4.2	.12	.14	1297	558.8	92.7	92.5	62.8
05.0	3.69	-0.20	3.5	.21	.23	1241	557.5	92.8	92.8	62.8
07.5	3.26	-0.20	3.1	.26	.29	1205	557.0	92.9	93.2	63.5
37210.0	3.32	-0.20	3.1	-15.27	-15.29	1202	557.1	93.3	94.1	65.1
11.0	3.41	-0.21	3.2	.26	.28	1210	557.2	93.6	94.6	66.0
12.0	3.91	-0.21	3.7	.19	.22	1247	557.5	94.0	95.3	67.2
13.0	4.01	-0.21	3.8	.19	.21	1254	557.8	94.6	96.1	68.4
14.0	4.11	-0.21	3.9	.18	.20	1260	558.2	95.3	97.0	69.8
37215.0	3.46	-0.21	3.2	-15.26	-15.28	1208	558.5	96.2	98.1	71.3
17.5	3.37	-0.22	3.2	.27	.28	1208	559.4	99.2	101.3	75.6
20.0	3.20	-0.22	3.0	.30	.31	1193	560.1	103.1	105.2	80.1
22.5	3.28	-0.17	3.1	.28	.29	1202	560.3	107.6	109.4	84.5
25.0	3.24	-0.13	3.1	.28	.29	1204	560.0	112.1	113.7	88.4
27.5	2.50	-0.13	2.4	.38	.40	1145	559.4	115.8	117.6	91.4
30.0	1.50	-0.15	1.4	.61	.63	1037	558.6	118.5	120.5	93.3
32.5	2.07	-0.16	1.9	.47	.50	1097	557.8	120.2	122.2	94.1
35.0	1.76	-0.16	1.6	.54	.57	1064	557.2	121.0	122.5	93.6
37.5	1.46	-0.14	1.3	.63	.66	1026	557.3	121.1	121.4	92.3
40.0	1.67	-0.12	1.6	.54	.56	1066	557.9	121.0	119.3	90.5
42.5	2.00	-0.09	1.9	.46	.48	1102	559.2	120.9	116.6	88.5
45.0	2.03	-0.08	2.0	.45	.46	1115	561.0	121.3	113.9	86.9
47.5	2.22	-0.10	2.1	.43	.43	1128	563.1	122.4	111.6	86.0

Table 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 α1

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_v	log ρ_s	T_v (°K)	z (km)	$\alpha_v - \alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37248.0	2.31	-0.11	2.2	-15.41	-15.42	1134	561.3	122.8	111.3	85.9
49.0	2.32	-0.12	2.2	.41	.42	1135	562.1	123.6	110.6	85.9
37250.0	2.20	-0.13	2.1	-15.44	-15.44	1125	562.9	124.5	110.2	86.0
50.5	4.26	-0.13	4.1	.15	.15	1295	563.3	125.1	110.0	86.1
51.0	8.21	-0.14	8.1	-14.85	-14.85	1540	563.6	125.7	109.9	86.3
51.5	8.74	-0.14	8.6	.83	.82	1568	564.0	126.3	109.8	86.5
52.0	4.10	-0.14	4.0	-15.16	-15.15	1290	564.3	127.0	109.8	86.8
52.5	3.34	-0.15	3.2	.26	.25	1228	564.6	127.7	109.9	87.1
53.0	1.52	-0.15	1.4	.62	.61	1046	564.9	128.4	110.0	87.4
53.5	1.44	-0.14	1.4	.62	.61	1046	565.2	129.2	110.1	87.8
54.0	2.89	-0.14	2.8	.32	.31	1195	565.4	130.0	110.3	88.3
54.5	2.89	-0.14	2.8	.32	.31	1195	565.6	130.8	110.5	88.7
37255.0	1.67	-0.13	1.5	-15.59	-15.58	1059	565.8	131.7	110.8	89.2
56.0	1.60	-0.11	1.5	.59	.58	1059	566.1	133.4	111.5	90.3
57.0	1.37	-0.09	1.3	.66	.64	1033	566.2	135.2	112.5	91.6
58.0	1.82	-0.08	1.7	.54	.52	1084	566.2	136.9	113.6	92.9
59.0	1.67	-0.09	1.6	.57	.55	1072	566.1	138.6	114.8	94.3
60.0	1.75	-0.10	1.6	.57	.55	1072	565.9	140.1	116.3	95.8
61.0	1.14	-0.13	1.0	.77	.75	988	565.6	141.5	117.8	97.3
37262.5	1.31	-0.16	1.2	-15.69	-15.68	1018	565.2	143.3	120.4	99.7
65.0	1.20	-0.17	1.0	.76	.76	986	563.4	145.4	125.1	103.5
67.5	1.34	-0.16	1.2	.68	.68	1015	561.4	146.4	129.9	107.1
70.0	1.64	-0.15	1.5	.57	.59	1053	559.6	146.6	134.6	110.4
72.5	2.06	-0.14	1.9	.46	.49	1099	558.3	146.4	138.9	113.2
75.0	2.10	-0.12	2.0	.44	.47	1110	557.6	146.0	142.6	115.8
77.5	2.10	-0.11	2.0	.43	.47	1111	557.5	145.8	145.6	118.1
80.0	1.81	-0.10	1.7	.50	.53	1080	558.0	146.1	148.0	120.5
82.5	1.31	-0.10	1.2	.65	.68	1018	558.7	147.3	150.1	123.1
85.0	1.17	-0.09	1.1	.69	.71	1006	559.6	149.6	152.2	126.0
87.5	0.99	-0.08	0.9	.77	.79	977	560.2	152.8	154.6	129.2
90.0	0.80	-0.07	0.7	.87	.89	942	560.5	156.8	157.6	132.6
92.5	0.65	-0.06	0.6	.94	.95	923	560.2	160.9	161.0	136.0
95.0	0.47	-0.05	0.4	-16.11	-16.13	877	559.6	164.4	164.7	139.0
97.5	0.59	-0.04	0.6	-15.93	-15.95	924	558.7	167.0	167.9	140.9
37300.0	0.63	-0.03	0.6	.92	.95	923	557.8	168.5	168.9	141.4
02.5	0.75	-0.02	0.7	.85	.89	943	557.2	169.1	166.3	140.3
05.0	0.96	0.00	1.0	.70	.73	997	557.1	169.0	161.2	137.6
07.5	0.56	0.01	0.6	.92	.95	924	557.6	168.6	155.0	133.9
10.0	0.50	0.02	0.5	-16.00	-16.02	903	558.8	168.3	148.7	129.8
12.5	0.49	0.02	0.5	.00	.02	905	560.5	168.3	142.6	125.8
15.0	0.49	0.03	0.5	.01	.01	907	562.6	169.0	137.2	122.4
17.5	0.34	0.03	0.4	.11	.10	884	564.7	170.8	132.8	120.0
20.0	0.39	0.02	0.4	.11	.09	885	566.4	173.6	129.8	119.1
22.5	0.41	0.01	0.4	.12	.09	886	567.5	177.4	128.2	119.6
25.0	0.41	0.00	0.4	.12	.09	886	567.8	181.7	128.3	121.7
27.5	0.39	-0.01	0.4	.12	.09	886	567.3	185.9	130.1	125.3
30.0	0.41	-0.02	0.4	.11	.09	885	566.0	189.4	133.4	130.1
32.5	0.52	-0.02	0.5	.01	.00	909	564.1	191.8	138.1	136.0
35.0	0.62	-0.02	0.6	-15.92	-15.93	930	562.1	193.2	143.8	142.4
37.5	0.74	-0.01	0.7	.85	.87	949	560.2	193.8	150.3	149.1
40.0	0.57	0.00	0.6	.92	.94	927	558.7	193.8	156.9	155.5
42.5	0.36	0.02	0.4	-16.09	-16.12	879	557.8	193.7	162.8	160.7
45.0	0.36	0.03	0.4	.09	.12	879	557.5	193.7	166.3	163.8
47.5	0.41	0.05	0.5	-15.99	.02	904	557.9	194.2	165.4	164.0
50.0	0.58	0.06	0.6	.91	-15.94	927	558.6	195.6	161.1	162.0
52.5	0.46	0.08	0.5	-16.00	-16.02	905	559.4	197.9	155.8	159.2
55.0	0.07	0.09	0.2	.39	.41	812	560.1	201.4	150.5	156.8

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 α1

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_π	log ρ_s	T_π (°K)	z (km)	$\alpha_\pi - \alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37357.5	0.21	0.10	0.3	−16.22	−16.23	852	560.4	205.6	146.0	155.3
60.0	0.21	0.10	0.3	.22	.23	852	560.3	210.1	142.4	154.9
62.5	0.30	0.10	0.4	.09	.11	881	559.7	214.3	139.9	155.7
65.0	0.27	0.11	0.4	.09	.12	880	558.8	217.6	138.4	157.6
67.5	0.24	0.12	0.3	.21	.24	850	557.9	219.8	137.9	160.5
70.0	0.09	0.11	0.2	.39	.42	809	557.2	221.0	137.9	163.9
72.5	0.10	0.11	0.2	.39	.42	808	556.9	221.5	138.2	167.0
75.0	0.05	0.12	0.2	.39	.42	809	557.3	221.6	138.4	168.4
77.5	0.21	0.13	0.3	.21	.24	851	558.4	221.7	137.9	166.8
80.0	0.24	0.14	0.4	.09	.11	882	560.0	222.0	136.6	163.0
82.5	0.02	0.15	0.2	.39	.40	814	562.1	223.0	134.4	158.3
85.0	0.11	0.16	0.3	.22	.21	857	564.2	224.9	131.4	153.6
87.5	0.04	0.17	0.2	.40	.38	818	566.1	227.8	127.9	149.3

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 α2

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_π	log ρ_s	T_π (°K)	z (km)	$\alpha_\pi - \alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36645.0	10.11	-0.03	10.1	-14.76	-14.73	1668	569.3	9.6	32.7	36.8
47.5	10.39	-0.03	10.4	.75	.72	1680	568.5	13.6	33.4	34.5
50.0	10.95	-0.03	10.9	.73	.71	1700	567.2	16.8	32.8	31.2
36651.0	11.2	-0.03	11.2	-14.71	-14.70	1712	566.5	17.9	32.3	29.7
51.5	11.7	-0.03	11.7	.69	.68	1736	566.1	18.4	32.0	28.9
52.0	11.8	-0.03	11.8	.69	.68	1739	565.8	18.8	31.6	28.1
52.5	11.8	-0.03	11.8	.69	.68	1737	565.4	19.2	31.2	27.2
53.0	12.4	-0.03	12.4	.67	.66	1765	565.0	19.5	30.8	26.3
53.5	14.4	-0.03	14.4	.60	.60	1858	564.6	19.8	30.4	25.4
54.0	16.5	-0.04	16.5	.54	.54	1953	564.2	20.1	29.9	24.5
54.5	16.4	-0.04	16.4	.54	.54	1946	563.8	20.3	29.4	23.6
55.0	14.0	-0.04	14.0	.61	.61	1834	563.4	20.5	28.9	22.7
55.5	11.5	-0.04	11.5	.70	.70	1713	563.0	20.7	28.4	21.7
56.0	10.2	-0.05	10.2	.75	.75	1647	562.7	20.9	27.8	20.7
56.5	10.0	-0.05	10.0	.76	.76	1636	562.3	21.0	27.3	19.8
57.0	10.4	-0.05	10.4	.74	.74	1655	561.9	21.1	26.7	18.8
36657.5	10.18	-0.05	10.1	-14.75	-14.76	1638	561.6	21.2	26.2	17.8
60.0	9.55	-0.06	9.5	.78	.79	1603	560.1	21.3	23.5	13.3
62.5	10.06	-0.08	10.0	.75	.77	1625	559.1	21.2	21.6	9.8
65.0	9.21	-0.10	9.1	.79	.81	1578	558.7	21.1	21.0	8.9
67.5	10.33	-0.11	10.2	.75	.76	1634	558.9	21.4	22.0	10.9
70.0	10.44	-0.13	10.3	.74	.76	1640	559.4	22.2	24.5	14.0
72.5	10.56	-0.14	10.4	.74	.75	1648	560.2	23.8	27.7	17.0
75.0	10.73	-0.15	10.6	.73	.74	1660	560.9	26.4	31.2	19.3
77.5	10.56	-0.16	10.4	.74	.75	1652	561.5	29.8	34.5	20.8
80.0	10.85	-0.17	10.7	.73	.73	1667	561.7	33.8	37.4	21.3
82.5	11.46	-0.18	11.3	.70	.71	1696	561.4	37.8	39.8	20.8
85.0	12.23	-0.18	12.0	.68	.69	1727	560.8	41.4	41.6	19.6
87.5	12.06	-0.18	11.9	.68	.69	1718	560.0	44.2	42.9	17.9
90.0	9.97	-0.18	9.8	.76	.78	1613	559.1	46.0	44.0	16.4
92.5	9.34	-0.19	9.2	.79	.81	1580	558.3	46.9	45.0	16.2
95.0	9.92	-0.20	9.7	.77	.79	1602	557.9	47.2	46.4	18.1
97.5	9.51	-0.21	9.3	.79	.81	1582	558.0	47.0	48.2	22.0
36700.0	10.65	-0.22	10.4	.74	.76	1637	558.7	46.7	50.9	27.2
02.5	10.17	-0.24	9.9	.77	.78	1615	560.0	46.6	54.2	33.1
05.0	8.90	-0.25	8.6	.83	.84	1554	561.7	46.8	58.2	39.3
07.5	7.53	-0.25	7.3	.90	.90	1489	563.5	47.8	62.7	45.3
10.0	7.05	-0.25	6.8	.94	.93	1466	565.3	49.7	67.3	50.8
12.5	6.85	-0.25	6.6	.95	.97	1432	558.7	52.5	71.8	55.5
15.0	4.86	-0.24	4.6	-15.10	-15.12	1313	559.1	56.1	75.8	59.1
17.5	3.46	-0.22	3.2	.26	.28	1213	559.1	60.0	79.0	61.5
20.0	3.48	-0.17	3.3	.24	.26	1222	558.8	63.8	81.1	62.5
22.5	4.16	-0.10	4.1	.15	.17	1281	558.2	66.9	82.1	62.1
25.0	4.32	-0.05	4.3	.12	.15	1294	557.4	69.1	81.9	60.4
27.5	4.65	0.00	4.6	.09	.12	1313	556.6	70.4	80.5	57.6
30.0	5.66	0.00	5.7	.00	.03	1381	556.2	70.8	78.2	54.0
32.5	6.01	0.01	6.0	-14.98	.01	1399	556.2	70.8	75.2	49.8
35.0	6.46	0.01	6.5	.94	-14.97	1429	556.8	70.4	72.0	45.6
37.5	6.74	0.00	6.7	.93	.95	1443	557.9	70.0	69.0	41.9
40.0	6.64	-0.05	6.6	.94	.95	1441	559.6	69.8	66.5	39.1
42.5	6.48	-0.12	6.4	.96	.96	1434	561.5	70.2	65.0	37.6
45.0	6.55	-0.19	6.4	.96	.96	1438	563.5	71.4	64.5	37.8
47.5	6.85	-0.23	6.6	.95	.94	1453	565.3	73.5	65.3	39.3
50.0	6.11	-0.25	5.9	-15.00	.99	1414	566.6	76.6	67.2	41.9
52.5	5.46	-0.27	5.2	.06	-15.04	1370	567.2	80.2	69.9	45.0
55.0	4.90	-0.28	4.6	.11	.10	1329	567.0	84.1	73.2	48.4
57.5	4.81	-0.29	4.5	.13	.11	1319	566.1	87.6	76.8	51.6
60.0	4.38	-0.30	4.1	.17	.16	1286	564.5	90.3	80.3	54.5

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 α2

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_T	log ρ_S	T_T (°K)	z (km)	$\alpha_\pi-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36762.5	5.48	-0.30	5.2	-15.06	-15.06	1354	562.6	92.1	83.6	57.1
65.0	6.89	-0.29	6.6	-14.96	-14.97	1429	560.5	93.0	86.6	59.3
67.5	6.27	-0.28	6.0	-15.00	-15.02	1387	558.6	93.3	89.2	61.4
70.0	4.91	-0.28	4.6	.12	.14	1296	557.0	93.1	91.4	63.4
72.5	4.50	-0.28	4.2	.16	.19	1266	556.0	92.7	93.4	65.5
75.0	3.29	-0.27	3.0	.31	.34	1175	555.6	92.5	95.4	67.9
77.5	3.46	-0.27	3.2	.28	.32	1189	555.7	92.7	97.5	70.7
80.0	3.80	-0.27	3.5	.25	.28	1211	556.2	93.5	99.7	73.8
82.5	3.25	-0.27	3.0	.32	.34	1174	556.9	95.2	102.3	77.1
85.0	3.26	-0.26	3.0	.32	.34	1175	557.6	98.0	105.2	80.6
87.5	3.28	-0.21	3.1	.30	.32	1185	558.1	101.5	108.3	84.0
90.0	3.41	-0.14	2.9	.33	.31	1192	566.6	105.7	111.5	87.1
92.5	2.58	-0.08	2.5	.39	.37	1158	566.1	109.8	114.5	89.5
95.0	2.33	-0.12	2.2	.44	.43	1129	565.0	113.2	117.0	91.2
97.5	2.36	-0.20	2.2	.43	.43	1128	563.3	115.8	118.9	92.1
36800.0	2.91	-0.19	2.7	.34	.35	1172	561.4	117.5	119.9	92.1
02.5	3.16	-0.19	3.0	.29	.31	1194	559.4	118.3	120.1	91.3
05.0	4.11	-0.18	3.9	.18	.20	1258	557.7	118.6	119.4	90.1
07.5	4.13	-0.17	4.0	.16	.20	1261	556.5	118.5	118.2	88.8
10.0	4.88	-0.11	4.8	.09	.12	1310	555.9	118.4	116.8	87.5
12.5	5.90	-0.03	5.9	.00	.04	1373	555.8	118.5	115.5	86.8
15.0	5.44	-0.01	5.4	.04	.08	1343	556.2	119.1	114.7	86.8
17.5	4.75	0.00	4.8	.10	.13	1305	556.9	120.5	114.6	87.8
20.0	4.07	-0.01	4.1	.17	.20	1260	557.8	122.8	115.5	89.8
22.5	2.94	-0.05	2.9	.33	.35	1171	558.4	126.0	117.3	92.7
25.0	2.88	-0.15	2.7	.36	.38	1155	558.8	129.9	120.2	96.2
27.5	2.85	-0.19	2.7	.35	.38	1157	558.8	134.1	124.0	100.3
30.0	2.87	-0.20	2.7	.35	.37	1158	558.4	138.0	128.3	104.4
32.5	3.98	-0.19	3.8	.19	.22	1246	557.7	141.2	133.1	108.3
35.0	4.16	-0.18	4.0	.16	.20	1262	556.9	143.5	137.7	111.6
37.5	3.51	-0.16	3.4	.23	.26	1220	556.2	144.9	141.7	114.0
40.0	3.17	-0.15	3.0	.28	.32	1190	555.8	145.5	144.5	115.4
42.5	2.88	-0.14	2.7	.32	.36	1167	555.9	145.7	145.7	115.8
45.0	2.65	-0.12	2.5	.35	.39	1152	556.5	145.6	145.2	115.4
47.5	2.25	-0.11	2.1	.43	.46	1116	557.7	145.5	143.2	114.4
50.0	1.85	-0.10	1.8	.49	.51	1088	559.4	145.8	140.4	113.2
52.5	1.23	-0.10	1.1	.71	.72	1001	561.3	146.7	137.5	112.2
55.0	1.75	-0.10	1.6	.55	.55	1071	563.3	148.4	134.8	111.6
57.5	1.56	-0.10	1.5	.58	.57	1061	564.9	151.1	132.8	111.8
60.0	2.12	-0.11	2.0	.46	.44	1122	566.0	154.6	131.8	112.8
62.5	2.34	-0.12	2.2	.42	.40	1144	566.4	158.7	132.0	114.6
65.0	2.20	-0.13	2.1	.44	.42	1134	566.1	162.8	133.4	117.2
67.5	2.29	-0.13	2.2	.41	.40	1144	565.1	166.3	135.9	120.5
70.0	2.25	-0.14	2.1	.43	.43	1131	563.5	169.0	139.5	124.2
72.5	2.28	-0.14	2.1	.42	.43	1129	561.6	170.7	143.9	128.0
75.0	2.23	-0.13	2.1	.42	.44	1126	559.6	171.6	148.9	131.6
77.5	2.09	-0.11	2.0	.43	.46	1113	557.9	171.8	154.2	134.9
80.0	2.07	-0.08	2.0	.43	.46	1112	556.6	171.6	159.7	137.7
82.5	2.05	-0.06	2.0	.43	.47	1111	555.9	171.2	164.8	140.0
85.0	1.90	-0.05	1.8	.47	.51	1089	555.8	171.0	169.0	141.7
87.5	1.90	-0.04	1.8	.47	.51	1090	556.2	171.3	171.6	143.2
90.0	1.61	-0.03	1.6	.52	.56	1069	556.9	172.3	171.9	144.6
92.5	1.48	-0.02	1.5	.55	.58	1059	557.8	174.1	170.6	146.3
95.0	1.44	-0.01	1.4	.58	.60	1048	558.5	176.8	169.1	148.4
97.5	1.20	0.01	1.2	.64	.67	1021	558.9	180.3	168.1	151.0
36900.0	2.28	0.02	2.3	.36	.38	1152	559.0	184.0	167.8	154.2
02.5	2.47	0.02	2.5	.32	.35	1172	558.6	187.6	168.1	157.7
05.0	2.20	0.02	2.2	.38	.41	1141	557.9	190.4	168.6	161.2
07.5	2.13	0.04	2.2	.37	.41	1140	557.1	192.4	168.5	163.7
10.0	1.80	0.05	1.8	.46	.50	1095	556.4	193.4	166.9	163.9

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TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 α2

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_π	log ρ_s	T_π (°K)	z (km)	$\alpha_\pi-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36912.5	1.48	0.06	1.5	-15.54	-15.58	1059	555.9	193.6	163.5	161.3
15.0	1.27	0.08	1.4	.57	.61	1046	555.9	193.3	158.8	156.6
17.5	0.71	0.09	0.8	.81	.85	956	556.5	192.7	153.2	150.9
20.0	0.47	0.11	0.6	.94	.97	919	557.7	192.1	147.3	144.8
22.5	0.64	0.12	0.8	.82	.84	960	559.3	191.8	141.2	139.0
25.0	1.14	0.14	1.3	.61	.62	1042	561.3	192.2	135.4	133.6
27.5	1.42	0.14	1.6	.52	.52	1086	563.3	193.3	130.2	129.2
30.0	1.55	0.12	1.7	.50	.49	1101	565.0	195.4	125.7	125.9
32.5	1.92	0.12	2.0	.43	.41	1139	566.2	198.4	122.4	124.0
35.0	1.81	0.11	1.9	.45	.43	1128	566.8	202.0	120.3	123.6
37.5	1.50	0.09	1.6	.53	.51	1092	566.6	205.7	119.6	124.7
40.0	1.59	0.07	1.7	.50	.48	1102	565.6	209.0	120.4	127.3
42.5	1.64	0.06	1.7	.50	.49	1100	564.1	211.5	122.5	131.2
45.0	1.63	0.05	1.7	.49	.50	1096	562.2	213.1	125.8	136.3
47.5	1.27	0.05	1.3	.61	.62	1040	560.3	213.8	130.0	142.3
50.0	1.38	0.05	1.4	.57	.60	1051	558.5	213.8	134.7	149.0
52.5	1.33	0.06	1.4	.57	.60	1048	557.1	213.4	139.6	156.1
55.0	1.26	0.07	1.3	.60	.64	1033	556.3	212.9	143.9	163.3
57.5	1.55	0.08	1.6	.51	.55	1072	556.1	212.6	147.2	170.4
60.0	1.59	0.10	1.7	.48	.52	1084	556.3	212.7	148.8	176.4
62.5	1.90	0.11	2.0	.41	.45	1119	557.0	213.5	148.3	174.9
65.0	2.21	0.13	2.3	.36	.39	1152	557.8	215.2	146.2	169.5
67.5	2.46	0.15	2.6	.30	.33	1182	558.5	217.9	142.9	164.6
70.0	1.86	0.16	2.0	.42	.44	1123	558.9	221.4	139.2	160.6
72.5	1.81	0.17	2.0	.42	.44	1123	559.0	225.3	135.4	157.5
75.0	1.49	0.17	1.7	.49	.52	1088	558.7	229.1	132.1	155.5
77.5	0.93	0.18	1.1	.68	.71	1006	558.1	232.3	129.4	154.3
80.0	0.83	0.20	1.0	.72	.75	989	557.3	234.6	127.2	153.8
82.5	0.63	0.20	0.8	.81	.85	954	556.5	236.1	125.7	153.8
85.0	0.46	0.20	0.7	.87	.91	935	556.0	236.7	124.6	153.8
87.5	0.18	0.21	0.4	-16.12	-16.16	870	555.9	236.8	123.8	153.3
90.0	0.13	0.21	0.3	.24	.28	842	556.4	236.6	123.0	152.1
92.5	0.13	0.22	0.4	.12	.15	872	557.5	236.5	121.9	149.9
95.0	0.46	0.22	0.7	-15.88	-15.90	939	559.1	236.6	120.4	146.9
97.5	0.63	0.24	0.9	.77	.78	978	561.0	237.2	118.3	143.3
37000.0	0.89	0.24	1.1	.69	.69	1012	563.0	238.7	115.8	139.4
02.5	0.94	0.25	1.2	.66	.65	1030	564.8	241.1	112.8	135.6
05.0	0.67	0.26	0.9	.79	.77	983	566.1	244.4	109.7	132.2
07.5	0.74	0.26	1.0	.74	.72	1001	566.8	248.4	106.6	129.4
10.0	0.61	0.26	0.9	.79	.77	982	566.0	252.7	103.7	127.3
12.5	0.46	0.26	0.7	.90	.89	944	565.2	256.5	101.3	126.0
15.0	0.78	0.25	1.0	.74	.74	994	563.7	259.6	99.5	125.5
17.5	1.07	0.25	1.3	.63	.63	1036	561.8	261.8	98.2	125.6
20.0	1.48	0.25	1.7	.51	.53	1082	559.9	263.0	97.4	126.0
37021.0	1.35	0.25	1.6	-15.53	-15.56	1069	559.1	263.3	97.2	126.2
21.5	1.45	0.25	1.7	.51	.53	1080	558.7	263.4	97.2	126.3
22.0	1.75	0.25	2.0	.44	.46	1112	558.4	263.4	97.1	126.4
22.5	1.75	0.25	2.0	.44	.46	1112	558.0	263.5	97.0	126.5
23.0	2.05	0.25	2.3	.38	.41	1141	557.7	263.6	97.0	126.5
23.5	2.15	0.25	2.4	.36	.39	1150	557.4	263.6	96.9	126.6
24.0	2.55	0.25	2.8	.29	.32	1186	557.1	263.6	96.8	126.6
24.5	2.85	0.25	3.1	.25	.28	1210	556.8	263.6	96.8	126.6
25.0	2.94	0.26	3.2	.23	.27	1217	556.6	263.6	96.7	126.6
25.5	2.54	0.26	2.8	.29	.33	1183	556.4	263.6	96.6	126.5
26.0	2.24	0.26	2.5	.34	.38	1155	556.2	263.5	96.6	126.5
26.5	2.04	0.26	2.3	.38	.42	1136	556.0	263.5	96.5	126.4
27.0	1.74	0.26	2.0	.44	.48	1105	555.8	263.5	96.4	126.2
27.5	1.44	0.26	1.7	.51	.55	1071	555.7	263.4	96.3	126.0
28.0	1.14	0.26	1.4	.59	.64	1034	555.6	263.4	96.1	125.8

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 α2

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_π	log ρ_B	T_π (°K)	z (km)	$\alpha_\pi-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37028.5	0.84	0.26	1.1	-15.70	-15.74	993	555.5	263.4	96.0	125.5
29.0	0.84	0.26	1.1	.70	.74	992	555.4	263.4	95.8	125.2
29.5	0.74	0.26	1.0	.74	.79	977	555.4	263.4	95.6	124.9
37030.0	0.69	0.26	1.0	-15.74	-15.79	977	555.4	263.4	95.4	124.5
32.5	0.91	0.27	1.2	.67	.71	1004	555.6	263.8	94.0	122.1
35.0	1.11	0.27	1.4	.61	.65	1029	556.2	264.8	91.8	118.7
37.5	1.38	0.28	1.7	.53	.57	1064	557.0	266.6	89.0	114.7
40.0	1.77	0.28	2.0	.47	.50	1096	557.8	269.4	85.5	110.3
42.5	1.92	0.28	2.2	.43	.46	1115	558.3	273.0	81.7	106.0
45.0	1.99	0.28	2.3	.42	.44	1124	558.5	277.1	77.7	102.1
47.5	1.81	0.27	2.1	.46	.48	1104	558.4	281.1	74.0	98.8
50.0	1.86	0.26	2.1	.45	.48	1104	557.8	284.5	70.9	96.5
52.5	2.01	0.24	2.2	.43	.46	1114	557.1	287.1	68.7	95.2
55.0	1.61	0.21	1.8	.51	.54	1074	556.4	288.7	67.7	95.0
57.5	0.99	0.16	1.2	.68	.72	1002	556.0	289.5	67.8	95.9
60.0	0.97	0.10	1.1	.72	.75	989	555.9	289.6	69.0	97.6
62.5	1.33	0.02	1.4	.61	.64	1031	556.5	289.4	71.1	99.7
65.0	1.21	0.00	1.2	.67	.70	1007	557.6	289.2	73.6	101.9
67.5	1.23	0.01	1.2	.68	.70	1010	559.2	289.1	76.2	103.9
70.0	1.11	0.02	1.1	.72	.73	999	561.2	289.6	78.5	105.3
72.5	1.02	0.07	1.1	.72	.72	1001	563.3	290.7	80.1	105.8
75.0	0.77	0.13	0.9	.82	.80	971	565.2	292.8	80.8	105.4
77.5	0.63	0.19	0.8	.87	.85	954	566.7	295.8	80.4	103.9
80.0	0.70	0.23	0.9	.83	.81	970	567.5	299.6	78.9	101.6
82.5	1.03	0.25	1.3	.68	.65	1028	567.6	303.5	76.4	98.6
85.0	1.16	0.26	1.4	.65	.63	1038	566.9	307.2	73.2	95.3
87.5	1.21	0.26	1.5	.62	.61	1046	565.6	310.1	69.4	91.8
90.0	1.46	0.26	1.7	.57	.56	1066	563.9	312.1	65.3	88.4
92.5	1.68	0.26	1.9	.52	.52	1085	562.0	313.2	61.1	85.3
95.0	1.81	0.25	2.1	.47	.48	1102	560.2	313.4	57.2	82.4
97.5	1.58	0.25	1.8	.53	.55	1069	558.8	313.2	53.6	79.9
37100.0	1.38	0.24	1.6	.58	.61	1046	557.9	312.8	50.5	77.6
02.5	1.36	0.23	1.6	.58	.61	1046	557.6	312.5	47.9	75.3
05.0	1.38	0.22	1.6	.58	.61	1047	557.9	312.5	45.6	73.0
07.5	1.46	0.21	1.7	.56	.58	1060	558.5	313.1	43.4	70.5
10.0	1.72	0.20	1.9	.51	.52	1084	559.4	314.5	41.3	67.8
12.5	1.94	0.19	2.1	.46	.47	1107	560.6	316.8	39.0	64.8
15.0	2.36	0.18	2.5	.39	.40	1147	561.2	320.3	36.3	61.6
17.5	2.67	0.17	2.8	.34	.34	1175	561.5	323.8	33.3	58.4
20.0	2.69	0.16	2.8	.33	.34	1176	561.3	327.6	30.1	55.4
22.5	2.46	0.14	2.6	.36	.37	1159	560.8	330.9	27.0	53.0
25.0	2.40	0.12	2.5	.38	.39	1150	560.1	333.4	24.5	51.4
27.5	2.26	0.10	2.4	.39	.41	1142	559.3	335.0	23.3	50.9
30.0	1.98	0.08	2.1	.44	.46	1113	558.7	335.7	23.9	51.7
32.5	1.69	0.07	1.8	.51	.53	1082	558.5	335.8	26.3	53.5
35.0	1.66	0.05	1.7	.53	.55	1072	558.9	335.6	30.1	56.1
37.5	1.39	0.02	1.4	.61	.63	1038	559.9	335.2	34.6	59.1
40.0	1.19	0.00	1.2	.68	.69	1013	561.4	335.1	39.3	62.1
42.5	1.12	0.00	1.1	.72	.72	1002	563.3	335.5	43.6	64.7
45.0	1.19	0.00	1.2	.68	.67	1019	565.3	336.7	47.2	66.5
47.5	1.31	0.00	1.3	.65	.63	1035	567.2	338.7	49.8	67.2
50.0	1.45	0.00	1.4	.62	.60	1050	568.7	341.7	51.2	66.8
52.5	1.47	0.00	1.5	.60	.57	1064	569.7	345.5	51.1	65.0
55.0	1.70	0.00	1.7	.55	.52	1087	569.8	349.6	49.7	62.1
57.5	2.54	0.01	2.6	.36	.33	1179	569.2	353.6	46.8	58.1
60.0	3.44	0.02	3.5	.23	.21	1253	568.0	356.8	42.7	53.3
62.5	5.07	0.05	5.1	.07	.05	1362	566.3	359.1	37.4	48.0
65.0	5.97	0.06	6.0	-14.99	-14.99	1414	564.4	0.5	31.2	42.6
67.5	4.97	0.06	5.0	-15.07	-15.07	1349	562.6	1.2	24.3	37.5

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 $\alpha 2$

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_v	log ρ_e	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37170.0	3.86	0.04	3.9	-15.17	-15.18	1272	561.1	1.3	17.0	33.2
72.5	3.04	0.03	3.1	.27	.28	1210	560.1	1.2	9.5	30.1
75.0	2.32	0.01	2.3	.40	.41	1139	559.7	1.1	2.2	28.6
77.5	2.40	-0.01	2.4	.38	.39	1149	559.8	1.4	5.6	28.6
80.0	2.80	-0.03	2.8	.31	.32	1186	560.3	2.2	12.4	29.6
82.5	3.12	-0.05	3.1	.27	.28	1213	561.0	3.9	18.7	31.0
85.0	4.02	-0.06	4.0	.16	.16	1284	561.7	6.5	24.1	32.2
87.5	5.32	-0.07	5.2	.04	.05	1366	562.2	10.0	28.5	32.8
90.0	6.16	-0.07	6.1	-14.98	-14.98	1422	562.4	14.0	31.8	32.6
92.5	7.30	-0.07	7.2	.90	.91	1484	561.9	18.2	34.0	31.4
95.0	7.95	-0.07	7.9	.86	.87	1520	561.4	21.9	35.0	29.1
97.5	7.68	-0.07	7.6	.88	.89	1502	560.7	24.8	34.9	25.9
37200.0	6.76	-0.08	6.7	.93	.94	1451	559.9	26.8	33.9	21.8
02.5	5.90	-0.08	5.8	.99	-15.01	1397	559.3	27.9	32.3	17.0
05.0	5.22	-0.10	5.1	-15.05	.06	1354	559.1	28.3	30.5	11.6
07.5	4.27	-0.11	4.2	.13	.14	1296	559.5	28.4	29.0	6.1
37210.0	3.41	-0.12	3.3	-15.24	-15.25	1231	560.4	28.3	28.2	1.7
10.5	3.52	-0.12	3.4	.22	.23	1240	560.7	28.3	28.2	2.0
11.0	3.62	-0.12	3.5	.21	.22	1248	560.9	28.2	28.2	2.8
11.5	3.93	-0.13	3.8	.17	.18	1272	561.2	28.3	28.3	3.7
12.0	4.33	-0.13	4.2	.13	.14	1301	561.5	28.3	28.4	4.7
12.5	5.44	-0.14	5.3	.03	.03	1376	561.9	28.3	28.6	5.7
13.0	6.34	-0.14	6.2	-14.96	-14.97	1432	562.2	28.4	28.8	6.8
13.5	6.04	-0.14	5.9	.98	.99	1415	562.6	28.4	29.1	7.8
14.0	5.95	-0.15	5.8	.99	.99	1410	562.9	28.6	29.4	8.8
14.5	5.75	-0.15	5.6	-15.01	-15.01	1399	563.3	28.7	29.8	9.8
37215.0	5.36	-0.16	5.2	-15.04	-15.04	1374	563.7	28.8	30.2	10.8
17.5	4.47	-0.17	4.3	.12	.11	1318	565.7	30.0	32.8	15.4
20.0	5.04	-0.18	4.9	.07	.05	1364	567.5	32.1	36.0	19.3
22.5	5.70	-0.18	5.5	.02	.00	1408	568.9	35.1	39.3	22.3
25.0	6.04	-0.19	5.8	.00	-14.97	1429	569.7	38.9	42.5	24.4
27.5	5.11	-0.20	4.9	.07	-15.04	1370	569.8	43.0	45.4	25.4
30.0	3.89	-0.20	3.7	.19	.17	1281	569.0	47.0	47.7	25.6
32.5	3.76	-0.21	3.6	.20	.18	1270	567.5	50.3	49.5	25.0
35.0	3.91	-0.22	3.7	.19	.18	1272	565.6	52.7	50.8	24.2
37.5	4.09	-0.22	3.9	.17	.17	1282	563.4	54.1	51.9	23.6
40.0	4.39	-0.23	4.2	.13	.14	1298	561.2	54.7	53.0	24.0
42.5	4.82	-0.24	4.6	.10	.11	1319	559.4	54.7	54.3	25.8
37245.0	5.45	-0.24	5.2	-15.04	-15.06	1353	558.0	54.4	56.1	29.2
46.0	5.74	-0.24	5.5	.02	.04	1369	557.6	54.3	57.0	30.8
47.0	6.05	-0.25	5.8	.00	.02	1386	557.4	54.2	58.0	32.7
48.0	6.05	-0.25	5.8	.00	.02	1384	557.2	54.1	59.1	34.7
49.0	6.05	-0.25	5.8	.00	.03	1383	557.1	54.0	60.4	36.8
50.0	8.16	-0.26	7.9	-14.87	-14.89	1497	557.1	54.1	61.7	39.0
51.0	8.56	-0.26	8.3	.85	.87	1517	557.2	54.2	63.1	41.3
52.0	7.16	-0.26	6.9	.93	.95	1443	557.3	54.4	64.6	43.5
53.0	5.27	-0.27	5.0	-15.07	-15.09	1332	557.5	54.7	66.2	45.8
54.0	5.37	-0.27	5.1	.06	.08	1338	557.8	55.2	67.9	48.0
37255.0	4.38	-0.28	4.1	-15.16	-15.18	1273	558.0	55.8	69.6	50.2
57.5	3.42	-0.27	3.2	.27	.28	1208	558.7	58.0	73.9	55.3
60.0	3.17	-0.26	2.9	.31	.32	1185	559.3	61.0	78.0	59.6
62.5	2.03	-0.25	1.8	.51	.53	1081	559.6	64.7	81.6	62.9
65.0	2.14	-0.23	1.9	.49	.50	1093	559.5	68.4	84.5	64.9
67.5	2.34	-0.20	2.1	.44	.46	1115	559.1	71.8	86.2	65.6
70.0	2.91	-0.15	2.8	.31	.33	1180	558.4	74.3	86.8	64.9
72.5	3.58	-0.09	3.5	.21	.24	1236	557.7	75.9	86.2	63.0

Table 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 $\alpha 2$

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_r	log ρ_s	T_r (°K)	z (km)	$a_r - a_{\odot}$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37275.0	4.00	-0.03	4.0	-15.15	-15.18	1272	557.0	76.6	84.5	60.0
77.5	4.29	0.00	4.3	.12	.15	1294	556.8	76.6	81.9	56.3
80.0	4.08	0.00	4.1	.14	.17	1280	557.0	76.2	78.8	52.3
82.5	3.60	0.00	3.6	.20	.22	1245	557.9	75.6	75.5	48.4
85.0	3.17	-0.02	3.2	.25	.27	1216	559.3	75.1	72.6	45.1
87.5	2.77	-0.07	2.7	.33	.34	1176	561.0	75.1	70.3	42.9
90.0	2.27	-0.14	2.1	.44	.44	1122	563.0	75.7	69.0	42.1
92.5	1.90	-0.19	1.7	.54	.53	1080	564.9	77.2	68.9	42.7
95.0	1.99	-0.24	1.8	.52	.50	1092	566.4	79.7	70.0	44.6
97.5	2.29	-0.26	2.0	.48	.46	1115	567.3	83.0	72.2	47.3
37300.0	2.87	-0.27	2.6	.36	.35	1174	567.5	86.7	75.1	50.4
02.5	3.04	-0.28	2.8	.33	.32	1189	566.9	90.3	78.5	53.7
05.0	2.67	-0.28	2.4	.40	.39	1150	565.6	93.3	82.1	56.8
07.5	2.13	-0.29	1.8	.53	.52	1084	563.8	95.5	85.5	59.5
10.0	1.75	-0.29	1.5	.60	.61	1045	561.8	96.6	88.7	61.9
12.5	1.52	-0.28	1.2	.70	.72	1002	559.7	97.0	91.4	64.0
15.0	1.32	-0.28	1.0	.78	.80	970	558.0	96.8	93.8	65.9
17.5	1.02	-0.28	0.7	.94	.97	919	556.8	96.4	95.8	67.8
20.0	0.95	-0.28	0.7	.94	.97	918	556.1	95.9	97.7	69.9
22.5	0.83	-0.27	0.6	-16.01	-16.04	898	556.0	95.7	99.5	72.3
25.0	1.08	-0.27	0.8	-15.89	-15.92	933	556.4	96.1	101.5	75.0
27.5	1.19	-0.26	0.9	.84	.87	949	557.0	97.3	103.7	78.0
30.0	1.31	-0.26	1.0	.79	.82	965	557.8	99.4	106.3	81.3
32.5	1.28	-0.24	1.0	.79	.82	966	558.4	102.5	109.1	84.5
35.0	1.33	-0.16	1.2	.71	.73	996	558.7	106.2	112.0	87.5
37.5	1.23	-0.12	1.1	.74	.77	984	558.6	110.1	114.9	90.1
40.0	1.08	-0.13	1.0	.78	.81	970	558.2	113.7	117.6	92.1
42.5	1.06	-0.19	0.9	.82	.85	955	557.4	116.6	119.6	93.2
45.0	1.14	-0.21	0.9	.82	.85	955	556.7	118.5	121.0	93.5
47.5	1.23	-0.21	1.0	.77	.80	971	556.0	119.6	121.5	93.0
50.0	1.21	-0.20	1.0	.77	.80	971	555.7	119.9	121.1	92.0
52.5	1.17	-0.18	1.0	.77	.80	971	555.9	119.9	120.1	90.6
55.0	1.06	-0.17	0.9	.81	.85	956	556.7	119.7	118.7	89.3
57.5	1.01	-0.14	0.9	.82	.84	957	558.0	119.6	117.3	88.3
60.0	0.97	-0.11	0.9	.82	.84	959	559.8	119.9	116.2	88.0
62.5	0.90	-0.07	0.8	.88	.89	944	561.7	120.9	115.8	88.5
65.0	0.87	-0.09	0.8	.88	.88	945	563.6	122.8	116.2	90.1
67.5	0.77	-0.15	0.6	-16.01	-16.00	909	565.2	125.7	117.7	92.7
70.0	0.67	-0.18	0.5	.09	.08	890	566.1	129.4	120.2	96.0
72.5	0.63	-0.20	0.4	.19	.17	867	566.4	133.6	123.6	100.0
75.0	0.54	-0.20	0.3	.31	.29	839	565.8	137.7	127.9	104.1
77.5	0.54	-0.19	0.3	.30	.29	839	564.5	141.2	132.6	108.2
80.0	0.74	-0.18	0.6	-15.99	-15.99	912	562.7	143.9	137.3	111.7
82.5	0.72	-0.15	0.6	.98	-16.00	911	560.7	145.6	141.6	114.5
85.0	0.80	-0.14	0.7	.91	-15.93	929	558.6	146.4	144.9	116.2
87.5	0.83	-0.13	0.7	.90	.94	928	556.8	146.7	146.6	116.9

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 Eta

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_v	log ρ_s	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36834.0	3.92	0.02	3.9	-14.94	-14.97	1227	511.5	198.4	157.7	162.7
36.0	4.10	0.03	4.1	.92	.95	1242	511.5	198.4	160.4	166.5
38.0	3.63	0.04	3.7	.96	.99	1214	511.8	198.3	161.7	168.2
40.0	3.49	0.06	3.6	.98	-15.00	1209	512.4	198.1	161.2	167.0
42.0	3.58	0.06	3.6	.98	-14.99	1212	513.5	198.0	158.8	163.5
44.0	3.32	0.07	3.4	-15.00	-15.01	1201	514.8	198.1	155.1	159.1
46.0	3.12	0.08	3.2	.03	.03	1189	516.3	198.6	150.8	154.5
48.0	2.49	0.08	2.6	.12	.11	1140	517.8	199.5	146.2	150.2
50.0	1.69	0.09	1.8	.28	.26	1059	519.3	201.0	141.6	146.3
52.0	1.32	0.10	1.4	.39	.37	1012	520.6	203.2	137.3	143.0
54.0	1.67	0.10	1.8	.29	.25	1065	521.5	205.9	133.5	140.4
56.0	2.07	0.10	2.2	.20	.16	1111	522.0	209.0	130.3	138.7
58.0	2.49	0.10	2.6	.13	.09	1152	522.0	212.3	127.8	137.8
60.0	2.64	0.10	2.7	.11	.08	1160	521.6	215.4	126.1	137.7
62.0	2.31	0.09	2.4	.16	.13	1128	520.7	218.2	125.2	138.6
64.0	2.33	0.08	2.4	.16	.14	1124	519.4	220.4	125.1	140.2
66.0	2.08	0.08	2.2	.20	.18	1099	517.9	222.0	125.7	142.6
68.0	1.86	0.08	1.9	.26	.26	1063	516.3	223.0	126.9	145.6
70.0	1.89	0.08	2.0	.23	.24	1070	514.8	223.5	128.7	149.1
72.0	1.84	0.08	1.9	.25	.27	1056	513.4	223.5	130.8	152.9
74.0	2.08	0.08	2.2	.19	.21	1084	512.2	223.3	133.1	156.9
76.0	2.11	0.08	2.2	.19	.22	1082	511.5	222.9	135.3	160.9
78.0	1.78	0.08	1.9	.25	.28	1049	511.1	222.6	137.2	164.4
80.0	1.83	0.09	1.9	.25	.28	1049	511.0	222.4	138.6	167.0
82.0	1.85	0.10	2.0	.23	.26	1060	511.3	222.4	139.4	168.1
84.0	1.78	0.10	1.9	.26	.28	1051	511.9	222.9	139.4	167.3
86.0	1.79	0.11	1.9	.26	.28	1052	512.5	224.0	138.7	165.2
88.0	1.77	0.12	1.9	.26	.28	1053	513.2	225.6	137.3	162.6
90.0	1.69	0.13	1.8	.28	.30	1044	513.8	227.7	135.5	160.0
92.0	1.58	0.14	1.7	.31	.32	1033	514.2	230.4	133.3	157.5
94.0	1.86	0.14	2.0	.24	.25	1066	514.4	233.3	131.0	155.3
96.0	2.10	0.15	2.2	.20	.21	1087	514.3	236.3	128.8	153.5
98.0	2.12	0.15	2.3	.18	.19	1096	514.0	239.0	126.6	152.0
36900.0	2.11	0.15	2.3	.18	.19	1094	513.5	241.2	124.6	150.8
02.0	2.42	0.16	2.6	.12	.14	1121	512.9	242.8	122.8	149.7
04.0	2.27	0.16	2.4	.16	.18	1100	512.2	243.8	121.2	148.7
06.0	1.81	0.16	2.0	.24	.26	1059	511.7	244.2	119.7	147.5
08.0	1.95	0.17	2.1	.22	.25	1068	511.4	244.2	118.3	145.9
10.0	1.96	0.18	2.1	.22	.25	1068	511.4	243.9	116.8	143.9
12.0	1.84	0.18	2.0	.24	.27	1057	511.7	243.3	115.2	141.5
14.0	1.98	0.18	2.2	.20	.22	1079	512.4	242.7	113.4	138.5
16.0	1.75	0.19	1.9	.27	.28	1049	513.4	242.2	111.3	135.1
18.0	1.61	0.19	1.8	.30	.30	1040	514.8	242.0	108.9	131.4
20.0	1.55	0.19	1.7	.32	.32	1031	516.3	242.0	106.3	127.6
22.0	1.41	0.20	1.6	.36	.34	1022	517.8	242.6	103.4	123.7
24.0	1.20	0.20	1.4	.42	.40	999	519.3	243.8	100.5	120.0
26.0	1.63	0.20	1.8	.31	.28	1050	520.5	245.6	97.5	116.7
28.0	2.24	0.20	2.4	.19	.16	1115	521.4	247.9	94.7	113.8
30.0	2.56	0.19	2.8	.12	.09	1154	521.9	250.7	92.1	111.5
32.0	2.78	0.18	3.0	.09	.06	1172	521.8	253.6	90.0	109.9
34.0	2.81	0.17	3.0	.09	.06	1171	521.4	256.4	88.5	109.1
36.0	2.71	0.15	2.9	.10	.08	1160	520.4	258.8	87.6	109.2
38.0	2.76	0.13	2.9	.10	.08	1158	519.2	260.7	87.4	110.0
40.0	2.84	0.10	2.9	.09	.08	1155	517.6	262.0	88.0	111.6
42.0	2.70	0.07	2.8	.11	.10	1143	516.2	262.7	89.2	113.9
44.0	2.45	0.04	2.5	.15	.16	1112	514.6	262.8	91.0	116.6
46.0	2.66	0.04	2.7	.11	.13	1128	513.3	262.6	93.2	119.7
48.0	2.29	0.05	2.3	.18	.21	1088	512.2	262.2	95.7	122.9
50.0	2.44	0.07	2.5	.14	.17	1105	511.5	261.7	98.2	125.9
52.0	2.48	0.09	2.6	.13	.16	1114	511.2	261.2	100.5	128.5

Table 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 Eta

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_T$	$\log \rho_S$	T_∞ (°K)	z (km)	$\alpha_\pi-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
36954.0	2.50	0.11	2.6	-15.13	-15.16	1113	511.2	260.9	102.5	130.6
56.0	2.70	0.12	2.8	.10	.13	1132	511.6	260.9	103.9	131.8
58.0	2.95	0.14	3.1	.06	.08	1158	512.1	261.3	104.6	132.0
60.0	3.00	0.16	3.2	.04	.06	1167	512.9	262.3	104.6	131.4
62.0	2.93	0.17	3.1	.06	.08	1159	513.6	263.9	103.8	129.8
64.0	3.12	0.18	3.3	.04	.05	1175	514.3	266.2	102.2	127.7
66.0	3.86	0.19	4.0	-14.96	-14.97	1228	514.7	268.9	100.1	125.1
68.0	4.47	0.19	4.7	.90	.90	1275	515.0	271.9	97.5	122.3
70.0	4.48	0.20	4.7	.90	.91	1272	515.0	274.9	94.6	119.4
72.0	3.37	0.20	3.6	-15.02	-15.03	1191	514.7	277.7	91.6	116.8
74.0	2.37	0.20	2.6	.16	.17	1106	514.2	280.0	88.6	114.3
76.0	1.76	0.20	2.0	.28	.29	1046	513.7	281.8	85.8	112.2
78.0	1.96	0.20	2.2	.23	.25	1065	513.1	282.9	83.2	110.5
80.0	1.61	0.20	1.8	.32	.34	1023	512.6	283.5	81.1	109.2
82.0	1.49	0.20	1.7	.35	.37	1011	512.4	283.7	79.4	108.1
84.0	1.45	0.20	1.6	.37	.39	1000	512.4	283.6	78.1	107.3
86.0	1.48	0.20	1.7	.35	.37	1012	512.8	283.3	77.2	106.6
88.0	1.80	0.19	2.0	.28	.29	1046	513.6	283.0	76.5	106.0
90.0	2.14	0.19	2.3	.22	.23	1077	514.7	282.8	76.0	105.2
92.0	2.40	0.18	2.6	.17	.17	1108	516.0	282.9	75.5	104.2
94.0	2.43	0.18	2.6	.17	.16	1110	517.6	283.4	74.9	103.0
96.0	1.94	0.18	2.1	.27	.25	1065	519.1	284.3	74.2	101.5
98.0	1.96	0.18	2.1	.27	.25	1067	520.6	285.9	73.1	99.6
37000.0	2.03	0.18	2.2	.26	.22	1078	521.8	288.1	71.7	97.6
02.0	2.27	0.18	2.4	.22	.19	1098	522.7	290.8	70.0	95.3
04.0	2.29	0.18	2.5	.21	.17	1107	523.1	294.0	68.0	93.0
06.0	2.38	0.18	2.6	.19	.15	1115	523.1	297.3	65.7	90.6
08.0	2.33	0.18	2.5	.21	.18	1104	522.5	300.4	63.3	88.5
10.0	2.47	0.18	2.6	.19	.16	1111	521.6	303.2	60.9	86.5
12.0	2.48	0.18	2.7	.18	.15	1116	520.3	305.4	58.6	84.9
14.0	2.55	0.17	2.7	.17	.16	1113	518.8	307.0	56.5	83.6
16.0	2.98	0.17	3.2	.10	.09	1152	517.2	308.0	54.7	82.7
18.0	3.02	0.17	3.2	.09	.10	1148	515.7	308.6	53.4	82.1
37020.0	3.52	0.16	3.7	-15.03	-15.04	1184	514.3	308.7	52.4	81.8
20.5	3.43	0.16	3.6	.04	.05	1176	514.0	308.7	52.2	81.8
21.0	3.10	0.16	3.3	.08	.09	1152	513.7	308.7	52.1	81.7
21.5	3.10	0.16	3.3	.08	.09	1152	513.5	308.6	52.0	81.7
22.0	4.00	0.16	4.2	-14.97	-14.99	1216	513.3	308.6	51.9	81.7
22.5	4.33	0.16	4.5	.94	.96	1236	513.0	308.5	51.8	81.6
23.0	4.41	0.15	4.6	.93	.95	1242	512.9	308.5	51.7	81.6
23.5	4.74	0.15	4.9	.90	.92	1261	512.7	308.4	51.6	81.6
24.0	6.04	0.15	6.2	.80	.82	1338	512.6	308.4	51.6	81.5
24.5	8.33	0.15	8.5	.66	.68	1462	512.4	308.3	51.6	81.5
25.0	7.68	0.15	7.8	.70	.72	1425	512.4	308.3	51.6	81.4
25.5	6.70	0.15	6.8	.76	.78	1371	512.3	308.2	51.6	81.4
26.0	5.72	0.14	5.9	.82	.84	1320	512.3	308.2	51.5	81.3
26.5	4.74	0.14	4.9	.90	.92	1259	512.2	308.2	51.5	81.2
27.0	3.43	0.14	3.6	-15.04	-15.06	1171	512.2	308.2	51.5	81.1
27.5	2.45	0.14	2.6	.18	.20	1092	512.3	308.2	51.5	81.0
37028.0	3.40	0.14	3.5	-15.05	-15.07	1161	512.3	308.2	51.5	80.8
30.0	3.28	0.14	3.4	.07	.09	1154	512.7	308.5	51.4	80.0
32.0	3.52	0.13	3.6	.05	.06	1169	513.3	309.3	50.9	78.8
34.0	3.70	0.14	3.8	.03	.04	1184	514.1	310.6	50.2	77.1
36.0	3.86	0.14	4.0	.00	.01	1203	515.2	312.5	48.9	75.0
38.0	3.88	0.14	4.0	.00	.01	1204	515.8	314.9	47.2	72.4
40.0	4.02	0.14	4.2	-14.98	-14.98	1218	516.2	317.9	44.9	69.6
42.0	4.11	0.13	4.2	.98	.98	1218	516.4	321.1	42.2	66.6
44.0	4.28	0.13	4.4	.96	.96	1232	516.3	324.3	39.0	63.5

Table 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 Eta

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_r$	$\log \rho_s$	T_r (°K)	z (km)	$a_r - a_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37046.0	4.20	0.12	4.3	-14.97	-14.97	1225	515.9	327.2	35.7	60.6
48.0	4.34	0.11	4.4	.96	.96	1232	515.4	329.6	32.4	58.1
50.0	4.71	0.10	4.8	.92	.92	1258	514.7	331.4	29.3	56.1
52.0	4.55	0.09	4.6	.93	.94	1246	514.1	332.6	27.0	54.9
54.0	4.15	0.08	4.2	.97	.98	1220	513.6	333.2	25.8	54.6
56.0	3.76	0.07	3.8	-15.01	-15.02	1193	513.3	333.4	26.1	55.0
58.0	2.88	0.06	3.0	.11	.12	1133	513.3	333.3	27.8	56.3
60.0	2.55	0.04	2.6	.17	.18	1101	513.7	333.0	30.8	58.2
62.0	3.09	0.03	3.1	.09	.10	1146	514.5	332.7	34.4	60.5
64.0	3.43	0.02	3.4	.05	.05	1174	515.6	332.5	38.4	63.0
66.0	4.15	0.00	4.2	-14.96	-14.95	1238	517.0	332.5	42.5	65.4
68.0	3.67	0.00	3.7	-15.02	-15.00	1206	518.5	332.9	46.4	67.7
70.0	2.91	0.00	2.9	.12	.10	1145	520.1	333.9	49.8	69.5
72.0	2.36	0.00	2.4	.21	.18	1102	521.5	335.4	52.6	70.7
74.0	2.20	0.00	2.2	.25	.21	1084	522.8	337.5	54.7	71.2
76.0	2.22	0.00	2.2	.25	.21	1085	523.6	340.1	56.0	71.0
78.0	2.31	0.00	2.3	.23	.19	1095	524.1	343.1	56.4	70.1
80.0	2.19	0.00	2.2	.26	.22	1083	524.1	346.2	55.8	68.5
82.0	2.33	0.00	2.3	.24	.20	1091	523.6	349.2	54.4	66.2
84.0	2.75	0.00	2.8	.15	.12	1134	522.6	351.7	52.2	63.4
86.0	2.94	0.01	3.0	.12	.10	1147	521.4	353.6	49.1	60.1
88.0	3.19	0.03	3.2	.10	.08	1160	519.9	355.0	45.5	56.6
90.0	3.28	0.05	3.3	.08	.07	1164	518.4	355.7	41.3	53.0
92.0	3.93	0.07	4.0	-14.99	-14.99	1213	516.9	355.9	36.7	49.4
94.0	4.07	0.07	4.1	.98	.98	1218	515.6	355.8	31.8	46.0
96.0	4.13	0.07	4.2	.97	.98	1223	514.6	355.4	26.8	42.8
98.0	3.99	0.06	4.0	.99	-15.00	1209	514.0	354.9	21.7	40.0
37100.0	3.92	0.05	4.0	.99	.00	1209	513.7	354.5	16.8	37.6
02.0	3.80	0.04	3.8	-15.01	.02	1195	513.8	354.3	12.2	35.6
04.0	3.29	0.03	3.3	.07	.08	1159	514.2	354.4	8.0	33.8
06.0	2.56	0.02	2.6	.17	.18	1102	514.9	354.9	4.9	32.3
08.0	2.48	0.01	2.5	.19	.19	1095	515.6	356.0	4.3	30.9
10.0	3.07	0.00	3.1	.10	.10	1148	516.3	357.8	6.0	29.4
12.0	3.84	-0.01	3.8	.01	.01	1204	516.9	0.1	8.2	27.7
14.0	4.39	-0.02	4.4	-14.95	-14.94	1248	517.3	2.8	10.0	25.8
16.0	5.00	-0.02	5.0	.89	.88	1288	517.4	5.8	11.4	23.5
18.0	5.27	-0.03	5.2	.87	.87	1301	517.3	8.8	12.4	21.0
20.0	5.29	-0.03	5.3	.86	.86	1306	516.8	11.5	13.0	18.4
22.0	4.72	-0.04	4.7	.91	.91	1266	516.1	13.6	13.5	15.8
24.0	4.64	-0.05	4.6	.92	.93	1258	515.3	15.2	14.1	13.8
26.0	4.10	-0.06	4.0	.98	.99	1215	514.6	16.2	15.2	12.9
28.0	4.60	-0.07	4.5	.93	.94	1249	514.0	16.7	16.8	13.9
30.0	4.47	-0.08	4.4	.94	.95	1242	513.6	16.7	19.2	16.5
32.0	4.78	-0.09	4.7	.91	.92	1262	513.6	16.5	22.2	20.2
34.0	5.30	-0.10	5.2	.86	.87	1296	513.9	16.1	25.8	24.5
36.0	4.74	-0.10	4.6	.92	.92	1259	514.7	15.7	29.7	29.0
38.0	4.26	-0.10	4.2	.96	.96	1235	515.7	15.5	33.8	33.5
40.0	4.12	-0.10	4.0	.98	.97	1224	517.1	15.5	38.0	37.7
42.0	3.56	-0.10	3.5	-15.04	-15.03	1191	518.6	16.0	42.1	41.5
44.0	3.21	-0.10	3.1	.09	.07	1162	520.1	16.9	45.0	44.7
46.0	3.12	-0.09	3.0	.11	.08	1157	521.5	18.5	49.4	47.3
48.0	2.66	-0.07	2.6	.17	.14	1125	522.7	20.8	52.3	49.2
50.0	2.31	-0.05	2.3	.22	.19	1098	523.5	23.5	54.6	50.1
52.0	2.15	-0.01	2.1	.26	.23	1078	523.8	26.7	56.2	50.2
54.0	2.77	0.00	2.8	.14	.10	1145	523.7	29.9	57.0	49.3
56.0	3.50	0.00	3.5	.04	.01	1202	523.1	32.9	57.0	47.5
58.0	4.23	0.00	4.2	-14.96	-14.93	1253	522.1	35.5	56.2	44.8
60.0	6.02	0.00	6.0	.81	.78	1368	520.7	37.6	54.7	41.4
62.0	7.96	0.00	8.0	.68	.67	1480	519.2	39.0	52.7	37.3
64.0	8.99	-0.01	9.0	.63	.62	1528	517.5	39.9	50.2	32.6

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 Eta

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_τ	log ρ_s	T_τ (°K)	z (km)	$\alpha_\tau-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37166.0	8.01	-0.01	8.0	-14.68	-14.68	1467	516.0	40.3	47.5	27.6
68.0	7.56	-0.02	7.5	.71	.71	1434	514.7	40.3	44.7	22.3
70.0	6.28	-0.05	6.2	.79	.80	1356	513.6	40.2	42.3	17.2
72.0	4.72	-0.07	4.6	.92	.93	1254	512.9	40.0	40.4	12.6
74.0	4.54	-0.09	4.4	.94	.95	1239	512.6	39.8	39.3	9.8
76.0	4.09	-0.11	4.0	.98	.99	1211	512.6	39.9	39.3	10.5
78.0	4.09	-0.13	4.0	.98	.99	1211	512.9	40.3	40.3	13.9
80.0	4.79	-0.14	4.6	.92	.93	1252	513.4	41.2	42.2	18.3
82.0	5.26	-0.15	5.1	.88	.89	1286	514.0	42.6	44.9	22.8
84.0	5.43	-0.16	5.3	.86	.87	1299	514.6	44.7	48.1	27.1
86.0	6.45	-0.16	6.3	.79	.79	1361	515.0	47.4	51.5	31.0
88.0	8.00	-0.17	7.8	.70	.70	1446	515.2	50.4	54.8	34.2
90.0	8.78	-0.17	8.6	.65	.65	1492	516.0	53.7	57.9	36.8
92.0	9.34	-0.17	9.2	.62	.63	1523	515.7	56.9	60.7	38.7
94.0	9.94	-0.16	9.8	.60	.60	1552	515.2	59.7	63.0	39.9
96.0	9.67	-0.16	9.5	.61	.61	1535	514.5	62.1	64.8	40.4
98.0	9.57	-0.16	9.4	.61	.62	1527	513.8	63.8	66.0	40.3
37200.0	9.97	-0.16	9.8	.59	.61	1545	513.1	65.0	66.6	39.7
02.0	9.60	-0.15	9.4	.61	.63	1522	512.6	65.6	66.8	38.8
04.0	8.11	-0.14	8.0	.68	.70	1448	512.3	65.9	66.6	37.6
06.0	5.95	-0.14	5.8	.82	.84	1325	512.4	65.8	66.2	36.6
08.0	5.96	-0.15	5.8	.82	.84	1326	512.9	65.6	65.7	35.7
10.0	6.22	-0.16	6.1	.80	.81	1345	513.7	65.4	65.2	35.4
12.0	6.53	-0.17	6.4	.78	.79	1365	514.9	65.4	65.0	35.6
14.0	6.48	-0.17	6.3	.79	.79	1363	516.3	65.7	65.1	36.5
16.0	6.36	-0.18	6.2	.80	.79	1361	517.9	66.3	65.7	38.0
18.0	6.33	-0.18	6.2	.80	.79	1365	519.4	67.6	66.7	40.0
20.0	6.10	-0.19	5.9	.83	.81	1350	520.9	69.4	68.2	42.4
22.0	6.28	-0.20	6.1	.82	.79	1366	522.0	71.8	70.1	44.9
24.0	6.30	-0.20	6.1	.82	.78	1368	522.7	74.7	72.2	47.4
26.0	5.71	-0.21	5.5	.86	.83	1332	523.0	77.9	74.5	49.7
28.0	4.81	-0.21	4.6	.94	.91	1272	522.8	81.1	76.9	51.8
30.0	4.43	-0.22	4.2	.98	.95	1242	522.1	84.1	79.2	53.7
32.0	4.07	-0.22	3.8	-15.02	-15.00	1210	521.0	86.6	81.3	55.2
34.0	4.08	-0.22	3.9	.01	-14.99	1214	519.6	88.6	83.2	56.4
36.0	3.58	-0.22	3.4	.07	-15.06	1172	518.0	89.8	84.9	57.3
38.0	3.63	-0.22	3.4	.06	.06	1167	516.3	90.6	86.4	58.2
40.0	4.15	-0.22	3.9	.01	.01	1200	514.7	90.8	87.6	59.0
42.0	4.73	-0.22	4.5	-14.94	-14.96	1236	513.3	90.6	88.7	59.8
44.0	4.70	-0.22	4.5	.94	.96	1232	512.3	90.3	89.8	61.0
46.0	4.89	-0.22	4.7	.93	.95	1241	511.6	89.9	90.9	62.4
37248.0	5.28	-0.22	5.1	-14.89	-14.92	1264	511.2	89.6	92.2	64.3
37249.0	5.32	-0.22	5.1	-14.89	-14.92	1263	511.2	89.5	92.9	65.4
49.5	5.32	-0.22	5.1	.90	.92	1262	511.2	89.5	93.2	66.0
50.0	5.62	-0.22	5.4	.87	.90	1280	511.2	89.5	93.6	66.6
50.5	7.22	-0.22	7.0	.76	.78	1370	511.3	89.5	94.1	67.2
51.0	9.22	-0.22	9.0	.65	.67	1472	511.4	89.5	94.5	67.8
51.5	9.52	-0.22	9.3	.64	.66	1486	511.4	89.6	95.0	68.5
52.0	6.62	-0.22	6.4	.80	.82	1337	511.5	89.7	95.4	69.2
52.5	4.62	-0.22	4.4	.96	.98	1217	511.7	89.8	95.9	69.9
53.0	4.92	-0.22	4.7	.93	.96	1237	511.8	90.0	96.4	70.7
53.5	4.22	-0.22	4.0	-15.00	-15.03	1191	511.9	90.2	97.0	71.4
54.0	5.52	-0.22	5.3	-14.88	-14.90	1274	512.0	90.4	97.5	72.2
54.5	6.22	-0.22	6.0	.83	.85	1315	512.2	90.7	98.1	73.0
55.0	5.22	-0.22	5.0	.91	.93	1256	512.3	91.0	98.7	73.8
55.5	5.22	-0.22	5.0	.91	.93	1257	512.5	91.3	99.3	74.6
56.0	4.22	-0.22	4.0	-15.01	-15.02	1192	512.6	91.7	99.9	75.4
56.5	3.62	-0.22	3.4	.08	.09	1150	512.8	92.1	100.6	76.2

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 Eta

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_v	log ρ_s	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37257.0	3.22	-0.22	3.0	-15.13	-15.15	1120	512.9	92.5	101.2	77.0
57.5	3.22	-0.22	3.0	.13	.15	1120	513.0	93.0	101.9	77.8
37258.0	3.56	-0.23	3.3	-15.09	-15.10	1144	513.2	93.5	102.6	78.6
60.0	2.84	-0.22	2.6	.19	.20	1090	513.6	96.0	105.3	81.8
62.0	2.00	-0.19	1.8	.35	.36	1016	513.8	98.8	108.1	84.7
64.0	1.39	-0.14	1.2	.52	.53	948	513.8	101.7	110.8	87.2
66.0	1.74	-0.07	1.7	.36	.38	1008	513.5	104.6	113.1	89.1
68.0	2.17	-0.04	2.1	.26	.28	1051	513.0	107.0	114.9	90.3
70.0	2.57	-0.06	2.5	.18	.20	1089	512.4	109.0	116.1	90.8
72.0	2.79	-0.11	2.7	.15	.17	1106	511.7	110.2	116.4	90.5
74.0	2.68	-0.12	2.6	.16	.19	1097	511.1	111.0	116.0	89.4
76.0	2.72	-0.09	2.6	.16	.19	1097	510.7	111.1	114.8	87.7
78.0	2.55	-0.04	2.5	.18	.21	1088	510.6	110.9	112.9	85.5
80.0	2.61	-0.05	2.6	.16	.19	1097	510.8	110.5	110.5	83.0
82.0	2.94	-0.08	2.9	.11	.14	1124	511.3	109.9	107.8	80.3
84.0	2.88	-0.08	2.8	.13	.15	1116	512.3	109.3	105.0	77.7
86.0	2.34	-0.08	2.3	.22	.23	1073	513.5	109.0	102.2	75.4
88.0	1.87	-0.08	1.8	.33	.34	1025	515.0	108.9	99.8	73.6
90.0	1.66	-0.08	1.6	.39	.38	1004	516.7	109.3	98.0	72.4
92.0	1.47	-0.10	1.4	.45	.44	983	518.4	110.2	96.7	71.9
94.0	1.65	-0.12	1.5	.42	.40	996	519.8	111.7	96.2	72.1
96.0	1.82	-0.14	1.7	.37	.35	1020	521.0	113.8	96.4	73.2
98.0	1.86	-0.16	1.7	.38	.35	1020	521.7	116.4	97.5	74.9
37300.0	1.93	-0.18	1.8	.35	.32	1032	521.9	119.4	99.3	77.1
02.0	2.04	-0.18	1.9	.33	.30	1042	521.7	122.3	101.7	79.6
04.0	2.18	-0.17	2.0	.31	.28	1051	521.0	124.9	104.6	82.4
06.0	2.48	-0.15	2.3	.25	.22	1079	520.0	127.0	107.8	85.2
08.0	1.90	-0.13	1.8	.35	.34	1026	518.6	128.6	111.2	88.0
10.0	1.20	-0.10	1.1	.56	.55	940	517.1	129.5	114.6	90.5
12.0	0.97	-0.10	0.9	.64	.65	910	515.5	129.9	117.9	92.8
14.0	1.42	-0.13	1.3	.48	.49	962	514.1	129.9	120.9	94.9
16.0	1.28	-0.16	1.1	.55	.57	935	512.9	129.6	123.5	96.6
18.0	1.34	-0.16	1.2	.51	.53	947	512.0	129.1	125.8	98.2
20.0	1.44	-0.14	1.3	.47	.50	959	511.5	128.6	127.6	99.5
22.0	1.37	-0.14	1.2	.51	.54	946	511.4	128.2	129.1	100.8
24.0	1.21	-0.13	1.1	.55	.57	934	511.6	128.1	130.3	102.2
26.0	1.39	-0.13	1.3	.47	.50	960	512.1	128.4	131.4	103.6
28.0	1.06	-0.12	0.9	.63	.65	909	512.7	129.2	132.4	105.3
30.0	1.20	-0.12	1.1	.54	.56	938	513.4	130.6	133.6	107.1
32.0	1.32	-0.12	1.2	.51	.52	953	514.0	132.6	134.9	109.1
34.0	1.38	-0.12	1.3	.47	.48	967	514.4	135.2	136.5	111.3
36.0	1.42	-0.12	1.3	.47	.47	969	514.7	138.1	138.4	113.5
38.0	1.37	-0.12	1.2	.50	.50	957	514.6	141.2	140.6	115.8
40.0	0.82	-0.12	0.7	.73	.74	885	514.4	144.2	143.0	118.0
42.0	0.85	-0.11	0.7	.72	.74	886	513.9	146.7	145.4	119.8
44.0	1.12	-0.10	1.0	.56	.58	931	513.2	148.7	147.7	121.4
46.0	1.29	-0.09	1.2	.48	.50	959	512.6	150.1	149.8	122.4
48.0	1.29	-0.08	1.2	.48	.50	958	512.0	151.0	151.2	122.8
50.0	1.09	-0.07	1.0	.55	.58	931	511.6	151.3	151.9	122.8
52.0	0.78	-0.07	0.7	.71	.74	886	511.4	151.3	151.7	122.2
54.0	0.44	-0.06	0.4	.95	.98	828	511.6	151.1	150.6	121.2
56.0	0.27	-0.06	0.2	-16.25	-16.27	737	512.2	150.8	149.0	120.0
58.0	0.33	-0.05	0.3	.08	.09	798	513.2	150.6	146.9	118.8
60.0	0.48	-0.05	0.4	-15.95	-15.96	831	514.5	150.6	144.6	117.7
62.0	0.52	-0.04	0.5	.86	.86	855	516.0	150.9	142.5	116.9
64.0	0.58	-0.04	0.5	.86	.85	856	517.6	151.7	140.8	116.6
66.0	0.70	-0.04	0.7	.72	.70	895	519.1	153.1	139.5	116.8
68.0	0.74	-0.05	0.7	.72	.69	897	520.5	155.1	138.9	117.7
70.0	0.75	-0.05	0.7	.72	.69	899	521.6	157.8	139.0	119.2

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1959 Eta

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_T	log ρ_S	T_T (°K)	z (km)	$\alpha_T-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37372.0	0.78	-0.06	0.7	-15.72	-15.68	900	522.2	160.8	140.0	121.5
74.0	0.71	-0.06	0.6	.79	.75	883	522.4	164.1	141.7	124.3
76.0	0.77	-0.06	0.7	.72	.68	901	522.1	167.4	144.2	127.5
78.0	0.83	-0.06	0.8	.65	.62	918	521.3	170.3	147.5	131.2
80.0	0.85	-0.05	0.8	.65	.62	917	520.2	172.7	151.5	134.9
82.0	0.93	-0.04	0.9	.59	.58	932	518.8	174.6	156.1	138.6
84.0	1.03	-0.04	0.9	.59	.58	930	517.3	175.7	161.2	141.9
86.0	1.07	-0.03	1.0	.54	.54	944	515.7	176.4	166.7	144.5
88.0	1.11	-0.02	1.1	.50	.51	956	514.3	176.6	172.2	146.2
90.0	1.08	-0.01	1.1	.50	.51	954	513.2	176.6	176.5	146.7
92.0	1.01	0.00	1.0	.54	.56	938	512.4	176.4	173.8	146.1
94.0	0.92	0.00	0.9	.58	.61	923	511.9	176.2	168.1	144.4
96.0	0.81	0.02	0.8	.63	.66	907	511.9	176.1	162.3	142.1
98.0	0.71	0.02	0.7	.69	.72	891	512.1	176.3	156.7	139.5
37400.0	0.60	0.03	0.6	.76	.78	874	512.6	177.0	151.4	136.8
02.0	0.71	0.03	0.7	.70	.71	892	513.3	178.1	146.6	134.4
04.0	0.72	0.04	0.8	.64	.65	909	513.9	179.8	142.4	132.4
06.0	0.58	0.04	0.6	.77	.77	875	514.5	182.2	138.9	131.0
08.0	0.66	0.04	0.7	.70	.71	893	515.0	185.0	136.2	130.3
10.0	0.63	0.03	0.7	.70	.71	894	515.1	188.2	134.3	130.4
12.0	0.50	0.02	0.5	.85	.85	856	515.1	191.4	133.3	131.2
14.0	0.37	0.02	0.4	.94	.95	834	514.7	194.4	133.2	132.9
16.0	0.27	0.01	0.3	-16.07	-16.08	803	514.2	196.9	134.0	135.2
18.0	0.17	0.00	0.2	.24	.26	745	513.5	198.9	135.6	138.2
20.0	0.21	0.00	0.2	.24	.26	744	512.9	200.2	137.9	141.7
22.0	0.24	0.00	0.2	.24	.26	743	512.3	201.0	140.8	145.6
24.0	0.32	0.01	0.3	.06	.08	801	511.9	201.3	144.2	149.8
26.0	0.41	0.02	0.4	-15.93	-15.96	832	511.8	201.2	147.9	154.1
28.0	0.56	0.02	0.6	.75	.78	874	512.1	200.9	151.6	158.5
30.0	0.65	0.02	0.7	.69	.71	893	512.8	200.6	155.0	162.6
32.0	0.65	0.04	0.7	.69	.70	895	513.8	200.3	157.9	166.3
34.0	0.64	0.04	0.7	.69	.69	897	515.1	200.3	159.8	169.3
36.0	0.57	0.06	0.6	.76	.75	881	516.7	200.6	160.5	171.0
38.0	0.48	0.06	0.5	.84	.82	863	518.2	201.4	159.9	171.4

Table 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1960 ξ1

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_r	log ρ_s	T_r (°K)	z (km)	$\alpha_r-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37246.0	5.02	0.02	5.0	-14.64	-14.65	1042	424.7	191.8	150.8	148.6
47.0	5.21	0.02	5.2	.62	.63	1053	425.0	191.0	150.2	147.5
48.0	5.21	0.02	5.2	.62	.63	1054	425.3	190.2	149.7	146.6
37249.0	6.49	0.02	6.5	-14.53	-14.53	1117	425.5	189.7	149.2	145.8
49.5	6.62	0.02	6.6	.52	.52	1122	425.7	189.4	148.9	145.5
50.0	7.60	0.02	7.6	.46	.46	1167	425.8	189.2	148.7	145.2
50.5	9.80	0.02	9.8	.35	.35	1261	425.9	189.0	148.5	145.0
37251.00	11.82	0.02	11.8	-14.27	-14.27	1342	425.9	188.9	148.4	144.8
51.25	14.89	0.02	14.9	.17	.17	1465	426.0	188.8	148.3	144.7
51.50	21.62	0.02	21.6	.01	.01	1727	426.0	188.8	148.3	144.6
51.75	28.36	0.01	28.4	-13.89	-13.89	1999	426.0	188.7	148.2	144.6
52.00	21.01	0.01	21.0	-14.02	-14.02	1704	426.1	188.7	148.2	144.5
52.25	6.31	0.01	6.3	.54	.54	1109	426.1	188.6	148.1	144.4
52.50	3.86	0.01	3.9	.75	.75	989	426.1	188.6	148.1	144.4
52.75	2.02	0.01	2.0	-15.04	-15.04	874	426.2	188.5	148.1	144.4
53.00	2.02	0.01	2.0	.04	.04	874	426.2	188.5	148.1	144.4
53.25	3.25	0.01	3.3	-14.82	-14.82	954	426.2	188.5	148.0	144.3
53.50	1.41	0.01	1.4	-15.20	-15.19	831	426.2	188.4	148.1	144.3
53.75	8.76	0.01	8.8	-14.40	-14.40	1220	426.2	188.4	148.1	144.3
54.00	11.21	0.01	11.2	.29	.29	1319	426.2	188.4	148.1	144.4
54.25	16.72	0.01	16.7	.12	.12	1536	426.2	188.4	148.1	144.4
54.50	11.21	0.01	11.2	.29	.29	1319	426.2	188.4	148.2	144.4
54.75	6.92	0.01	6.9	.50	.50	1136	426.2	188.3	148.2	144.4
37255.0	5.08	0.01	5.1	-14.63	-14.63	1051	426.2	188.3	148.3	144.5
55.5	4.35	0.01	4.4	.70	.70	1014	426.2	188.3	148.4	144.6
56.0	4.04	0.01	4.0	.74	.74	993	426.2	188.2	148.6	144.7
56.5	3.55	0.00	3.6	.79	.78	971	426.2	188.2	148.8	144.9
57.0	3.06	0.00	3.1	.85	.85	942	426.1	188.1	149.1	145.1
57.5	3.55	0.00	3.6	.79	.79	970	426.1	188.0	149.4	145.3
58.0	4.04	0.00	4.0	.74	.74	992	426.0	188.0	149.7	145.6
58.5	4.04	0.00	4.0	.74	.74	992	425.9	187.8	150.1	145.8
59.0	4.78	0.00	4.8	.66	.66	1034	425.8	187.7	150.5	146.1
59.5	6.25	0.00	6.2	.55	.55	1101	425.7	187.5	151.0	146.4
60.0	6.00	0.00	6.0	.56	.57	1091	425.6	187.3	151.5	146.6
60.5	4.29	0.00	4.3	.71	.71	1006	425.5	187.1	152.0	146.9
61.0	3.31	0.00	3.3	.82	.83	951	425.4	186.8	152.6	147.2
61.5	3.55	0.00	3.6	.79	.79	968	425.2	186.6	153.2	147.5
37262.0	3.68	0.00	3.7	-14.77	-14.78	973	425.1	186.2	153.8	147.8
63.0	3.54	0.00	3.5	.80	.81	961	424.8	185.5	155.2	148.3
64.0	3.80	-0.01	3.8	.76	.77	977	424.4	184.6	156.7	148.8
65.0	3.31	-0.01	3.3	.82	.84	948	424.1	183.5	158.3	149.1
66.0	3.19	-0.01	3.2	.83	.85	942	423.7	182.3	160.0	149.3
67.0	3.25	-0.01	3.2	.83	.85	940	423.3	181.0	161.7	149.3
68.0	3.80	-0.01	3.8	.76	.78	972	422.8	179.5	163.5	149.0
69.0	5.15	-0.01	5.1	.63	.66	1037	422.4	177.9	165.2	148.5
70.0	6.19	-0.01	6.2	.54	.57	1087	422.0	176.1	166.7	147.8
71.0	5.02	-0.01	5.0	.64	.67	1030	421.6	174.3	167.9	146.7
37272.0	5.08	-0.01	5.1	-14.63	-14.66	1033	421.1	172.3	168.7	145.4
74.0	5.78	-0.01	5.8	.57	.61	1064	420.4	168.2	168.2	141.9
76.0	7.29	-0.01	7.3	.47	.51	1127	419.7	163.6	164.9	137.6
78.0	5.99	-0.01	6.0	.55	.60	1068	419.1	158.9	160.0	132.4
80.0	5.52	-0.01	5.5	.59	.64	1044	418.8	153.9	154.2	126.8
82.0	5.56	0.00	5.6	.58	.64	1048	418.6	148.7	147.9	120.7
84.0	5.61	0.00	5.6	.58	.64	1047	418.7	143.5	141.3	114.3
86.0	5.00	0.00	5.0	.64	.69	1019	418.9	138.2	134.6	107.7

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1960 ξ1

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_π	log ρ_s	T_π (°K)	z (km)	$\alpha_\pi-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37288.0	3.98	0.00	4.0	-14.74	-14.78	971	419.5	132.8	127.7	101.1
90.0	3.09	0.00	3.1	.85	.89	924	420.2	127.5	120.9	94.4
92.0	2.33	0.00	2.3	.99	-15.02	880	421.2	122.2	114.3	88.0
94.0	3.30	0.00	3.3	.84	-14.86	937	422.4	117.0	107.8	81.7
96.0	4.36	0.00	4.4	.72	.73	996	423.8	112.0	101.6	75.7
98.0	4.91	0.00	4.9	.68	.68	1022	425.3	107.1	95.7	70.1
37300.0	5.42	0.00	5.4	.64	.64	1048	426.9	102.6	90.2	65.1
02.0	6.34	0.00	6.3	.58	.57	1092	428.5	98.3	85.3	60.6
04.0	6.61	0.00	6.6	.57	.54	1109	430.1	94.4	81.0	56.9
06.0	6.49	-0.02	6.5	.58	.54	1107	431.7	91.0	77.3	54.0
08.0	6.48	-0.03	6.4	.59	.55	1105	433.1	88.1	74.4	51.9
10.0	5.08	-0.04	5.0	.70	.65	1041	434.4	85.7	72.2	50.5
12.0	4.16	-0.05	4.1	.79	.73	997	435.5	84.0	70.6	49.9
14.0	3.84	-0.05	3.8	.82	.76	982	436.4	82.8	69.8	49.7
16.0	3.49	-0.06	3.4	.87	.81	961	437.0	82.2	69.4	49.9
18.0	3.65	-0.06	3.6	.85	.78	974	437.3	81.9	69.4	50.2
20.0	3.73	-0.06	3.7	.83	.76	981	437.3	81.8	69.6	50.5
22.0	3.77	-0.06	3.7	.83	.76	981	437.0	81.6	69.9	50.6
24.0	4.22	-0.06	4.2	.77	.71	1009	436.5	81.1	70.0	50.2
26.0	4.66	-0.05	4.6	.73	.67	1029	435.6	80.1	70.0	49.5
28.0	5.03	-0.05	5.0	.69	.64	1048	434.5	78.7	69.5	48.2
30.0	5.09	-0.05	5.0	.68	.64	1046	433.2	76.6	68.6	46.3
32.0	5.62	-0.04	5.6	.63	.60	1072	431.8	74.0	67.2	43.9
34.0	7.58	-0.04	7.5	.50	.48	1154	430.2	70.8	65.2	40.9
36.0	7.39	-0.04	7.4	.51	.49	1144	428.5	67.3	62.7	37.3
38.0	6.42	-0.04	6.4	.57	.56	1095	426.9	63.3	59.6	33.3
40.0	6.02	-0.04	6.0	.59	.60	1072	425.1	59.0	56.2	28.9
42.0	5.39	-0.03	5.4	.64	.65	1040	423.6	54.5	52.3	24.1
44.0	5.81	-0.03	5.8	.60	.63	1055	422.1	49.8	48.2	19.3
46.0	6.43	-0.03	6.4	.56	.59	1077	420.8	44.9	43.9	14.6
48.0	6.82	-0.03	6.8	.53	.57	1091	419.7	39.9	39.6	10.8
50.0	6.60	-0.03	6.6	.54	.59	1080	418.8	34.9	35.6	9.6
52.0	6.45	-0.03	6.4	.56	.60	1069	418.2	29.8	32.0	11.8
54.0	6.49	-0.03	6.5	.55	.60	1072	417.8	24.8	29.1	16.2
56.0	6.66	-0.03	6.6	.54	.59	1075	417.6	19.8	27.3	21.5
58.0	6.64	-0.02	6.6	.54	.59	1075	417.7	15.0	26.8	26.9
60.0	6.51	-0.02	6.5	.55	.60	1072	418.0	10.2	27.7	32.3
62.0	6.03	-0.03	6.0	.59	.63	1052	418.4	5.7	29.6	37.5
64.0	5.51	-0.03	5.5	.62	.67	1032	419.1	1.5	32.3	42.5
66.0	5.17	-0.02	5.2	.65	.69	1020	419.8	357.5	35.4	47.0
68.0	4.88	-0.01	4.9	.68	.71	1008	420.6	353.9	38.6	51.1
70.0	4.32	-0.01	4.3	.73	.76	981	421.4	350.8	41.6	54.7
72.0	4.03	-0.01	4.0	.77	.79	968	422.2	348.1	44.5	57.6
74.0	3.95	0.00	4.0	.77	.79	969	423.0	346.0	46.8	59.9
76.0	4.15	0.00	4.2	.75	.77	979	423.6	344.5	48.7	61.6
78.0	4.44	0.00	4.4	.74	.75	989	424.2	343.5	50.0	62.6
80.0	4.58	0.00	4.6	.72	.73	998	424.6	343.0	50.6	63.0
82.0	5.06	0.00	5.1	.68	.69	1020	424.8	343.0	50.7	62.8
84.0	5.40	0.01	5.4	.66	.67	1031	424.9	343.0	50.0	62.2
86.0	5.97	0.02	6.0	.62	.62	1055	424.7	343.0	48.8	61.3
88.0	5.01	0.03	6.0	.62	.63	1053	424.4	342.8	47.1	60.2
90.0	6.04	0.04	6.1	.61	.63	1055	424.0	342.1	45.1	59.1
92.0	5.63	0.04	5.7	.64	.66	1036	423.4	340.9	42.8	58.2
94.0	4.39	0.03	4.4	.75	.77	976	422.7	339.1	40.5	57.6
96.0	4.06	0.04	4.1	.78	.81	961	421.9	336.7	38.5	57.7
98.0	3.87	0.04	3.9	.80	.83	950	421.1	333.8	37.0	58.4
37400.0	3.38	0.04	3.4	.85	.89	926	420.3	330.5	36.4	60.0
02.0	3.66	0.03	3.7	.81	.85	940	419.5	326.7	36.9	62.4
04.0	3.73	0.03	3.8	.80	.84	946	418.9	322.6	38.6	65.5
06.0	3.44	0.03	3.5	.83	.88	931	418.3	318.2	41.4	69.5
37408.0	3.27	0.03	3.3	-14.85	-14.90	922	417.9	313.6	45.3	74.0
10.0	3.08	0.03	3.1	.87	.92	913	417.8	308.8	50.0	79.0
12.0	3.36	0.02	3.4	.82	.88	930	417.8	303.9	55.3	84.5
14.0	3.52	0.00	3.5	.81	.86	937	418.1	299.0	61.0	90.2

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1961 δ1

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_v	log ρ_s	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37349.0	3.0	11.0	14.0	-16.53	-16.62	920	641.0	306.5	69.1	91.5
50.0	2.8	11.0	13.8	.54	.62	919	641.7	307.4	67.4	90.2
51.0	3.1	10.9	14.0	.53	.61	922	642.2	308.1	65.8	89.1
52.0	3.4	10.8	14.2	.52	.60	925	642.8	308.6	64.2	88.0
53.0	3.1	10.7	13.8	.53	.61	923	643.2	308.9	62.6	87.1
54.0	3.3	10.6	13.9	.53	.60	925	643.6	309.0	61.2	86.3
55.0	2.8	10.5	13.3	.54	.61	921	644.1	309.0	59.9	85.7
56.0	3.1	10.3	13.4	.54	.60	924	644.5	308.7	58.7	85.2
57.0	3.8	10.1	13.9	.52	.58	929	644.9	308.3	57.8	84.9
58.0	5.1	9.9	15.0	.48	.54	940	645.4	307.8	57.0	84.8
59.0	6.4	9.6	16.0	.45	.51	949	646.0	307.2	56.4	84.8
37360.0	4.9	9.4	14.3	-16.50	-16.56	937	646.6	306.5	56.1	85.0
60.5	3.5	9.3	12.8	.55	.60	924	647.0	306.1	56.0	85.1
61.0	3.2	9.2	12.4	.56	.61	921	647.3	305.7	56.0	85.3
61.5	3.1	9.0	12.1	.57	.62	919	647.7	305.3	56.0	85.4
62.0	2.9	8.9	11.8	.58	.63	916	648.1	304.9	56.1	85.7
62.5	2.4	8.9	11.2	.60	.65	911	648.6	304.5	56.2	85.9
63.0	3.0	8.7	11.7	.58	.63	917	649.0	304.0	56.4	86.1
63.5	3.9	8.6	12.5	.55	.60	925	649.5	303.6	56.6	86.4
64.0	6.4	8.5	14.9	.48	.52	947	650.1	303.2	56.8	86.7
64.5	7.3	8.4	15.7	.45	.49	954	650.6	302.8	57.1	86.9
65.0	9.0	8.3	17.3	.41	.45	968	651.2	302.4	57.4	87.2
65.5	5.5	8.3	13.8	.51	.55	939	651.8	301.9	57.8	87.5
66.0	2.6	8.2	10.8	.62	.65	911	652.4	301.5	58.1	87.8
66.5	2.4	8.1	10.5	.63	.66	908	653.0	301.2	58.5	88.1
67.0	2.5	8.0	10.5	.63	.66	909	653.7	300.8	58.9	88.4
67.5	2.8	7.9	10.7	.62	.65	912	654.4	300.4	59.3	88.6
68.0	3.1	7.8	10.9	.62	.64	914	655.1	300.1	59.7	88.9
68.5	7.8	7.8	15.6	.46	.48	959	655.8	299.8	60.2	89.1
69.0	9.7	7.8	17.5	.41	.43	974	656.5	299.5	60.6	89.4
69.5	2.8	7.8	10.6	.63	.64	913	657.3	299.3	61.0	89.6
70.0	2.3	7.8	10.1	.65	.66	908	658.0	299.1	61.4	89.7
70.5	1.8	7.8	9.6	.68	.68	903	658.8	298.9	61.8	89.9
37371.0	1.9	7.8	9.7	-16.67	-16.68	904	659.6	298.8	62.2	90.0
72.0	1.6	7.9	9.5	.69	.68	903	661.2	298.6	62.9	90.2
73.0	2.3	8.0	10.3	.65	.64	913	662.8	298.6	63.5	90.2
74.0	2.5	8.1	10.6	.64	.63	918	664.3	298.8	64.0	90.1
75.0	2.3	8.2	10.5	.65	.63	917	665.8	299.2	64.4	89.9
76.0	2.0	8.4	10.4	.66	.63	917	667.3	299.8	64.6	89.5
77.0	2.5	8.5	11.0	.64	.60	924	668.7	300.6	64.7	89.0
78.0	3.8	8.7	12.5	.59	.54	940	670.0	301.7	64.6	88.4
79.0	4.5	8.9	13.4	.56	.51	950	671.2	302.9	64.4	87.7
80.0	5.0	9.0	14.0	.54	.49	956	672.3	304.3	64.0	86.9
81.0	5.1	9.2	14.3	.53	.48	960	673.2	305.8	63.4	86.0
82.0	6.0	9.4	15.4	.50	.44	970	674.0	307.4	62.7	85.0
83.0	5.7	9.5	15.2	.51	.44	969	674.7	309.0	61.8	84.0
84.0	6.0	9.6	15.6	.50	.43	973	675.3	310.5	60.9	83.0
85.0	8.9	9.7	18.6	.42	.35	999	675.7	312.0	59.8	82.0
86.0	12.3	9.7	22.0	.34	.28	1024	676.0	313.3	58.7	81.1
87.0	12.1	9.7	21.8	.35	.28	1024	676.2	314.5	57.5	80.2
88.0	11.0	9.7	20.7	.37	.30	1017	676.3	315.4	56.3	79.3
89.0	10.6	9.6	20.2	.38	.31	1014	676.3	316.2	55.0	78.5
90.0	10.6	9.5	20.1	.37	.31	1014	676.2	316.7	53.9	77.9
91.0	10.3	9.4	19.7	.38	.31	1012	676.1	317.1	52.7	77.3
92.0	9.3	9.3	18.6	.40	.34	1004	675.9	317.2	51.7	76.9
93.0	7.2	9.2	16.4	.45	.39	987	675.8	317.1	50.7	76.6
94.0	5.2	9.0	14.2	.51	.53	980	675.6	316.9	49.9	76.4
95.0	4.2	8.8	13.0	.55	.57	968	675.4	316.6	49.2	76.4

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1961 δ1

MJD	$-10^7 P$	$10^7 \dot{P}_R$	$-10^7 \dot{P}_A$	$\log \rho_\pi$	$\log \rho_s$	T_π (°K)	z (km)	$\alpha_\pi - \alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37396.0	4.4	8.7	13.1	-16.54	-16.56	970	675.2	316.0	48.7	76.4
97.0	3.9	8.5	12.4	.57	.59	963	675.0	315.4	48.3	76.6
98.0	4.0	8.3	12.3	.57	.59	962	674.8	314.8	48.1	76.8
99.0	3.3	8.2	11.5	.60	.62	954	674.8	314.0	48.0	77.1
37400.0	3.1	8.0	11.1	.61	.63	950	674.8	313.2	48.1	77.5
01.0	2.4	7.9	10.3	.64	.66	941	674.9	312.3	48.3	77.9
02.0	0.7	7.7	8.4	.73	.75	917	675.2	311.5	48.6	78.2
03.0	2.8	7.6	10.4	.64	.66	943	675.5	310.7	49.0	78.6
04.0	7.9	7.5	15.4	.47	.48	995	676.0	309.9	49.4	78.9
05.0	6.0	7.5	13.5	.53	.54	977	676.6	309.2	49.9	79.2
06.0	2.5	7.5	10.0	.66	.67	939	677.2	308.5	50.4	79.3
07.0	3.1	7.5	10.6	.63	.64	947	678.0	307.9	50.8	79.4
08.0	2.1	7.5	9.6	.68	.68	935	678.9	307.5	51.2	79.3
09.0	2.1	7.5	9.6	.68	.68	936	679.8	307.2	51.5	79.1
10.0	3.1	7.5	10.6	.64	.64	948	680.8	307.0	51.6	78.8
11.0	3.6	7.6	11.2	.62	.61	956	681.9	307.1	51.7	78.3
12.0	4.1	7.6	11.7	.60	.59	962	683.0	307.3	51.6	77.7
13.0	3.8	7.7	11.5	.61	.59	961	684.0	307.7	51.4	76.9
14.0	5.6	7.7	13.3	.55	.53	981	685.1	308.3	51.0	76.0
15.0	5.6	7.8	13.4	.54	.52	983	686.1	309.2	50.5	75.0
16.0	6.6	7.8	14.4	.51	.49	994	687.1	310.2	49.8	73.8
17.0	5.9	7.9	13.8	.53	.50	990	688.0	311.4	48.9	72.6
18.0	5.5	7.9	13.4	.54	.51	987	688.9	312.8	47.9	71.3
19.0	5.4	7.9	13.3	.55	.51	987	689.6	314.2	46.8	69.9
20.0	4.4	7.8	12.2	.58	.54	977	690.3	315.7	45.6	68.6
21.0	4.2	7.8	12.0	.59	.54	976	690.9	317.2	44.2	67.2
22.0	4.2	7.7	11.9	.59	.54	976	691.4	318.6	42.8	65.9
23.0	3.0	7.6	10.6	.64	.59	962	691.8	320.0	41.4	64.7
24.0	2.9	7.4	10.3	.64	.60	960	692.1	321.2	39.9	63.6
25.0	4.8	7.2	12.0	.57	.53	982	692.4	322.2	38.5	62.7
26.0	5.7	7.0	12.7	.55	.50	991	692.5	323.0	37.2	61.9
27.0	2.8	6.7	9.5	.67	.62	953	692.6	323.7	36.0	61.3
28.0	0.9	6.4	7.3	.78	.73	922	692.7	324.1	35.1	61.0
29.0	0.1	6.1	6.2	.85	.80	904	692.7	324.3	34.4	60.9
30.0	1.8	5.8	7.6	.75	.71	929	692.6	324.3	33.9	61.0
31.0	2.9	5.5	8.4	.71	.74	953	692.5	324.2	33.8	61.4
32.0	4.1	5.2	9.3	.66	.69	967	692.4	323.8	34.2	62.1
33.0	4.1	4.8	8.9	.68	.71	962	692.4	323.3	34.8	63.0
34.0	4.5	4.4	8.9	.68	.71	962	692.5	322.7	35.9	64.2
35.0	4.3	4.1	8.4	.70	.73	956	692.7	322.0	37.2	65.6
36.0	3.2	3.7	6.9	.78	.81	932	692.9	321.2	38.9	67.1
37.0	4.1	3.2	7.3	.76	.79	939	693.2	320.4	40.8	68.8
38.0	5.9	2.7	8.6	.69	.71	960	693.7	319.5	42.9	70.7
39.0	7.4	2.0	9.4	.65	.67	972	694.2	318.6	45.2	72.6
40.0	8.4	1.3	9.7	.64	.66	977	694.9	317.7	47.6	74.6
41.0	9.6	0.8	10.4	.61	.63	987	695.7	316.8	50.0	76.6
42.0	11.1	0.4	11.5	.57	.58	1001	696.6	315.9	52.4	78.5
43.0	12.6	0.1	12.7	.53	.54	1016	697.6	315.1	54.8	80.4
44.0	11.7	-0.2	11.5	.57	.58	1002	698.6	314.4	57.2	82.3
45.0	11.0	-0.3	10.7	.61	.61	993	699.8	313.8	59.5	84.0
46.0	10.2	-0.4	9.8	.65	.64	981	701.0	313.3	61.7	85.6
47.0	9.1	-0.4	8.7	.70	.69	966	702.2	313.0	63.7	87.1
48.0	8.1	-0.4	7.7	.76	.75	950	703.5	312.8	65.6	88.4
49.0	8.6	-0.3	8.3	.73	.71	960	704.8	312.8	67.2	89.4
50.0	9.5	-0.3	9.2	.69	.67	974	706.0	313.0	68.7	90.3
51.0	9.7	-0.3	9.4	.69	.66	977	707.2	313.4	70.0	90.9
52.0	9.3	-0.2	9.1	.71	.67	972	708.4	314.0	70.9	91.3
53.0	8.7	-0.1	8.6	.74	.70	964	709.5	314.9	71.7	91.4
54.0	7.3	0.1	7.4	.81	.77	945	710.5	315.9	72.2	91.3
55.0	7.4	0.5	7.9	.79	.74	953	711.4	317.1	72.4	91.0

Table 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1961 δ1

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	$\log \rho_v$	$\log \rho_s$	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37456.0	8.4	1.3	9.7	-16.70	-16.65	979	712.1	318.4	72.3	90.5
57.0	7.0	2.1	9.1	.73	.68	970	712.8	319.9	72.0	89.8
58.0	4.6	3.2	7.8	.80	.75	950	713.3	321.3	71.5	89.0
59.0	2.8	4.4	7.2	.84	.78	939	713.8	322.8	70.7	87.9
60.0	1.4	5.6	7.0	.86	.80	935	714.0	324.2	69.7	86.8
61.0	0.4	6.7	7.1	.85	.79	937	714.2	325.5	68.5	85.5
62.0	-0.3	7.5	7.2	.85	.79	938	714.3	326.6	67.1	84.2
63.0	-0.3	8.0	7.7	.82	.84	956	714.3	327.5	65.6	82.8
64.0	-0.3	8.3	8.0	.80	.82	961	714.2	328.3	63.9	81.4
65.0	0.3	8.5	8.8	.76	.78	974	714.0	328.8	62.1	80.0
66.0	1.3	8.6	9.9	.70	.73	990	713.7	329.1	60.3	78.6
67.0	1.6	8.7	10.3	.68	.71	996	713.4	329.2	58.4	77.3
68.0	1.8	8.7	10.5	.67	.70	999	713.1	329.1	56.4	76.0
69.0	3.0	8.7	11.7	.62	.65	1016	712.9	328.8	54.5	74.8
70.0	3.8	8.6	12.4	.59	.62	1025	712.6	328.4	52.6	73.7
71.0	7.0	8.4	15.4	.49	.52	1058	712.4	327.8	50.8	72.7
72.0	5.1	8.3	13.4	.55	.58	1038	712.2	327.2	49.1	71.8
73.0	4.9	8.2	13.1	.56	.59	1036	712.1	326.4	47.5	71.0
74.0	2.6	8.0	10.6	.65	.68	1006	712.1	325.5	46.0	70.3
75.0	1.2	7.9	9.1	.71	.74	986	712.2	324.6	44.6	69.7
76.0	0.6	7.7	8.3	.75	.78	974	712.4	323.7	43.5	69.2
77.0	-0.1	7.5	7.4	.80	.82	960	712.7	322.7	42.5	68.8
78.0	-0.2	7.3	7.1	.81	.84	956	713.1	321.8	41.6	68.4
79.0	-0.5	7.2	6.7	.84	.86	949	713.6	320.8	41.0	68.1
80.0	-1.1	7.0	5.9	.89	.91	934	714.2	320.0	40.4	67.8
81.0	-1.4	6.9	5.5	.92	.94	926	714.9	319.2	40.0	67.6
82.0	-1.4	6.8	5.4	.93	.95	924	715.7	318.5	39.8	67.3
83.0	-1.2	6.7	5.5	.92	.93	928	716.6	317.8	39.6	67.0
84.0	-0.8	6.6	5.8	.90	.91	935	717.5	317.4	39.4	66.6
85.0	-0.7	6.5	5.8	.90	.90	936	718.4	317.0	39.3	66.2
86.0	-0.3	6.4	6.1	.88	.88	944	719.4	316.9	39.2	65.8
87.0	0.1	6.3	6.4	.86	.85	951	720.3	316.9	39.1	65.2
88.0	0.4	6.3	6.7	.84	.83	958	721.3	317.2	38.9	64.6
89.0	0.2	6.2	6.4	.86	.85	953	722.2	317.6	38.7	63.9
90.0	0.3	6.2	6.5	.85	.84	956	723.1	318.2	38.4	63.1
91.0	0.5	6.1	6.6	.84	.83	959	723.9	319.1	37.9	62.2
92.0	2.4	6.1	8.5	.73	.72	994	724.6	320.2	37.4	61.3
37493.0	2.6	6.1	8.7	-16.72	-16.70	998	725.3	321.4	36.7	60.3
93.5	4.7	6.1	10.8	.63	.61	1030	725.6	322.0	36.4	59.8
94.0	7.0	6.0	13.0	.55	.52	1058	725.8	322.7	36.0	59.2
94.5	7.7	6.0	13.7	.52	.50	1067	726.1	323.4	35.6	58.7
95.0	11.1	6.0	17.1	.43	.40	1104	726.3	324.2	35.1	58.2
95.5	9.7	5.9	15.6	.47	.44	1089	726.5	324.9	34.6	57.7
96.0	6.8	5.9	12.7	.55	.53	1057	726.7	325.6	34.1	57.1
96.5	5.5	5.9	11.4	.60	.57	1041	726.8	326.3	33.6	56.6
97.0	4.9	5.8	10.7	.63	.60	1032	726.9	327.0	33.1	56.1
97.5	5.1	5.8	10.9	.62	.59	1035	727.0	327.8	32.5	55.6
98.0	8.0	5.7	13.7	.52	.49	1071	727.1	328.4	32.0	55.1
98.5	9.9	5.7	15.6	.46	.43	1092	727.2	329.1	31.4	54.7
99.0	12.0	5.6	17.6	.41	.38	1113	727.2	329.7	30.8	54.2
99.5	7.9	5.5	13.4	.52	.50	1069	727.2	330.2	30.2	53.8
37500.0	6.3	5.4	11.7	.58	.55	1048	727.2	330.8	29.6	53.5
00.5	5.9	5.4	11.3	.59	.57	1043	727.2	331.2	29.1	53.1
37501.0	6.2	5.3	11.5	-16.59	-16.56	1046	727.2	331.7	28.5	52.8
02.0	5.8	5.1	10.9	.61	.58	1039	727.2	332.4	27.5	52.4
03.0	5.6	4.9	10.5	.62	.59	1035	727.1	332.9	26.6	52.1
04.0	4.8	4.7	9.5	.66	.63	1021	727.0	333.2	25.9	52.0

TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1961 $\delta 1$

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_v	log ρ_s	T_v (°K)	z (km)	$\alpha_v-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37505.0	6.1	4.5	10.6	-16.61	-16.66	1050	727.7	333.3	25.4	52.2
05.5	6.2	4.4	10.6	.61	.66	1050	727.7	333.2	25.3	52.4
06.0	2.8	4.2	7.0	.79	.83	990	727.6	333.2	25.3	52.6
06.5	3.4	4.1	7.5	.76	.80	1000	727.6	333.1	25.3	52.9
07.0	7.8	4.0	11.8	.56	.61	1068	727.5	332.9	25.4	53.2
07.5	15.7	3.9	19.6	.34	.38	1153	727.5	332.8	25.6	53.6
08.0	11.1	3.7	14.8	.46	.51	1105	727.5	332.5	26.0	54.1
08.5	3.6	3.6	7.2	.77	.82	995	727.4	332.3	26.4	54.6
09.0	2.3	3.5	5.8	.86	.91	966	727.4	332.0	26.8	55.2
09.5	2.9	3.3	6.2	.83	.88	975	727.4	331.7	27.4	55.8
37510.0	2.4	3.2	5.6	-16.88	-16.93	962	727.4	331.4	28.0	56.4
11.0	2.2	3.0	5.2	.91	.96	952	727.5	330.6	29.5	57.8
12.0	2.7	2.7	5.4	.89	.94	957	727.7	329.8	31.3	59.4
13.0	2.8	2.5	5.3	.90	.95	955	727.9	329.0	33.2	61.1
14.0	4.6	2.2	6.8	.79	.84	989	728.3	328.1	35.3	62.8
15.0	5.1	2.0	7.1	.77	.82	996	728.8	327.3	37.4	64.6
16.0	4.3	1.7	6.0	.85	.89	973	729.4	326.4	39.6	66.4
17.0	3.8	1.4	5.2	.91	.95	954	730.1	325.6	41.9	68.2
18.0	4.5	1.2	5.7	.88	.91	966	731.0	324.8	44.1	69.9
19.0	5.7	0.8	6.5	.82	.85	984	731.9	324.1	46.2	71.5
20.0	6.9	0.5	7.4	.77	.79	1003	732.9	323.5	48.3	73.1
21.0	9.7	0.3	10.0	.64	.66	1047	734.0	323.0	50.3	74.4
22.0	10.5	0.1	10.6	.62	.64	1056	735.2	322.7	52.1	75.6
23.0	11.2	-0.1	11.1	.60	.62	1064	736.4	322.5	53.7	76.7
24.0	9.5	-0.2	9.3	.68	.69	1037	737.6	322.5	55.2	77.5
25.0	10.3	-0.2	10.1	.65	.66	1049	738.8	322.7	56.4	78.1
26.0	11.0	-0.3	10.7	.63	.63	1058	740.0	323.1	57.4	78.5
27.0	10.7	-0.2	10.5	.64	.64	1055	741.1	323.7	58.2	78.6
28.0	10.3	-0.1	10.2	.66	.65	1051	742.2	324.6	58.7	78.5
29.0	10.2	0.1	10.3	.66	.65	1052	743.2	325.6	59.0	78.1
30.0	10.0	0.5	10.5	.66	.64	1055	744.1	326.8	59.0	77.6
31.0	9.2	1.0	10.2	.67	.65	1051	744.9	328.2	58.7	76.8
32.0	8.3	1.8	10.1	.68	.66	1049	745.6	329.7	58.2	75.7
33.0	5.8	2.7	8.5	.76	.73	1023	746.2	331.3	57.4	74.6
34.0	3.2	3.6	6.8	.85	.83	992	746.6	332.9	56.3	73.2
35.0	2.2	4.4	6.6	.87	.84	988	746.9	334.5	55.1	71.7
36.0	1.4	5.1	6.5	.87	.85	986	747.1	335.9	53.6	70.1
37.0	1.1	5.5	6.6	.87	.84	989	747.1	337.3	51.8	68.4
38.0	0.9	5.8	6.7	.86	.83	991	747.1	338.4	49.9	66.7
39.0	0.9	6.0	6.9	.84	.82	996	747.0	339.4	47.9	64.9
40.0	1.4	6.1	7.5	.80	.78	1009	746.7	340.2	45.7	63.2
41.0	1.6	6.1	7.7	.79	.76	1013	746.4	340.7	43.4	61.5
42.0	1.5	6.1	7.6	.79	.77	1012	746.0	341.0	41.0	59.8
43.0	1.9	6.0	7.9	.77	.75	1018	745.6	341.2	38.6	58.4
44.0	1.5	5.9	7.4	.79	.77	1010	745.1	341.1	36.2	57.0
45.0	0.7	5.7	6.4	.85	.83	990	744.7	340.9	33.8	55.8
46.0	1.1	5.5	6.6	.83	.82	995	744.2	340.6	31.6	54.8
47.0	1.5	5.3	6.8	.82	.80	1000	743.8	340.1	29.5	54.1
48.0	1.9	5.0	6.9	.81	.80	1003	743.4	339.5	27.6	53.6
49.0	2.6	4.8	7.4	.77	.76	1013	743.1	338.8	26.1	53.2
50.0	3.8	4.5	8.3	.72	.71	1031	742.8	338.1	25.0	53.2
51.0	5.1	4.3	9.4	.67	.66	1050	742.7	337.3	24.2	53.3
52.0	5.7	4.0	9.7	.65	.64	1055	742.6	336.5	24.0	53.7
53.0	6.0	3.7	9.7	.65	.64	1056	742.6	335.7	24.3	54.2
54.0	7.1	3.5	10.6	.61	.60	1070	742.7	335.0	25.0	54.8
55.0	7.5	3.3	10.8	.60	.59	1073	742.9	334.2	26.1	55.6
56.0	7.8	3.1	10.9	.60	.59	1075	743.2	333.5	27.4	56.5
57.0	7.5	2.9	10.4	.62	.60	1068	743.5	332.9	29.0	57.4
58.0	7.4	2.7	10.1	.63	.62	1064	743.9	332.4	30.7	58.3

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TABLE 5.—*Acceleration, drag, atmospheric densities, atmospheric temperature, and geometric parameters*—Continued

Satellite 1961 δ1

MJD	$-10^7\dot{P}$	$10^7\dot{P}_R$	$-10^7\dot{P}_A$	log ρ_r	log ρ_s	T_r (°K)	z (km)	$\alpha_r-\alpha_\odot$ (deg.)	ψ'_0 (deg.)	ψ'_{30} (deg.)
37559.0	7.1	2.5	9.6	−16.66	−16.64	1056	744.4	332.0	32.5	59.2
60.0	6.9	2.4	9.3	.67	.65	1051	745.0	331.8	34.3	60.0
61.0	6.3	2.4	8.7	.70	.68	1041	745.5	331.7	36.0	60.8
62.0	5.5	2.3	7.8	.75	.73	1025	746.1	331.8	37.6	61.5
63.0	4.3	2.3	6.6	.83	.80	1001	746.7	332.1	39.2	62.0
64.0	3.5	2.3	5.8	.88	.86	983	747.3	332.6	40.6	62.4
65.0	4.2	2.4	6.6	.83	.80	1001	747.9	333.3	41.8	62.7
66.0	4.3	2.4	6.7	.83	.79	1003	748.5	334.2	42.8	62.8
67.0	4.6	2.5	7.1	.80	.77	1011	749.1	335.3	43.6	62.7
68.0	4.6	2.6	7.2	.80	.76	1013	749.6	336.6	44.2	62.5
69.0	4.3	2.7	7.0	.81	.78	1009	750.1	338.0	44.6	62.1
70.0	4.0	2.9	7.0	.82	.78	1009	750.6	339.5	44.7	61.5
71.0	3.9	3.1	7.0	.82	.77	1010	751.1	341.1	44.6	60.8
72.0	4.2	3.3	7.5	.79	.74	1020	751.5	342.6	44.3	60.0
73.0	11.1	3.5	14.6	.50	.45	1126	752.0	344.1	43.7	59.0
74.0	10.1	3.7	13.8	.52	.48	1117	752.6	345.5	42.9	58.0

TABLE 6.—*Unsmoothed accelerations dP/dt of Satellite 1958 Alpha*

MJD	$-10^6 \frac{dP}{dt}$	MJD	$-10^6 \frac{dP}{dt}$	MJD	$-10^6 \frac{dP}{dt}$	MJD	$-10^6 \frac{dP}{dt}$
36305.0	5.0	36325.0	6.7	36345.0	5.2	36645.0	4.3
05.5	5.1	25.5	6.2	45.5	5.3	45.5	4.3
06.0	5.2	26.0	5.2	46.0	5.0	46.0	4.5
06.5	5.0	26.5	5.0	46.5	4.7	46.5	4.6
07.0	4.6	27.0	4.7	47.0	4.2	47.0	4.3
07.5	4.7	27.5	6.0	47.5	4.8	47.5	4.6
08.0	4.5	28.0	7.7	48.0	5.4	48.0	4.6
08.5	4.5	28.5	6.4	48.5	6.0	48.5	4.9
09.0	5.6	29.0	6.2	49.0	5.7	49.0	5.1
09.5	6.2	29.5	5.6	49.5	4.8	49.5	5.4
10.0	6.5	30.0	5.3				
10.5	6.1	30.5	6.0	36630.5	4.8	36668.0	6.9
11.0	5.1	31.0	6.0	31.0	4.6	68.5	7.0
11.5	5.2	31.5	6.0	31.5	4.6	69.0	7.4
12.0	5.0	32.0	6.9	32.0	4.4	69.5	6.8
12.5	4.7	32.5	6.2	32.5	3.9	70.0	5.4
13.0	5.3	33.0	4.8	33.0	4.1	70.5	5.4
13.5	5.2	33.5	5.1	33.5	4.4	71.0	6.1
14.0	5.4	34.0	4.8	34.0	4.7	71.5	6.6
14.5	4.9	34.5	5.2	34.5	5.3	72.0	7.1
15.0	4.5	35.0	5.5	35.0	4.2	72.5	6.9
15.5	4.0	35.5	5.1	35.5	4.2	73.0	5.6
16.0	4.5	36.0	5.1	36.0	4.1	73.5	5.4
16.5	4.8	36.5	5.0	36.5	3.8	74.0	6.2
17.0	6.3	37.0	5.0	37.0	3.8	74.5	7.1
17.5	7.1	37.5	5.1	37.5	4.0	75.0	7.4
18.0	6.4	38.0	5.1	38.0	3.6	75.5	7.4
18.5	5.1	38.5	5.0	38.5	4.1	76.0	6.2
19.0	4.6	39.0	4.7	39.0	4.1	76.5	6.3
19.5	4.9	39.5	5.1	39.5	4.8	77.0	6.3
20.0	5.4	40.0	4.4	40.0	4.8	77.5	6.6
20.5	6.4	40.5	4.0	40.5	4.8	78.0	6.8
21.0	6.9	41.0	3.5	41.0	3.7	78.5	7.4
21.5	7.7	41.5	4.5	41.5	3.9	79.0	7.4
22.0	7.2	42.0	5.7	42.0	4.2	79.5	6.5
22.5	6.5	42.5	5.4	42.5	3.9	80.0	5.8
23.0	5.2	43.0	4.7	43.0	4.9	80.5	5.6
23.5	5.2	43.5	3.9	43.5	4.9	81.0	6.6
24.0	7.2	44.0	3.3	44.0	4.4	81.5	7.4
24.5	7.5	44.5	4.0	44.5	4.2	82.0	8.3

Table 6.—*Unsmoothed accelerations dP/dt of Satellite 1958 Alpha*—Continued

MJD	$-10^6 \frac{dP}{dt}$	MJD	$-10^6 \frac{dP}{dt}$	MJD	$-10^6 \frac{dP}{dt}$	MJD	$-10^6 \frac{dP}{dt}$
36682.5	7.9	36706.0	6.4	37010.0	4.8	37209.5	3.5
83.0	7.9	06.5	6.1	10.5	4.5	10.0	2.2
83.5	7.5	07.0	7.8			10.5	1.8
84.0	6.8	07.5	7.8	37191.0	3.8	11.0	3.1
84.5	7.3	08.0	7.5	91.5	4.0	11.5	4.0
85.0	6.9	08.5	6.3	92.0	4.5	12.0	4.5
85.5	7.4	09.0	6.8	92.5	4.3	12.5	3.4
86.0	8.1	09.5	6.9	93.0	4.3	13.0	3.0
86.5	7.9	10.0	8.2	93.5	4.1		
87.0	7.5	10.5	7.0	94.0	3.9	37216.5	3.7
87.5	7.5	11.0	7.0	94.5	4.2	17.0	3.8
88.0	7.1	11.5	6.7	95.0	3.7	17.5	4.2
88.5	7.1			95.5	4.4	18.0	4.0
89.0	6.6	36996.5	5.1	96.0	4.4	18.5	4.7
		97.0	5.6	96.5	5.4	19.0	4.4
36690.0	6.3	97.5	5.8	97.0	5.6	19.5	4.7
91.0	5.5	98.0	5.8	97.5	5.2	20.0	5.2
92.0	5.6	98.5	5.6	98.0	3.4	20.5	5.0
93.0	6.5	99.0	5.2	98.5	3.2	21.0	5.0
94.0	6.0	99.5	5.2	99.0	2.8	21.5	5.0
95.0	5.1	37000.0	5.0	99.5	3.4	22.0	5.5
96.0	5.8	00.5	5.0	37200.0	4.1	22.5	5.3
97.0	6.3	01.0	5.2	00.5	4.6	23.0	5.1
98.0	6.2	01.5	5.2	01.0	4.4	23.5	5.1
		02.0	5.0	01.5	4.2	24.0	4.9
36698.5	6.1	02.5	5.2	02.0	3.1	24.5	4.9
99.0	6.3	03.0	5.5	02.5	3.1	25.0	4.9
99.5	6.8	03.5	5.3	03.0	2.9	25.5	6.3
36700.0	6.5	04.0	4.8	03.5	3.6	26.0	7.0
00.5	7.2	04.5	4.8	04.0	3.1	26.5	5.2
01.0	7.4	05.0	4.6	04.5	3.8	27.0	2.5
01.5	7.2	05.5	4.6	05.0	3.6	27.5	3.2
02.0	7.2	06.0	4.4	05.5	3.4	28.0	6.2
02.5	6.7	06.5	5.1	06.0	2.3	28.5	5.0
03.0	5.7	07.0	5.3	06.5	3.0	29.0	4.4
03.5	6.7	07.5	6.3	07.0	3.2	29.5	2.9
04.0	7.8	08.0	5.6	07.5	3.5	30.0	3.8
04.5	8.1	08.5	5.2	08.0	3.9	30.5	4.3
05.0	7.8	09.0	4.3	08.5	4.0	31.0	3.6
05.5	6.4	09.5	4.3	09.0	3.7	31.5	4.1

TABLE 6.—*Unsmoothed accelerations dP/dt of Satellite 1958 Alpha*—Continued

MJD	$-10^6 \frac{dP}{dt}$	MJD	$-10^6 \frac{dP}{dt}$	MJD	$-10^6 \frac{dP}{dt}$	MJD	$-10^6 \frac{dP}{dt}$
37232.0	4.5	37242.5	5.6	37358.5	1.8	37369.0	2.0
32.5	4.3	43.0	5.6	59.0	1.8	69.5	1.6
33.0	5.2	43.5	4.5	59.5	1.6	70.0	1.1
33.5	5.2	44.0	5.0	60.0	1.8	70.5	1.4
34.0	4.8	44.5	4.8	60.5	1.3	71.0	1.6
34.5	4.4	45.0	5.0	61.0	1.3	71.5	1.4
35.0	4.0	45.5	6.2	61.5	0.9	72.0	1.8
35.5	4.0	46.0	6.2	62.0	0.9	72.5	1.8
36.0	4.0	46.5	5.8	62.5	1.1	73.0	1.8
36.5	4.5	47.0	5.3	63.0	1.5	73.5	2.1
37.0	4.3	47.5	5.8	63.5	2.0	74.0	1.6
37.5	4.1	48.0	5.8	64.0	2.0	74.5	1.2
38.0	4.3	48.5	6.3	64.5	1.8	75.0	1.6
38.5	4.6	49.0	6.1	65.0	2.0	75.5	1.6
39.0	3.5	49.5	6.1	65.5	1.8	76.0	1.7
39.5	3.7			66.0	1.3	76.5	1.9
40.0	4.4	37356.0	1.5	66.5	1.1	77.0	1.7
40.5	4.9	56.5	1.6	67.0	1.6	77.5	1.7
41.0	5.1	57.0	1.4	67.5	1.6	78.0	1.7
41.5	5.6	57.5	1.4	68.0	1.8	78.5	1.7
42.0	6.5	58.0	1.6	68.5	2.4	79.0	1.7

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