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The Ranger VI Flight Path and Its Determination From Tracking Data

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ABSTRACT

This Report describes the current best estimate of the *Ranger VI* spacecraft flight path and the way in which it was determined. Deep Space Instrumentation Facility tracking of the spacecraft was virtually continuous from injection to lunar impact. Postflight analysis of the tracking data resulted in valuable determinations of the masses of the Earth and the Moon, tracking station locations, lunar ephemeris scale factor, and a lunar radius to the *Ranger VI* impact point, which is 3 km less than the previously accepted value. The impact location of *Ranger VI* is known to within 1.2 km on the surface of the Moon.

I. INTRODUCTION

This Report describes the current best estimate of the *Ranger VI* spacecraft flight path and the way in which it was determined. Deep Space Instrumentation Facility (DSIF) tracking of the spacecraft was virtually continuous from injection to lunar impact. Postflight analysis of the tracking data resulted in valuable determinations of the masses of the Earth and the Moon, tracking station locations, lunar ephemeris scale factor, and radius of the Moon to the *Ranger VI* impact point. The impact location of *Ranger VI* is known to within 1.2 km, using the standard deviation as a measure of uncertainties.

The primary objective of the *Ranger* Block III (*Ranger* 6 through 9) flights is to obtain TV pictures of the lunar surface which will be of benefit to both the scientific program and the U.S. manned lunar flight program. The *Ranger VI* spacecraft, which was launched from Cape Kennedy on January 30, 1964, and 65 hr 35 min later impacted the Moon on target, did not accomplish its primary objective due to a failure of the TV subsystem. However, the capabilities of Earth-based radio guidance were dramatically demonstrated by this mission, and the postflight analysis provided significant information in the determination of the physical constants mentioned above.

During the launch phase the *Atlas* and *Agena* stages performed within tolerance and injected the spacecraft on a lunar flyby trajectory with a miss distance of approximately 800 km. The Sea of Tranquillity was selected as the general area of impact, since it was the most favorable location for the prevailing lunar surface lighting conditions. Sixteen hours after launch a near perfect midcourse maneuver was executed. The resultant impact

point was only 30 km from the chosen target area center. This difference is well within the bound expected and is a combination of the uncertainties in the orbit at the time the desired maneuver was determined plus the tolerances of the spacecraft guidance hardware.

Section II of this Report describes the DSIF transponder orbit determination. Comparisons are made among determinations based on premaneuver tracking only, postmaneuver tracking only, and combined estimates based on premaneuver and postmaneuver tracking. Solutions for the masses of the Earth and the Moon, lunar ephemeris scale factor, and tracking station locations are compared to determinations based upon the *Mariner II* (Venus) and previous *Ranger* missions. The determination of the lunar radius at the *Ranger VI* impact point is also presented.

Section III discusses the operational considerations associated with the midcourse maneuver policy and the execution of the maneuver. The postflight evaluation described in this section shows that the response of the spacecraft to the maneuver turn and velocity increment commands was well within expected tolerances.

Section IV summarizes the key events in the DSIF tracking of the *Ranger VI* mission and gives a general description of the DSIF stations and tracking modes. The determination of the lunar radius at the *Ranger VI* impact point is a direct function of the "recorded" time of impact. The recordings of this event time as measured by the DSIF Goldstone tracking stations are presented and discussed.

Section V describes the Eastern Test Range (ETR) tracking of the *Agena* launch vehicle. The ETR orbit analysis is divided into three parts: (1) the parking orbit; (2) the postinjection but preretrorocket phases, during which the spacecraft was still attached to the *Agena*; and (3) the postretrorocket orbit of the *Agena*.

Section VI describes the *Ranger VI* orbit in terms of its trajectory parameters near the Earth, in translunar flight, and near the Moon.

II. ANALYSIS OF DSIF TRANSPONDER TRACKING DATA

A. Introduction

This Section has a step by step development of the significant results obtained from tracking data. The results are presented in blocks such as premaneuver data only, postmaneuver data only, postmaneuver data with premaneuver data as a priority with the lunar constraint applied. All solutions are over periods of free flight and a discontinuity results at the maneuver epoch. With this approach the effects and information of various data blocks can be seen as the target error statistics change and settle to their final value when all the data is included. The various blocks are consistent within themselves and with each other.

B. Summary of the Data Used in Orbit Determination

The complete sequence of tracking events and ground tracking modes is described in Section IV. Fig. 1 gives an overall picture of the data for each station as to their time and place in the orbit. Table 1 summarizes the data used in the orbit calculations both for real-time and postflight analysis. It is a gross performance record of the data taking and handling system. Column 3 gives the total number of data points taken at each station. The editing of the data resulted in the actual number of points used in real time and postflight analysis, shown in columns 4 and 10, respectively. The postflight data were

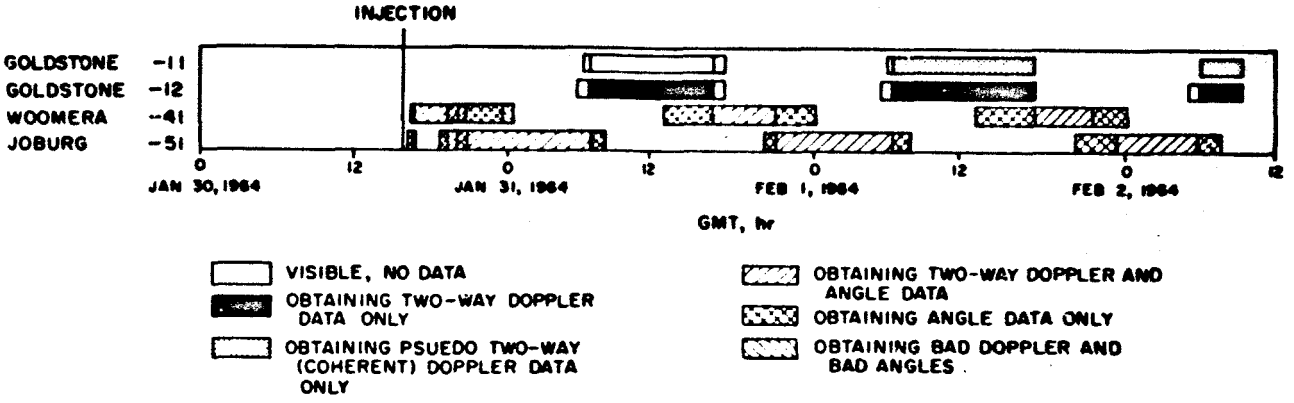


Fig. 1. *Ranger VI* tracking station view periods and data coverage

Table 1. Summary of data used to determine orbit

Station (1)	Data type (2)	Points received (3)	Number of points used in real time (% of received) (4)	Bad format (% of received) (5)	Points lost due to bad adjacent point (% of received) (6)	Bad data condition code (% of received) (7)	Blunder points (% of received) (8)	Rejection limits on blunder points (9)	Points used in postflight analysis, obtained from station tapes* (10)
Premidcourse maneuver									
12	2-way doppler	158	148 (93.7)	1 (0.6)	3 (1.9)	3 (1.5)	3 (1.9)	0.1 cps	137
41	2-way doppler	190	134 (70.5)	5 (2.6)	19 (10.0)	20 (10.5)	12 (6.4)	0.1 cps	140
	HA, Dec	426	334 (78.4)	8 (1.9)	34 (8.0)	46 (10.8)	4 (0.9)	0.1 deg	—
51 (Pass No. 1)	2-way doppler	233	19 (8.2)	5 (2.1)	0 (0)	203 (87.1)	6 (2.6)	0.5 cps	21
	HA, Dec	245	45 (18.4)	5 (2.0)	0 (0)	190 (77.6)	5 (2.0)	0.1 deg	—
51 (Pass No. 2)	2-way doppler	624	459 (73.6)	39 (6.2)	51 (8.2)	59 (9.4)	16 (2.6)	0.1 cps	543
	HA, Dec	703	537 (76.4)	44 (6.3)	51 (7.3)	70 (10.0)	1 (0.1)	0.1 deg	—
Postmidcourse maneuver									
41 (Pass No. 1)	2-way doppler	308	226 (73.4)	8 (2.6)	31 (10.0)	22 (7.2)	21 (6.8)	0.2 cps	259
41 (Pass No. 2)	2-way doppler	388	107 (27.6)	7 (1.8)	88 (22.7)	127 (32.7)	59 (15.2)	0.2 cps	146
12 (Pass No. 1)	2-way doppler	418	384 (91.9)	6 (1.4)	16 (3.8)	8 (1.9)	4 (1)	0.2 cps	384
12 (Pass No. 2)	2-way doppler	617	615 (99.7)	1 (0.2)	1 (0.1)	0 (0)	0 (0)	0.2 cps	667
12 (Pass No. 3)	2-way doppler	218	196 (90.0)	3 (1.3)	4 (1.8)	14 (6.4)	1 (0.5)	0.2 cps	189
51 (Pass No. 1)	2-way doppler	536	397 (74.1)	33 (6.2)	56 (10.4)	21 (3.9)	29 (5.4)	0.2 cps	397
51 (Pass No. 2)	2-way doppler	358	264 (73.7)	35 (9.8)	46 (12.8)	7 (2.0)	6 (1.7)	0.2 cps	364

*Data tapes were flown in from the DSIF stations and reprocessed so that transmission errors are deleted.

obtained from paper tapes punched at the station and mailed to the Jet Propulsion Laboratory (JPL).

Of particular interest is the number and percentage of data sets rejected for bad format and "blunder points." No attempt is made in real time to unscramble data messages containing format errors. Blunder points can create significant problems in converging on an orbit when very few data are available and hence are important in influencing the time required to establish the first estimate of the orbit. The number and percentage of points omitted because of "bad data conditions" are listed in column 7. When the tracking station operators or automatic detectors recognized that the data being transmitted would not be usable, the data condition codeword indicated the condition. These conditions occurred when retuning the ground transmitter to maximize the signal received at the spacecraft when commands were being sent, during the acquisition phase, and during known equipment malfunction periods.

Another source of data loss is the continuous counter which causes an adjacent point to be lost if the previous count was in error by bad format, data condition code, or, if it was a counter restart (column 6). This loss does not occur often enough to lose many data, and it does not warrant relinquishing the benefits of continuous count data (i.e., data compression explained in Appendix A).

Once the data are edited, they are weighted. This weighting is an effective variance weight rather than just a variance on the data themselves. Various error contributors are considered and a summation of variances is made. The assumed error sources for the data types used during the mission and the contribution to the total weight from each of the error sources are shown in Appendix B. The data types discussed are coherent two-way doppler (CC3) and angles [local hour angle (HA) and declination (Dec) used in real-time orbits].

The approximate weights for the two-way doppler—since they vary with count time, range, elevation angle and elevation angle rate—are displayed in Table 2 along with the number of points used and the visible data noise.

Table 2. Approximate doppler weights*

Station	Premidcourse			Postmidcourse		
	Weight (uncorrelated)	Number of points	Apparent data noise,** cps	Weight (uncorrelated)	Number of points	Apparent data noise,** cps
12	0.12	137	0.021	0.085	1180	0.013
41	0.09	140	0.012	0.14-0.19	405	0.03-0.05
51	0.40	21 (5-sec sample)	0.075	0.15-0.20	661	0.03-0.05
51	0.10	543	0.032			

*For exact weights, see Appendices B, C and H.
**All points are at 60-sec sample unless otherwise stated; 1 cps = 0.156 m/sec.

C. *Premaneuver Orbit Based on Premaneuver Tracking Only*

Table 3, columns 1 through 5, gives the statistics of the data fit to the calculated orbit, and Figs. 2 through 7 show the actual data point residuals (i.e., the observed data minus the calculated data). Only doppler data were used in the orbit calculations because the antennas underwent modifications before and after *Ranger VI*, and biases of unknown magnitude exist in the angular data. However, the angular residuals are shown and are extremely helpful in real-time orbit determination, especially when there are data from only one station. Note that there is a consistency between the doppler and that there are *no* biases. This noise level is on the order of 0.005 m/sec.

Table 3. Statistics on premidcourse maneuver data

Station	Number of doppler points	No a priority from postmaneuver			With a priority from postmaneuver	
		Standard deviation, cps	Mean, cps	Remarks*	Standard deviation, cps	Mean, cps
(1)	(2)	(3)	(4)	(5)	(6)	(7)
12	27	0.022	0.0050	Data below 17 deg, not rubidium	0.029	−0.0039
	110	0.020	0.0014	Data above 17 deg, not rubidium	0.020	−0.0022
41	140	0.012	0.0008	Data above 17 deg	0.012	−0.0027
51	21	0.075	0.0042	Pass No. 1 above 17 deg, 5-sec count	0.078	0.0113
	45	0.019	0.0003	Pass No. 2 below 17 deg	0.018	0.0051
	489	0.032	0.0014	Pass No. 2 above 17 deg	0.032	−0.0011
	9	0.043	0.0039	Pass No. 2 below 17 deg	0.043	−0.0032

*17 deg was chosen as a point above which uncertainty in atmospheric effects would be negligible. Rubidium standards are available at Station 12; Stations 41 and 51 do not have the equipment. The remarks are made primarily for data weighting considerations (Appendix B).

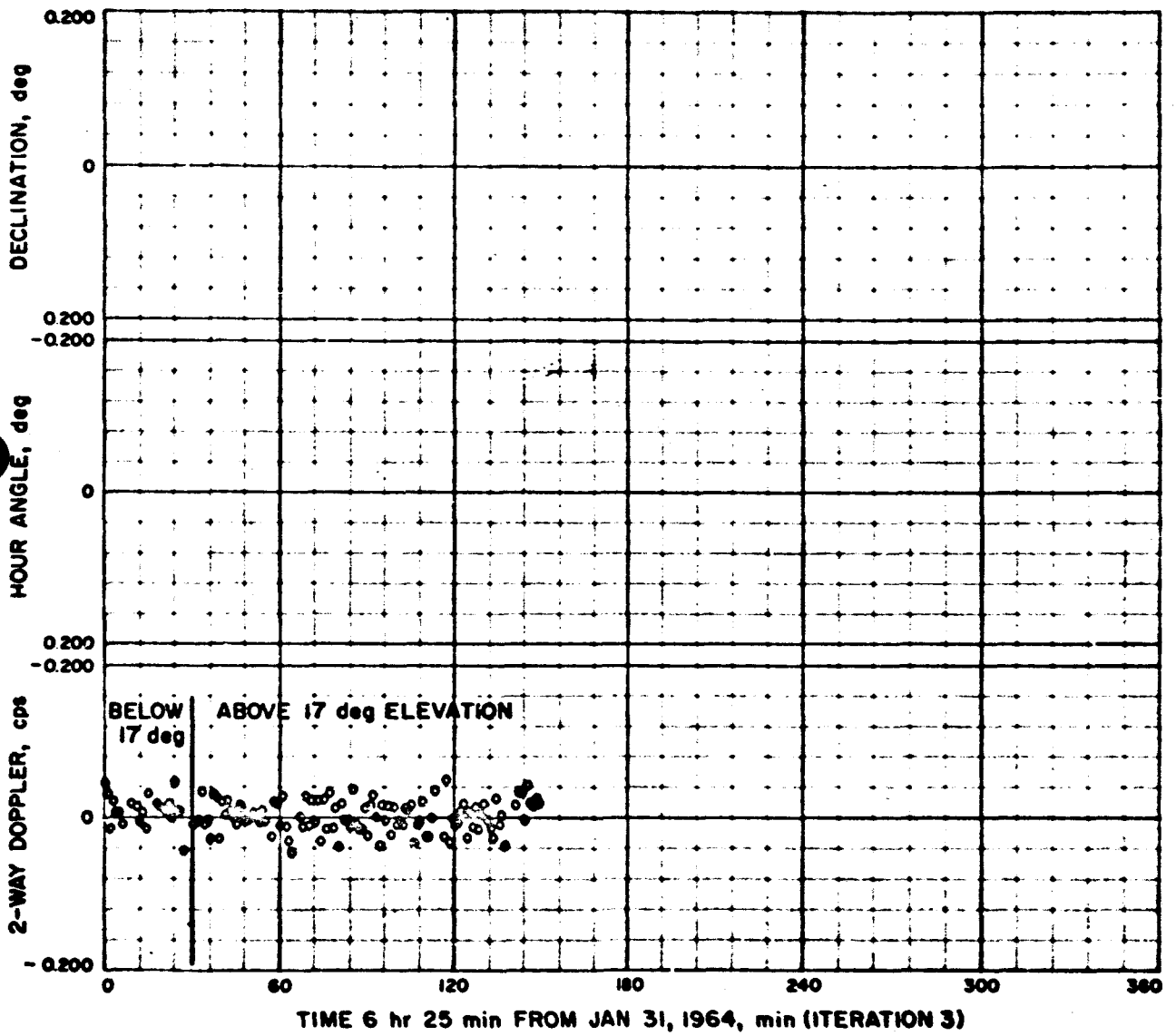


Fig. 2. Station 12 pass No. 01/311 promaneuver residuals (6:25 GMT)

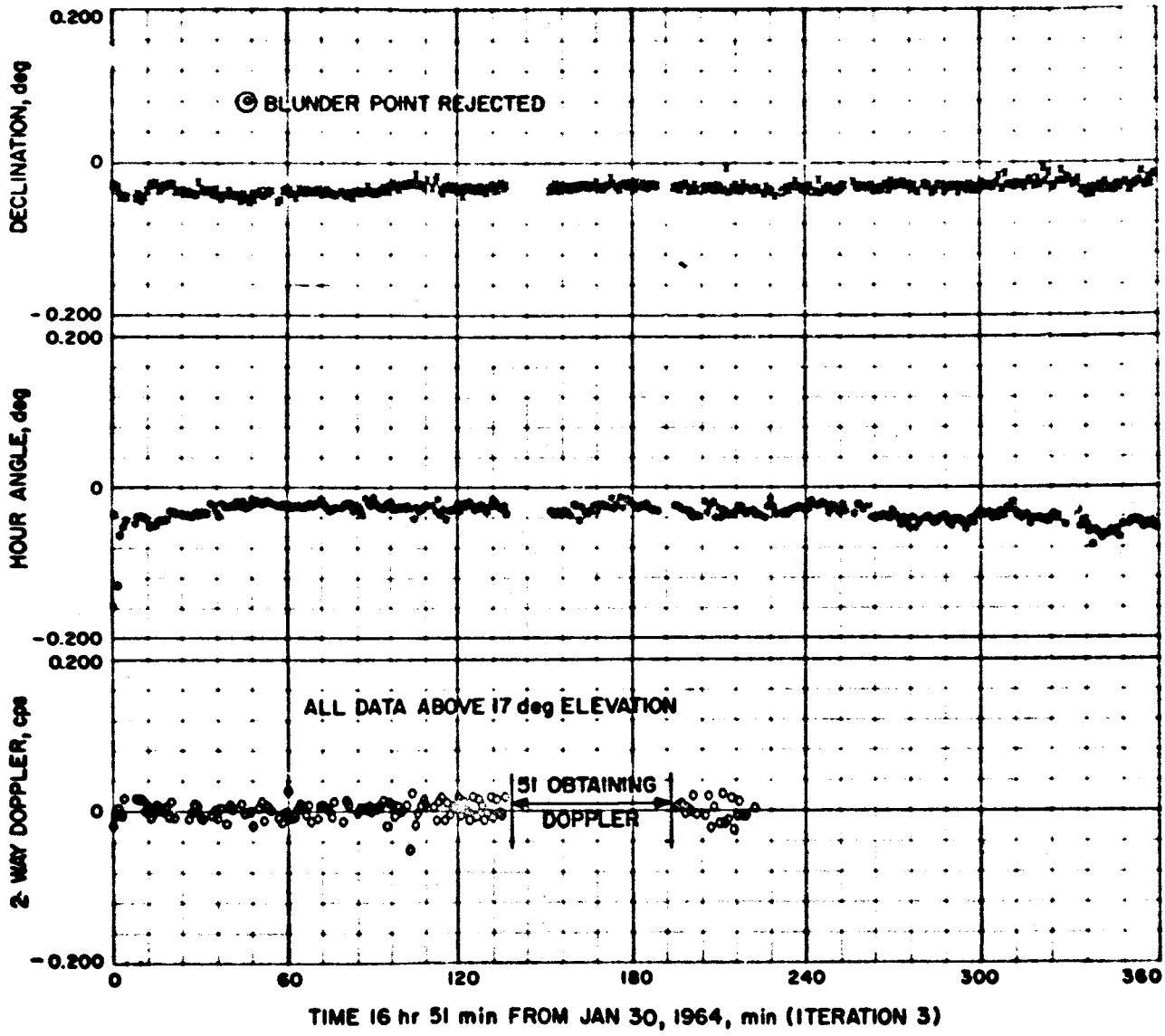


Fig. 3. Station 41 pass No. 01/301 premaneuver residuals (16:51 GMT)

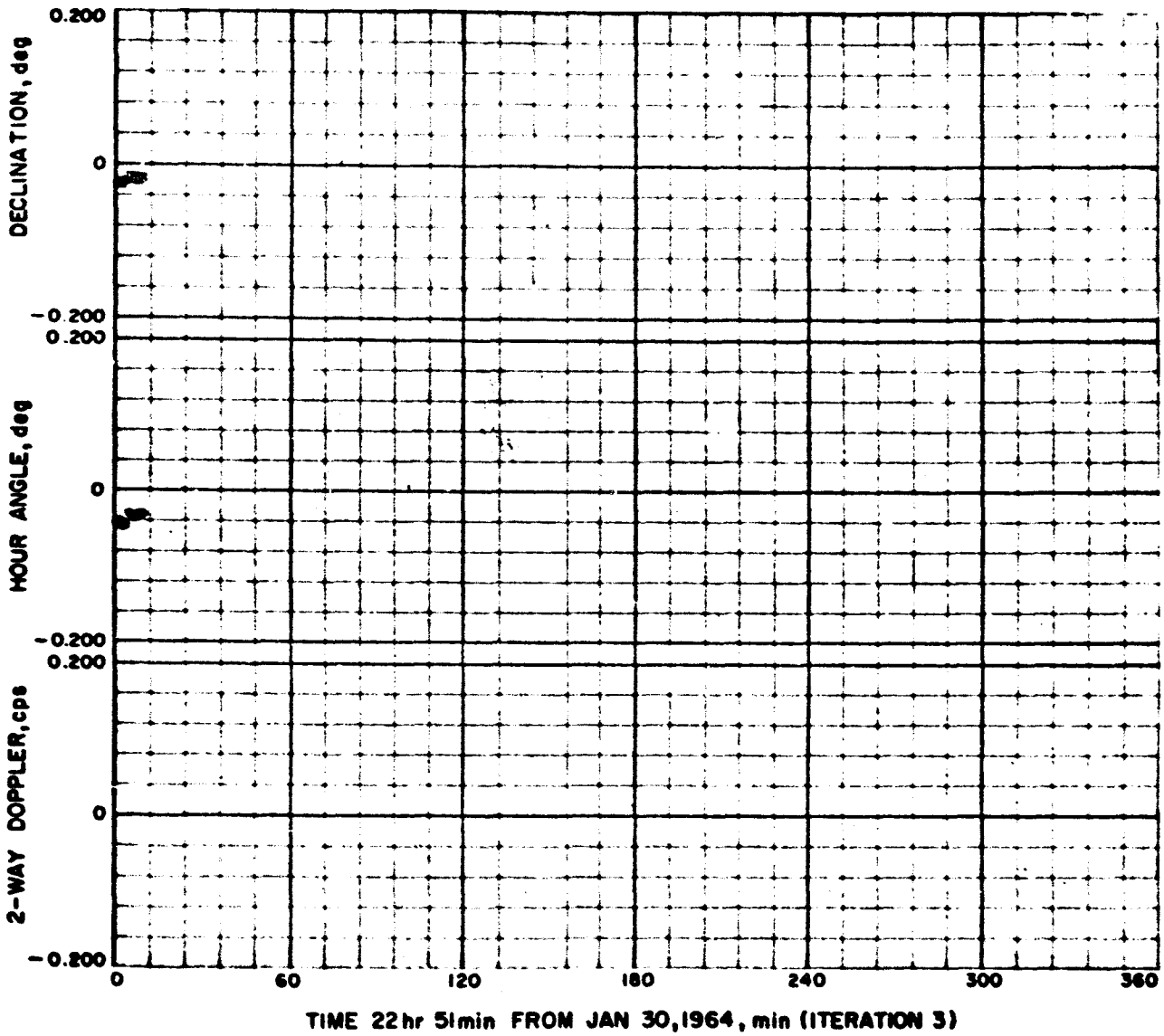


Fig. 4. Station 41 pass No. 01/302 premaneuver residuals (22:51 GMT)

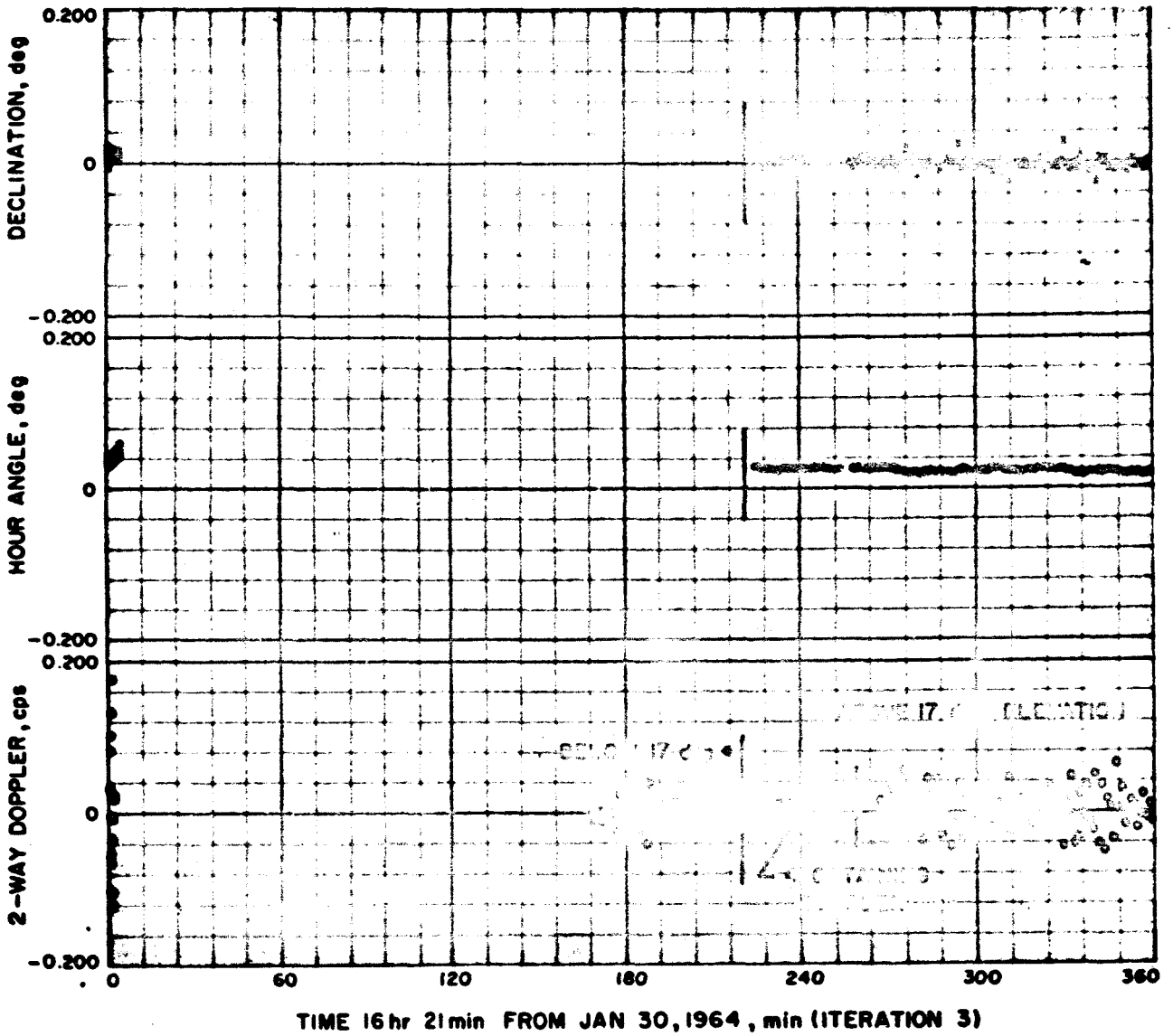


Fig. 5. Station 51 pass No. 01/301 premaneuver residuals (16:21 GMT)

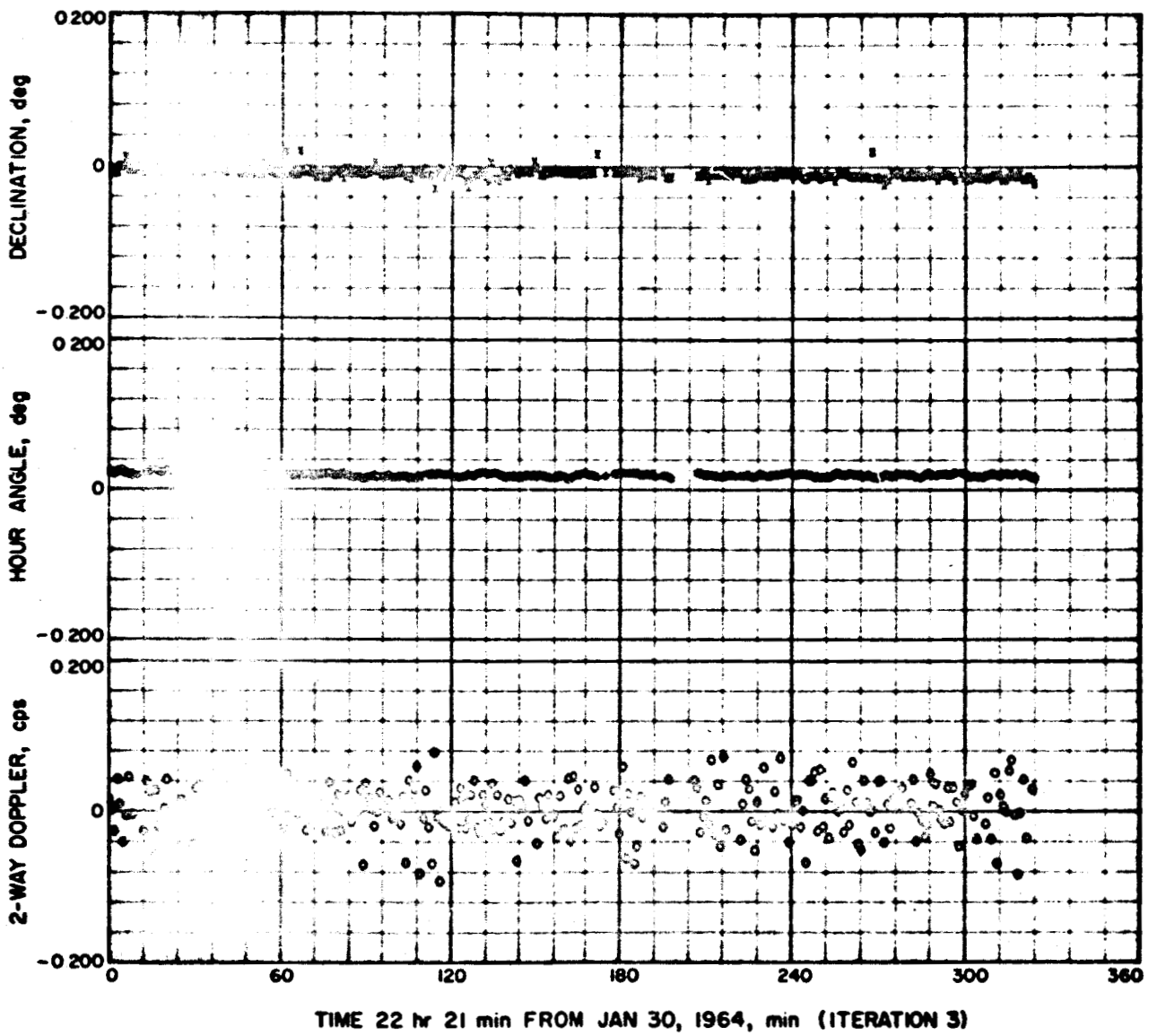


Fig. 6. Station 51 pass No. 01/303 premaneuver residuals (22:21 GMT)

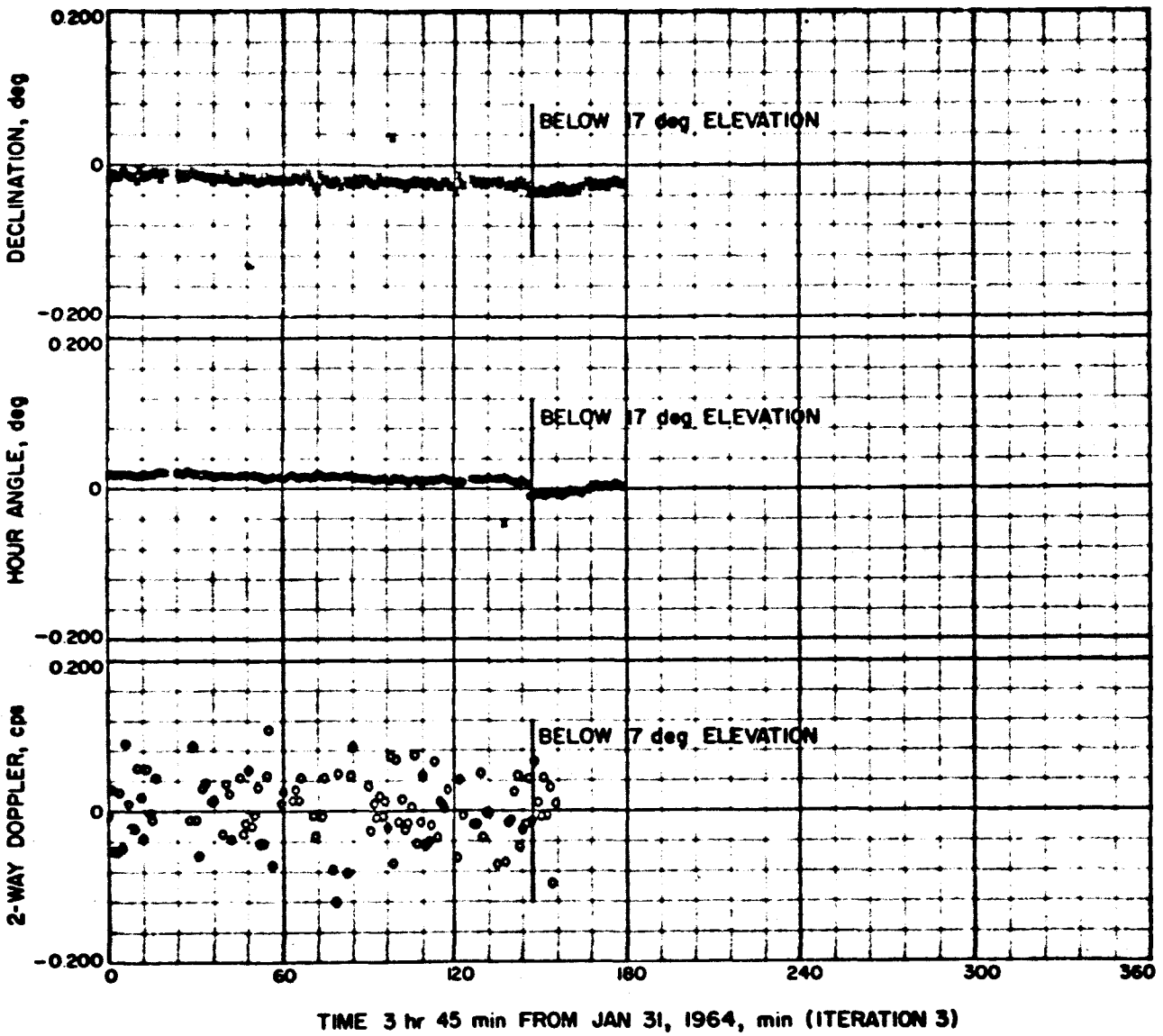


Fig. 7. Station 51 pass No. 01/303 premaneuver residuals (3:45 GMT)

Station 51 (Johannesburg, S. A.) residuals display the effect of the transmitter stability as a function of time (i.e., the longer the signal travel time the larger the data noise, Figs. 5 through 7). Also, the early Station 51 data are noisier since the quantizing error is dominant at the higher sample rate of 1/5 sec required because of high accelerations.

Table 4, columns 1 through 7, displays the vector of parameters that were estimated, the a priori information and the statistics on the parameters when only premaneuver data were used. The estimated parameters are the Cartesian space-fixed components of position (X, Y, Z) and velocity (DX, DY, DZ), GM_{Earth} $(GM_{\oplus})$, GM_{Moon} $(GM_{☾})$, the scale factor for the lunar ephemeris (REM), a solar pressure constant pertaining to the effective coefficient for reflection of solar radiation (GB), and the tracking station coordinates (radius, latitude, and longitude). This Table, like so many others used throughout this Report, is described as the Report progresses. Note the large a priori uncertainties on all parameters. This shows that in the final solution the tracking data were

Table 4. Estimated parameter statistics

Parameters estimated	Units	A priority 1-σ		Standard deviation on parameters using premaneuver data			Standard deviation on parameters using postmaneuver data		Standard deviation on parameters using premaneuver estimate as a priority for postmaneuver data		Standard deviation on parameters using postmaneuver as a priority for premaneuver data			REM constraint
		Actually used	Presently accepted	Injection epoch	Maneuver epoch	Closest approach	Maneuver epoch	Impact epoch	Maneuver epoch	Impact epoch	Injection epoch	Maneuver epoch	Closest approach	Postmaneuver orbit at impact epoch
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Space-fixed geocentric equatorial Cartesian coordinates														
X	km	1×10^4	(5)*	0.157	0.385	2.86	3.02	2.34	0.096	0.512	0.030	0.094	0.451	0.211
Y	km	1×10^4	(5)	0.341	9.07	32.4	3.80	2.71	2.39	1.94	0.088	2.38	5.50	0.631
Z	km	1×10^4	(5)	0.201	7.33	29.1	8.51	3.64	2.49	2.78	0.090	2.41	5.62	0.934
DX	m/sec	1×10^2	(10)	0.492	0.022	13.8	0.015	0.276	0.0039	0.209	0.149	0.006	2.40	0.070
DY	m/sec	1×10^2	(10)	0.250	0.099	5.55	0.027	1.51	0.017	1.15	0.146	0.027	1.52	0.369
DZ	m/sec	1×10^2	(10)	0.316	0.077	7.80	0.041	2.00	0.023	1.54	0.196	0.025	1.85	0.476
$GM_{\oplus}$	km^3/sec^2	10	(4)	4.25			7.20		1.15		1.15			1.14
$GM_{☾}$	km^3/sec^2	5	(0.3)	5.00			0.434		0.192		0.199			0.141
REM	m	50	(20)	50.0			39.8		19.3		20.3			6.1
CB	—	0.3	(0.2)	0.300			0.298		0.297		0.297			0.296
Station 12														
Radius	m	$X_1 = 500$ m (100) m		95			59		58		58			58
Latitude	deg	$X_2 = 500$ m (100) m		0.00089			0.00074		0.00074		0.00074			0.00074
Longitude	deg	$X_3 = 100$ m (100) m		0.00320			0.00093		0.00073		0.00074			0.00032
Station 41														
Radius	m	0.001 deg ≈ 110 m		128			67		52		52			46
Latitude	deg			0.00100			0.00080		0.00072		0.00071			0.00071
Longitude	deg			0.00320			0.00086		0.00072		0.00073			0.00039
Station 51														
Radius	m			74			50		42		42			42
Latitude	deg			0.000880			0.00082		0.00077		0.00076			0.00076
Longitude	deg			0.00310			0.00082		0.00071		0.00071			0.00036

*Approximate known uncertainty before estimate, which in most cases is a magnitude smaller than a priority actually used.

Table 5. Correlation matrix on premaneuver data at injection epoch

Parameters	Standard deviation	Correlation coefficients																		
		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$	$GM_{\oplus}$	REM	CB	$GM_{☾}$	RI (3)	LA (3)	LO (3)	RI (4)	LA (4)	LO (4)	RI (5)	LA (5)	LO (5)
X	0.16 km	1	−0.795	−0.540	0.621	0.471	0.360	−0.135	0	−0.004	−0.022	0.054	−0.035	−0.741	−0.522	−0.190	−0.663	−0.114	−0.174	−0.795
Y	0.34 km		1	0.118	−0.884	−0.844	−0.260	0.276	0	0	0.006	−0.178	0.119	0.934	0.189	0.084	0.795	0.286	0.020	0.974
Z	0.20 km			1	0.245	0.298	−0.550	0.450	0	0	0.006	−0.073	0.049	0.095	0.712	0.259	−0.144	0.160	0.697	0.051
$\dot{X}$	0.492 m/sec				1	0.832	−0.165	0.140	0	0	−0.001	0.024	−0.015	−0.859	0.158	0.020	−0.937	0.058	0.169	−0.945
$\dot{Y}$	0.251 m/sec					1	0.252	−0.109	0	0.001	0.003	0.108	−0.072	−0.757	0.085	0.167	−0.721	−0.300	0.396	−0.796
$\dot{Z}$	0.316 m/sec						1	−0.678	0	−0.006	−0.020	0.226	−0.152	−0.141	−0.649	−0.061	0.202	−0.721	−0.001	−0.063
$GM_{\oplus}$	4.25 km³/sec²							1	−0.001	0.011	0.029	−0.450	0.304	0.214	0.474	0.352	−0.312	0.826	0.344	0.100
REM	0.050 km								1	0	0	0	0	0	−0.001	0	−0.001	0.001	0	0
CB	0.30									1	0	0.001	−0.001	−0.006	0.004	0.003	0.004	−0.013	−0.005	0.002
$GM_{☾}$	5.00 km³/sec²										1	−0.005	0.003	−0.021	0.028	0.019	0.007	−0.029	−0.011	0.012
RI (3)	0.095 km											1	0.046	−0.035	−0.184	−0.166	0.089	−0.410	−0.064	−0.114
LA (3)	0.00089 deg												1	−0.021	0.124	0.112	−0.061	0.277	0.043	0.076
LO (3)	0.00321 deg													1	0.129	0.107	0.780	0.187	0.073	0.934
RI (4)	0.128 km														1	0.299	−0.228	0.440	0.221	0.093
LA (4)	0.00102 deg															1	−0.181	0.285	0.146	0.071
LO (4)	0.00323 deg																1	−0.257	−0.101	0.884
RI (5)	0.074 km																	1	−0.180	0.091
LA (5)	0.00088 deg																		1	0.036
LO (5)	0.00306 deg																			1
		Earth-fixed spherical coordinates																		
		R	ϕ	λ	V	γ	σ													
R	0.11 km	1	−0.806	−0.088	−0.851	−0.329	−0.156													
ϕ	0.0017 deg		1	0.189	0.941	0.628	0.389													
λ	0.0032 deg			1	0.218	0.301	0.265													
V	0.113 m/sec				1	0.746	0.499													
γ	0.0009 deg					1	0.842													
σ	0.0016 deg						1													

Table 6. Correlation matrix on premaneuver data at maneuver epoch

Parameter	Standard deviation	Correlation coefficients																		
		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$	$GM_{\oplus}$	REM	CB	$GM_{☾}$	RI (3)	LA (3)	LO (3)	RI (4)	LA (4)	LO (4)	RI (5)	LA (5)	LO (5)
X	0.39 km	1	−0.327	−0.884	0.430	−0.306	−0.873	0.718	0	−0.002	−0.010	−0.310	0.209	0.524	0.731	0.206	0.145	0.563	0.403	0.481
Y	9.07 km		1	−0.062	−0.960	0.999	−0.060	0.076	0	0.001	0	0.016	−0.010	−0.897	0.034	−0.004	−0.944	0.056	0.024	−0.978
Z	7.33 km			1	−0.001	−0.089	0.993	−0.705	0	0	−0.010	0.214	−0.145	−0.149	−0.785	−0.224	0.219	−0.534	−0.458	−0.074
$\dot{X}$	0.022 m/sec				1	−0.964	0.005	0.143	0	−0.006	−0.022	−0.156	0.104	0.930	0.020	0.101	0.854	0.130	0.024	0.986
$\dot{Y}$	0.099 m/sec					1	−0.085	−0.661	0	0.004	0.007	0.019	−0.012	−0.895	0.059	−0.010	−0.942	0.070	0.009	−0.976
$\dot{Z}$	0.078 m/sec							1	0	0.003	0	0.191	−0.129	−0.141	−0.789	−0.247	0.208	−0.460	−0.527	−0.072
$GM_{\oplus}$	4.25 km³/sec²								−0.001	0.011	0.029	−0.450	0.304	0.214	0.474	0.352	−0.312	0.826	0.344	0.100
REM	0.050 km								1	0	0	0	0	0.001	−0.001	0	0	0.001	0	0
CB	0.30									1	0	0.001	−0.001	−0.006	0.004	0.003	0.004	−0.013	−0.005	0.002
$GM_{☾}$	5.00 km³/sec²										1	−0.005	0.003	−0.021	0.028	0.019	0.007	−0.029	−0.011	0.012
RI (3)	0.095 km											1	0.046	0.035	−0.184	−0.166	0.089	−0.410	−0.064	−0.114
LA (3)	0.00069 deg												1	−0.021	0.124	0.112	−0.061	0.277	0.043	0.076
LO (3)	0.00321 deg													1	0.129	0.107	0.780	0.187	0.073	0.934
RI (4)	0.128 km														1	0.299	−0.228	0.440	0.221	0.093
LA (4)	0.00102 deg															1	−0.181	0.285	0.146	0.071
LO (4)	0.00323 deg																1	−0.257	−0.101	0.884
RI (5)	0.074 km																	1	−0.180	0.091
LA (5)	0.00068 deg																		1	0.036
LO (5)	0.00306 deg																			1
		Earth-fixed spherical coordinates																		
		R	ϕ	λ	V	γ	σ													
R	0.15 km	1	−0.722	0.012	−0.408	0.107	0.739													
ϕ	0.0025 deg		1	0.062	0.911	−0.674	−0.998													
λ	0.0031 deg			1	0.090	−0.072	−0.061													
V	0.025 m/sec				1	−0.881	−0.909													
γ	0.00003 deg					1	0.662													
σ	0.00073 deg						1													

the sole contributors to the strong solutions. The station radius, latitude, and longitude are in an unnatural coordinate system. A more natural one is the X_1, X_2, X_3 system where X_3 is along the Earth spin axis and X_1, X_2 are parallel to the equatorial plane with X_1 in the station meridian and X_2 completing the orthogonal system. For this X_1, X_2, X_3 system a 1-σ a priority of 500, 500, and 100 m, respectively, was used and then rotated into the radius, latitude, longitude system for input into the program. The 100 m used on X_3 was used to keep X_3 within its known bounds, for this is one parameter that cannot be estimated from the data. The uncertainty on X_1, X_2, X_3 is transformed into the radius, latitude, and longitude system by

$$\begin{bmatrix} \cos\phi & \dfrac{-R\sin\phi}{57.295779} & 0 \\ 0 & 0 & \dfrac{R\cos\phi}{57.295779} \\ \sin\phi & \dfrac{R\cos\phi}{57.295779} & 0 \end{bmatrix}^{t} \begin{bmatrix} 0.25^{km^2} = \sigma_1^2 & 0 & 0 \\ 0 & 0.25^{km^2} = \sigma_2^2 & 0 \\ 0 & 0 & 0.01^{km^2} = \sigma_3^2 \end{bmatrix} \begin{bmatrix} \cos\phi & \dfrac{-R\sin\phi}{57.295779} & 0 \\ 0 & 0 & \dfrac{R\cos\phi}{57.295779} \\ \sin\phi & \dfrac{R\cos\phi}{57.295779} & 0 \end{bmatrix}^{t}$$

= input a priori covariance for a tracking station

where ϕ = the station geocentric latitude; R = the station geocentric radius. In parentheses next to the input a priority in Table 4 is the accepted realistic uncertainty in these parameters. The statistics are displayed at injection epoch, maneuver epoch, and lunar closest approach. The most significant result here is the solution for GM and, of course, the probe's position and velocity. Position at injection is known to within 0.5 km and velocity to within 0.5 m/sec. Note that at maneuver epoch the velocity uncertainty has decreased. This is because the spacecraft is moving slowly (1.5 km/sec) at maneuver epoch compared to its moving fast at injection (11 km/sec). The correlation matrices, both in space-fixed Cartesian and

Table 7. Values of estimated parameters at maneuver epoch*

Parameters estimated (1)	Units (2)	Nominals (3)	Premaneuver, no a priority from postmaneuver (4)	Postmaneuver, no a priority from premaneuver (5)	Postmaneuver with a priority from premaneuver (6)	Premaneuver with a priority from postmaneuver (7)	With REM constraint (8)
X	km	—	−169638.82	−169642.14	−169640.40	−169639.09	−169640.40
Y	km	—	−2928.1380	−2928.9956	−2928.6339	−2928.4060	−2928.4773
Z	km	—	−10683.048	−10671.608	−10676.441	−10676.529	−10676.566
DX	m/sec	—	−1845.1682**	−1807.8626**	−1807.8720**	−1845.1674**	−1807.8724**
DY	m/sec	—	−404.16339	−395.24578	−395.22410	−404.16908	−395.22270
DZ	m/sec	—	85.245439	100.46492	100.45332	85.313467	100.45143
$GM_{\oplus}$	km^3/sec^2	398603.20	398603.04	398603.75	398600.63	398600.75	398600.61
$GM_{☾}$	km^3/sec^2	4902.7779	4902.7441	4902.6332	4902.6293	4902.6664	4902.6182
REM	km	6378.3254	6378.3254	6378.3147	6378.3095	6378.3039	6378.3111
GB	—	0.4	0.3986	0.4045	0.3868	0.391	0.3889
Station 12							
Radius	km	6372.0164	6371.8849	6371.8792	6371.8770	6371.8776	6371.8773
Latitude	deg	35.116540	35.117368	35.117409	35.117400	35.117402	35.117400
Longitude	deg	243.19539	243.19508	243.19463	243.19428	243.19435	243.19422
Station 41							
Radius	km	6372.6076	6372.7126	6372.6432	6372.6040	6372.6112	6372.6042
Latitude	deg	−31.212360	−31.211811	−31.212164	−31.211875	−31.211914	−31.211876
Longitude	deg	136.88617	136.88659	136.88775	136.88727	136.88729	136.88722
Station .							
Radius	km	6375.5503	6375.5232	6375.4930	6375.4980	6375.4991	6375.4976
Latitude	deg	−25.738763	−25.738862	−25.739014	−25.739277	−25.739260	−25.739268
Longitude	deg	27.685588	27.685466	27.685576	27.685181	27.685219	27.685129

*Maneuver epoch was 08:37:09.000 GMT January 31, 1964.

**The differences in velocity components are due to the maneuver; premaneuver conditions are before the maneuver while postmaneuver are after the maneuver. This is also true of position, but the changes are not as dramatic, since positional changes are on the order of < 1 km.

Earth-fixed spherical coordinates, are shown in Table 5 (at injection epoch) and Table 6 (at maneuver epoch). Note the correlations in longitudes and in Y. The smallest eigenvalue of the position covariance matrix at maneuver epoch is approximately along the X axis, the next largest eigenvalue along the Y, and the largest along Z. This is because the spacecraft orbit plane is almost coincident with the X–Y plane and the direction of motion lies close to the X axis (i.e., Table 7) and in the direction of doppler measurements, whereas Z is normal to the doppler measurements and not as easily determined. Table 7, column 4, shows the parameter solution.

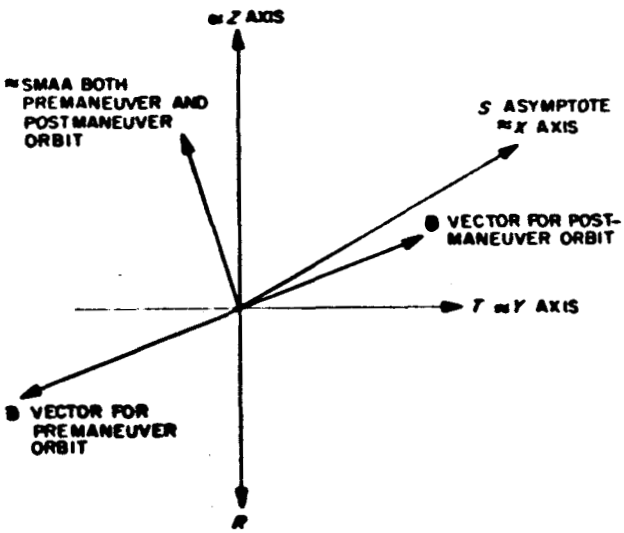


Fig. 8. Rough approximation of coordinate system relationship

At closest approach the statistics are mapped into the B plane system (Appendix C). The semimajor axis (SMAA) and semiminor axis (SMIA) (Appendix I) are the square roots of the eigenvalues of the covariance matrix in the B plane, and DEL T is the uncertainty in linearized flight time or the third dimension normal to the B plane along the incoming asymptote (Table 8). Figure 8 is a rough approximation of the coordinate system relationship, where Z in the space-fixed Cartesian system is approximately along the $\mathbf{B} \cdot \mathbf{R}$ direction.

Table 9 shows the consistency in the orbit estimates when data from various stations were used. The estimate differences are well within the associated uncertainties, and the data fit is about the same in all cases. This consistency was weaker, however, in real-time processing of the data. Small biases were evident and postflight investigation uncovered: (1) an 8 msec timing bias at Station 41 which was verified by telemetry—the station acknowledged that the wrong delay time had been used when synchronizing with WWV in Hawaii (Fig. 9); (2) a wrong transmitter frequency reported in real time on early data to Station 51; and (3) the biased angular data, in turn, biased the doppler (Figs. 10 and 11 which are comparable to Figs. 3 and 5). The Station 51 frequency was recorded only at regular intervals, but it is evident that the frequency had changed (Fig. 12). The recorder was monitoring another output channel, and, as a result, these biased data were in the inflight computations but were deleted for the postflight evaluation. These errors caused a difference in the B vector of some 66 km. This difference is rather large compared to the 30 km 1-σ uncertainty obtainable inflight from "error free" data, but the error was well within mission requirements of 150 km.

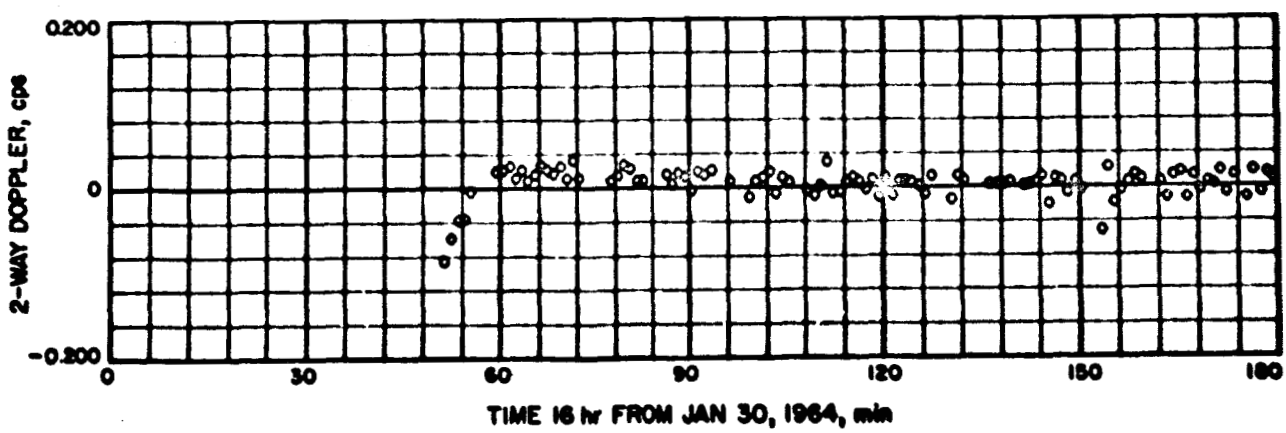


Fig. 9. Station 41 pass No. 01/301 residuals with wrong absolute time (16:00 GMT)

Table 8. Statistics in the target parameter (B) system

Premaneuver data only				Postmaneuver data only				Premaneuver as a priori for postmaneuver				Postmaneuver as a priori for premaneuver				With REM constraint			
Geocentric standard deviation	Correlation matrix			Geocentric standard deviation	Correlation matrix			Geocentric standard deviation	Correlation matrix			Geocentric standard deviation	Correlation matrix			Selenocentric standard deviation	Correlation matrix		
	B • R	B • T	TL		B • R	B • T	TL		B • R	B • T	TL		B • R	B • T	TL		B • R	B • T	TL
19.1 km B • R	1	0.187	−0.153	7.4 km B • R	1	0.465	0.096	6.00 km B • R	1	0.99	0.93	5.61 km B • R	1	0.71	0.54	1.99 B • R	1	0.91	0.78
16.4 km B • T		1	−0.651	6.1 km B • T		1	−0.836	2.15 km B • T		1	0.88	4.43 km B • T		1	−0.08	0.67 B • T		1	4.07
11.9 sec TL			1	2.90 sec TL			1	0.27 sec TL			1	2.06 sec TL			1	0.15 sec TL			1
SMAA = 19.7 km SMIA = 15.5 km DEL T = 11.9 sec θ = 110 deg Where SMAA is 110 deg counter-clockwise from the lunar equator				SMAA = 8.3 km SMIA = 4.8 km DEL T = 2.90 sec θ = 118 deg				SMAA = 6.4 km SMIA = 0.3 km DEL T = 0.27 sec θ = 104 deg				SMAA = 6.6 km SMIA = 2.6 km DEL T = 2.06 sec θ = 125 deg				SMAA = 2.1 km SMIA = 0.3 km DEL T = 0.15 sec θ = 107 deg			

Table 9. Orbit estimate using data supplied by various stations

Data from stations	Data fit	Changes in position at maneuver epoch with its uncertainty, km		
		X	Y	Z
12 and 51 (late)*	$\sigma_{12} = 0.023, \mu_{12} = -0.0004$ $\sigma_{51} = 0.031, \mu_{51} = -0.0004$	Δ = −5 σ = 10.2	+4.8 9.7	64.0 106.6
12 and 41	$\sigma_{12} = 0.023, \mu_{12} = 0.0013$ $\sigma_{41} = 0.011, \mu_{41} = 0.0005$	Δ = +0.1 σ = 4.1	−0.1 14.7	−3.5 76.0
12 and 51 (early)	$\sigma_{12} = 0.022, \mu_{12} = 0.0011$ $\sigma_{51} = 0.076, \mu_{51} = -0.0040$	Δ = −20.0 σ = 56.0	−33.0 83.2	+350.0 1086.4
All data**	$\sigma_{12} = 0.023, \mu = -0.0003$ $\sigma_{41} = 0.012, \mu = -0.0006$ $\sigma_{51\,(early)}{}^{*} = 0.076, \mu = -0.0003$ $\sigma_{51\,(late)}{}^{*} = 0.033, \mu = -0.0010$	Δ = 0 σ = 0.4	0 9.1	0 7.3

*(early) means data on the first pass (21 — 5-sec pts).
(late) means data on the second pass.
**The all-data fit is the base case (Δ = 0 by definition).

In conclusion, the results bear out a good fit to all the data, and the solution vector on the physical constants is consistent with presently accepted values. The statistics are not very startling since the only significant improvement came in $GM_{\oplus}$ and its statistic is the same as the pre-*Ranger* "accepted" uncertainty. These results are used as the a priority for the postmaneuver orbit, although the postmaneuver data can be processed without this a priority.

D. Postmaneuver Orbit Based on Postmaneuver Tracking Only

Table 10, columns 1 through 5, gives the data residual statistics for various time blocks during a station pass depending on whether the station data were above or below 17 deg and whether they were on or off the rubidium standard. Figs. 13 through 23 show the data point residuals. Note the difference in noise characteristics among Stations 12, 41 and 51. Station 12 has the rubidium standard for its transmitter reference whereas 41 and 51 do not. It is clearly evident in Fig. 13 when Station 12 was not on the rubidium standard. Because of the accelerations at impact, a higher sample rate was used and the data are noisier (Fig. 17). The solution parameter vector and its statistics are displayed in Tables 4 (columns 8 and 9) and 7 (column 5). It can be seen that $GM_{\oplus}$ statistics have been reduced from ± 5.0 km^3 sec^{-2} to ± 0.434 km^3/sec^2, and that station location uncertainties have decreased a factor of 4 in longitude. Also, some information has come in on the *REM* solution. Table 11 shows the correlation matrices on the estimated parameters both in space-fixed Cartesian and Earth-fixed spherical coordinate systems. These statistics and solutions are also displayed at impact in Tables 8 and 12, respectively.

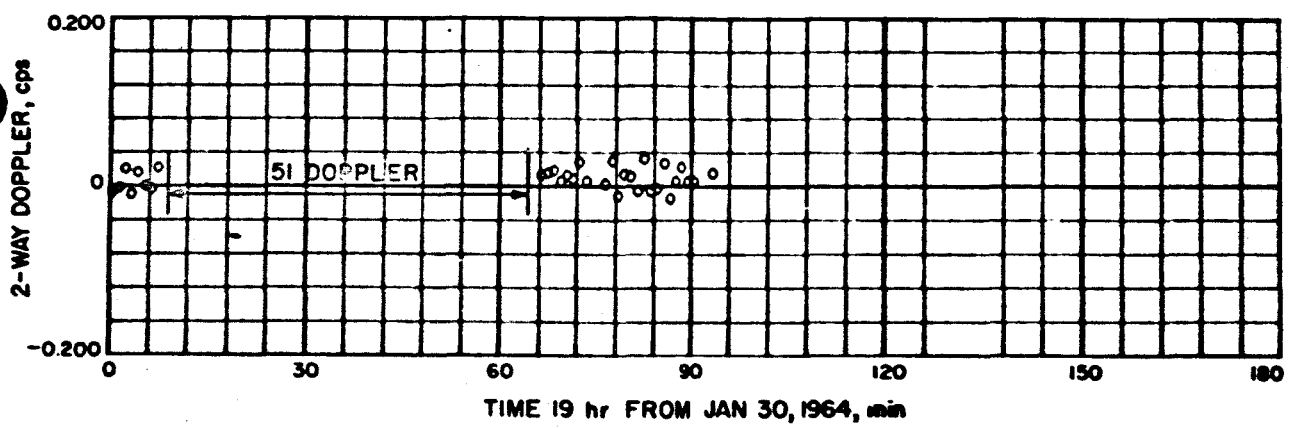


Fig. 10. Station 41 pass No. 01/301 residuals with angle fit (19:00 GMT)

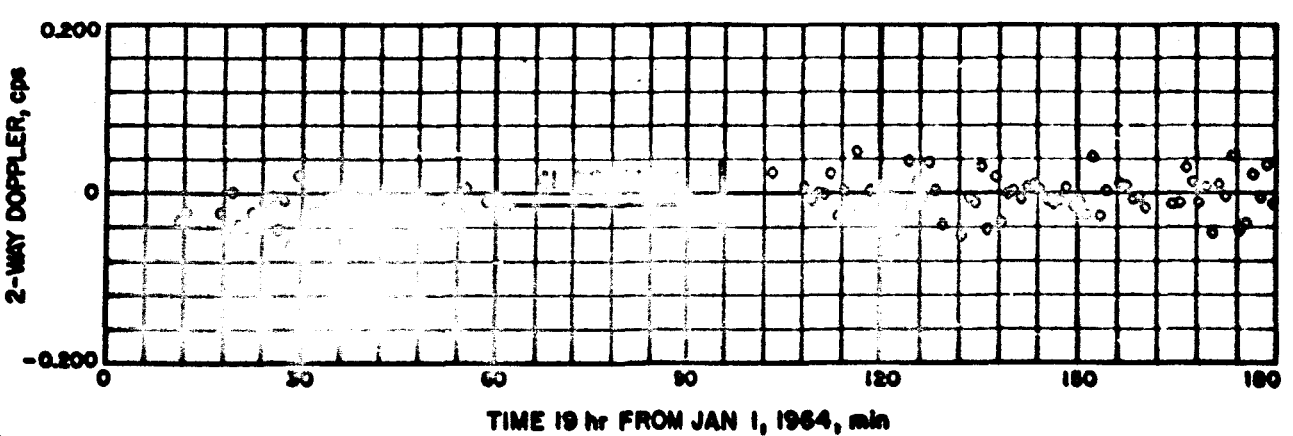


Fig. 11. Station 51 pass No. 01/302 residuals with angle fit (19:00 GMT)

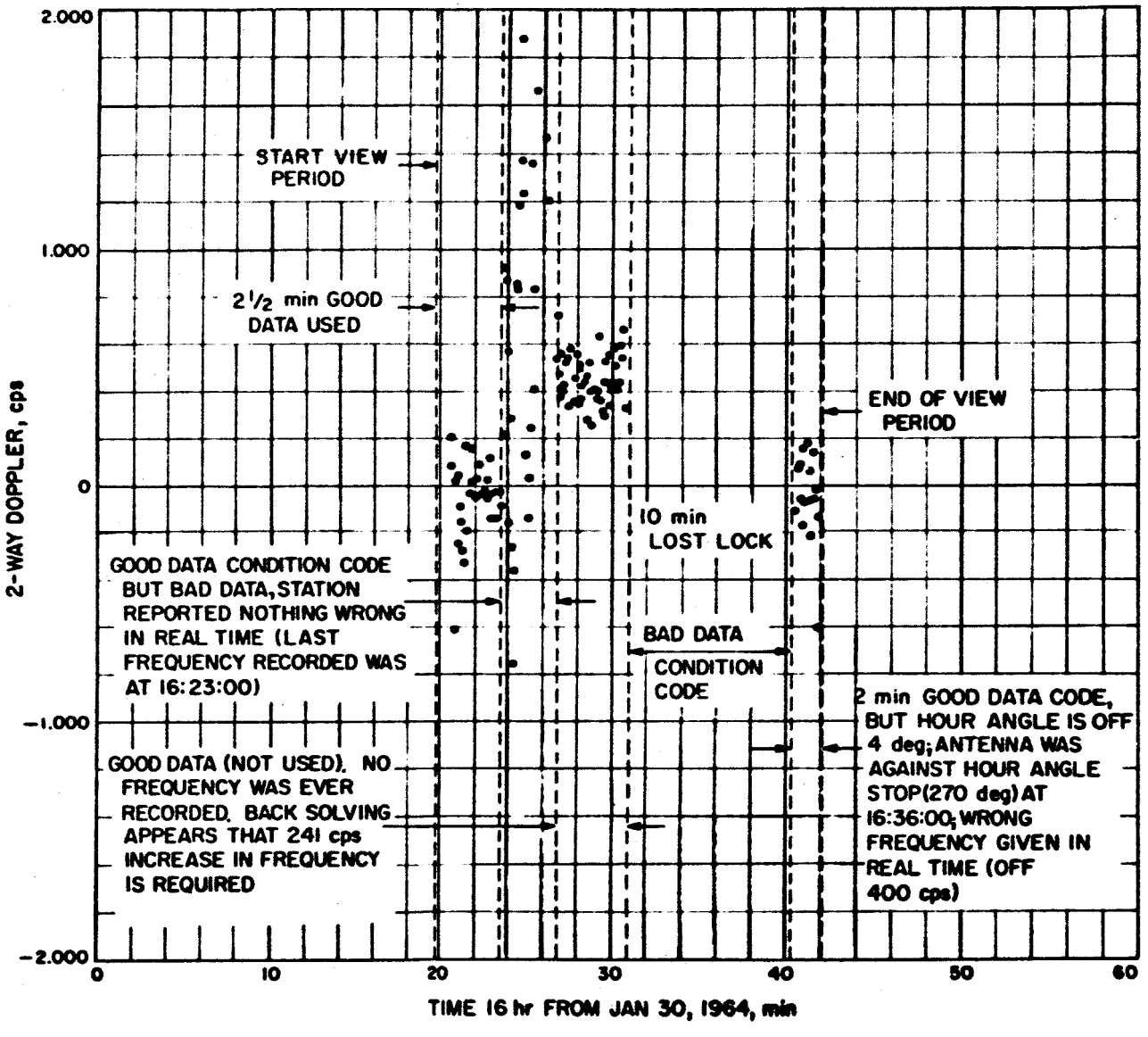


Fig. 12. Station 51 pass No. 01/301 residuals on all early data

Table 10. Statistics on postmaneuver data

Station	No a priority from premaneuver				With premaneuver data as a priority		With REM constraint	
	Number of doppler points	Standard deviation cps	Mean, cps	Remarks*	Standard deviation cps	Mean, cps	Standard deviation cps	Mean, cps
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
12	41	0.0220	0.0015	Pass No. 1, above 17 deg, not rubidium	0.0220	−0.0006	0.0222	−0.0004
	324	0.0093	0.0001	Pass No. 1, above 17 deg rubidium	0.0094	0.0012	0.0094	0.0013
	19	0.0130	−0.0029	Pass No. 1, below 17 deg, rubidium	0.0130	−0.0033	0.0133	−0.0036
	53	0.0120	0.0076	Pass No. 2, below 17 deg, rubidium	0.0120	0.0079	0.0120	0.0075
	543	0.0088	−0.0000	Pass No. 2, below 17 deg, rubidium	0.0088	−0.0005	0.0088	−0.0007
	71	0.0091	−0.0098	Pass No. 2, below 17 deg, rubidium	0.0090	−0.0089	0.0090	−0.0095
	54	0.0097	0.0018	Pass No. 3, below 17 deg, rubidium	0.0099	0.0063	0.0098	0.0051
	57	0.0087	−0.0009	Pass No. 3, above 17 deg, rubidium	0.0089	0.0008	0.0091	−0.0013
	11	0.0140	−0.0077	Pass No. 3, above 17 deg, not rubidium	0.0130	−0.0098	0.0133	−0.0138
	20	0.0087	−0.0001	Pass No. 3, above 17 deg, rubidium	0.0088	−0.0047	0.0089	−0.0122
	35	0.0250	−0.0012	Pass No. 3, above 17 deg, not rubidium	0.0350	0.0134	0.0332	−0.0268
	12	0.2110	−0.0487	Pass No. 3, above 17 deg, not rubidium (5-sec count)	0.2070	−0.0779	0.2060	−0.2340
41	259	0.0330	−0.0011	Pass No. 1, above 17 deg, not rubidium	0.0280	−0.0018	0.0333	−0.0001
	146	0.0510	0.0042	Pass No. 2, above 17 deg, not rubidium	0.0470	−0.0004	0.0515	0.0060
51	397	0.0277	+0.0006	Pass No. 1, above 17 deg, not rubidium	0.0276	−0.0018	0.0276	−0.0022
	264	0.0471	−0.0005	Pass No. 2, above 17 deg, not rubidium	0.0473	−0.0045	0.0473	−0.0009
	0.01 cps = 0.00156 m/sec							

*17 deg was chosen as a point above which uncertainties in atmospheric effects would be negligible. Rubidium standards are available at Station 12; Stations 41 and 51 do not have the equipment. The remarks are made primarily for data weighting considerations (Appendix B).

Notice (column 5, Table 12) the consistent results when only Goldstone data were used. Other consistency checks were made on effects due to differences in ephemeris and universal time (ET − UT), the lunar scale factor (*REM*), the Moon's moments of inertia, and solar pressure. The effect of a change of 1 sec in ET − UT was essentially a change in longitude of the conditions prevailing at the maneuver epoch with all the impact parameters virtually staying the same. The *REM* perturbation moved the position at maneuver radially along the Earth–Moon line and left the impact parameters unchanged. Both solar pressure and moments of inertia were of very small effect (i.e., less than 1 km in B). The primary check was always the comparison of the position vector at maneuver epoch, meaning that the position vector, obtained using only premaneuver data, should be almost the same (except for the small shift due to maneuver execution) as the position vector when using only postmaneuver data. Table 13 shows these values with the small maneuver position increments. Again the solutions are all within the 1-σ estimates and assure consistency. One discrepancy in the postmaneuver data which is apparent in Table 12 is the difference in recorded and calculated impact time. Although it is well within the standard deviation calculated at this time, it later becomes much too large. The discrepancy is explained in Section II E 3.

E. Combined Estimate Based on Premaneuver and Postmaneuver Tracking

1. Method of Combining

In an effort to obtain the best estimate on the postmidcourse maneuver orbit, the premidcourse maneuver data compiled in a covariance matrix were used as a priority for the postmidcourse maneuver data. The same was done for the premidcourse maneuver orbit where the postmidcourse maneuver data were used as an a priori covariance matrix for the premidcourse maneuver data.

Table 11. Correlation matrix on postmaneuver data at maneuver epoch

Parameters	Standard deviation	Correlation coefficients																		
		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$	$GM_{\oplus}$	REM	C8	$GM_{☾}$	RI (3)	LA (3)	LO (3)	RI (4)	LA (4)	LO (4)	RI (5)	LA (5)	LO (5)
		1	−0.187	−0.791	−0.831	0.416	0.276	−0.534	−0.815	0.024	0.314	−0.032	0.006	−0.014	0.024	0.014	−0.305	0.015	0.009	−0.252
X	3.02 km		1	0.285	0.066	0.205	−0.682	−0.196	0.408	−0.009	−0.771	0.100	−0.052	−0.844	0.079	0.036	−0.726	0.080	0.021	−0.748
Y	3.8 km			1	0.962	−0.347	−0.456	−0.033	0.523	−0.044	−0.634	0.032	0.013	−0.119	−0.046	−0.028	0.293	−0.053	−0.022	0.214
Z	8.5 km				1	−0.464	−0.273	0.107	0.482	−0.046	−0.431	0.010	0.010	0.130	−0.061	−0.034	0.513	−0.071	−0.027	0.440
$\dot{X}$	0.015 m/sec					1	−0.618	−0.545	0.136	0.008	−0.279	−0.040	0.020	−0.615	−0.015	−0.025	−0.647	−0.026	−0.006	−0.670
$\dot{Y}$	0.027 m/sec						1	0.453	−0.618	−0.008	0.850	−0.026	−0.004	0.834	0.040	0.024	0.561	0.026	0.011	0.636
$\dot{Z}$	0.041 m/sec							1	0.392	0.073	0.488	0.026	−0.023	0.415	0.050	0.028	0.310	0.060	0.019	0.349
$GM_{\oplus}$	7.20 km³/sec²								1	0.005	−0.442	0.030	−0.007	−0.415	−0.027	−0.015	−0.185	0.002	−0.002	−0.241
REM	0.040 km									1	0.005	−0.005	0.003	−0.009	0	0	−0.020	−0.004	−0.001	−0.019
C8	0.29										1	−0.041	0.008	0.768	0.011	0.010	0.459	−0.003	0.003	0.526
$GM_{☾}$	0.434 km³/sec²											1	0.962	−0.048	0.017	0.008	−0.056	0.014	0.004	−0.054
RI (3)	0.059 km												1	0.026	−0.008	−0.004	0.024	−0.006	−0.002	0.023
LA (3)	0.00074 deg													1	−0.028	−0.012	0.880	−0.050	−0.014	0.916
LO (3)	0.00093 deg														1	−0.568	−0.089	0.023	0.007	−0.049
RI (4)	0.067 km															1	−0.029	0.012	0.004	−0.024
LA (4)	0.00080 deg																1	−0.084	−0.027	0.950
LO (4)	0.00086 deg																	1	−0.811	−0.086
RI (5)	0.050 km																		1	−0.016
LA (5)	0.00082 deg																			1
LO (5)	0.00083 deg																			

		Earth-fixed spherical coordinates					
		R	φ	λ	V	γ	σ
R	2.60 km	1	0.713	−0.146	0.979	0.944	−0.700
φ	0.0029 deg		1	−0.294	0.742	0.889	−0.900
λ	0.0013 deg			1	−0.011	−0.255	−0.004
V	0.200 m/sec				1	0.950	−0.726
γ	0.00021 deg					1	−0.791
σ	0.00040 deg						1

Table 12. Impact parameter estimates

Parameter* (1)	Premaneuver data only (2)	Postmaneuver data only (3)	Postmaneuver data only: Goldstone data only (4)	Premaneuver data as a priority for postmaneuver (5)	Postmaneuver data as a priority for premaneuver (6)
B • TT, km	−4507.96	2750.06	2749.93	2751.43	−4505.28
B • RT, km	1594.40	−770.01	−770.71	−764.42	1581.29
TF,** hr	64.624443 (closest approach)	48.619326	48.619322	48.619378	64.622328
Latitude,* deg	−8.653	9.409		9.303**	−9.044
Longitude,* deg	190.232	21.401		21.426**	191.628
GMT**	Feb 2, 1964 08:54:09.00	Feb 2, 1964 09:24:30.29		Feb 2, 1964 09:24:30.46	Feb 2, 1964 08:54:16.70
Altitude, km	788.5	0.0		0.0	781.75

*See Appendix C for definition.

**Based on a lunar radius of 1738.00 km. Observed impact time at Goldstone, California corrected for signal travel time was 09:24:31.86. Best lunar elevation from Air Force Map (Ref. 1) September 1962 (LAC 60) = 1738.40 km, U.S. Army Map = 1738.9 km (Ref. 2).

†Of impact or closest approach.

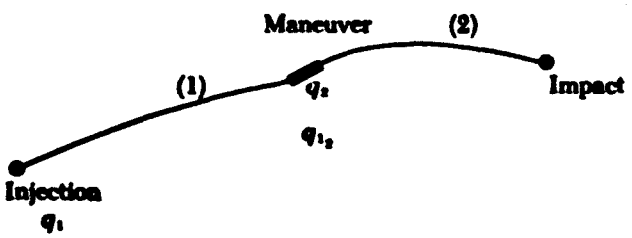
**Best latitude = 9.44 deg and best longitude = 21.50 deg with $R_{☾}$ = 1735.3 km for best match of recorded impact time.

Table 13. Positions at maneuver epoch

Premaneuver only*		Postmaneuver only	Post − pre, km
X	−169638.82		
ΔX	−1.25		
X + ΔX	−169640.07 ± 0.385	−169642.14 ± 2.86	2.07
Y	−2928.1380		
ΔY	−0.296		
Y + ΔY	−2928.4340 ± 9.07	−2928.9956 ± 3.80	0.56
Z	−10683.048		
ΔZ	−0.515		
Z + ΔZ	−10683.563 ± 7.33	−10671.608 ± 8.51	11.9

*Δ's are the positional changes during maneuver motor burn.

Theoretically, the physical constant solutions should be the same, and thus the entire two phases should be consistent by having the same physical constants. When premidcourse and postmidcourse were done independently of each other this was not the case, as is evident in Table 7. The method of combining this information was:



$$\Delta q_1^* = (A_1^T W A_1 + \Lambda_{2_1}^{-1})^{-1} [A_1^T W (O_1 - C_1) + \Lambda_{2_1}^{-1} (q_{2_1} - q_1)]$$

$$q_1^* = q_{2_1} + \Delta q_1^* = \text{best premaneuver estimate}$$

where

$$\Lambda_{2_1} = U(\Lambda_2 + \Lambda_M) U^T$$

$$\Lambda_2 = (A_2^T W A_2 + \tilde{\Lambda}^{-1})^{-1}$$

U = maps $(q_2 - q_m)$ to injection

$\tilde{\Lambda}$ = a priori covariance

$$A_2 = \frac{\partial \text{ observable in block (2) (postmaneuver)}}{\partial \text{ estimated parameter}}$$

$$q_{2_1} = U(q_2 - q_m)$$

q_2 = vector of estimated parameters from block (2) data only

$\Lambda_2 = (A_2^T W A_2)^{-1}$ covariance on estimated parameters from block (2) data only

W = diagonal weighting matrix on observables

$O - C$ = residuals (i.e., observed data − calculated data)

Λ_M = covariance on maneuver (diagonal and very pessimistic)

q_m = maneuver estimate based on maneuver commands

The expression for the best postmaneuver estimate is very similar.

$$\Delta q_2^* = (A_2^T W A_2 + \Lambda_{1_2}^{-1})^{-1} [A_2^T W (O_2 - C_2) + \Lambda_{1_2}^{-1} (q_{1_2} - q_2)]$$

$$q_2^* = q_{1_2} + \Delta q_2^* + q_m$$

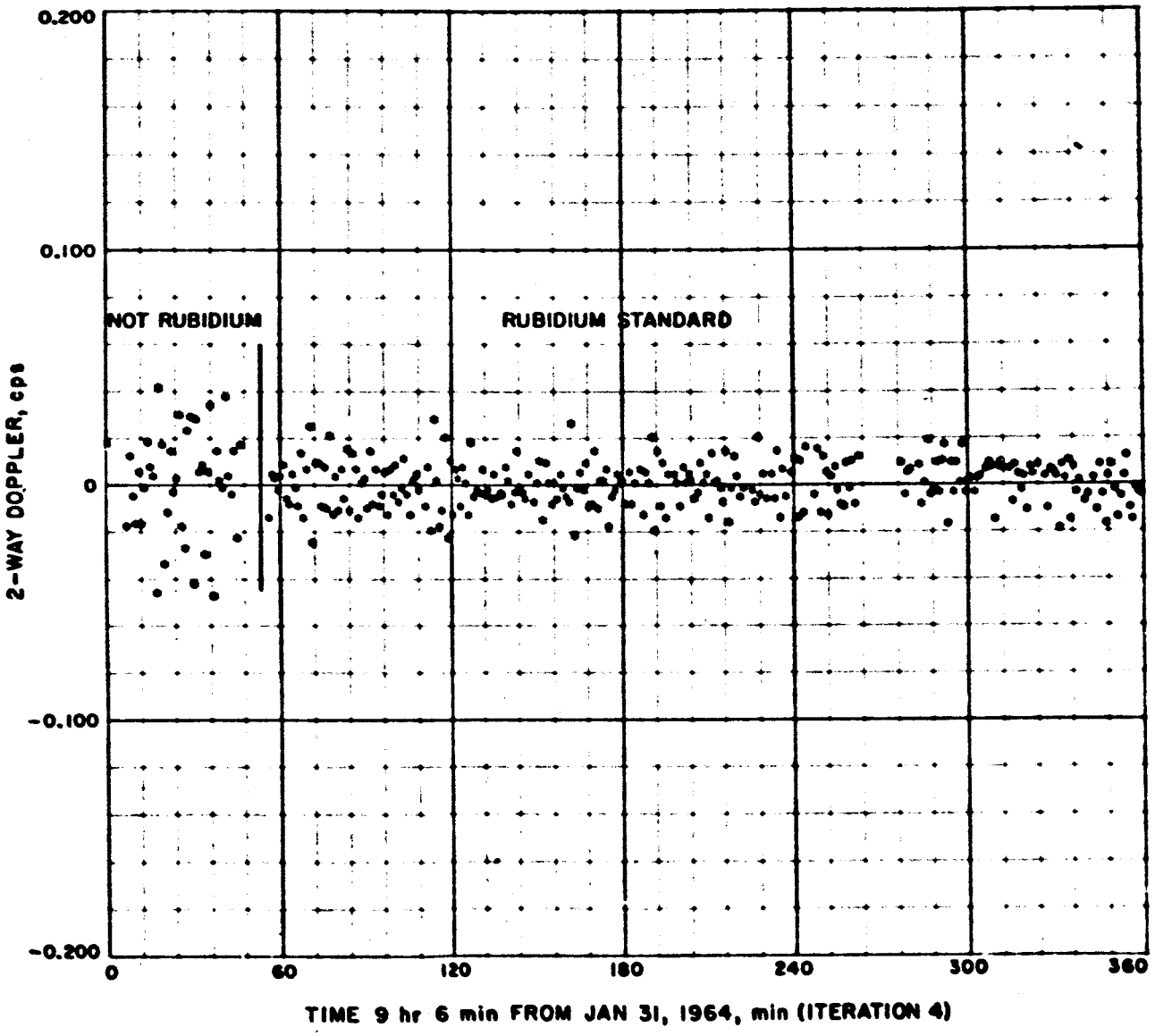


Fig. 13. Station 12 pass No. 01/313 postmaneuver residuals (19:06 GMT)

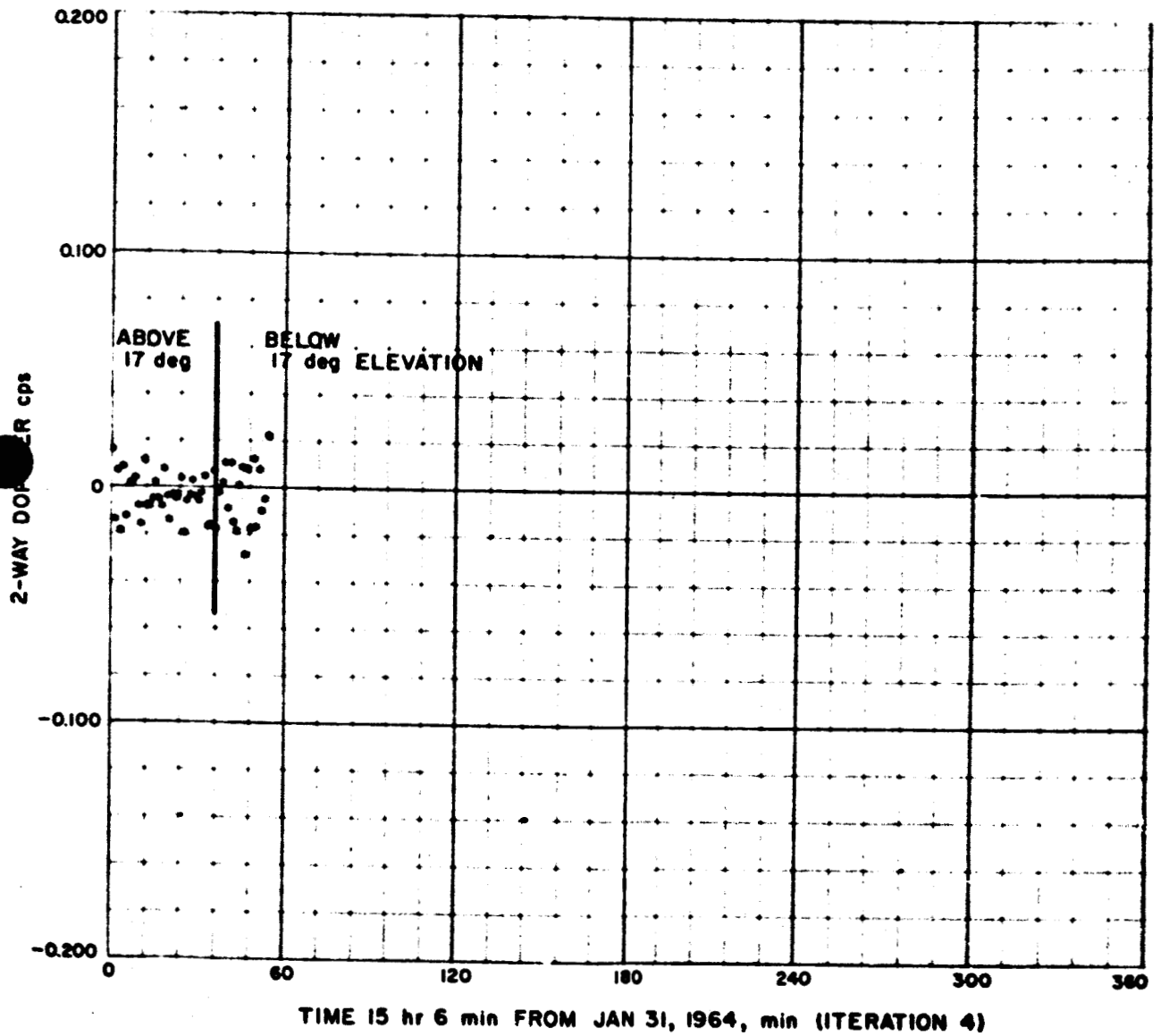


Fig. 14. Station 12 pass No. 01/314 postmaneuver residuals (15:06 GMT)

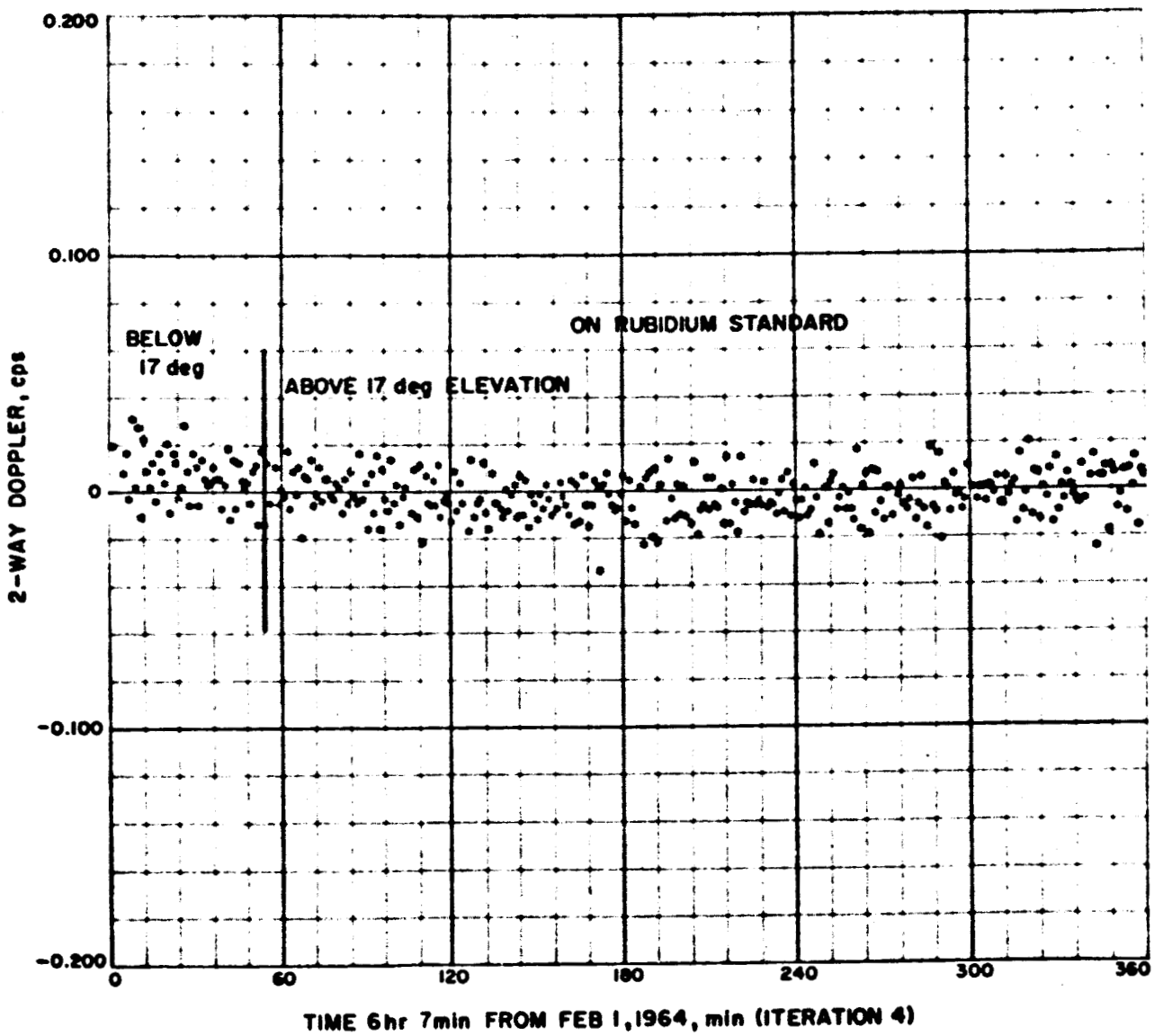


Fig. 15. Station 12 pass No. 02/321 postmaneuver residuals (6:07 GMT)

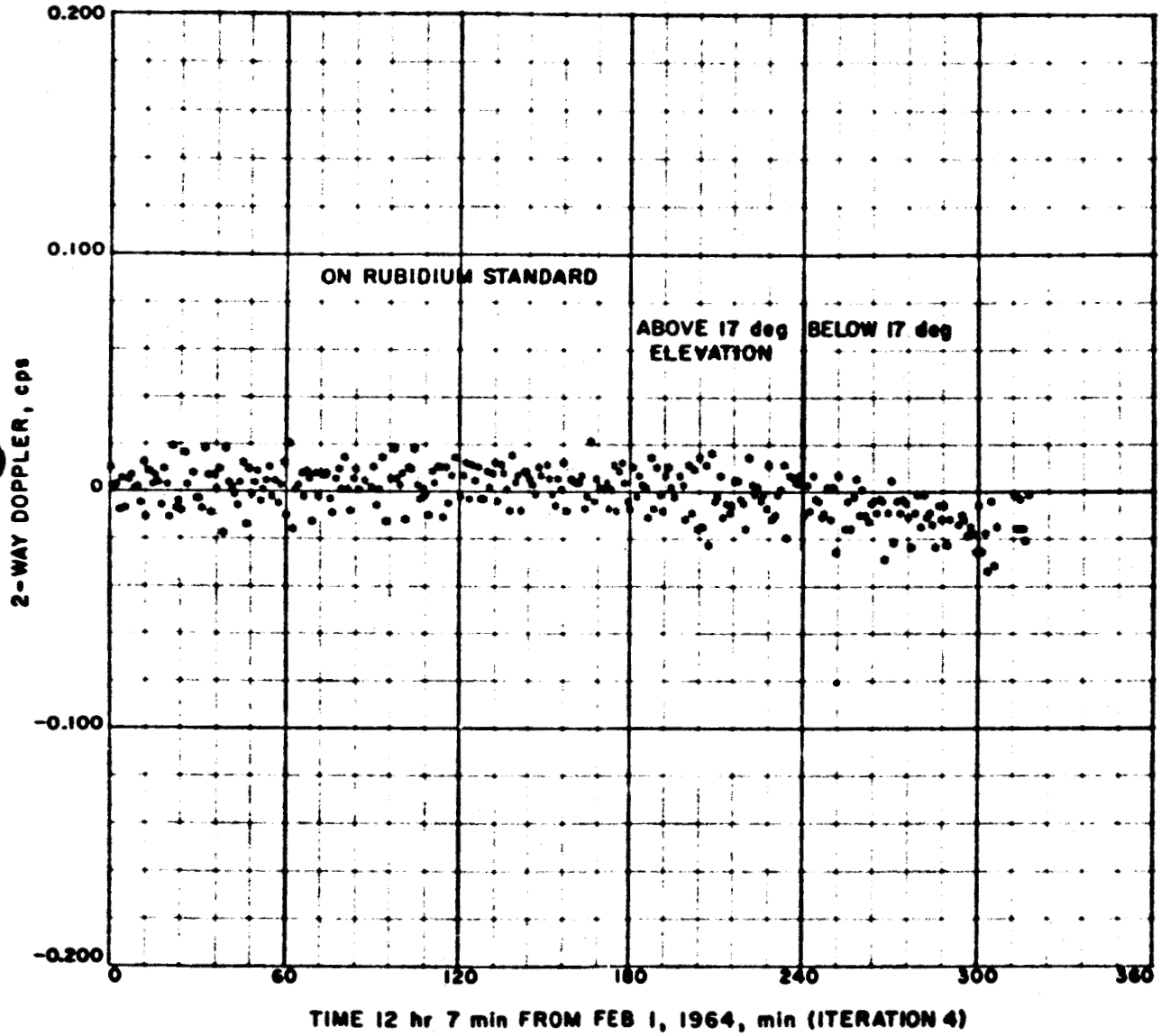


Fig. 16. Station 12 pass No. 02/322 postmaneuver residuals (12:07 GMT)

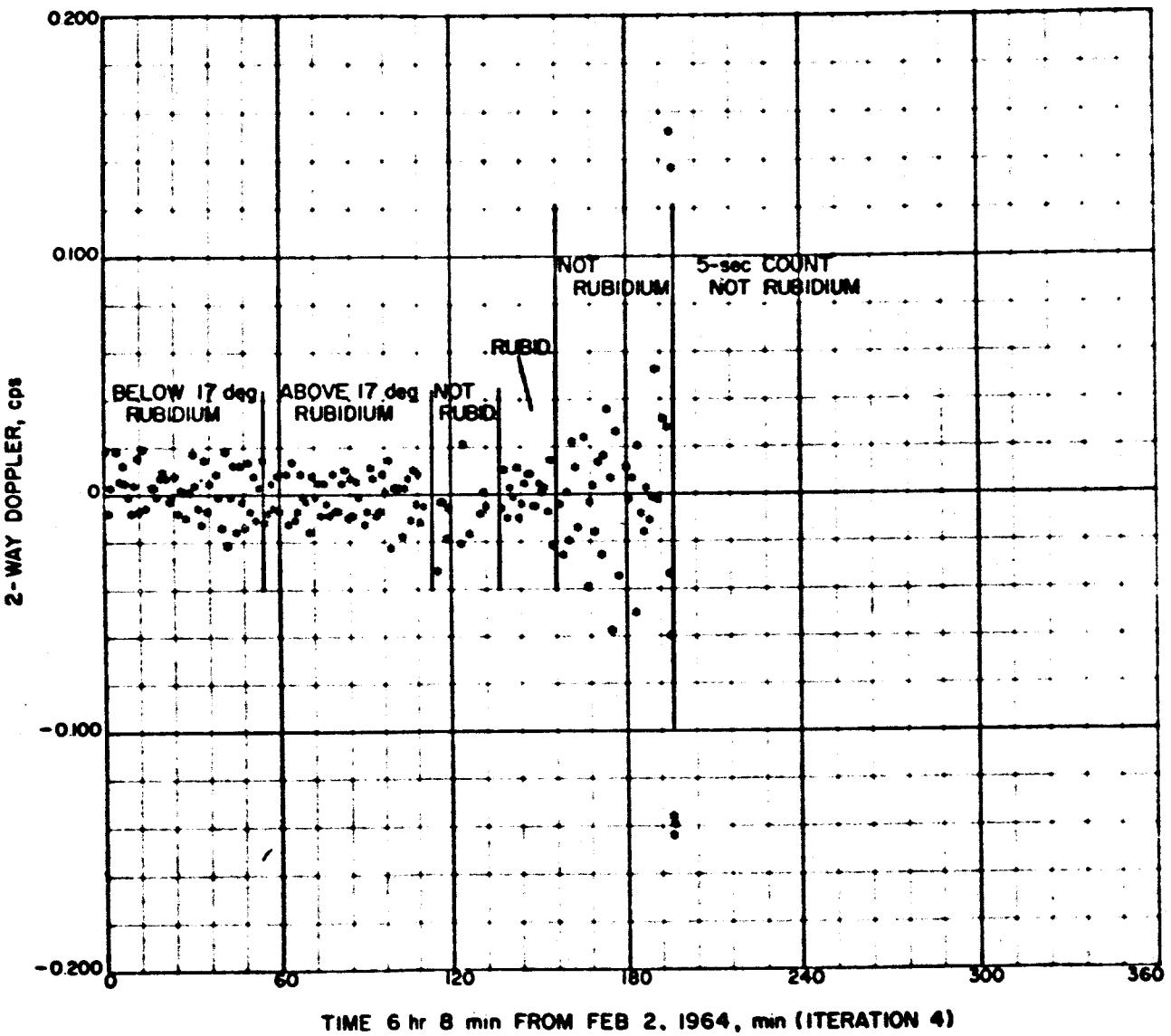


Fig. 17. Station 12 pass No. 03/331 postmaneuver residuals (6:08 GMT)

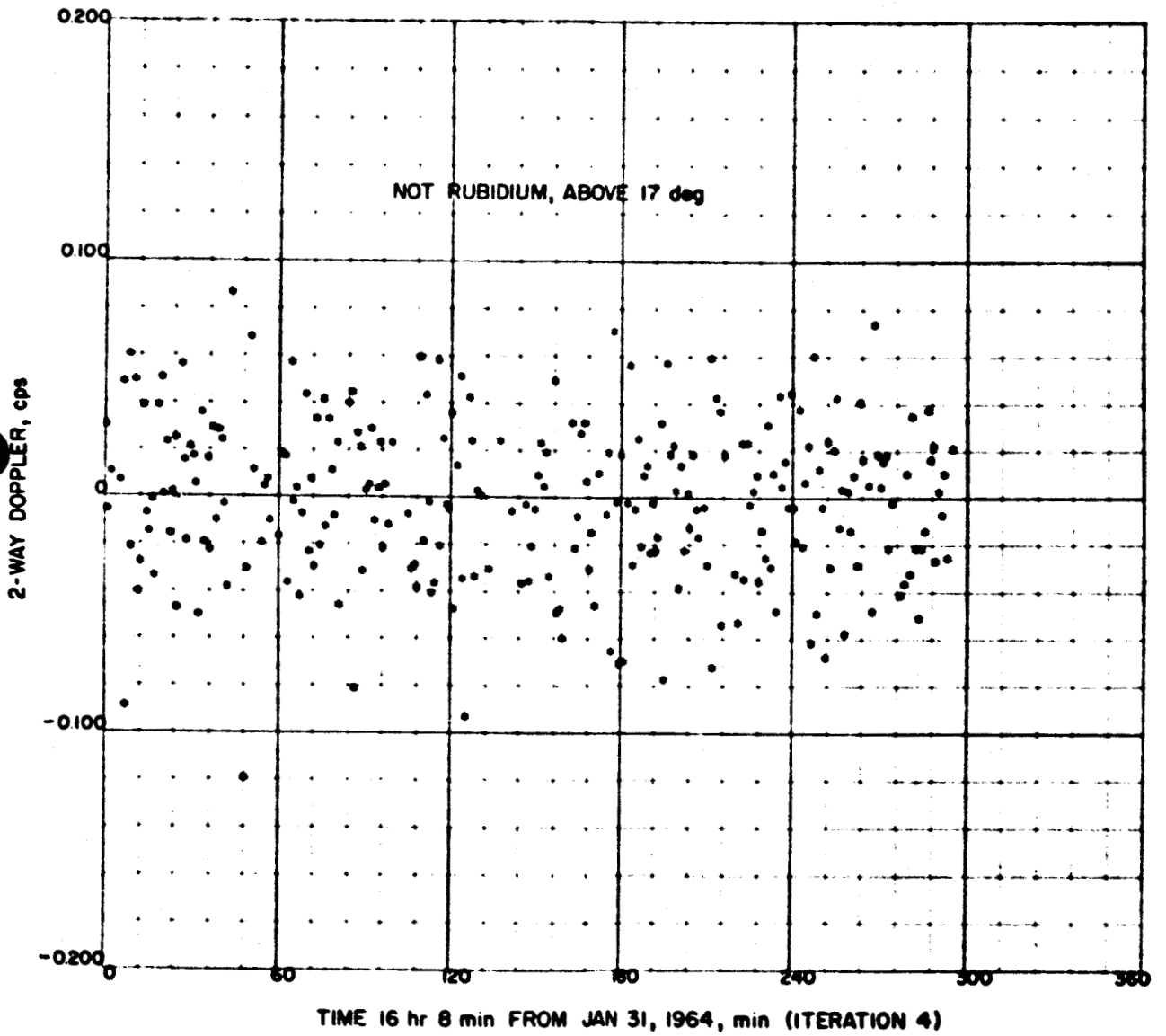


Fig. 18. Station 41 pass No. 01/311 postmaneuver residuals (16:08 GMT)

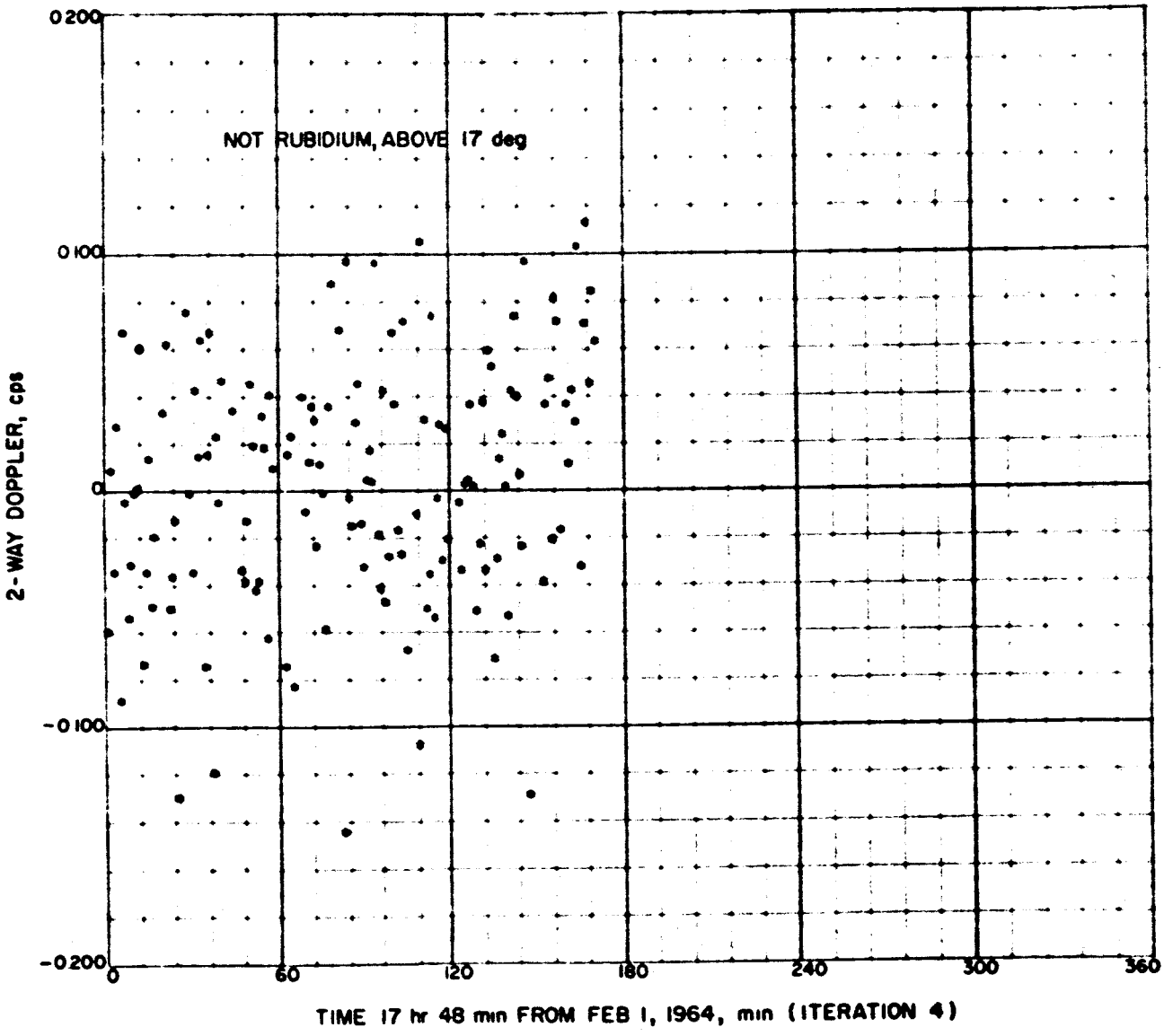


Fig. 19. Station 41 pass No. 02/011 postmaneuver residuals (17:48 GMT)

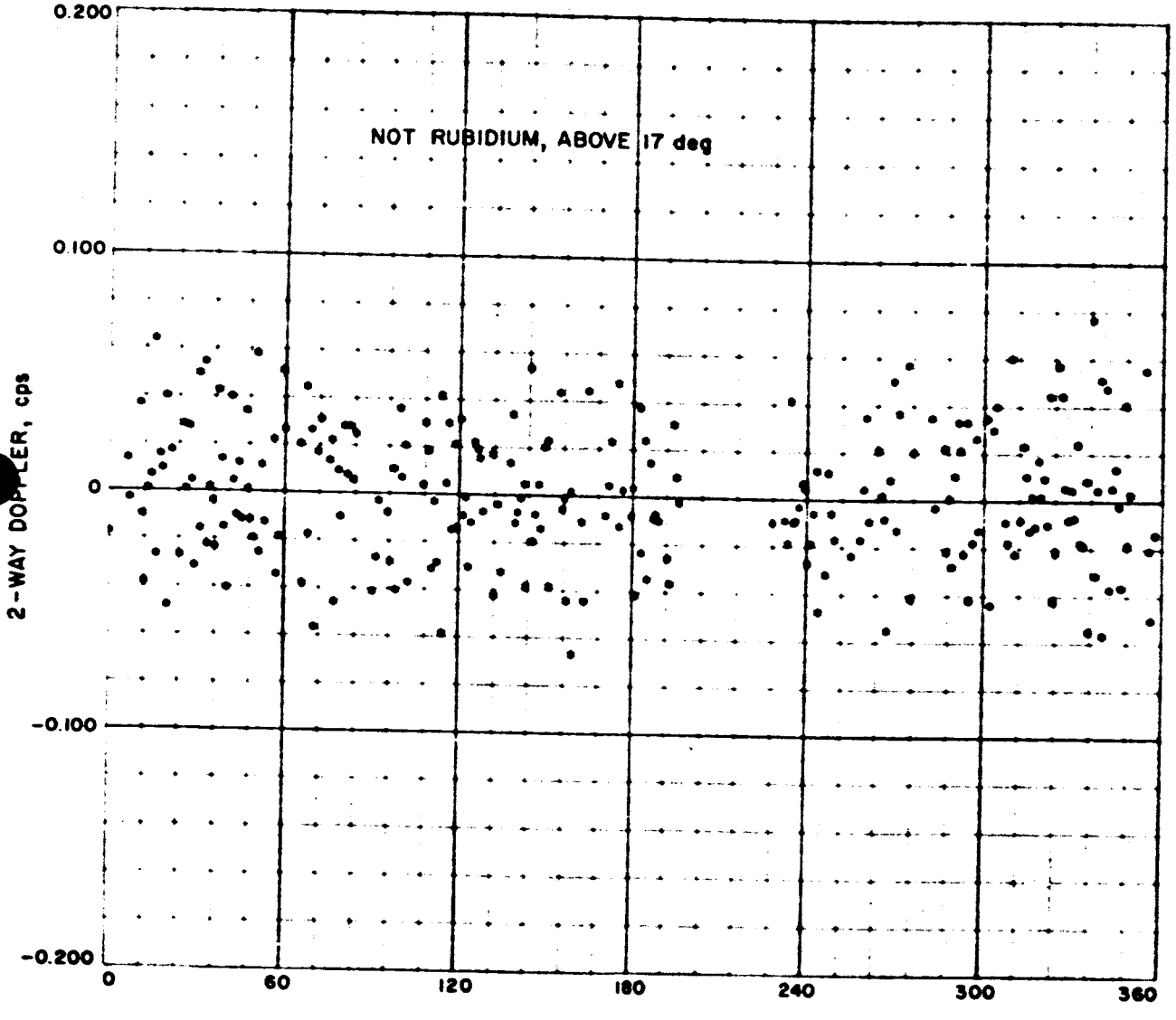


Fig. 20. Station 51 pass No. 01/311 postmaneuver residuals (21:06 GMT)

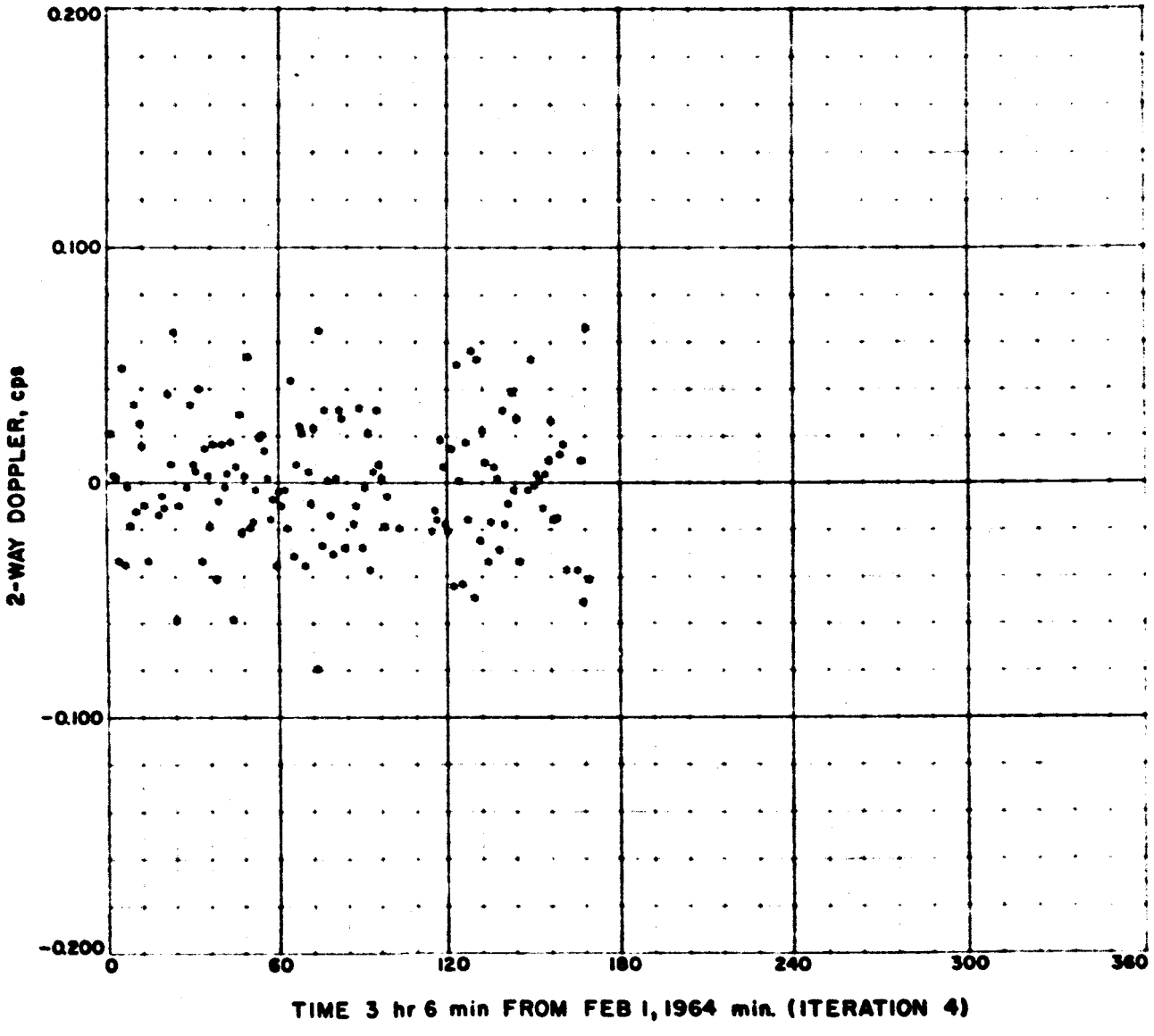


Fig. 21. Station 51 pass No. 01/311 postmaneuver residuals (3:06 GMT)

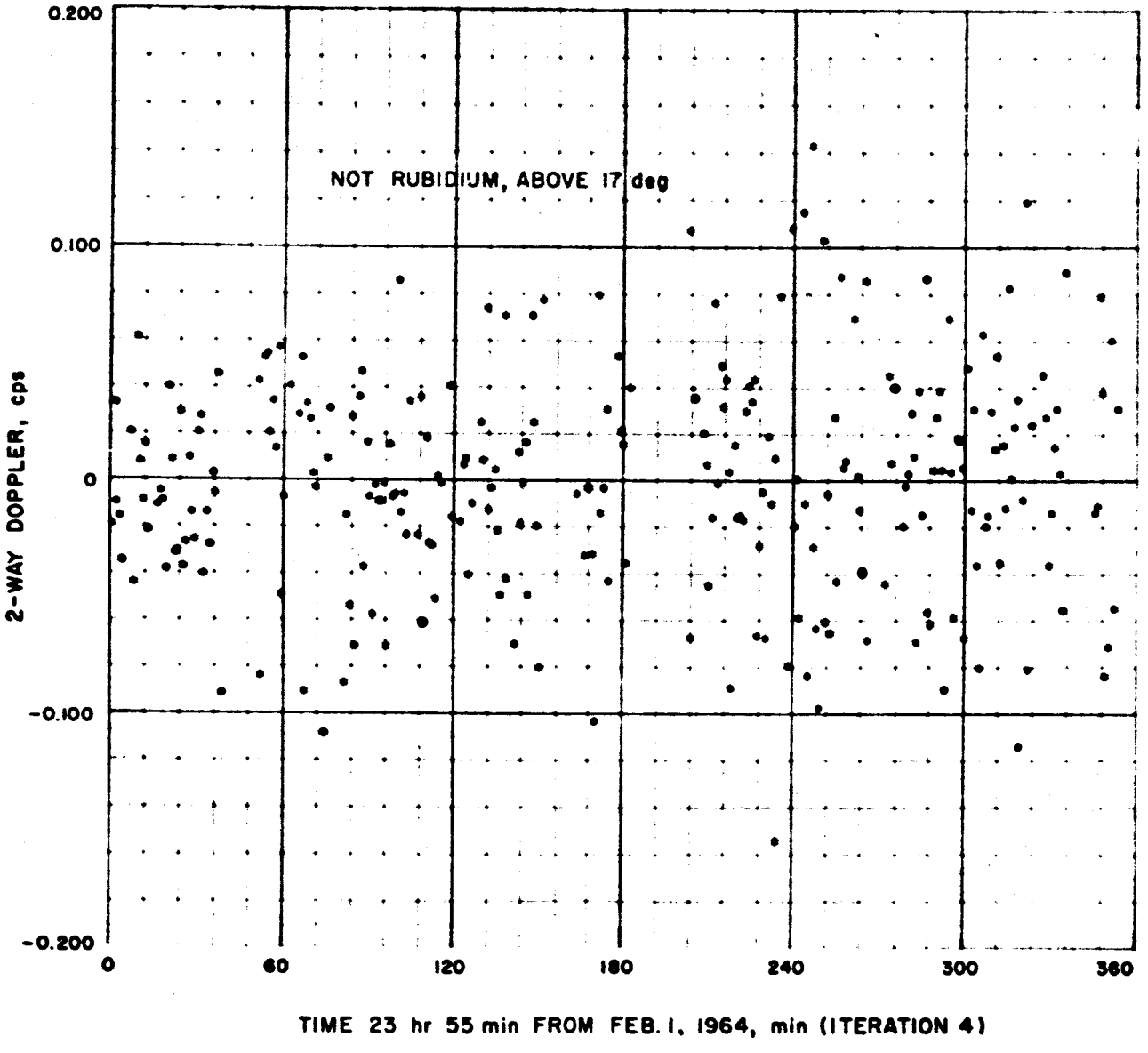


Fig. 22. Station 51 pass No. 02/011 postmaneuver residuals (23:55 GMT)

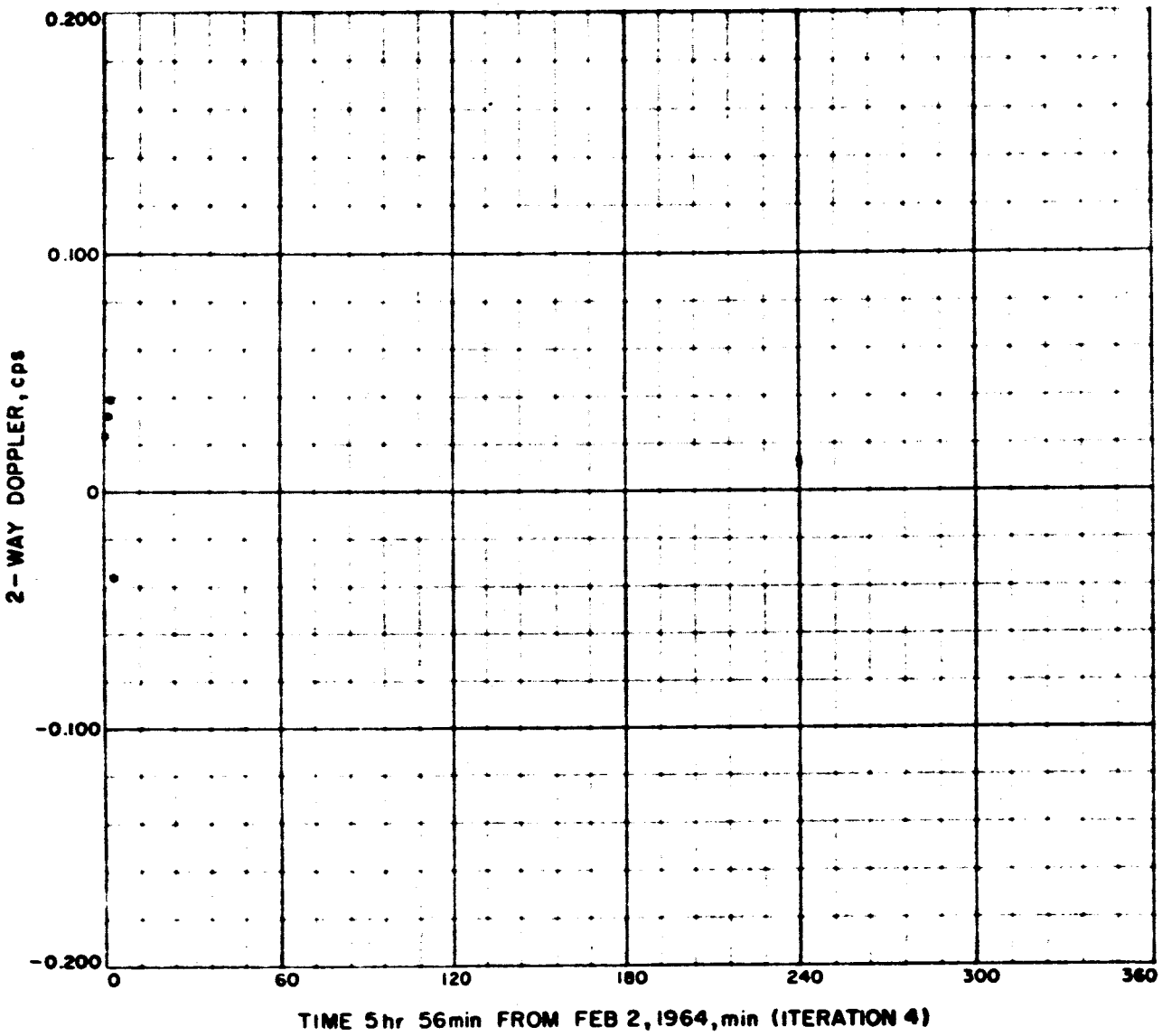


Fig. 23. Station 51 pass No. 02/011 postmaneuver residuals (5:56 GMT)

The best premaneuver estimate was then mapped to the maneuver epoch and differenced with the best postmaneuver estimate to give the best maneuver estimate, discussed in Section III C.

2. Results of Combining Premaneuver and Postmaneuver Data

Columns 6 and 7 of Table 10 show the data statistics and Figs. 24 through 34 show the data residuals on the postmaneuver data when the premaneuver data are used for a priority. The data fit is almost the same as when no a priority was used, confirming that the data packages are consistent among themselves. Table 7, column 6 displays the solution vector, and Table 4, columns 10 and 11, gives the statistics. Now the power of combining the two phases is dramatically seen. $GM_{\oplus}$, $GM_{☾}$, and REM are measured a factor of two better than each separate estimate. Station location uncertainties are reduced, too. The most pleasing part is the solution for

REM, which in real life is dependent on $GM_{\oplus}$ and $GM_{☾}$, but is uncoupled in the orbit determination program (ODP). *REM* is related to the *GM*'s by the following constraint (Ref. 3)

$$REM = 86.315745(GM_{\oplus} + GM_{☾})^{1/2}$$

If *REM* is calculated from the constraint equation above, using the $GM_{\oplus}$ and $GM_{☾}$ values obtained in Table 7, the corresponding *REM* equals 6378.3112 km, which is a −14.2 m change from the nominal. The solution in the ODP is a −15.9 m change from the nominal and is then only 1.7 m from the constrained value. The correlation matrices are displayed in Table 14. Notice the correlations in longitude and latitude; this is due to the choice of the coordinate system explained in Section III B. Tables 8 and 12 show the impact conditions. Notice the slight change in impact time of 0.15 sec and its uncertainty, which is reduced a magnitude from 2.5 to 0.27 sec.

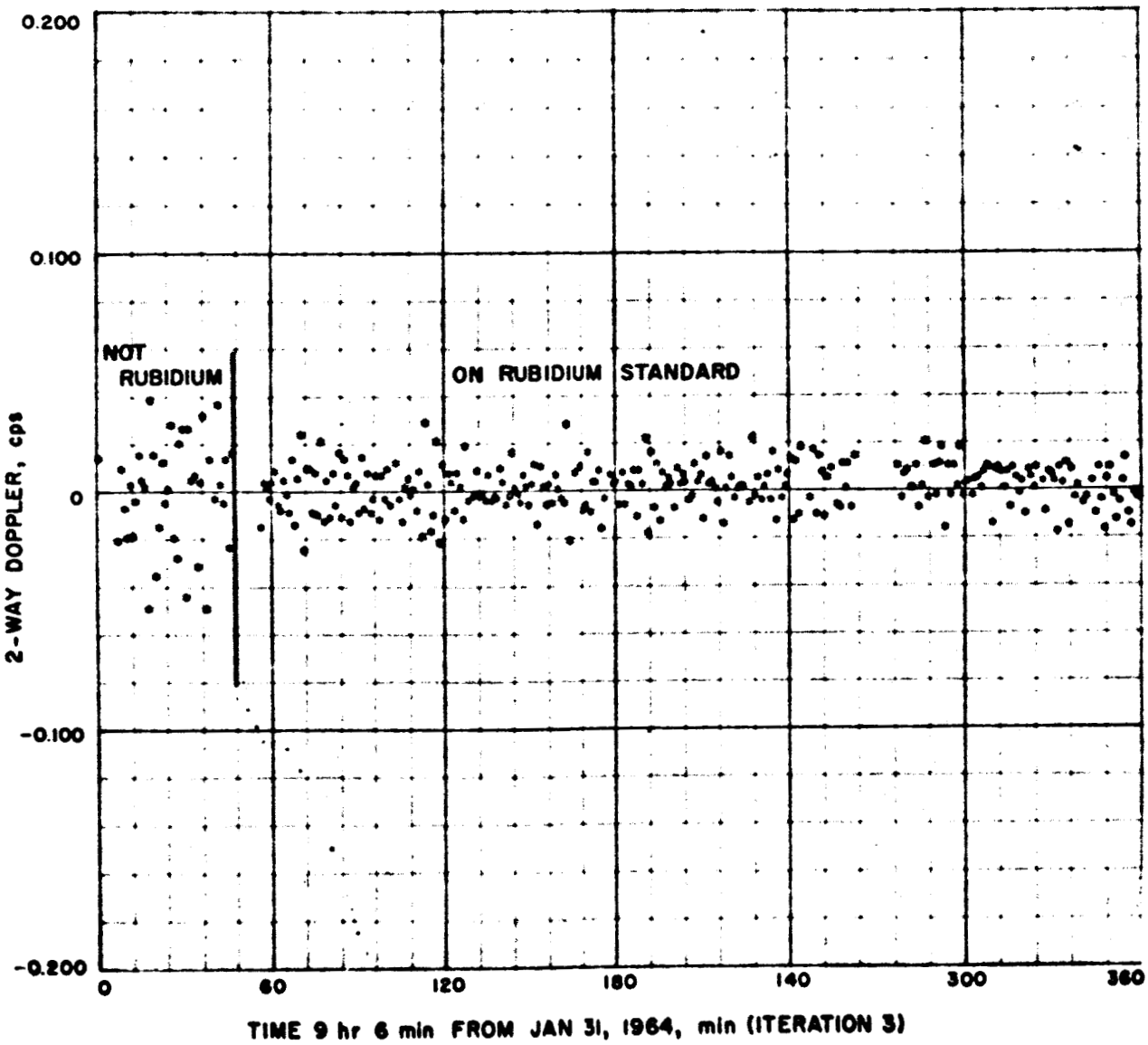


Fig. 24. Station 12 pass No. 01/313 residuals with promaneuver data used for a priority (9:06 GMT)

Table 14. Correlation matrix on postmaneuver data with premaneuver data as a priority at maneuver epoch

Parameters	Standard deviation	Correlation coefficients																		
		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$	$GM_{\oplus}$	REM	CB	$GM_{☾}$	RI (3)	LA (3)	LO (3)	RI (4)	LA (4)	LO (4)	RI (5)	LA (5)	LO (5)
X	0.10 km	1	0.411	−0.796	−0.582	0.517	−0.384	0.391	0.445	−0.096	−0.125	−0.042	−0.068	−0.266	0.409	−0.358	−0.374	0.012	0.170	−0.312
Y	2.39 km		1	−0.568	−0.841	0.656	−0.813	0.133	0.798	0.060	−0.785	0.043	−0.032	−0.916	0.361	−0.169	−0.919	−0.004	0.132	−0.947
Z	2.49 km			1	0.867	−0.787	0.630	−0.556	−0.771	0.059	0.276	0.009	0.047	0.553	−0.317	0.187	0.641	−0.083	−0.177	0.608
$\dot{X}$	0.006 m/sec				1	−0.863	0.844	−0.405	−0.940	0.007	0.616	−0.025	0.022	0.879	−0.339	0.169	0.910	−0.046	−0.178	0.891
$\dot{Y}$	0.018 m/sec					1	−0.936	0.078	0.956	0.086	−0.509	0.036	0.003	−0.775	0.451	−0.210	−0.760	−0.066	0.160	−0.753
$\dot{Z}$	0.023 m/sec						1	0.042	−0.957	−0.173	0.638	−0.055	−0.006	0.892	−0.450	0.199	0.851	0.088	−0.141	0.868
$GM_{\oplus}$	1.15 km³/sec²							1	0.152	0.064	0.121	−0.038	−0.036	−0.055	−0.240	0.099	−0.188	0.291	0.070	−0.129
REM	0.019 km								1	0.098	−0.612	0.045	−0.002	−0.907	0.398	−0.173	−0.890	−0.033	0.161	−0.891
CB	0.29									1	−0.182	−0.007	0.003	−0.087	−0.043	0.016	−0.054	−0.007	−0.015	−0.061
$GM_{☾}$	0.19 km³/sec²										1	−0.026	0.003	0.799	−0.314	0.122	0.757	0.063	−0.091	0.775
RI (3)	0.058 km											1	0.978	−0.034	0.002	0.001	−0.043	−0.021	0.012	−0.053
LA (3)	0.00074 deg												1	0.022	−0.022	0.015	0.014	−0.013	−0.002	0.015
LO (3)	0.00073 deg													1	−0.348	0.146	0.950	0.042	−0.140	0.965
RI (4)	0.052 km														1	−0.574	−0.392	0.122	−0.170	−0.317
LA (4)	0.00072 deg															1	0.144	−0.093	0.120	0.146
LO (4)	0.00072 deg																1	0.002	−0.149	0.949
RI (5)	0.042 km																	1	−0.861	−0.002
LA (5)	0.00077 deg																		1	−0.123
LO (5)	0.00071 deg																			1

		Earth-fixed spherical coordinates					
		R	ϕ	λ	V	γ	σ
R	0.09 km	1	−0.658	−0.096	0.261	−0.309	0.560
ϕ	0.0084 deg		1	0.568	0.324	0.670	−0.918
λ	0.0081 deg			1	0.844	0.441	−0.753
V	0.023 m/sec				1	0.560	−0.394
γ	0.00001 deg					1	−0.458
σ	0.00021 deg						1

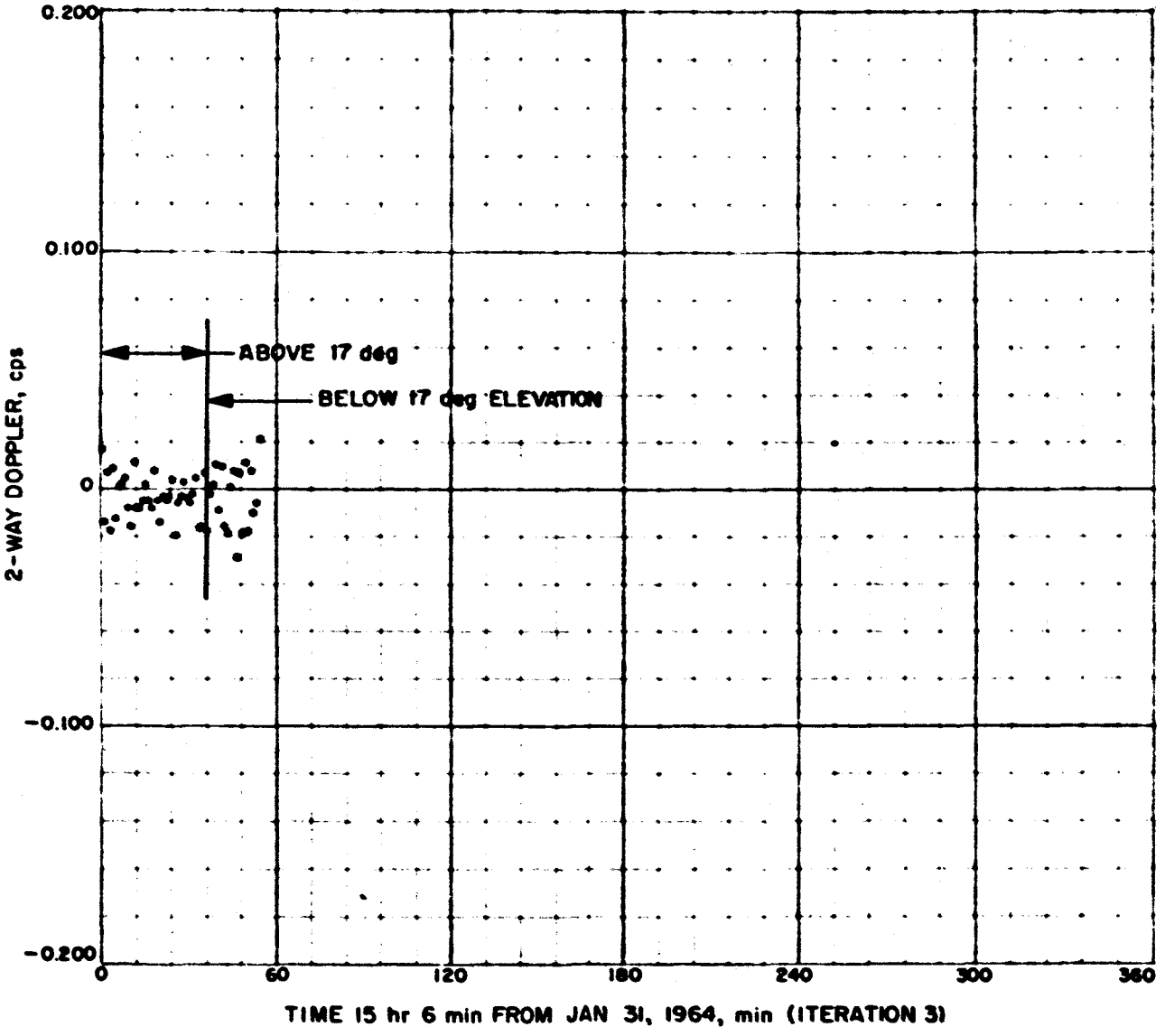


Fig. 25. Station 12 pass No. 01/314 residuals with premaneuver data used for a priority (15:06 GMT)

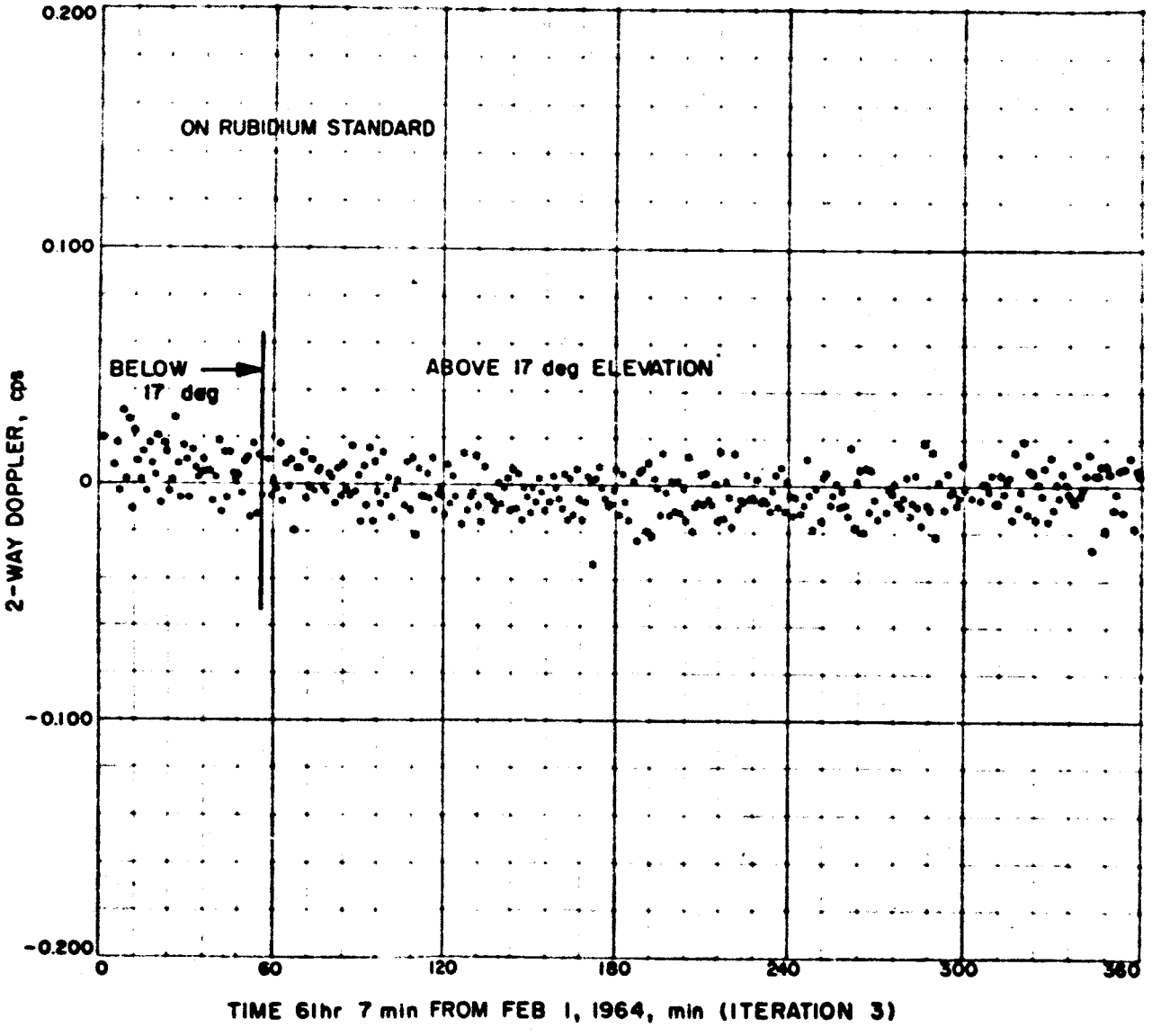


Fig. 26. Station 12 pass No. 02/321 residuals with premaneuver data used for a priority (6:07 GMT)

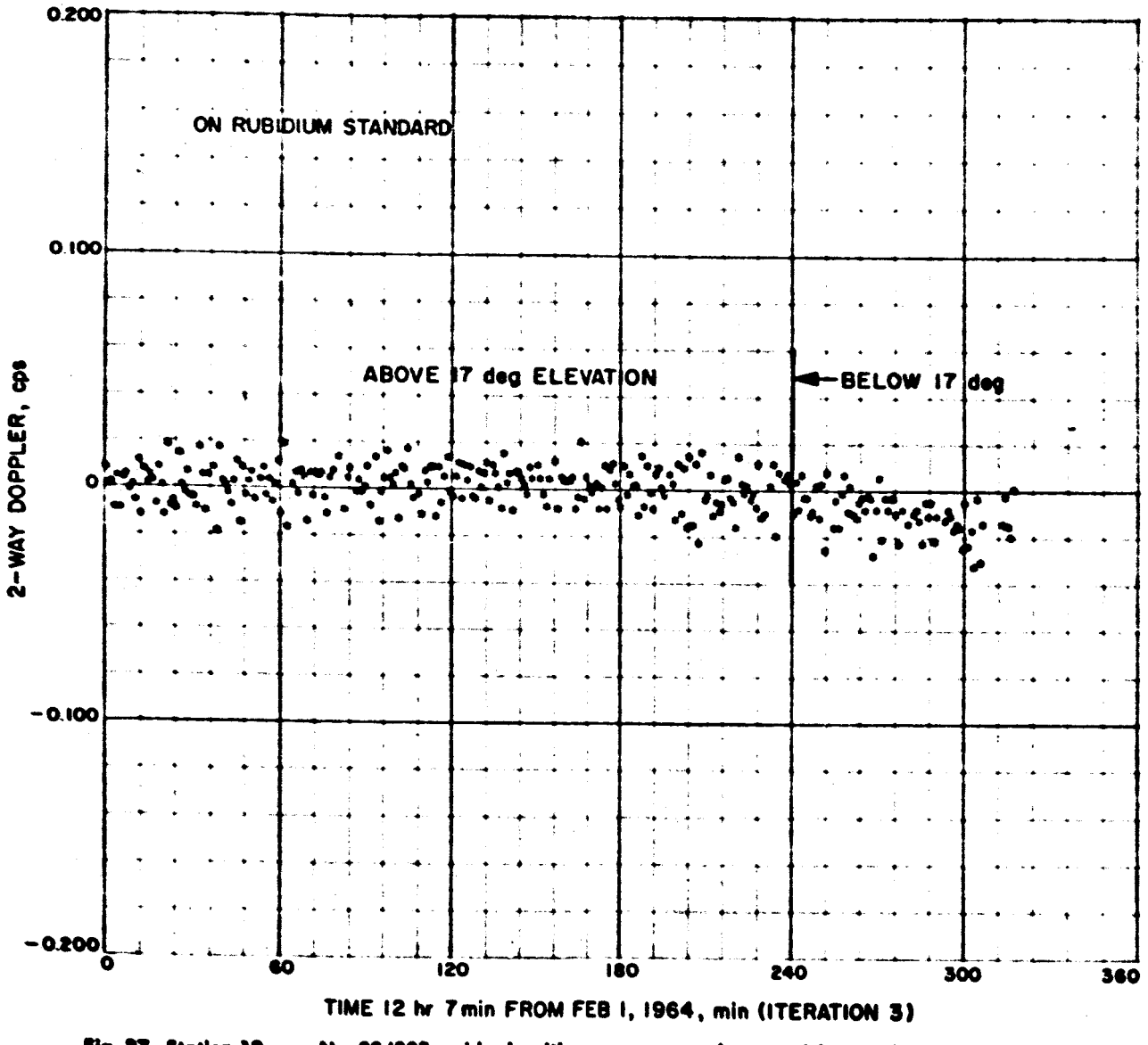


Fig. 27. Station 12 pass No. 02/322 residuals with promaneuver data used for a priority (12:07 GMT)

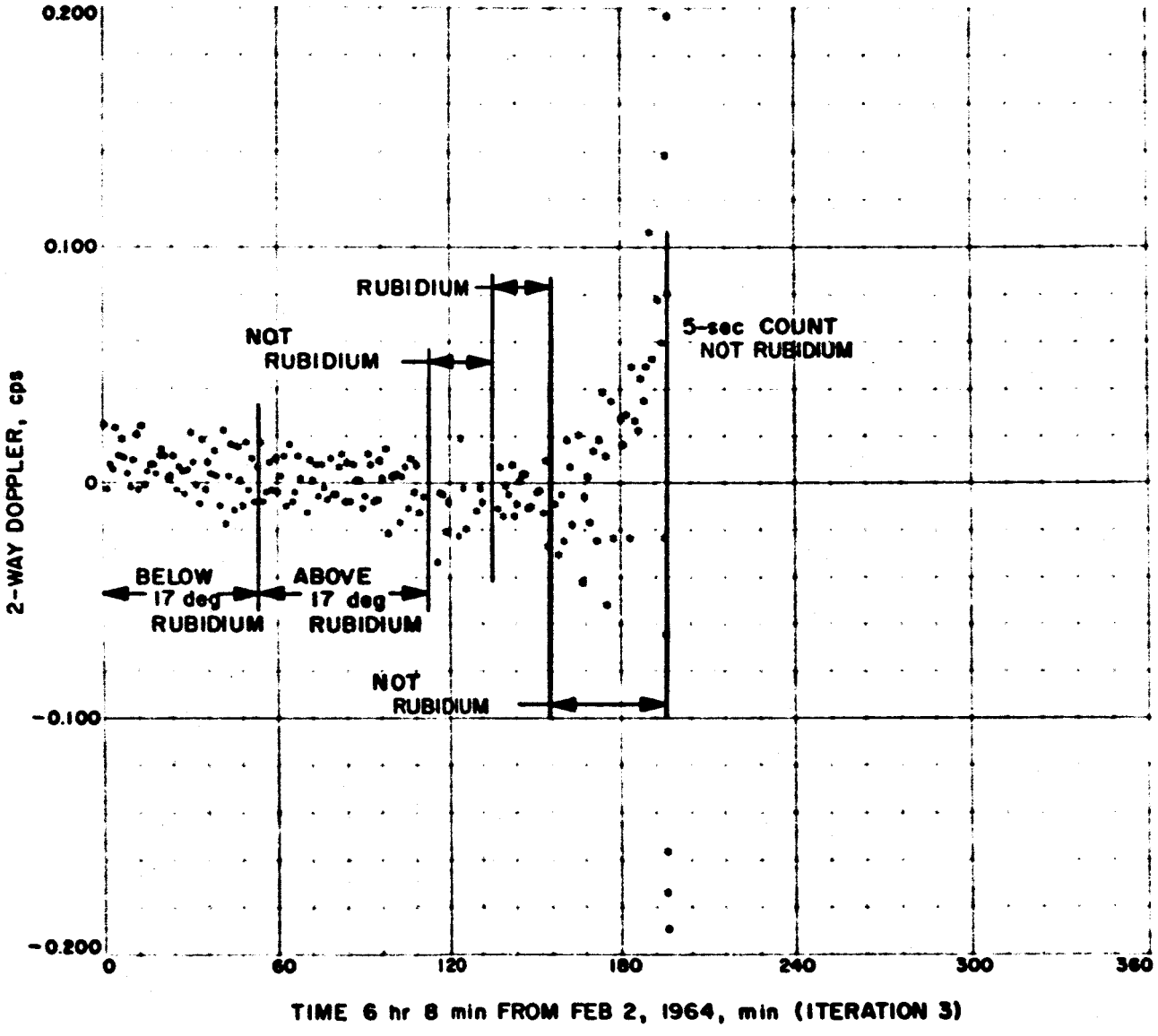


Fig. 28. Station 12 pass No. 03/331 residuals with premaneuver data used for a priority (6:08 GMT)

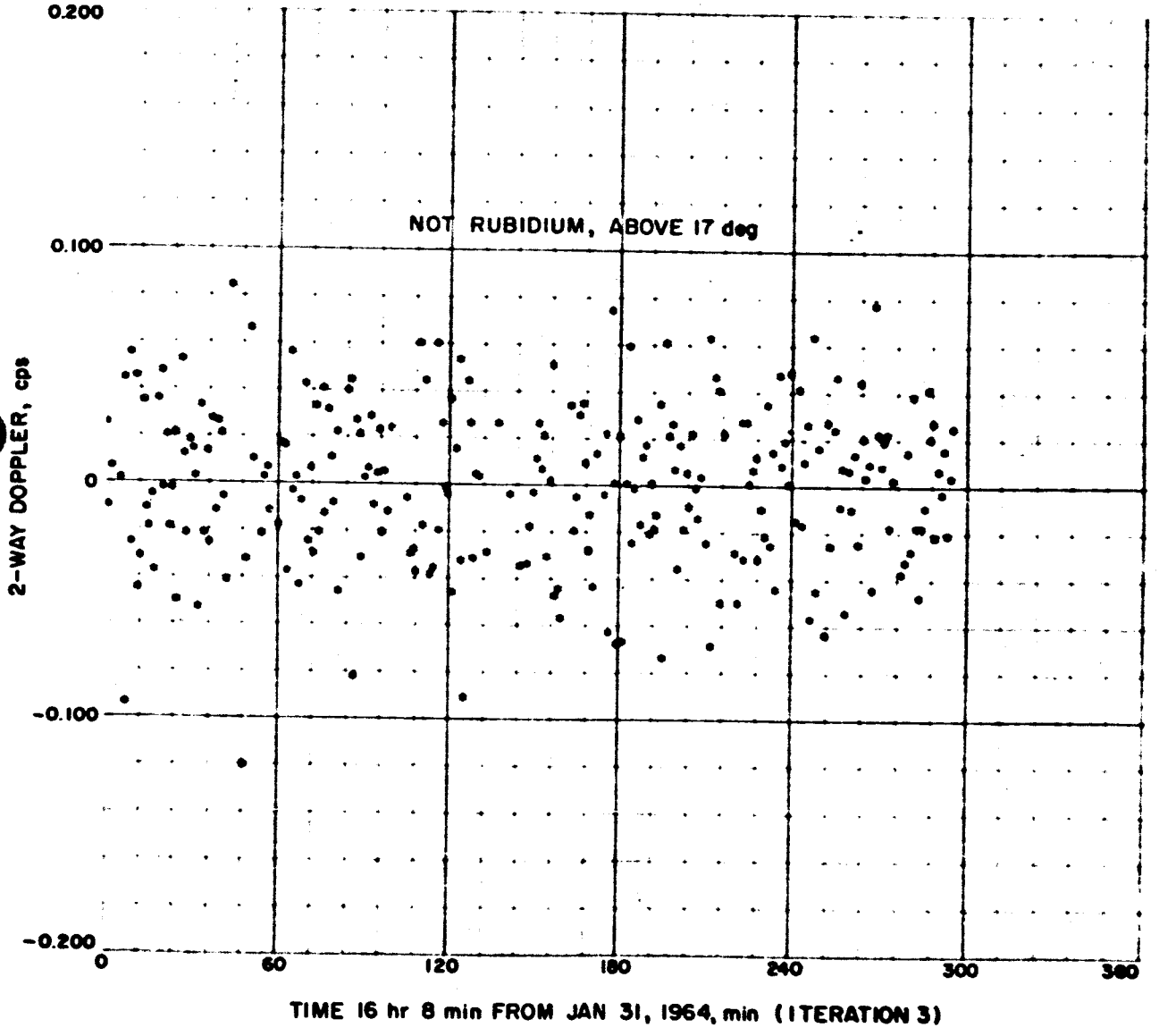


Fig. 29. Station 41 pass No. 01/311 residuals with premaneuver data used for a priority (16:08 GMT)

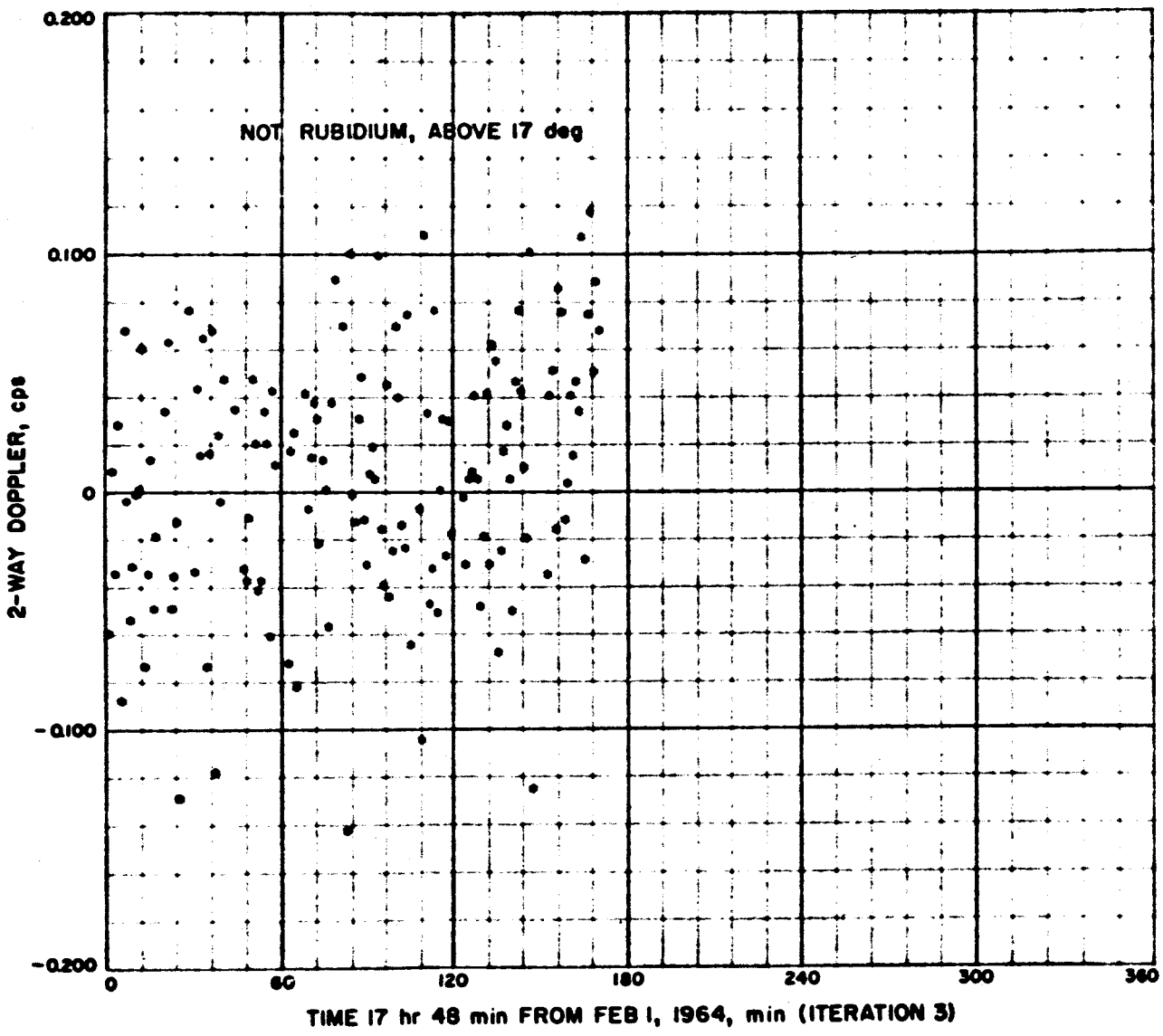


Fig. 30. Station 41 pass No. 02/011 residuals with premaneuver data used for a priority (17:48 GMT)

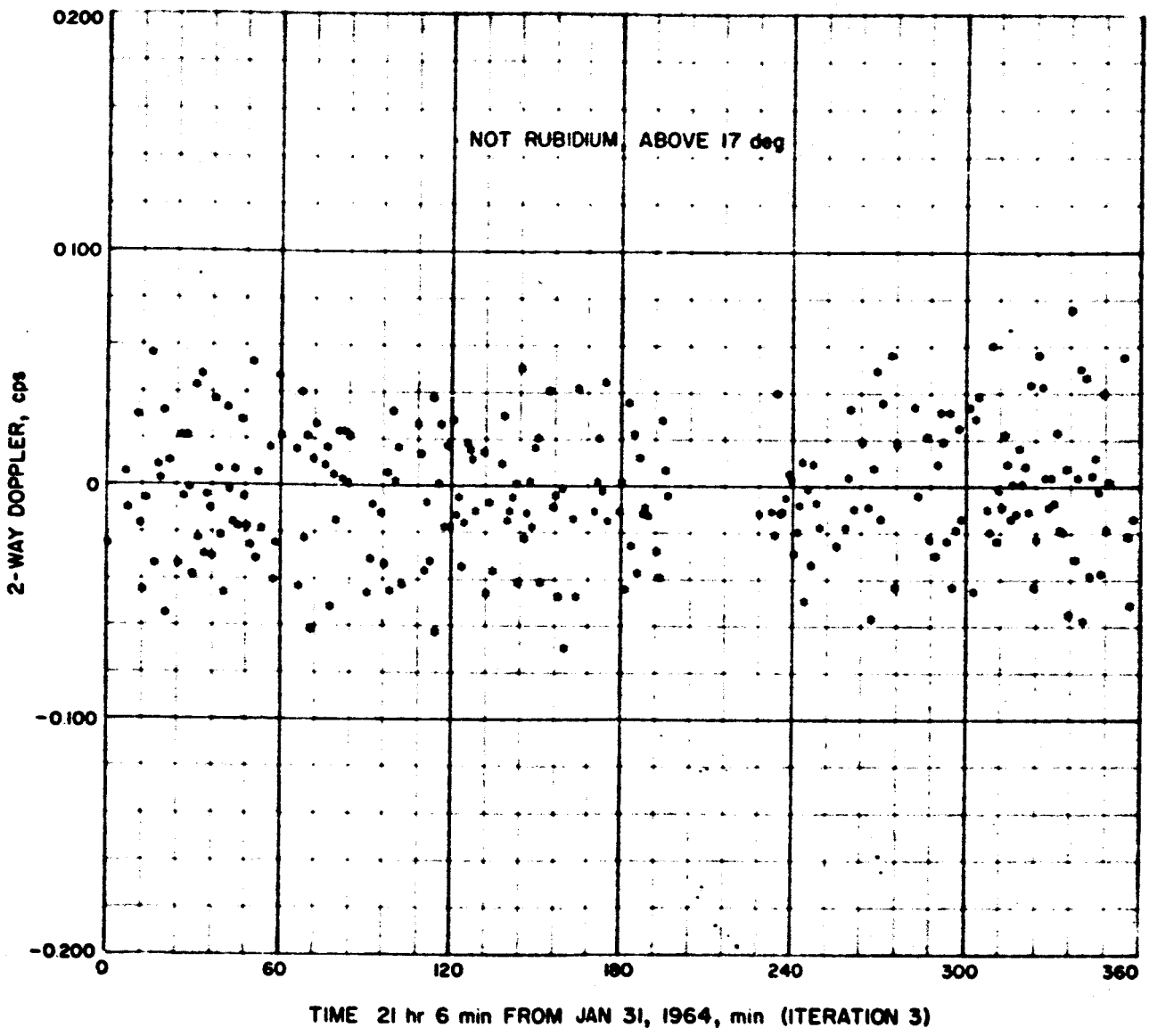


Fig. 31. Station 51 pass No. 01/311 residuals with premaneuver data used for a priority (21:06 GMT)

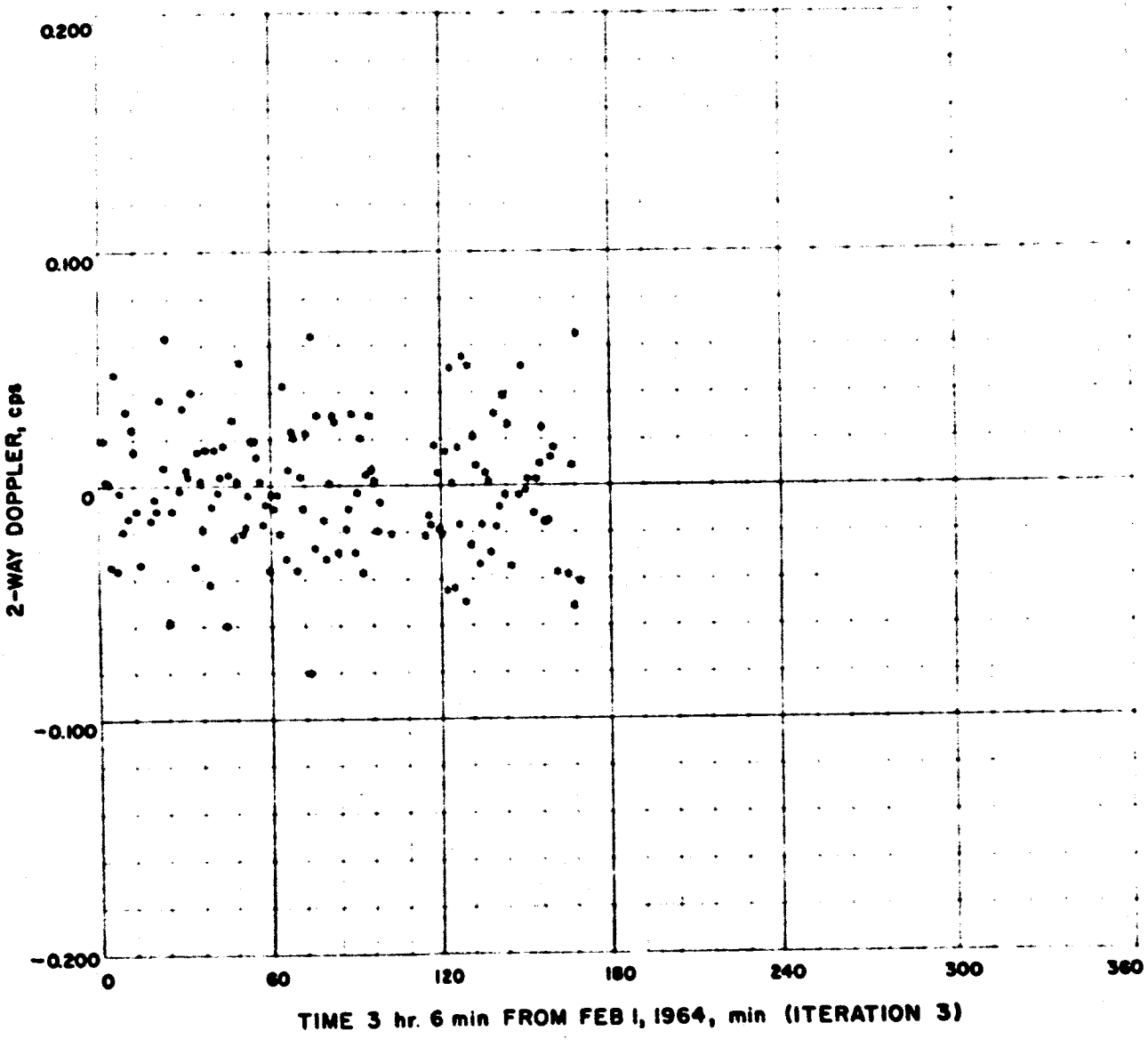


Fig. 32. Station 51 pass No. 01/311 residuals with premaneuver data used for a priority (3:06 GMT)

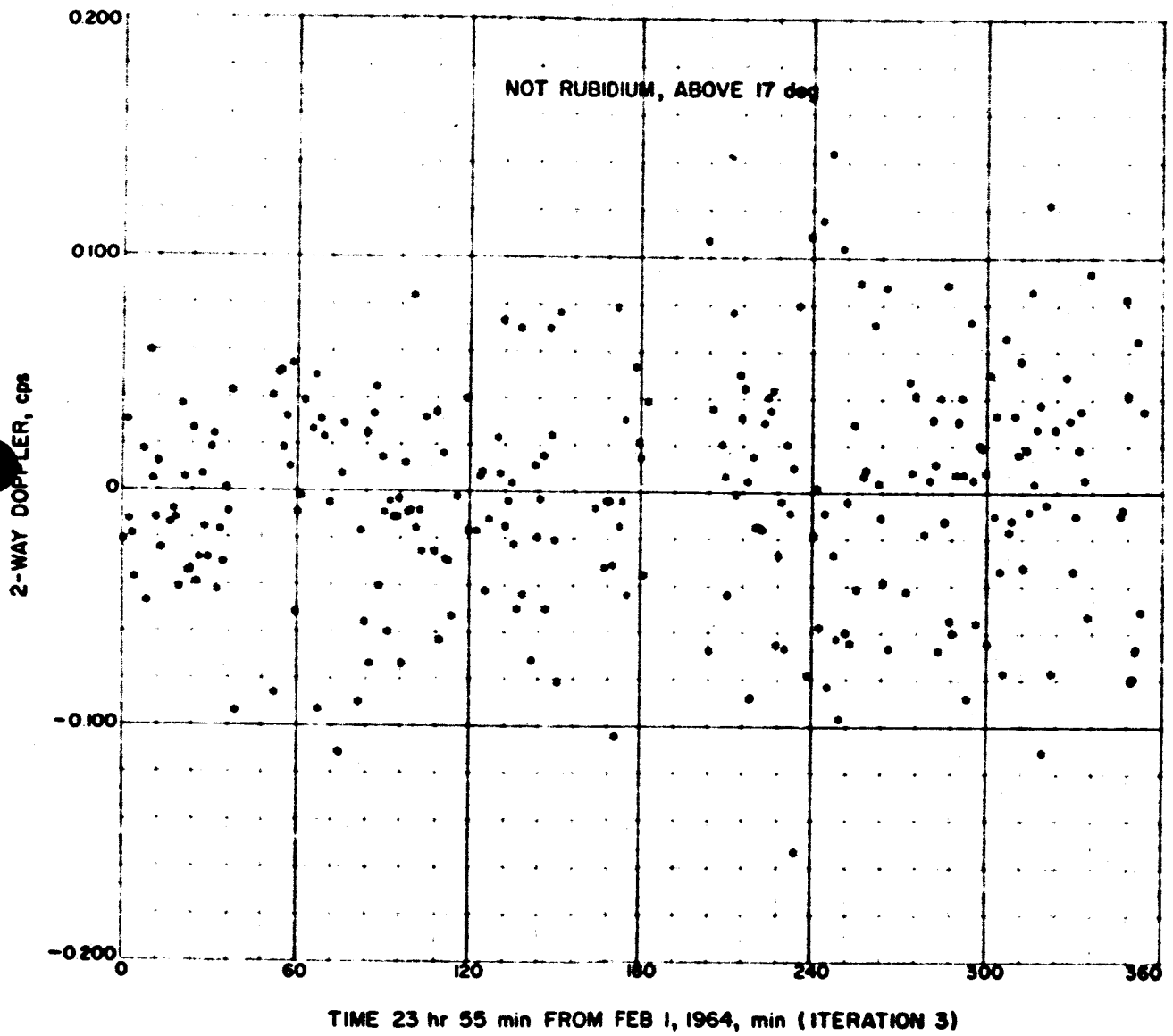


Fig. 33. Station 51 pass No. 02/011 residuals with premaneuver data used for a priority (23:55 GMT)

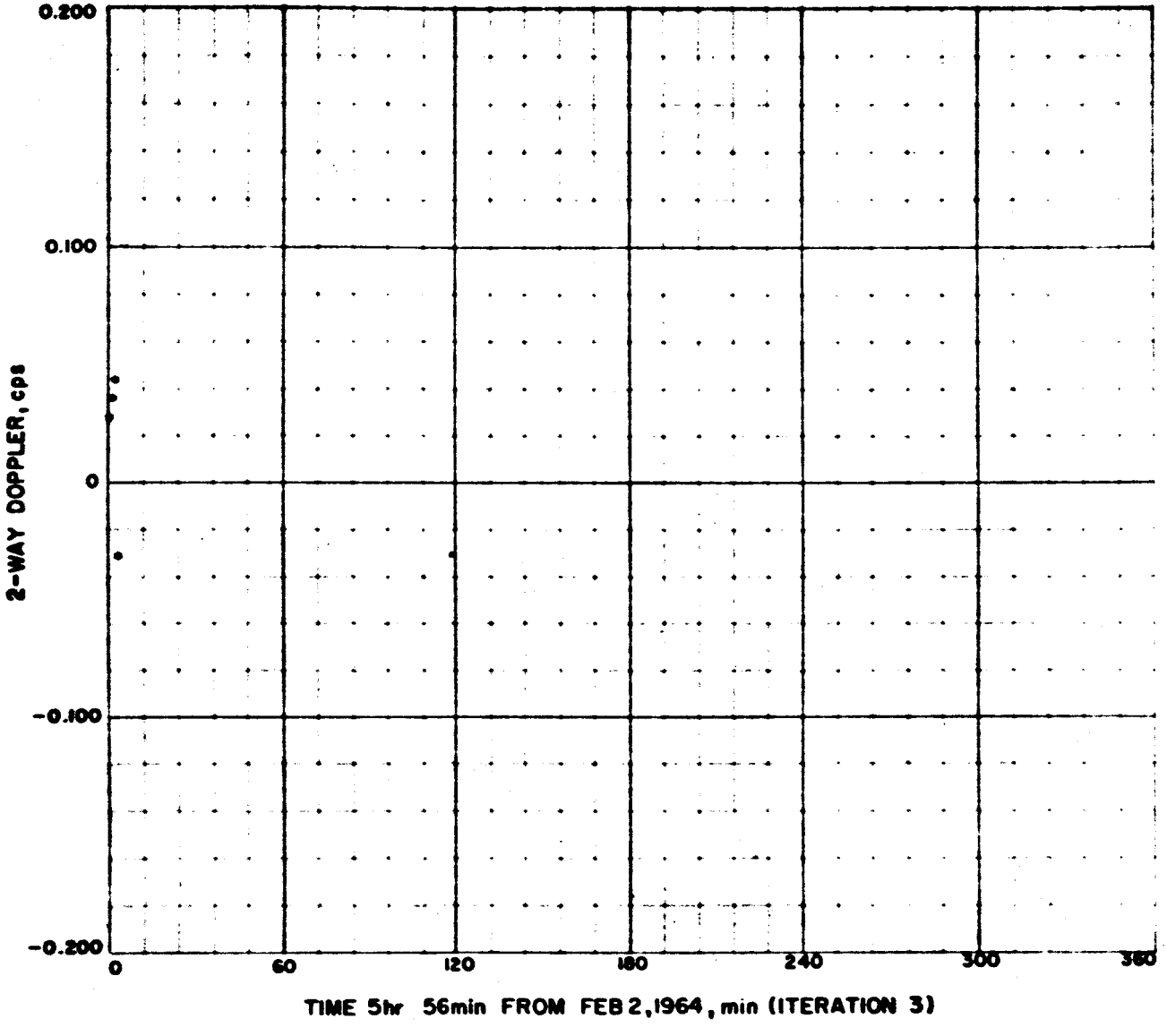


Fig. 34. Station 51 pass No. 02/011 residuals with premaneuver data used for a priority (5:56 GMT)

The acid test is to see how this solution compares with the postmaneuver data used as a priority for the premaneuver data. The solution vector should be essentially[1] the same. The results are very satisfying as can be seen in Tables 7 (columns 6 and 7) and 4 (columns 10 and 13). Both the parameter solutions and the statistics agree very well with the other result. The data fit is shown in Table 3, columns 6 and 7, and in the residuals (Figs. 35 through 40, compared with Figs. 2 through 7) again, with almost the same characteristics as when only premaneuver data are used. Correlation matrixes are shown in Tables 15 and 16. Encounter parameters are displayed in Table 8. When the converged conditions are mapped to maneuver epoch and position and velocity are differenced with the postmaneuver estimate (i.e., with premaneuver data as a priority), the best estimate of the

[1]Computer calculating noise has crept in since the printout is in single precision, and thus has to be handled as single precision input at times.

Table 15. Correlation matrix on premaneuver data with postmaneuver data as a priority at injection epoch

Parameters	Standard deviation	Correlation coefficients																		
		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$	$GM_{\oplus}$	REM	CS	$GM_{☾}$	RI (3)	LA (3)	LO (3)	RI (4)	LA (4)	LO (4)	RI (5)	LA (5)	LO (5)
X	0.03 km	1	−0.217	−0.156	0.168	−0.044	0.028	0.168	0.100	0.142	−0.250	0.038	0.032	−0.291	−0.317	−0.248	−0.273	−0.095	0.138	−0.287
Y	0.09 km		1	−0.614	−0.862	−0.794	−0.297	0.166	−0.693	−0.057	0.758	−0.057	0.008	0.825	−0.188	−0.044	0.773	0.457	−0.493	0.826
Z	0.09 km			1	0.688	0.761	0.261	0.214	0.580	−0.055	−0.283	0.008	−0.026	−0.438	0.090	0.122	−0.467	−0.602	0.819	−0.452
$\dot{X}$	0.151 m/sec				1	0.564	−0.133	0.207	0.890	0.027	−0.721	0.036	−0.032	−0.904	0.295	−0.123	−0.918	−0.200	0.370	−0.936
$\dot{Y}$	0.147 m/sec					1	0.717	−0.151	0.322	0.010	−0.428	0.032	−0.010	−0.410	0.011	0.265	−0.376	−0.699	0.794	−0.396
$\dot{Z}$	0.194 m/sec						1	−0.422	−0.339	0.015	0.002	0.020	0.024	0.187	−0.258	0.317	0.256	−0.698	0.644	0.240
$GM_{\oplus}$	1.15 km³/sec²							1	0.139	0.063	0.129	−0.038	−0.036	−0.043	−0.243	0.098	−0.177	0.300	0.060	−0.117
REM	0.020 km								1	0.095	−0.629	0.044	−0.003	−0.912	0.378	−0.159	−0.894	−0.058	0.182	−0.896
CS	0.29									1	−0.178	−0.008	0.003	−0.084	−0.045	0.016	−0.051	−0.005	−0.018	−0.058
$GM_{☾}$	0.195 km³/sec²										1	−0.026	0.004	0.806	−0.297	0.111	0.764	0.079	−0.105	0.783
RI (3)	0.058 km											1	0.978	−0.032	0.000	0.001	−0.041	−0.020	0.010	−0.051
LA (3)	0.00074 deg												1	0.023	−0.020	0.015	0.014	−0.012	−0.002	0.015
LO (3)	0.00073 deg													1	−0.328	0.136	0.950	0.049	−0.142	0.965
RI (4)	0.052 km														1	−0.575	−0.374	0.136	−0.190	−0.298
LA (4)	0.00072 deg															1	0.136	−0.099	0.128	0.136
LO (4)	0.00072 deg																1	0.005	−0.147	0.949
RI (5)	0.042 km																	1	−0.862	0.002
LA (5)	0.00076 deg																		1	−0.122
LO (5)	0.00071 deg																			1

		Earth-fixed spherical coordinates					
		R	ϕ	λ	V	γ	σ
R	0.04 km	1	−0.745	0.617	−0.901	0.044	0.365
ϕ	0.00077 deg		1	−0.563	0.796	−0.174	−0.362
λ	0.00074 deg			1	−0.523	0.169	0.357
V	0.040 m/sec				1	0.243	−0.097
γ	0.00036 deg					1	0.836
σ	0.00119 deg						1

Table 16. Correlation matrix on premaneuver data with postmaneuver data as a priority at maneuver epoch

Parameters	Standard deviation	Correlation coefficients																		
		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$	$GM_{\oplus}$	REM	CB	$GM_{☾}$	RI (3)	LA (3)	LO (3)	RI (4)	LA (4)	LO (4)	RI (5)	LA (5)	LO (5)
X	0.09 km	1	0.374	−0.788	−0.333	0.405	−0.759	0.393	0.413	−0.100	−0.097	−0.046	−0.069	−0.228	0.402	−0.362	−0.339	0.044	0.131	−0.274
Y	2.38 km		1	−0.542	−0.925	0.991	−0.581	0.121	0.807	0.057	−0.793	0.042	−0.032	−0.916	0.343	−0.160	−0.919	−0.005	0.128	−0.947
Z	2.44 km			1	0.647	−0.584	0.955	−0.561	−0.750	0.063	0.258	0.012	0.047	0.527	−0.307	0.188	0.618	−0.111	−0.145	0.583
$\dot{X}$	0.006 m/sec				1	−0.945	0.640	−0.069	−0.928	−0.056	0.757	−0.050	0.018	0.947	−0.384	0.216	0.934	−0.040	−0.049	0.971
$\dot{Y}$	0.027 m/sec					1	0.587	0.139	0.825	0.063	−0.777	0.039	−0.033	−0.914	0.380	−0.195	−0.921	0.090	0.021	−0.949
$\dot{Z}$	0.026 m/sec						1	−0.481	−0.763	0.076	0.310	0.006	0.046	0.557	−0.279	0.096	0.635	0.124	−0.396	0.603
$GM_{\oplus}$	1.15 km³/sec²							1	0.139	0.063	0.129	−0.038	−0.036	−0.043	−0.242	0.098	−0.177	0.300	0.060	−0.117
REM	0.020 km								1	0.095	−0.629	0.044	−0.003	−0.912	0.378	−0.159	−0.894	−0.058	0.182	−0.896
CB	0.29									1	−0.178	−0.008	0.003	−0.084	−0.045	0.016	−0.051	−0.005	−0.018	−0.058
$GM_{☾}$	0.195 km³/sec²										1	−0.026	0.004	0.806	−0.297	0.111	0.764	0.079	−0.105	0.783
RI (3)	0.058 km											1	0.978	−0.032	0	0.001	−0.042	−0.020	0.010	−0.051
LA (3)	0.00074 deg												1	0.023	−0.020	0.015	0.014	−0.012	−0.002	0.015
LO (3)	0.00073 deg													1	−0.329	0.136	0.950	0.049	−0.142	0.965
RI (4)	0.052 km														1	−0.575	−0.374	0.136	−0.190	−0.298
LA (4)	0.00072 deg															1	0.136	−0.099	0.128	0.136
LO (4)	0.00072 deg																1	0.005	−0.147	0.949
RI (5)	0.042 km																	1	−0.862	0.002
LA (5)	0.00076 deg																		1	−0.122
LO (5)	0.00071 deg																			1
		Earth-fixed spherical coordinates																		
		R	ϕ	λ	V	γ	σ													
R	0.09 km	1	−0.658	−0.078	0.038	−0.193	0.634													
ϕ	0.00082 deg		1	0.542	0.663	−0.230	−0.989													
λ	0.00080 deg			1	0.617	−0.329	−0.567													
V	0.008 m/sec				1	−0.633	−0.723													
γ	0.0 deg					1	0.279													
σ	0.00025 deg						1													

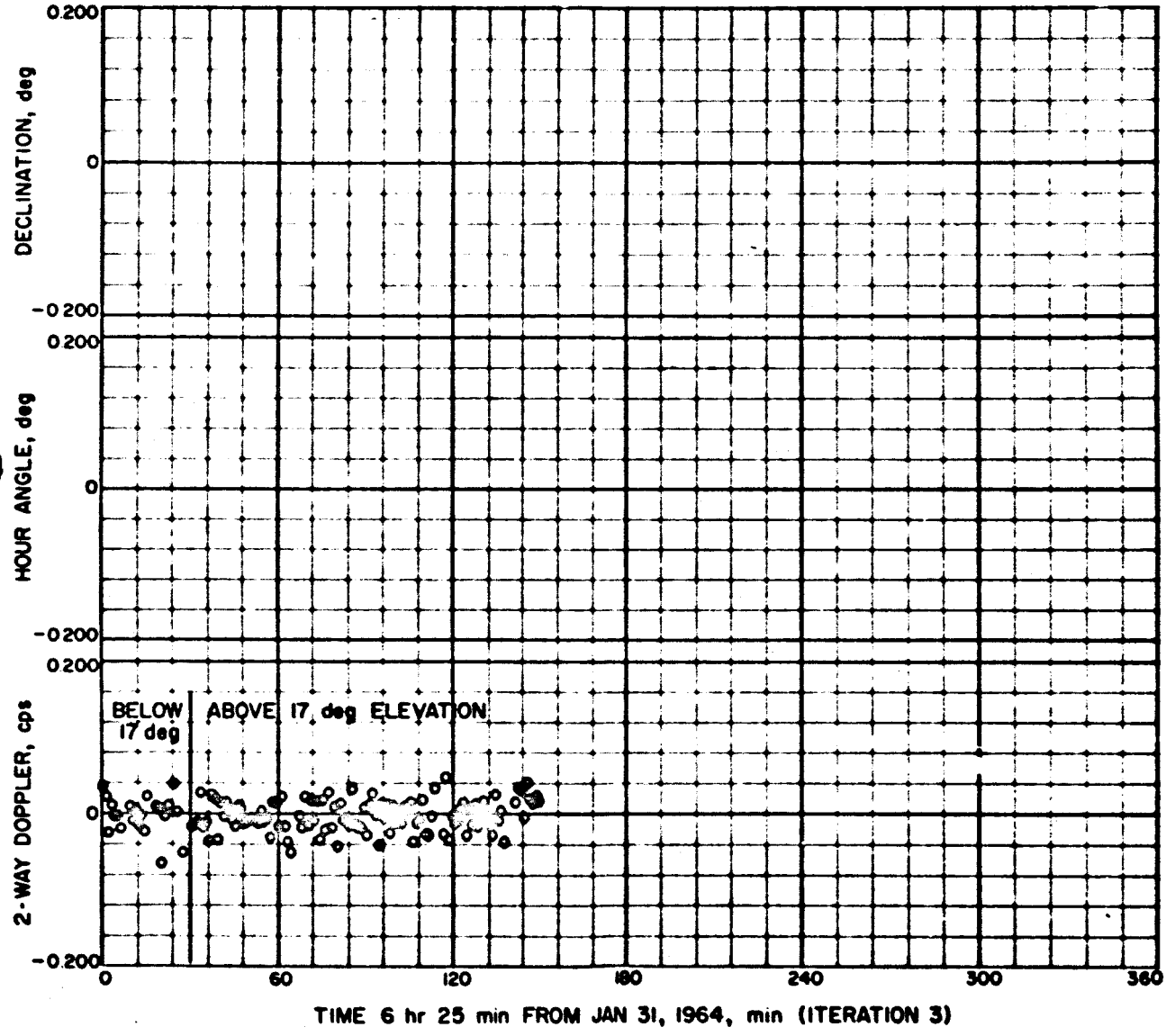


Fig. 35. Station 12 pass No. 01/311 residuals with postmaneuver data used for a priority (6:25 GMT)

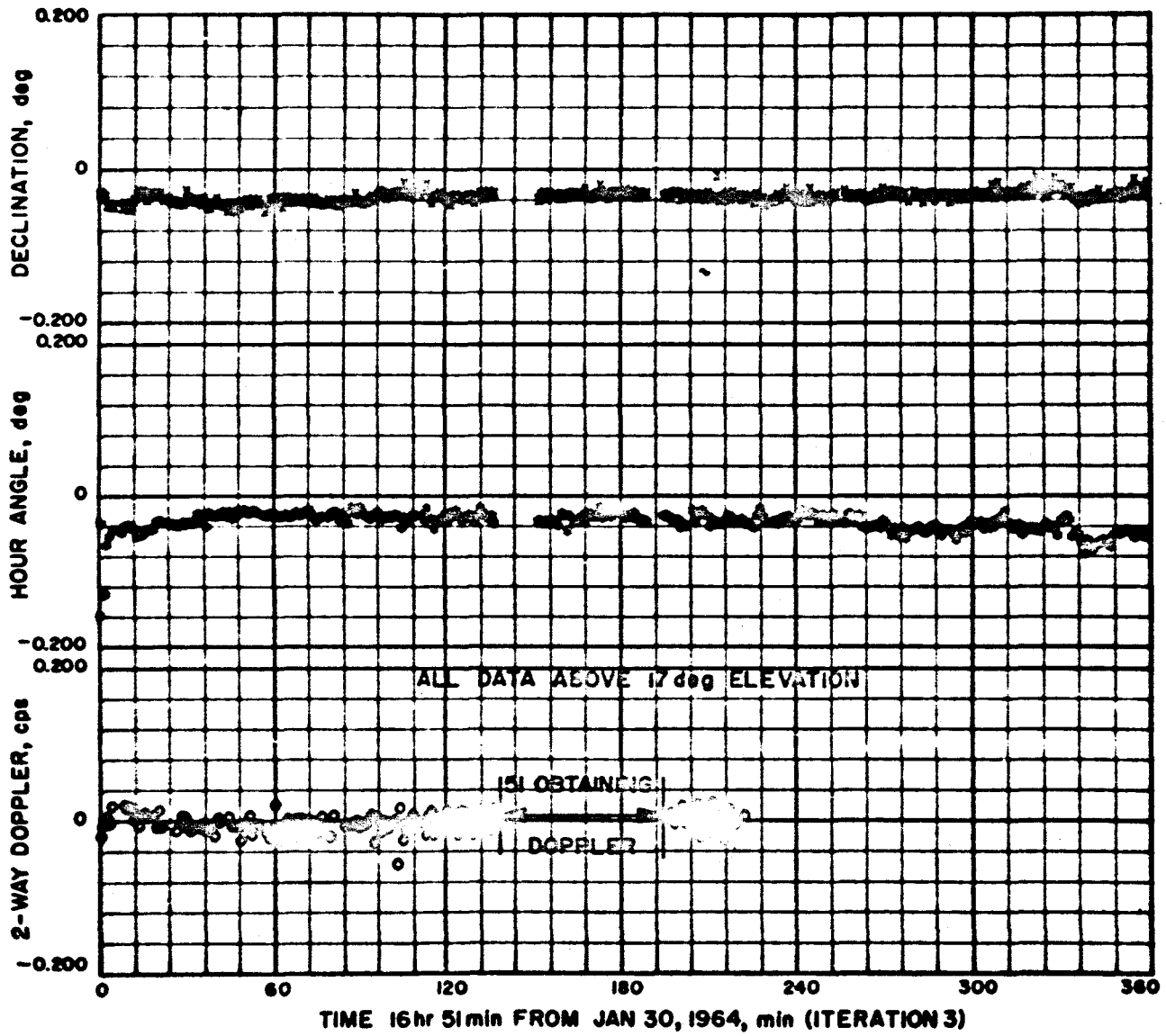


Fig. 36. Station 41 pass No. 01/301 residuals with postmaneuver data used for a priority (16:51 GMT)

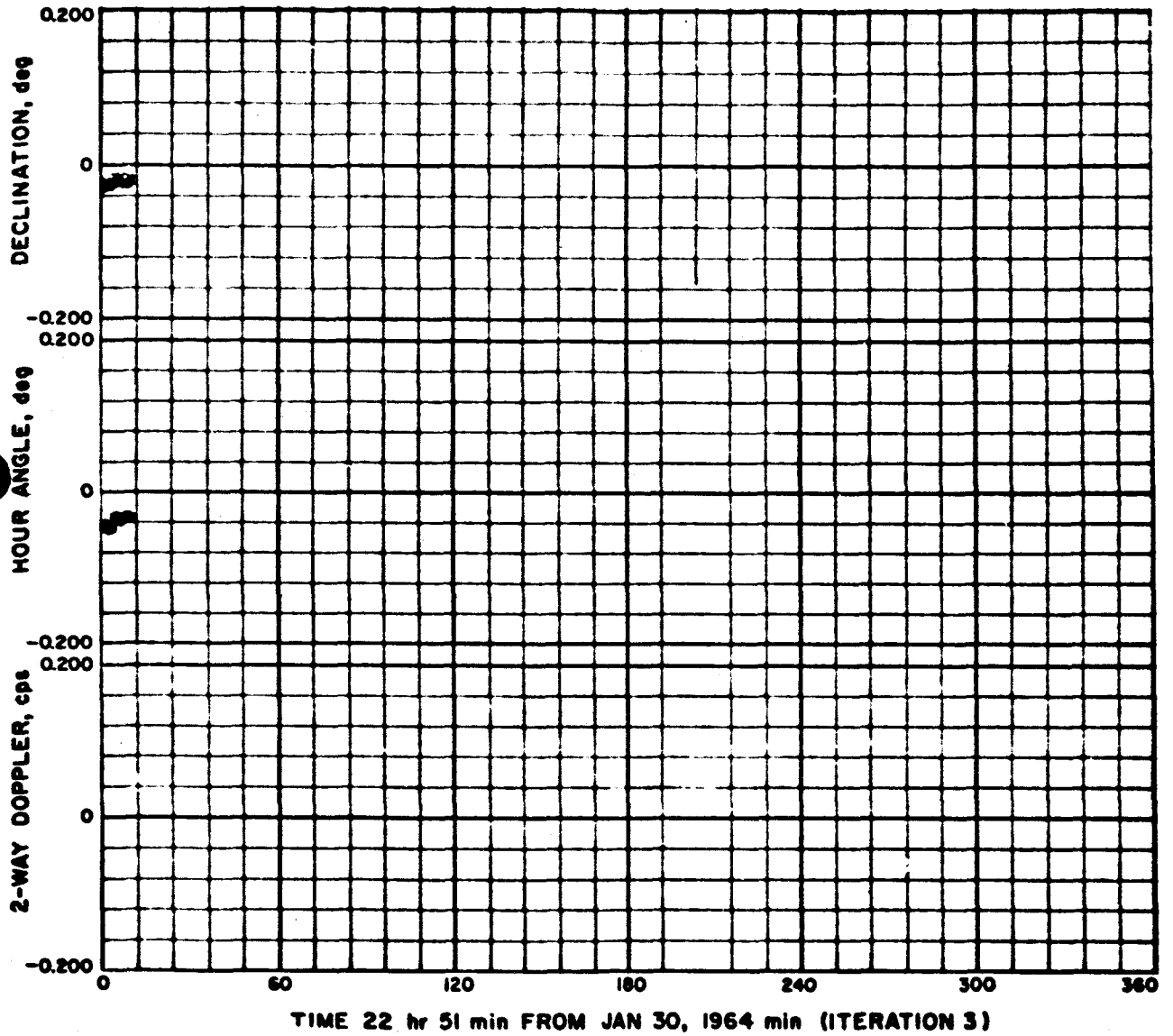


Fig. 37. Station 41 pass No. 01/302 residuals with postmaneuver data used for a priority (22:51 GMT)

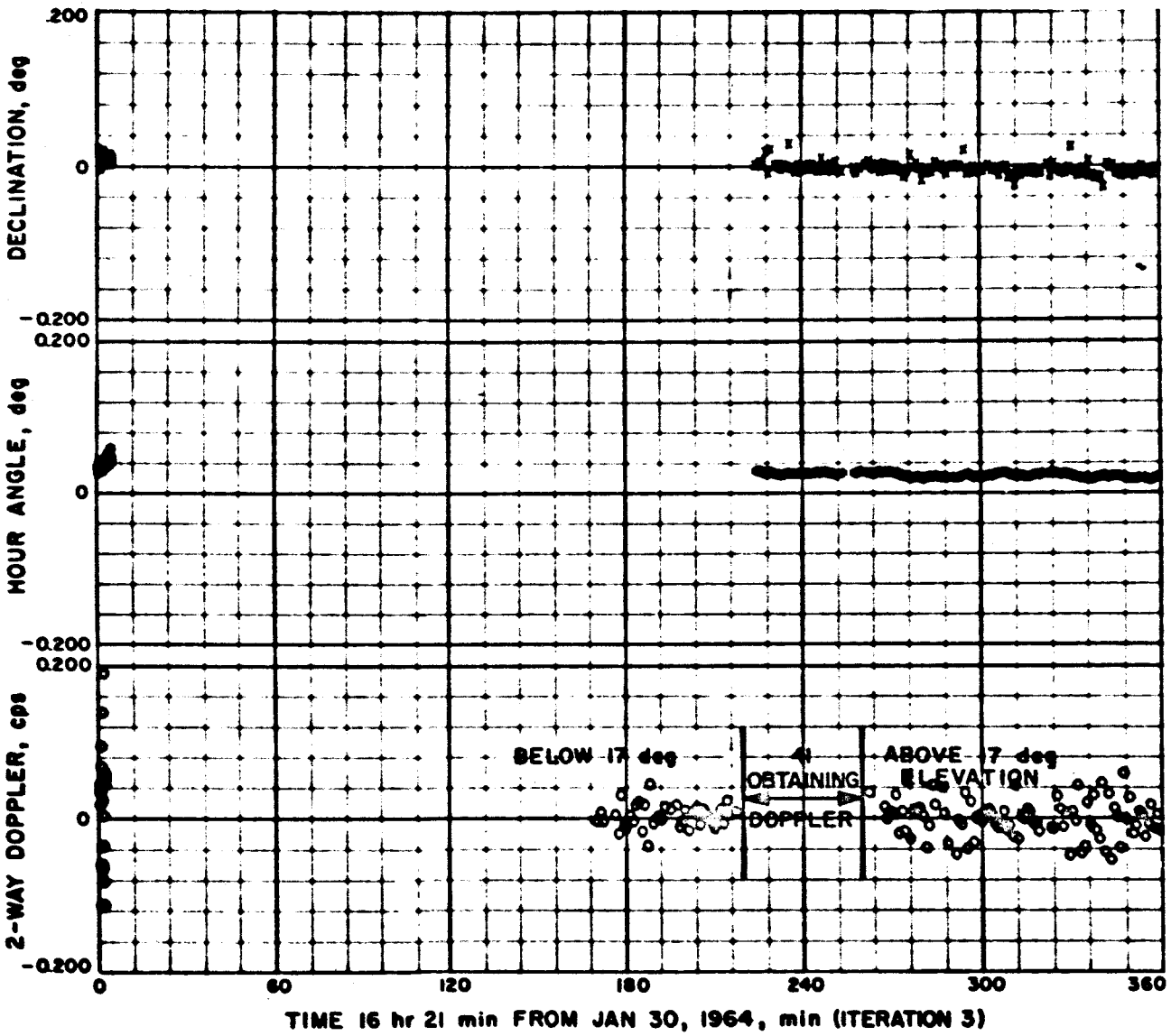


Fig. 38. Station 51 pass No. 01/301 residuals with postmaneuver data used for a priority (16:21 GMT)

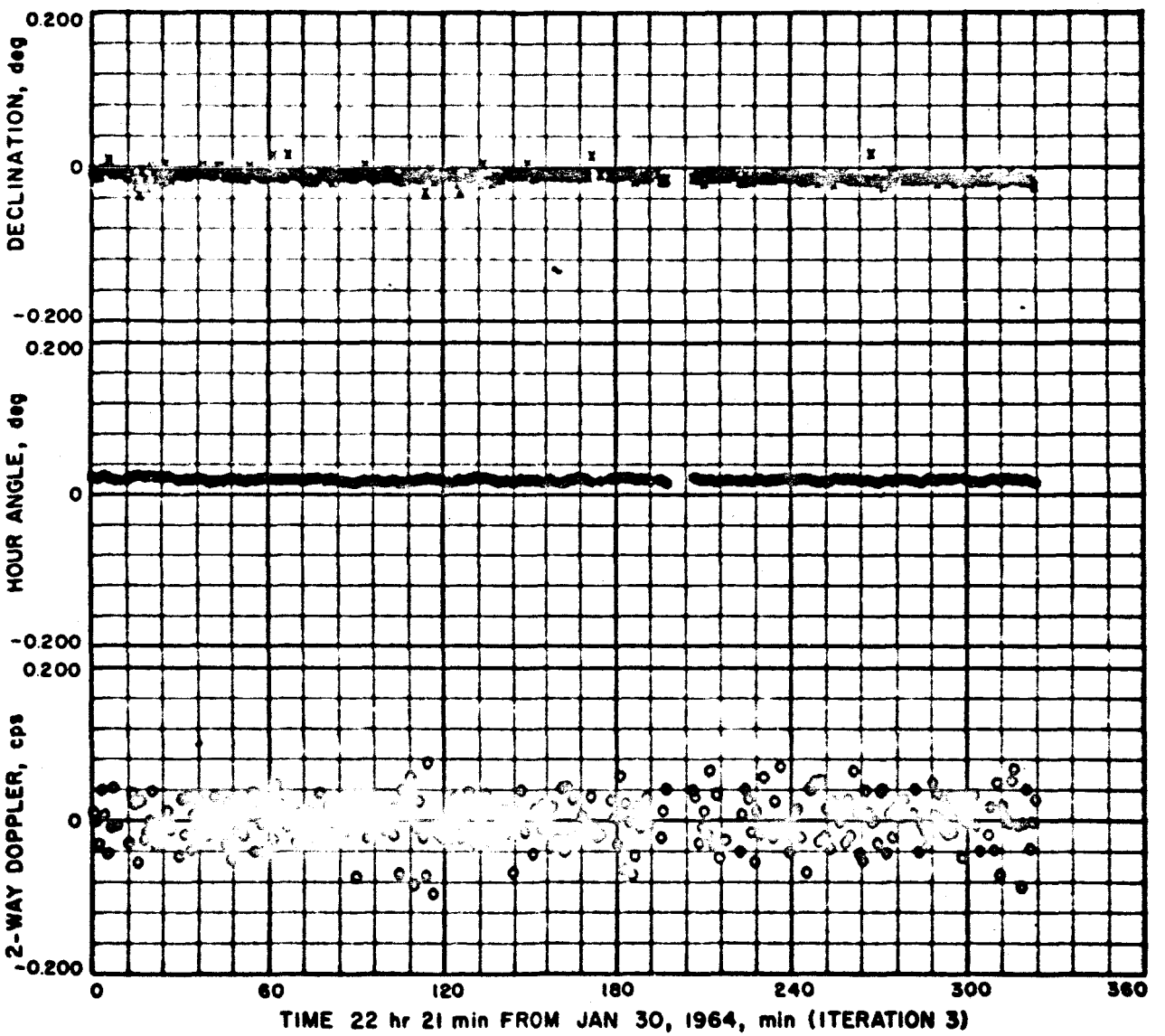


Fig. 39. Station 51 pass No. 01/303 residuals with postmaneuver data used for a priority (22:21 GMT)

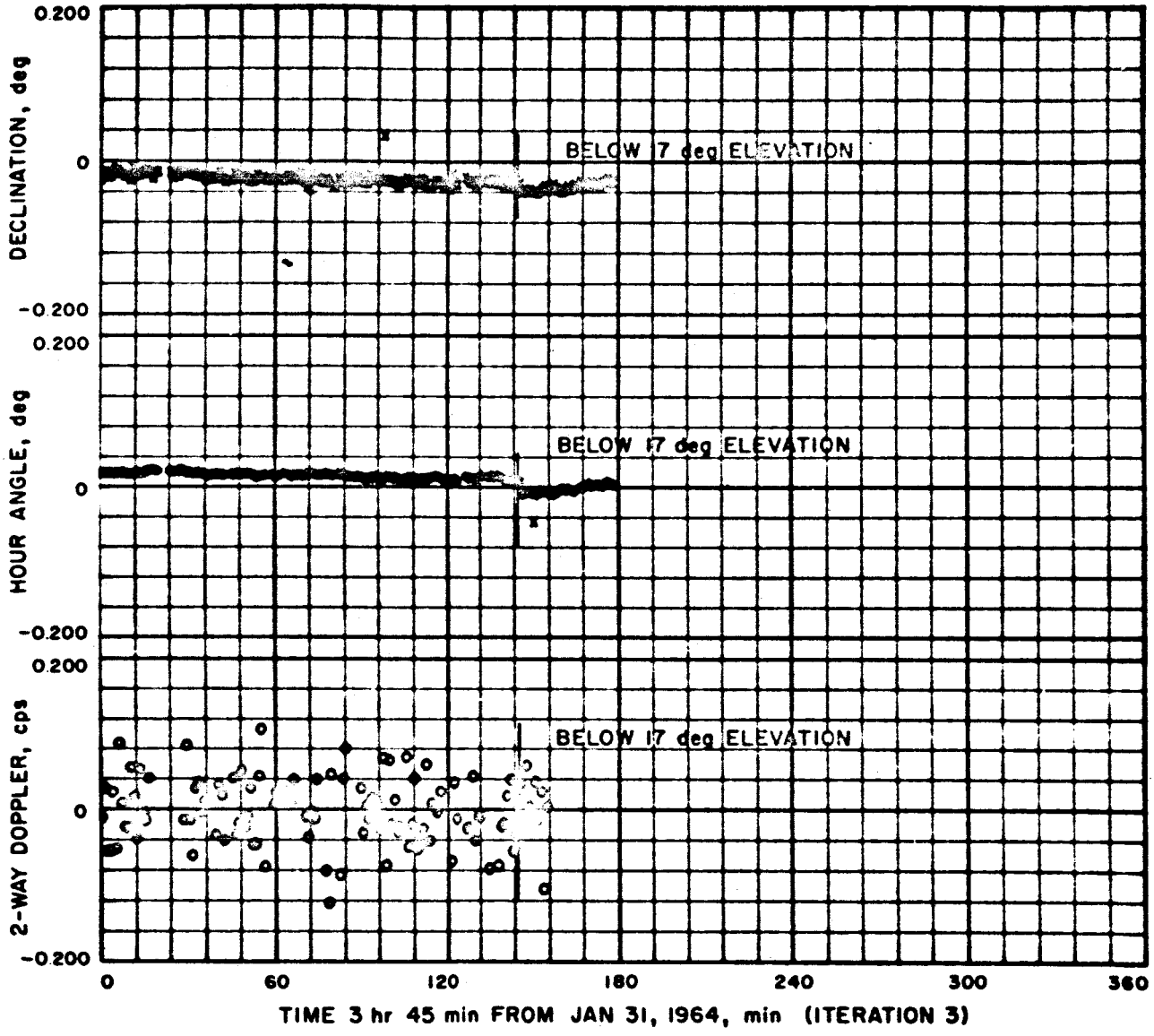


Fig. 40. Station 51 pass No. 01/303 residuals with postmaneuver data used for a priority (3:45 GMT)

maneuver is formed. This estimate will also be discussed in Section III C. Note in Table 17 that the positions, after the maneuver increments are added, agree within tenths of kilometers. This Table should not be confused with Table 13 in which positions are obtained independently by each premaneuver and postmaneuver data block.

As a summary for these different data-block fits, Table 18 tabulates the weighted sum of the squared (SOS) residuals. The effect of adding a priori data degrades the fit some but only slightly in these cases, as evident in the residual plots. Post-SOS cannot match pre-SOS since it is a function of the number of data points, and post-SOS has many more points than pre-SOS. Also tabulated is QSOS which gives a measure of the effect of the a priority on the SOS.

Throughout this Section *REM* (the scale factor for the lunar ephemeris) has been considered as an independent parameter. Comments were made previously on the close

Table 17. Position at maneuver epoch using both a priori solutions

Data set	Cartesian coordinates, km		
	X	Y	Z
(1) Best premaneuver	−169639.09	−2928.4060	−10676.529
(2) Position increment through maneuver	−1.25	−0.296	−0.515
(3) Sum of (1) and (2)	−169640.34	−2928.7020	−10677.044
(4) Best postmaneuver	−169640.40	−2928.6339	−10676.441
(5) Difference	0.06	0.0681	0.603

agreement with the actual constraint equation [i.e., $REM = 86.315745\,(GM_{\oplus} + GM_{☾})^{1/3}$]; however, statistics on the complete parameter set are degraded by ignoring the known constraint. The constraint was applied to the best postmaneuver solution (i.e., premaneuver data as a priority) by the method described by D. L. Cain.[2] Briefly, it sets the constraint equation equal to G

$$G = REM - 86.315745\,(GM_{\oplus} + GM_{☾})^{1/3} = 0$$

and uses a Lagrange multiplier on the original Q function to be minimized.

$$Q_{\text{originally}} = \underset{1\times n}{(O-C)^T}\ \underset{n\times n}{W}\ \underset{n\times 1}{(O-C)}$$

$$W = \text{weight on data}$$

$$(O - C) = \text{residual}$$

has G added to it

$$Q_{\text{constraint}} = (O-C)^T W (O-C) + \lambda G$$

When first order terms are collected after taking partials to minimize Q, the resulting solution can be expressed in terms of the original solution plus one additional term. The new solution vector q_{new} is obtained by

$$q_{new} = q_{\text{original}} + \Delta q$$

$$\Delta q = \Lambda C^T \underbrace{(C\Lambda C^T)^{-1}}_{\text{scalar}} D$$

$$C = \frac{\partial G}{\partial q}$$

D = the value of G when the estimates for REM, $GM_{\oplus}$ and $GM_{☾}$ from the original solution are placed in the constraint equation

Λ = the original covariance matrix

[2]D. L. Cain, "Least Squares with Side Conditions," January 2, 1963 (internal communication).

Table 18. Summary of the minimized residual quantity

Orbit	SOS*	QSOS**
Premaneuver only	58.390	58.567
Premaneuver with postmaneuver as a priority	59.153	60.403
Postmaneuver only	68.550	68.845
Postmaneuver with premaneuver as a priority	69.791	71.248

*$SOS = \sum_{i=1}^{n} (W(O-C))^2$; sum of the squared weighted residuals where W = weight, O = observed data, and C = calculated data.

**QSOS = SOS plus the product $\delta x^T \Gamma^{-1} \delta x$, where δx is the difference in the a priori parameter set and the value of the parameter set on the next to last iteration, and Γ is the a priori covariance on the parameter set.

and the statistics are given by

$$\Lambda_{new} = \Lambda - \Lambda C^T (C\Lambda C^T)^{-1} C\Lambda$$

The results are listed in Tables 4, 7, and 19. Now the estimate on REM fits the constraint exactly, and the statistics have been reduced considerably. Y, REM, and station longitude uncertainties have decreased a factor of 2. Statistics in the B plane have had the REM constraint applied, but, in addition, they also have been transformed from geocentric to selenocentric uncertainties,[3] which give a proper uncertainty to the impact location of *Ranger VI*. The 2.1 km SMAA maps to a 1.2 km uncertainty on the lunar surface. Note also in Table 7 that the solution vector has not changed significantly. Table 10 tabulates the data statistics using the constraint, and, since they are almost the same as the best postmaneuver orbit (except for a slight change at impact), only these residuals are shown in Fig. 41.

3. Observations and Conclusions

a. Landing point. Table 12 gives the landing point. Its statistics after the REM constraint was applied are given in Table 8. However, as pointed out earlier in this Report, there is a discrepancy in impact time of 1.5 sec which is a magnitude larger than the calculated statistics. An extensive search of the program and the data revealed no errors and in fact only strengthened the result, for the solution for impact time was almost independent of all perturbations except lunar elevation. Variations in the REM, UT−ET, solar pressure, $GM_{☾}$, the Moon's inertia, absolute timing of data, and amounts of data gave essentially the same answers. The remedy then was to change the lunar elevation, based on the impact time

[3]C. Thornton, "Covariance Matrix of Spacecraft Selenocentric Cartesian Position and Velocity," November 14, 1963 (internal communication).

Table 19. Correlation matrix on postmaneuver data with premaneuver data as a priority and the *REM* constraint applied at maneuver epoch

Parameters	Standard deviation	Correlation coefficients																		
		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$	$GM_{\odot}$	*REM*	*GB*	$GM_{☾}$	*RI* (3)	*LA* (3)	*LO* (3)	*RI* (4)	*LA* (4)	*LO* (4)	*RI* (5)	*LA* (5)	*LO* (5)
X	0.09 km	1	0.277	−0.795	−0.590	0.623	−0.332	0.473	0.484	−0.129	0.128	−0.063	0.075	0.044	0.310	−0.316	−0.211	0.055	0.134	−0.082
Y	1.53 km		1	−0.223	−0.579	−0.227	−0.424	0.411	0.338	−0.008	−0.561	0.0001	0.060	−0.802	0.005	0.020	−0.787	0.146	0.040	−0.876
Z	2.01 km			1	0.826	−0.787	0.297	−0.818	−0.836	0.135	−0.207	0.052	0.064	0.068	−0.054	0.085	0.334	−0.195	−0.119	0.248
$\dot{X}$	0.003 m/sec				1	−0.496	0.379	−0.941	−0.914	0.131	0.149	0.037	0.050	0.576	0.092	0.006	0.717	−0.257	−0.113	0.643
$\dot{Y}$	0.007 m/sec					1	−0.427	0.611	0.657	0.021	0.423	−0.043	−0.013	0.338	0.040	0.059	0.077	0.130	0.085	0.214
$\dot{Z}$	0.006 m/sec						1	−0.476	−0.485	−0.372	−0.103	−0.022	0.009	0.194	0.039	0.007	0.278	−0.135	−0.026	0.276
$GM_{\odot}$	1.14 km³/sec²							1	0.992	0.079	0.015	−0.029	−0.036	−0.467	−0.187	0.068	−0.606	0.277	0.095	−0.535
REM	0.006 km								1	0.057	0.137	−0.027	−0.034	−0.390	−0.184	0.065	−0.543	0.271	0.095	−0.467
GB	0.296									1	−0.170	−0.012	0.002	−0.025	−0.095	0.034	0.031	0.004	−0.027	0.023
$GM_{☾}$	0.141 km³/sec²										1	0.016	0.012	0.588	0.010	−0.022	0.469	−0.029	0.005	0.513
RI (3)	0.058 km											1	0.979	0.039	−0.028	0.013	0.008	−0.014	0.004	−0.009
LA (3)	0.00074 deg												1	0.069	−0.027	0.017	0.039	−0.012	−0.003	0.043
LO (3)	0.00032 deg													1	0.200	−0.085	0.821	−0.161	−0.035	0.859
RI (4)	0.046 km														1	−0.554	0.011	0.207	−0.270	0.198
LA (4)	0.00071 deg															1	−0.049	−0.122	0.153	−0.057
LO (4)	0.00039 deg																1	−0.190	−0.061	0.821
RI (5)	0.042 km																	1	−0.859	−0.216
LA (5)	0.00076 deg																		1	−0.007
LO (5)	0.00036 deg																			1

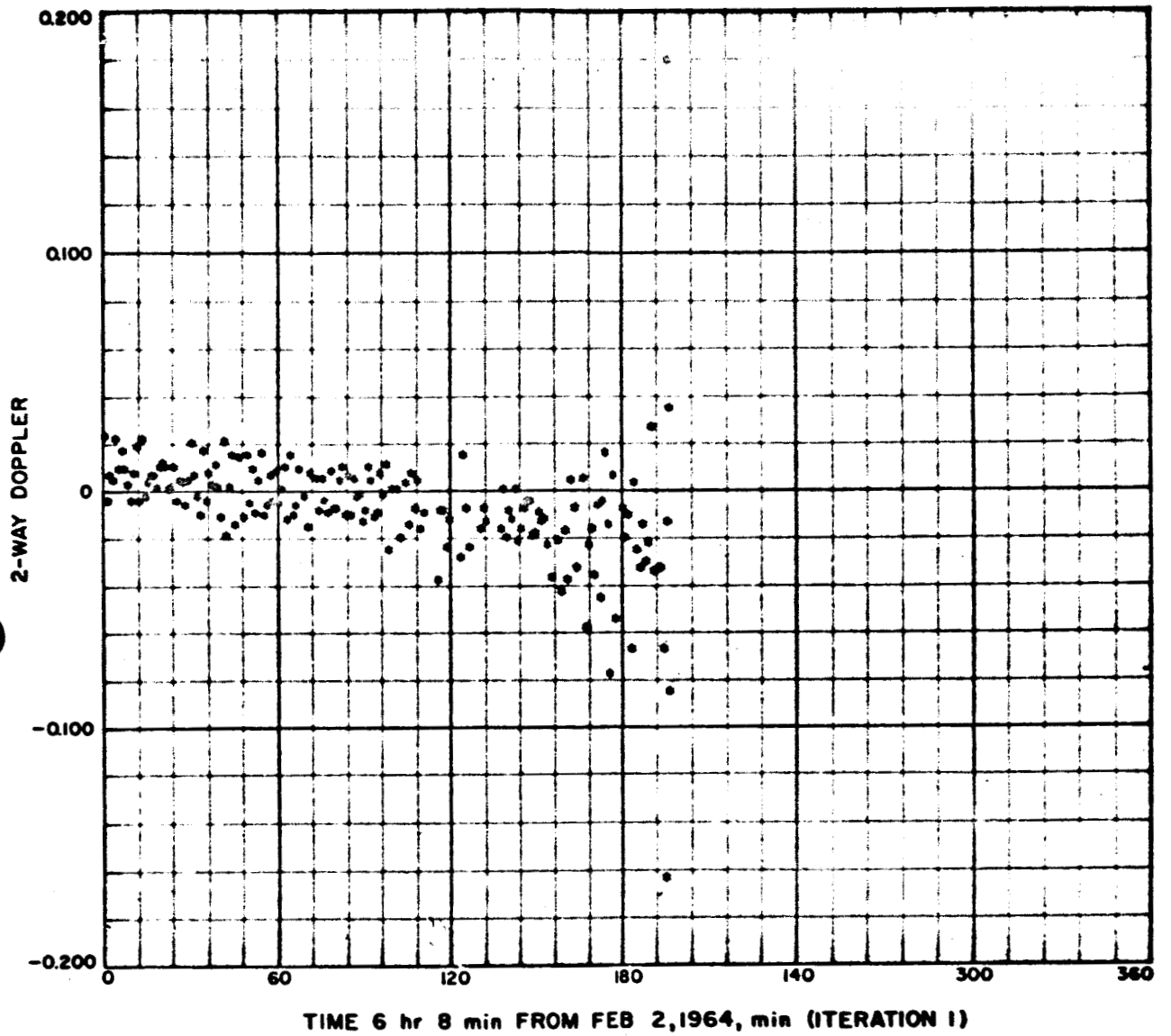


Fig. 41. Station 12 pass No. 03/331 residuals with *REM* constraint. Seven points are off plot, max = −0.49 (06:08 GMT)

recording which is displayed in Section IV. The recording is at least accurate to 0.03 sec, which is many times better than the calculated sigma and a strong data point for a lunar elevation.

A check was also made on available lunar elevation data compiled by different groups, primarily the Army Map Service in Washington, D.C., and the Air Force Lunar Map Service (ACIC) in St. Louis, Missouri. The selection of ACIC's LAC 60 map gave a lunar radius at impact of 1738.4 km with an uncertainty of ±1.0 km. On the Army map the elevation was not as well defined but appeared to be higher, 1738.9 km.

By making the lunar radius 3.1 km smaller, the impact time residual can be eliminated. The uncertainty in the radius, +0.3 km, is derived from the uncertainty in the calculated impact time. The *Ranger VII* impact radius was similarly smaller than anticipated. The implications

of these two results might be that the Moon's center of mass is 3.0 km closer to the surface at the impact point than was previously thought.

b. Station locations. There is a wealth of knowledge to be obtained from radio tracking, especially in determining station locations. By inspecting our covariance matrices we can immediately see that the information on longitude is valuable. However, there is much more information here. A different coordinate system will show that another direction normal to longitude is measured much better and that differences in station parameters are determined significantly better than absolute station locations.

If the coordinate system used is the X_1, X_2, X_3 system described in Section II C rather than the conventional radius, latitude, longitude system, it can be seen that two parameters are estimated very well whereas the third is left undetermined. The distance off the spin axis X_1 and normal to this parallel to the equatorial plane X_2 (i.e., longitude) are well determined, but along the spin axis X_3 there is no information. This becomes very evident in Table 20 which shows the 9×9 normalized covariance matrix on station locations rotated from the radius, latitude, and longitude system into the X_1, X_2, X_3 system. The 1-σ a priority used in the initial estimation is shown in Table 4. The contrast between the a priority and a posteriori solution statistics is significant in the parameters X_1 and X_2. The data contain essentially no information about X_3 since its a priority was ± 100, and the data results give ± 99.8 for X_3 (Station 12). The best estimate on X_1 and X_2 was made at Station 12, Goldstone, where the best data quality and longest tracking coverage were obtained. Ref. 4 gives a thorough explanation of why a complete pass of data from rise to set is necessary for good station solutions. Fig. 42 shows the signature in the doppler residuals for a complete station pass

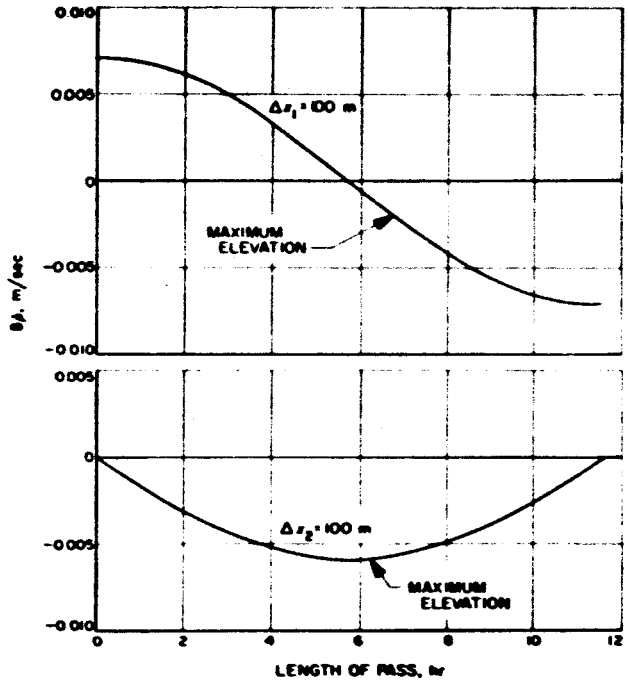


Fig. 42. Change in range rate caused by station location errors

caused by errors in X_1 and X_2, and it can be seen why they are so easily separated and determined. In Table 21, results are summarized as differences from the old survey. A comparison can be made on Goldstone with the X_1 and X_2 parameters. The results from the *Mariner II* mission, New Survey, and *Ranger VI* compare very well. Preliminary results on *Ranger VII* are also in good agreement with *Ranger VI*. Note also the correlations in Table 20 among the three stations' X_2 (i.e., longitude), and the statistics in Table 21 on the differences in station X_2. There will be many fine estimates on station locations

Table 20. Station location statistics

	Correlation matrix								
Standard deviation, m	X_1 (12)	X_2 (12)	X_3 (12)	X_1 (41)	X_2 (41)	X_3 (41)	X_1 (51)	X_2 (51)	X_3 (51)
9.7 X_1 (12)	1	0.146	−0.019	−0.207	0.154	−0.017	0.044	0.254	0.031
29.0 X_2 (12)		1	−0.059	−0.115	0.821	0.126	0.371	0.859	−0.003
99.8 X_3 (12)			1	−0.012	−0.029	0.021	−0.025	−0.026	0.002
37.7 X_1 (41)				1	0.042	0.290	−0.055	−0.143	−0.110
37.4 X_2 (41)					1	0.043	0.474	0.821	0.013
82.8 X_3 (41)						1	0.074	0.103	0.198
19.8 X_1 (51)							1	0.423	0.136
36.5 X_2 (51)								1	−0.036
92.4 X_3 (51)									1

Table 21. Comparison of station locations

Station	Δx, m	Δy, m	Δz, m	σx, m	σy, m	σz, m
Mariner II Δ = *Mariner II* − *old survey*						
12	−157.8	−93.2	−110.4	13.5	44.0	99.9
41	Stations 41 and 51 had insufficient tracking for station location solutions.					
51						
12–41						
12–51						
41–51						
New survey Δ = new survey − old survey						
12	−133.3	−103.[illegible]	191.0	26.0	26.0	26.0
41	−63.5	−3.3	41.4	26.0	26.0	26.0
51	−17.8	0.0	−16.1	26.0	26.0	26.0
12–41				36.8	36.8	36.8
12–51				36.8	36.8	36.8
41–51				36.8	36.8	36.8
Ranger VI Δ = *Ranger VI* − *old survey*						
12	−169.5	−123.2	−1.6	9.7	35.5	99.8
41	25.0	122.1	48.3	38.0	43.3	83.0
51	−81.9	−45.5	−49.0	19.0	40.0	92.0
12–41	−194.5	−245.3	−49.9	39.2	21.5	128.4
12–51	−87.6	−77.7	47.4	21.6	18.8	135.9
41–51	106.9	167.6	97.3	43.6	22.2	111.3

coming from future space probes; for the overseas stations will soon have the Goldstone capabilities, and tracking will be such that all horizon data, whether in the 2- or 3-way mode,[4] will be valuable.

c. Physical constants. Estimates on three physical constants were obtained with the tracking data. $GM_{\oplus}$, $GM_{☾}$ and *REM* were estimated with uncertainties lower than any previous estimates (Table 19). The estimate on *REM*, of course, comes primarily from the good estimates on $GM_{\oplus}$ and $GM_{☾}$, although the agreement of the independent solution is very encouraging. As expected, the constrained solution brought the statistics down slightly on all parameters (Table 4, columns 12 and 15).

Table 22 and Figs. 43 and 44 show the results on $GM_{\oplus}$ and $GM_{☾}$ from *Ranger VI* and previous missions.

Table 22. $GM_{\oplus}$ and $GM_{☾}$ mission estimates

Mission	Value, km^3/sec^2	Standard deviation, km^3/sec^2	Tracking period
$GM_{\oplus}$ estimates			
Nominal JPL*	398603.20	±4.0	4 days
Ranger 3	398600.49	±4.1	8 hr
Ranger 4**	398601.87	±13.3	8 hr
Ranger 5*	398599.20	±13.2	65 hr
Ranger VI	398600.61	±1.1	
$GM_{☾}$ estimates			
Nominal JPL (prior to *Mariner II*)	4900.7589	±5.0	
Nominal JPL (after *Mariner II*)	4902.7779	±0.3	Venus cruise data
Ranger VI	4902.6182	±0.14	65 hr of data

*Ref. 3.
**Ref. 5.
*Ref. 6.

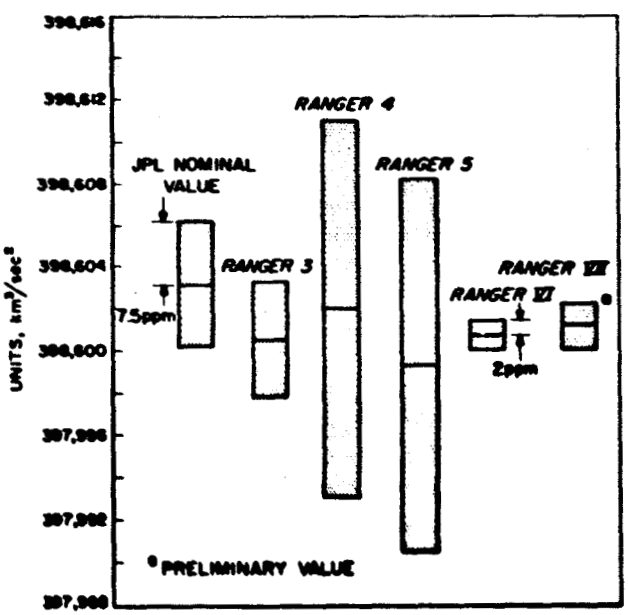


Fig. 43. $GM_{\oplus}$ with probable errors

[4]See Section IV on various tracking modes. The 3-way mode data are not used presently, due to insufficient reference frequency stability.

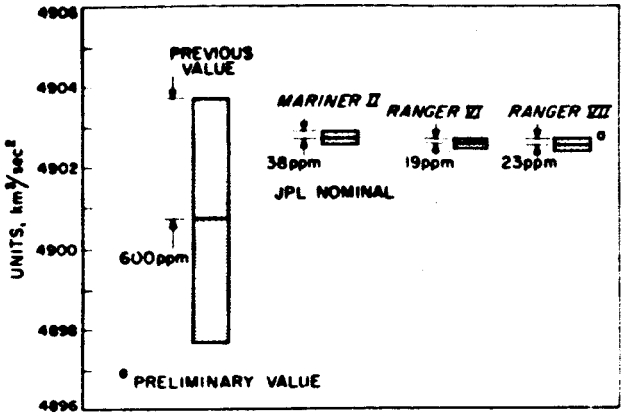


Fig. 44. $GM_{☾}$ with probable errors

Notice how consistent the results are. The mean seems to average close to 398601.2 km³/sec² for $GM_{\oplus}$. Note that the uncertainty in $GM_{\oplus}$ is about a factor of 4 smaller than the nominal JPL value (Ref. 3). The estimate on $GM_{☾}$ is consistent with the *Mariner II* estimate, and its uncertainty is also a factor of 2 smaller. The results are very encouraging in that the *Mariner* estimate was obtained by the 28-day periodic effect of the Moon in *Mariner's* cruise phase data, whereas the *Ranger* solution was derived purely from the direct gravitational force of the Moon. These estimates are truly from the data for, as seen in Table 4, the a priori assumptions were a magnitude larger than the final uncertainties.

With these estimates on $GM_{\oplus}$ and $GM_{☾}$ an Earth–Moon mass ratio can be determined.

$$\mu^{-1} = \frac{GM_{\oplus}}{GM_{☾}} = \frac{398600.61}{4902.6182} = 81.3036 \pm 0.0023$$

This μ^{-1} agrees favorably with the *Mariner II* result

$$\mu^{-1} = 81.3015 \pm 0.0034$$

The mean lunar distance is obtained directly from the constrained estimate of *REM* as described by Clarke (Ref. 7) or Brouwer (Ref. 8)

$$A_{☾} = 60.2665878\, REM = 384{,}399.0 \pm 0.25 \text{ km}$$
(probable error)

This result may be compared with some previous measurements. For consistency with normal astronomical practices, the *probable error* has been used as a measure of statistical uncertainty in the subsequent comparisons.

Fischer (Ref. 9) interpreted the measurements of star occultations at the same point on the lunar limb by O'Keefe and Anderson (Ref. 10) to obtain the value $A_{☾} = 384{,}400.9 \pm 4.7$ km and interpreted the dynamic results as $A_{☾} = 384{,}400 \pm 2.0$ km, which is in good agreement with *Ranger VI*.

Measurements of radar round-trip times to the reflecting surface on the Moon were performed over eight lunations in 1959 and 1960 by Yaplee (Ref. 11). The results provide an accurate measurement of the mean distance from the Earth to the *mean radar surface*, representing the average surface over the range of reflecting surfaces presented during several lunations. Yaplee reported a mean lunar distance of $A_{☾} = 384{,}400.2 \pm 1.2$ km. In order to obtain this figure he assumed the radius to the *mean radar surface* (MRS) to be 1738 ± 1 km and the speed of propagation to be 299 792.8 km/sec. This result can be compared to the *Ranger VI* results in two ways. First, consistent values of the propagation speed must be used since both experiments actually measure in the length unit of "light-seconds." Correcting Yaplee's reported value into the system of units[5] used on *Ranger VI* $A_{☾} = 384{,}399.8 \pm 1.2$ km is obtained still using the radius to the MRS as 1738 ± 1 km. The agreement is quite good.

It seems that if Yaplee's result is expressed without putting in the relatively uncertain radius to the MRS and in light-second length units the mean distance from the center-of-Earth to the MRS[6] is $382{,}661.8 \pm 0.1$ km. Thus, if a more accurate measurement of $A_{☾}$ is available his results may be interpreted as a measurement of the *lunar radius* to the MRS. Using the $A_{☾}$ of *Ranger VI* $R_{MRS} = 1737.2 \pm 0.27$ km is obtained. As described earlier, the radius to the *Ranger VI* impact point is estimated to be $R_{R_6} = 1735.3 \pm 0.20$ km. Just how consistent these two estimates are may be verified by comparison with lunar maps. Using the U.S. Army Lunar Map (Ref. 2), the *altitude difference* between the MRS and the *Ranger VI* impact point can be estimated fairly accurately to be 2.2 ± 0.5 km, which compares well with the value of 1.9 ± 0.34 km obtained by combining the *Ranger VI* results with the new interpretation of Yaplee's measurements. Perhaps more careful attention to determining the altitude difference between *Ranger* impact *points* and the MRS by optical means will establish an even closer verification. More refined analysis will be performed in the future.

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[5] C = 299,792.5 km/sec in *Ranger VI*.

[6] B. S. Yaplee (private communication), November 25, 1964.

4. Limitations

This section discusses the limitations of the *Ranger VI* flight path analysis described in this Report and predicts the outcome to be expected from a more extensive analysis, which will be undertaken after the completion of the *Ranger* Block III (*Ranger 6* through 9) missions. The *Ranger Block III Summary Analysis* will be performed with the aid of the "next generation" ODP now being developed at JPL.

The ODP (Ref. 12) used for the *Ranger VI* analysis lacks certain desirable capabilities which will be incorporated in next generation ODP. The principal items are summarized in Table 23. It is significant to note that errors introduced during computations due to interpolation and the buildup of round-off error are the major contributions to the two-way doppler weighting sigma discussed in Appendix B. This means that the full potential of the DSIF tracking data has not been realized in the *Ranger VI* analysis. The two-way weighting sigma (for one sample min at Station 12 at lunar encounter) can be reduced DSIF tracking data has not been realized in the *Ranger VI* from 0.013 m sec to less than 0.005 m sec if the computing noise is made negligible compared to the other error sources. The buildup of computing error acts as a low frequency noise source. Such an error usually is not detectable in plots of the doppler residuals such as Figs. 24 through 34. These plots tend to illustrate only the high frequency noise sources.

In addition to the computing noise discussed above, other numerical limitations exist in the analysis. Their existence is illustrated by the fact that certain constraints hold only to a limited precision. Examples include the physical constant solutions and the spacecraft position at the midcourse maneuver epoch. The physical constant solutions obtained from using the results of premaneuver data as a priori information when processing postmaneuver data should be identical to the physical constant solutions obtained when using the results of postmaneuver data as a priori information when processing premaneuver data, in that both orbits use the same set of data but in a different order. Table 7 compares the physical constant solutions from these two orbits. Although the standard deviation of each physical constant shown in Table 4 exceeds the discrepancy between the two solutions, it is still clear that numerical difficulties do exist. For example, $\Delta GM_{☾} = 0.037$ km³/sec² which is a variation in the sixth digit where a variation in the eighth digit may be expected due to round-off in that although the same computations are performed they are accomplished in a different sequence for the two solutions. Notice that $\Delta GM_{☾}$ is overshadowed by the

Table 23. Limitations of *Ranger VI* analysis which will be overcome for *Ranger Block III Summary Analysis*

Limitation of ODP used for *Ranger VI* analysis	Characteristics of "next generation" ODP which will be used for *Ranger Block III Summary Analysis*
1. Trajectory and most other computations are in single precision. Errors are introduced during computations due to interpolation and the buildup of round off error, which are the main contributions to the data weighting sigma (Appendix B), e.g., computing noise contributed 0.012 m/sec out of a total weighting sigma of 0.013 m/sec for Station 12 two-way doppler near lunar encounter.	1. Double precision will be used throughout. The computing program will be formulated and the trajectory integration step size can be chosen to ensure that computing noise is a minor contributor to the data weighting sigma.
2. A fixed empirical correction is applied for tropospheric effects. Ionospheric effects are ignored but could appear as an "inward" displacement for a daylight tracking pass.	2. Ionospheric corrections will be applied and a more sophisticated model will be incorporated for the troposphere.
3. Certain operations must be carried out external to the ODP. This sometimes makes an exact iterative solution cumbersome and impractical. These external operations include: a. The application of the $GM_{\oplus}$, $GM_{☾}$, REM constraint (maintains the "calculated" period consistent with the "observed" period of the Moon).* b. Velocity increments due to the midcourse maneuver (and the spring separation of the spacecraft from the launch vehicle when applicable) are not automatically "solved for" and the ODP does not properly constrain the spacecraft at these maneuver points.	3. Maneuver velocity increments will be added to the solution vector and the necessary constraints will be incorporated in the ODP. Tracking data from injection to lunar impact can be processed in a single run as opposed to the premaneuver and postmaneuver segments which had to be treated separately for the *Ranger VI* analysis.
4. Size of solution vector is limited to 20 parameters. Nineteen parameters were used for the *Ranger VI* analysis which did not include the maneuver velocity increments in the solution vector.	4. Size of solution vector will be nominally 30 parameters but will vary depending on nature of run. This will allow the inclusion of added parameters mentioned above (3.).

*The lunar ephemeris is an input to the ODP and the "observed" angular position of the Moon with respect to the Earth is fixed, independent of the $GM_{\oplus}$, $GM_{☾}$, REM solutions.

$\sigma_{GM_{☾}} = 0.14$ km³/sec² for this analysis, but it will not be acceptable for the summary analysis which should yield a $\sigma_{GM_{☾}} = 0.03$ km³/sec², as discussed below.

The discrepancies in spacecraft position at the midcourse maneuver epoch are shown in Table 17 in which, for example, the spacecraft is displaced 0.6 km in the Z direction above what the magnitude of the maneuver would indicate. The current ODP constrains these positions statistically through the application of an a priori covariance matrix but does not include a physical constraint. The $GM_{\oplus}, GM_{☾}, REM$ constraint was applied as a side condition (Section II E 3) after the ODP processed the postmaneuver data using the results of the premaneuver data as a priori information. That is, the constraint is not applied in the iterative process but only after the orbit has converged without recognizing the constraint.

The next generation ODP will be formulated and the trajectory integration step size can be chosen to ensure that during postflight analysis computing noise will be a minor contributor to the data weighting sigma. In addition, the maneuver velocity increments will be added to the list of "solve for" parameters, and the equations which constrain the spacecraft positions at maneuver epoch and which constrain the $GM_{\oplus}, GM_{☾}, REM$ parameters will be added to the regression model. Also, the atmospheric refraction model will be improved in that the ionospheric effects will be added and the tropospheric model will be increased in sophistication. The size of the solution vector will be increased from its present limit of 20 parameters to allow the inclusion of the maneuver velocity increments and possibly timing biases which may be important within the first few hours after launch, as illustrated in Fig. 9.

It is desirable to develop a model complete enough so that the "fitters world" will contain all the parameters necessary to represent the "real world" data (remove all trends from the residuals), and so that realistic statistics are associated with the solution vector parameters. Table 24 is a comparison of the physical constant statistics between the *Ranger VI* postflight analysis and the *Ranger Block III Summary Analysis*. An improvement factor of 3 is realized for $GM_{\oplus}$ and 5 for $GM_{☾}$. The slow relative motion of points on the Earth's crust (which will not be included in the ODP model) may limit the knowledge of station locations to 5 m in the radial direction normal to the Earth's spin axis and to 5 m in the difference in longitude between two stations. The major reduction in statistics is the result of the improved model (i.e., double precision, built-in constraints, midcourse maneuver model, improved refraction model) to be used for the *Summary Analysis*; however, some improvement will also be realized from combining the results of the *Mariner* (Venus and Mars) and the other *Ranger* flights for a consistent solution of the physical constants ($GM_{\oplus}$, $GM_{☾}$, *REM*, and tracking station locations). Also data such as TV pictures of the spacecraft lunar impact point will be available as a check on the orbit determination process.

5. Summary

Combining the premaneuver and postmaneuver data and applying the lunar constraint equation on the *REM* and the *GM* has provided new and independent estimates on the values for $GM_{\oplus}$, $GM_{☾}$, *REM*, station locations, and a lunar radius at the impact point. The statistics on all these parameters are as good or better than any other estimates available.

The solutions on the *GM*'s are consistent with recently established results and are several factors lower in their

Table 24. Physical constant statistics: comparison between Ranger VI analysis and *Ranger Block III Summary Analysis*

Physical constant	Standard deviation	
	Ranger VI postflight analysis	Ranger Block III Summary Analysis
$GM_{\oplus}$	1.14 km³/sec² = (2.8 × 10⁻⁶) $GM_{\oplus}$	0.4 km³/sec² = (1 × 10⁻⁶) $GM_{\oplus}$
$GM_{☾}$	0.14 km³/sec² = (30 × 10⁻⁶) $GM_{☾}$	0.03 km³/sec² = (6 × 10⁻⁶) $GM_{☾}$
REM	6.1 m = (1 × 10⁻⁶) REM	2 m = (0.3 × 10⁻⁶) REM
Station locations*		
r_i (outward radial distance normal to Earth's spin axis)	9.7 m	5 m
$r_i - r_j$ ~ (difference in longitude between two stations)	30 m	5 m

*The Ranger VI analysis quotes results for Station 12 and ignores the effect of the ionosphere. The majority of the Station 12 doppler was obtained at night when ionospheric effects were at a minimum.

uncertainty. *REM* provides the mean lunar distance, and using it there is good agreement with Yaplee's recent radar bounce work in determining a lunar radius measurement. *Ranger VII* also showed an effect that wanted to decrease the lunar radius approximately 3.0 km. The station location measurements are made in only two coordinates: the longitude direction and off the Earth's spin axis. The statistics in these coordinates are better than the present land surveys because it is difficult for them to account for the continent discontinuity and local vertical discrepancies.

With future space probes and new equipment being installed at the tracking stations, more and better estimates will be achieved through Earth-based radio tracking.

III. MIDCOURSE AND TERMINAL MANEUVER ANALYSIS

A. Introduction

The Maneuver Analysis Group (MAG) is responsible for the real-time exploration of the possible maneuver alternatives existing in both standard and nonstandard flight sequences. As a result of this exploration a definitive recommended maneuver policy along with certain available alternatives emerges. The exploration of maneuver alternatives must be conducted within the framework constructed by the following constraints and considerations:

1. The impact site must be selected so that upon arrival, the lighting conditions are suitable for high resolution photography. Because it is thought that the changes in the lunar albedo are negligible over small areas, dependence upon shadowing must be made in order to obtain the desired information. A precise criteria for the selection of suitable landing locations is given by the Figure of Merit formulated by the Space Sciences Division of JPL (Ref. 13). This technique calculates the minimum size, right circular cone of 15 deg slope that will be detected under a given set of lighting conditions and viewing geometry. In general, this criteria predicts excellent results in the region where the lighting angle is between 50 and 80 deg.

2. It is very desirable that the impact site be within a mare area since this is the desired landing terrain for the *Apollo* capsule.

3. It is also desired that the mare area selected be between ±10 deg of the lunar equator, again for compatibility with the manned lunar program.

4. If no suitable impact area can be found, the possibility of a west-side flyby is allowed, and selection is made here on a combined basis of optimizing the Figure of Merit and obtaining maximum camera coverage, especially on the back side of the Moon.

5. There are additional spacecraft and geometrical constraints to be taken into consideration. Among these are:

   a. The magnitude of the maneuver cannot exceed the maximum provided.

   b. At no time before the completion of the mission may the Earth–probe near limb of the Moon angle fall below 15 deg. Violation of this constraint will result in loss of Earth lock.

   c. It is desired that the flight time be adjusted so that the automatic preset timer on board the spacecraft will activate the fully scanned cameras no later than 5 min and no earlier than 45 min before impact.

   d. At no time during the midcourse sequence should the roll axis of the spacecraft lie within 40 deg of the probe–Earth line. If this constraint is violated, spacecraft telemetry during the maneuver may be lost as the null cone of the omniantenna is pointed at the Earth. This constraint is complicated because entering the forbidden cone does not necessarily mean telemetry loss, and if loss occurs it may be lost for some channels only. The severity of the telemetry degradation is a function

of the "clock" angle, i.e., the part of the cone that has been entered. Coordination with Spacecraft Data Analysis Team (SDAT) is required in flight for a complete analysis if this problem arises. Constraints c and d may be mutually exclusive, in which case the timer will take precedence over the midcourse telemetry.

e. It is desirable that the entire terminal phase (impact − 130 min to impact) be visible from the Goldstone stations.

f. The postmidcourse trajectory must be such that the required second pitch turn during the terminal maneuver does not become less than −47 deg. In addition, the second pitch turn may not be greater than +55 deg if accurate roll stabilization is required.

g. The primary optical axis of the TV subsystem may not be pointed to within 38 deg of the probe–Earth line because of mechanical limitations.

During the performance of the maneuver, it is possible to determine from telemetry if the roll and pitch turns are being executed as commanded. If the turns are significantly different than desired, the question immediately arises whether the incorrect maneuver being performed is better than no maneuver. Using linear analysis, the MAG can determine in real time the effect upon the trajectory of any combination of observed turns and an assumed velocity increment and, in conjunction with a representative from the Space Sciences Division, recommend whether or not to send RTC-8, which inhibits the motor burn and returns the spacecraft to the cruise-mode orientation.

The investigation of the proper terminal maneuver can be broken into three main possibilities:

1. The nominal terminal maneuver which aligns the primary optical axis of the TV subsystem along the velocity vector at the point of impact.

2. The optimum terminal maneuver which seeks to make the optimum trade-off between camera smear, due to misalignment between the cameras and the velocity, and the viewing geometry.

3. No maneuver at all which improves reliability.

The constraints on the terminal maneuver mentioned in the preceding section apply here also in choosing the proper terminal maneuver. Figures 45 and 46 depict the midcourse roll–pitch turn and the terminal pitch–yaw–pitch turn sequences.

B. Midcourse Maneuver Situation

For the January 30, 1964 launch there were two nominal prelaunch aiming points selected, one at 8.5 deg latitude and 21.0 deg longitude in the Sea of Tranquillity, and an alternate in the Sea of Vapors at 13 deg latitude and 3 deg longitude. The alternate point was selected because the Sea of Tranquillity was but 19 deg from the terminator, and it was feared that the actual target uncertainties due to midcourse execution and orbit determination errors might dictate the selection of the alternate point, 35 deg from the terminator.

During the mission, it was clear from the first orbit that the premidcourse trajectory lay well within the 60 m/sec correction capability. The behavior of the orbit's estimation is detailed elsewhere in this Report, but, relative to the size of the correction to be performed, each determination yielded the same result. The figures quoted here refer only to the nominal premidcourse orbit. This orbit provided the basis for the final computation of the midcourse maneuver. Table 25 details the estimate of the premaneuver orbit, the desired target parameters and the change in the target parameters required to attain the desired terminal conditions.

Table 25. Premaneuver and postmaneuver target conditions

Target parameters	Premaneuver orbit	Launch vehicle aiming point	Sea of Tranquillity		Sea of Vapors	
			Desired	Perturbation required	Desired	Perturbation required
B • RT	1660 km	−536	−725	−2385	−1100	−2760
B • TT	−4518 km	498	2740	+7258	1950	+6468
TF	64.62 hr	65.53	65.29	0.66	65.29	0.66

Also registered in Table 25 is the prelaunch target point. It may be noted that this point is some 2300 km away from the primary postmidcourse aiming point. The prelaunch target conditions are chosen so as to optimize the probability of impacting in the visible lighted portion of the Moon in the event a spacecraft malfunction occurs which precludes the performance of the midcourse trajectory correction. Likewise, the flight time of the prelaunch targeted trajectory is biased from the final desired to enhance the likelihood that the TV package will be activated automatically at an acceptable time even if no command capability is ever established with the spacecraft.

Figure 47 plots the perturbation required to reach the Sea of Tranquillity inside the capability ellipse for 60 m/sec 16 hr after injection. The interpretation of this

Fig. 45. *Ranger midcourse maneuver*

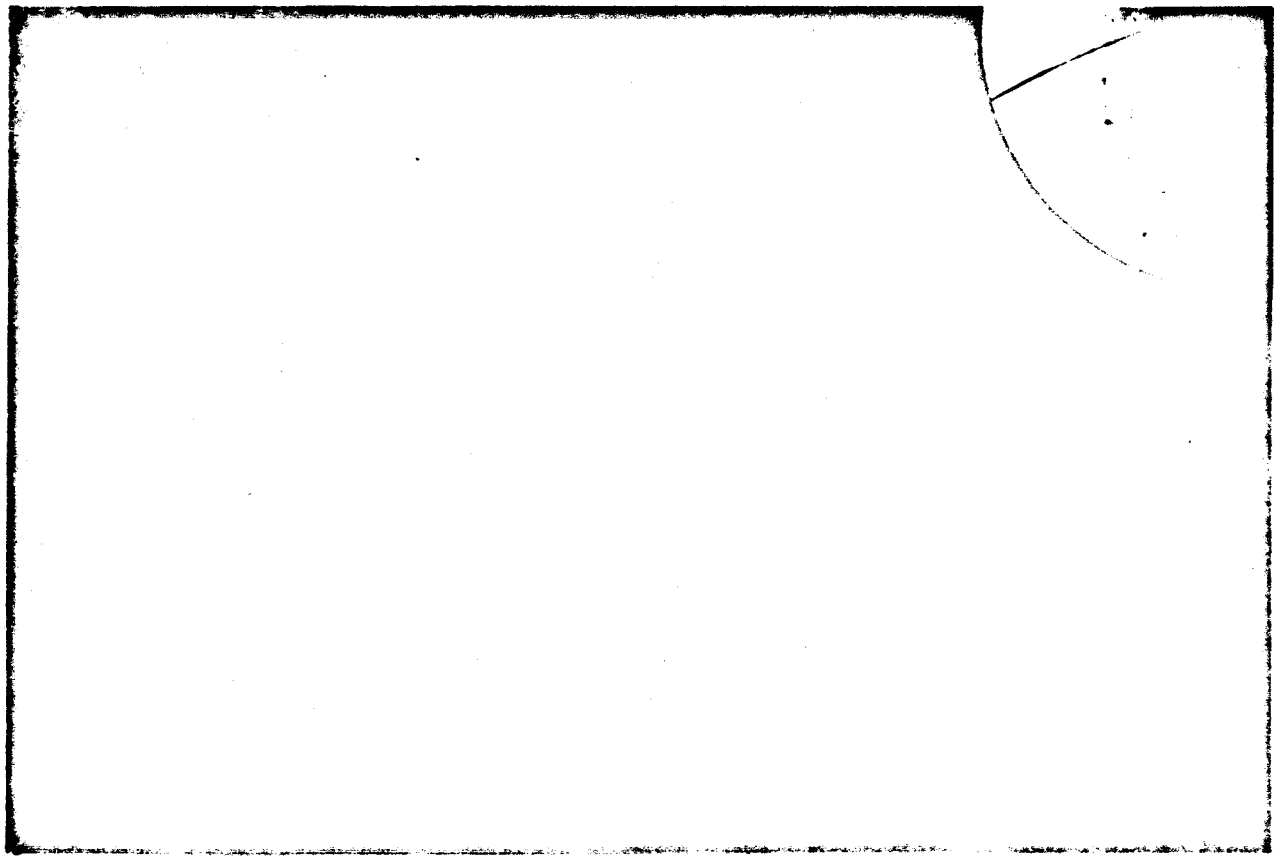

Fig. 46. *Ranger terminal maneuver*

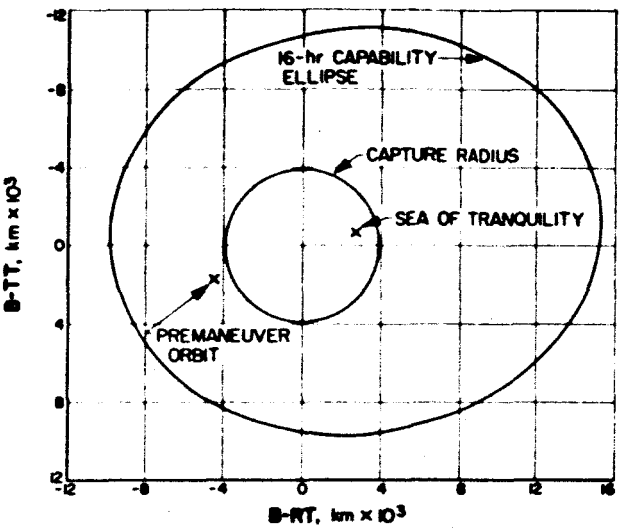

Fig. 47. *Ranger VI* midcourse guidance requirement and capability

Figure is that if the premaneuver B·RT, B·TT point lies within the ellipse, the desired correction is possible with the 60 m sec capability provided. A summary of the target dispersion statistics is provided in Table 26. Here are listed the 1-σ values for the semimajor and semiminor axes of the B plane dispersion ellipse along with the flight time uncertainties for the orbit determination, midcourse execution, and combined error ellipses.

Nominally the flight time is adjusted during the midcourse maneuver so that impact will occur 15 min after the TV backup clock applies full power to the F channel cameras.[1] If, however, the roll axis turns to within 40 deg of the probe–Earth line at any time during the performance of the nominal maneuver, consideration is given to modifying the flight time from the nominal desired to a value such that an antenna constraint violation does not occur or, at least, occurs in a minimum fashion. For *Ranger VI* it was considered acceptable to have the cameras automatically activated anywhere in the interval 11–34 min before nominal impact. The required unmodified maneuver yielded a severe antenna constraint violation; the roll axis entered the null cone 50 sec after the start of the pitch turn and did not emerge until the motor had been completed and Sun reacquisition had started. Moreover, adjusting the flight time within the acceptable window yielded no appreciable improvement. Because of the ineffectiveness of any possible modification and

[1]F refers to the fully scanned cameras, P refers to the partially scanned cameras.

Table 26. Expected target dispersions from orbit determination and midcourse execution errors

1-σ	Orbit determination	Maneuver execution	Combined
Semimajor axis, km	80	73	95
Semiminor axis, km	31	40	72
Flight time uncertainty, sec	66	48	82
Angle from T-axis clockwise, deg	−47	66	−69

because it was anticipated that most of the telemetry could be received in spite of the violation, the unmodified flight time of 65.29 hr from injection to impact was selected. This completed the postmaneuver aiming point selection.

Consideration was given to the possibility of sending RTC-8, interrupting the midcourse sequence, in the event a malfunction occurred during the turning sequence of the midcourse maneuver. This is a particularly difficult decision to make in real time for a maneuver, once stopped, may not be attempted again, and the spacecraft is committed to remain on the premidcourse trajectory.

The *Ranger VI* premidcourse trajectory took the probe on a west-side flyby of the Moon, having a closest approach distance of 2550 km (altitude of 812 km) at a subprobe point of latitude = −10 deg, longitude = −168 deg. On this trajectory, a very satisfactory mapping of the unexplored portion of the Moon could be obtained, although the pictures would by no means have met the mission high resolution objectives. In order to obtain this back-side mapping however, a terminal maneuver would have had to be performed. Without this reorientation of the spacecraft, the camera field of view would not have intercepted the Moon. If a real malfunction occurs during the midcourse, the likelihood of being able to successfully perform a terminal maneuver is cast in grave doubt; except in unusual circumstances, then, RTC-8 is not to be sent if a terminal maneuver is obligatory on the premidcourse trajectory. Because of these considerations it was decided that no postmidcourse trajectory could be less advantageous than the existing course, and the decision was made by the Project Manager not to send RTC-8 under any circumstances.

Approximately 3 hr before the initiation of the maneuver, at 08:30:00 GMT January 31, 1964, the final computation was made, using the latest estimate of the injection conditions. The important parameters of the required maneuver are registered in Table 27.

Table 27. Commanded maneuver, January 31, 1964

Event	Magnitude	Duration, sec	Time initiated
Roll turn	−11.96 deg	54	08:30:44
Pitch turn	−70.98 deg	328	08:40:09
Velocity increment	41.27 m/sec	67	08:57:09

During the performance of the maneuver, the telemetry yields direct readings on the duration and polarity of the turns and the length of the motor burn. These measurements, observed in real time during the performance of the maneuver, all had the correct polarity and, to within the accuracy of these measurements, were of the exact duration commanded. This, coupled with the real-time doppler reduction (discussed elsewhere in this Report), gave almost immediate verification that the maneuver had been performed correctly.

C. Terminal Maneuver Situation

At the time the terminal maneuver was being considered, the following data represented the best estimate of the impact parameters:

Impact latitude = 8.00 deg

Impact longitude = 20.11 deg

Time of impact = Feb. 2, 1964 at 9:24.40 GMT

Automatic camera turnon = 9:11.12 GMT

Figure 48 depicts the impact geometry with the cameras in the cruise mode orientation. The C vector represents the central pointing direction of the four P cameras; A and B represent the pointing directions for the 25 and 8.4 deg field of view F cameras. A terminal maneuver, if performed, would have aligned the C vector with the impact velocity vector. In the cruise mode the C vector was 12.5 deg from the velocity vector, and with the path angle shown of 42.5 deg, an impact velocity of 2.66 km/sec and a shutter speed of 2 m/sec, the resultant blurring due to camera motion was 1.85 m. That is, the center of the field of view at the time the shutter closed would be observing a point on the surface 1.85 m away from the point viewed at the time the shutter opened. This is an acceptable level of blur; an amount three times this figure could probably be tolerated and still meet the mission objectives.

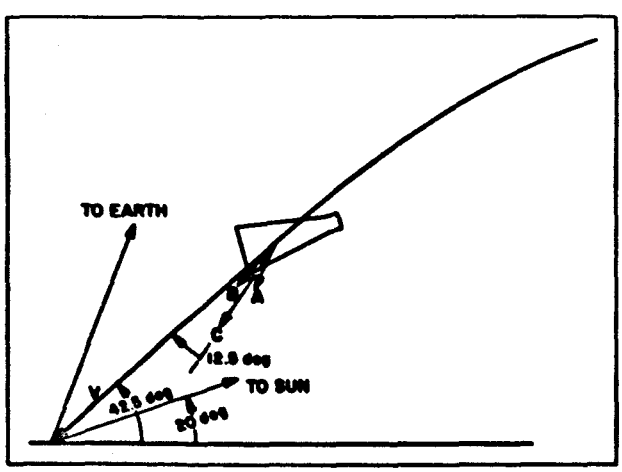

Fig. 48. Lunar approach geometry (no terminal maneuver)

In addition, the TV experimenters pointed out that the "no terminal maneuver" viewing geometry was such as to allow direct observation of shadows from objects having a 30-deg slope from the horizontal. If the camera were aligned with the velocity vector, this situation would have been destroyed. These considerations coupled with the possibility of a spacecraft failure during the terminal maneuver led the Project Manager to decide not to perform a terminal maneuver.

D. Commanded and Actual Maneuver Compared

The *Ranger VI* midcourse maneuver was performed well within the expected tolerances to produce a near perfect impact in the Sea of Tranquillity. The purpose of this section is to numerically evaluate the midcourse accuracy, obtaining estimates of the maneuver execution error in terms of effective pitch, yaw, and shutoff errors. These estimates are derived directly from the final estimate of the velocity added by the maneuver, and they have uncertainties associated with them; the estimation errors are presented and discussed below.

It is estimated that the *Ranger VI* maneuver was performed with a 0.97 mrad pointing error in pitch, a −5.2 mrad error in yaw and a −0.044 m/sec error in shutoff. For the maneuver performed, the expected standard deviations of these errors were 3.7 mrad, 8.6 mrad and 0.18 m/sec, respectively. In addition, the uncertainties in these estimates are 0.14 mrad, 0.23 mrad and 3.5×10^{-3} m/sec.

It is possible, in postflight analysis, to account for a few of the random errors that constitute the final pointing and shutoff errors. In particular, the turn and velocity magnitude resolution errors and the limit cycle errors in

Table 28. Data used in error computations

Data	Roll turn, θ_a^*	Pitch turn, θ_p^*	Yaw turn, θ_y^*
Ideal turn	−12.013	−71.062	0
Resolution error	0.052	0.082	0
Limit cycle error	0.218	0.120	−0.097
Ideal velocity increment = 41.1785 m/sec, Resolution error = 0.0021 m/sec			

roll, pitch, and yaw can all be obtained. By simulating a maneuver containing these errors—but otherwise ideal—the pointing and shutoff errors attributable to the remaining sources can be estimated. (The data used to remove these effects are registered in Table 25.) The remaining execution errors are estimated to be −2.5 mrad, −0.22 mrad, and −0.046 m/sec, respectively, in pitch, yaw and motor shutoff.

Table 29 contains the results of the computations, giving the estimates of the pointing and shutoff with and without the observable errors. It is interesting that all the errors are considerably below their 1-σ values; this is true even after the removal of the effects of the roll limit cycle, a usually predominant error which was fortuitously low for *Ranger VI*, from the yaw channel. The velocity variances used were obtained by using tracking data alone; i.e., no weight was given to the spacecraft maneuver data. The values for the expected execution errors* and the actual limit cycle errors were obtained from the Guidance and Control Division.

Table 29. Estimated *Ranger VI* maneuver execution errors

Error computation	Pitch, mrad	Yaw, mrad	Velocity magnitude, m/sec	
Estimated error	0.97	5.2	−0.044	Including all error sources
Standard deviation of expected error	3.7	8.6	0.18	
Ratio of estimated error to its standard deviation	0.36	0.60	0.24	
Estimated error	−2.5	−0.22	−0.046	With removal of all identifiable error sources
Standard deviation of expected error	3.1	5.9	0.17	
Ratio of estimated error to its standard deviation	0.81	0.37	0.27	
Standard deviation of the error in the estimate	0.14	0.23	0.0035	Applicable to both sets of results

*G. D. Pace, "*Ranger* Block III Midcourse Execution Capabilities," October 10, 1963 (internal communication).

Table 30. Comparison of inflight and postflight orbit estimates

	B • TT, km	B • RT, km	Closest approach or impact	SMAA,* km	SMIA,* km	θ, deg	DEL T,* sec
Premaneuver estimate							
Inflight (premaneuver data only)	−4517.73	1660.01	08:54:31.25	79.5	30.7	53	64
Postflight (premaneuver data only)	−4507.96	1594.40	08:54:09.00	19.7	15.5	110	12
Postflight (best, all data)	−4505.28	1581.29	08:54:16.70	–	–	–	–
Difference (post − in)	9.8	−65.6	−22.25 sec	–	–	–	–
Postmaneuver estimate							
Inflight	2753.89	−768.35	09:24:30	21.4	5.9	90	1.7
Best postflight	2751.43	−764.42	09:24:30	2.1	0.3	107	0.15
Difference (post − in)	2.46	3.93	0	–	–	–	–
Aiming point	2740.25	−725.50	09:24:24	–	–	–	–
Difference (post − aim)	11.18	38.92	6	–	–	–	–
Recorded impact time (corrected for travel time)			09:24:31.86	–	–	–	–

*Explained in Appendix I

These errors were also evaluated in the B plane along with the orbit determination errors. Table 30 tabulates the orbit determination errors as obtained from comparisons of postflight orbits and the inflight real-time orbits. The large error in B•RT is the primary orbit determination error mentioned earlier. Table 31 summarizes the two error sources. Fortunately the maneuver error tended to cancel out the orbit determination error and, as a net result, a miss of only 16 mi from the nominal aiming point exists.

Table 31. Summary of OD and maneuver errors

	$\Delta B \cdot T$, km	$\Delta B \cdot R$, km	ΔT, sec
Inflight orbit (best estimate)	12.41	−78.7	−14.5
Execution error in maneuver	1.4	26.7	+6.0
Total error	13.8	−52.0	−8.5
Δ Latitude / Δ Longitude — From nominal aiming point	0.80 deg ≈ 24.0 km / 0.45 deg ≈ 12.0 km		27 km = 16 mi on lunar surface

A rather dramatic display of the maneuver performance is shown in Fig. 49. The continuous dark line was the predicted doppler shift. The actual received doppler points are plotted as dots. The orientation of the velocity increment was such that 97% was directly measurable by the doppler shift.

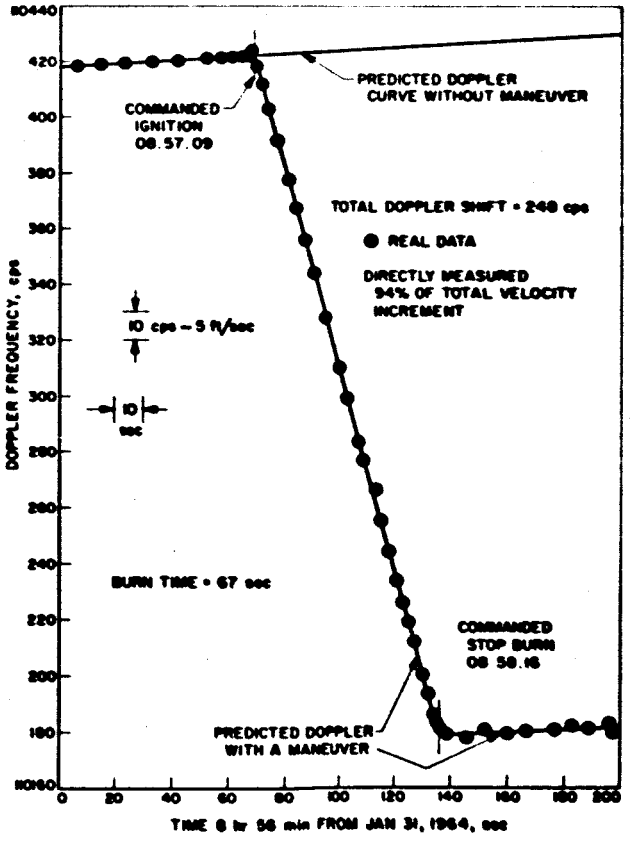

Fig. 49. *Ranger VI* doppler during maneuver

IV. TRACKING SEQUENCE OF EVENTS

A. Introduction

Ranger VI was launched from Cape Kennedy on January 30, 1964, at 15:49:09.092 GMT. Significant events, including their associated times, through lunar impact are listed in Table 32. At the time of the first *Agena* cutoff, the *Agena B–Ranger VI* spacecraft was in a circular parking orbit at an altitude of 186.89 km and a space-fixed velocity of 7.381 km/sec. The circular parking orbit was terminated by second *Agena* ignition. Second *Agena* cutoff marked the time of injection into the lunar transfer orbit at an altitude of 644.50 km and a space-fixed velocity of 9.443 km/sec. *Agena*–spacecraft separation appeared normal and *Ranger VI* continued on a lunar impact trajectory. Event blips B-2-4 and B-2-1 Number 4, observed by Station 41 at 16:50:07 and 16:52:01 GMT, respectively, confirmed solar panel extension and initiation of the Sun acquisition sequence. Earth acquisition was confirmed by event blip B-2-1 Number 5 at 19:20:02 GMT by Station 41.

The first ground commands were sent to the spacecraft by Station 51 on January 30. Two "clear commands" (RTC-0) were sent at 20:08:00 and at 21:10:00 GMT. These were followed by the spacecraft antenna changeover command (RTC-3) sent at 21:12:00 GMT. This last command switched the spacecraft transmitter from the omniantenna to the high gain antenna. A rise in received signal strength and a B-20 event blip at 21:12:40 GMT confirmed the antenna switchover.

The corrective maneuver commands were sent to *Ranger VI* by Station 12 starting at 07:29:00 GMT on January 31. All guidance commands were correctly received by the spacecraft, changeover was made from the high gain antenna to the omniantenna, and the midcourse maneuver execute command was initiated at 08:30:00 GMT. The midcourse maneuver began at 08:57:09 GMT and terminated at 08:58:17 GMT. The two-way doppler shift occurred during the maneuver, and the time over which it occurred indicated that a perfect midcourse maneuver had been executed. After the maneuver, the spacecraft, responding to on-board commands, reacquired the Sun and then the Earth. Station 12 then sent the command RTC-3 to switch the spacecraft transmitter from the omniantenna to the high gain antenna.

Ranger VI was again in a cruise mode proceeding on a lunar impact trajectory. Subsequent orbital computations using postmidcourse tracking, indicated that a terminal maneuver would not be required. At 09:08:00 GMT on February 2, Station 12 sent the backup command (RTC-7)

Table 32. Review of key event times

Event	Date	GMT	Time, interval
Atlas liftoff	Jan 30, 1964	15:49:09.09	Launch = L
Shroud ejection		15:54:15.00	L + 305.91*
Atlas–Agena separation		15:54:18.08	L + 308.99*
First Agena cutoff		15:57:33.45	L + 504.36*
Agena stage parking orbit injection, I		15:57:32.00	L + 502.91*
Second Agena cutoff		16:16:47.45	L + 1658.36*
Premidcourse reference epoch for orbit determination, E		16:16:41.00	L + 1651.91*
Fire interface connectors		16:19:18.23	L + 1809.14*
Spacecraft separation from Agena		16:19:23.24	L + 1814.15*
Agena retromaneuver cutoff		16:36:11	L + 2222*
Start maneuver turns	Jan 31, 1964	08:30:44	L + 16^{h}41^{m}34.91*
Start maneuver motor burn		08:58:21	L + 17^{h}09^{m}12*
Postmidcourse reference epoch for orbit determination, E_1		08:58:21	L + 17^{h}09^{m}12*
Stop maneuver motor burn		08:58:16	L + 17^{h}09^{m}08*
Impact Moon	Feb 2, 1964	09:24:31.86*	L + 2 day + 17^{h}35^{m}22.77*

*Correction of −1.29 sec travel time of light has been added.

to activate the TV subsystem warmup. The TV power supply (battery) voltage, as determined from telemetry, did not indicate that the TV was on full power. Two additional RTC-7 commands were sent to the spacecraft but failed to turn the TV system on. The *Ranger VI* impacted the lighted side of the lunar surface at 09:24:31.86 GMT on February 2. Total flight time was 65 hr 35 min 22.768 sec.

B. General Information

The DSIF consists of four permanent deep space tracking stations, a launch station, and a Mobile Tracking Station (MTS). Each permanent station is equipped with a paraboloidal antenna 85 ft in diameter mounted for tracking in hour angle and declination. The MTS is equipped with a paraboloidal antenna 10 ft in diameter for tracking in azimuth and elevation. The launch station is equipped with a manually operated, 6-ft antenna. Detailed characteristics of the deep space tracking systems employed in the *Ranger VI* mission have been provided.[a] The names and approximate locations of the stations that provided postinjection tracking data used in the orbital computations are given in Table 33.

Table 33. DSIF station locations

Station	Location	Latitude, deg	Longitude, deg
11	Goldstone, California	35.4 N	243.2 E
12	Goldstone, California	35.3 N	243.2 E
41	Woomera, Australia	31.4 S	136.9 E
51	Johannesburg, South Africa	25.9 S	27.7 E

Table 34 shows the nominal visibility periods of the spacecraft to the DSIF stations during the course of the mission. Rise time is defined as the time that the spacecraft first appears at a 5-deg angle above the station. Since these are nominal periods, signals may be received prior to rise time and after set time.

The modes of operation of the DSIF stations are identified as ground station tracking modes. A two part code is used to define the station configuration. The first part defines the transmit receive mode, and the second defines the antenna feed configuration. Table 35 summarizes the *Ranger VI* ground modes.

C. Transponder Tracking

The DSIF tracked the *Ranger VI* transponder from shortly after injection into transfer orbit until lunar impact. Initial acquisition was made by Station 51 at 16:19:44 GMT, January 30. Lunar impact was marked by an abrupt loss of signal observed by Stations 11 and 12

[a]Jet Propulsion Laboratory, Tracking Instruction Manual No. 332-17, *Ranger VI* Mission, Volume I (EPD-145 Rev. 1), January 6, 1964.

Table 34. Nominal view periods[a] vs actual tracking periods at stations

Date	Station[b]	Nominal rise	Nominal set	Nominal view period	Acquisition by station[c]	Loss of signal by station	Actual view period
Jan 30, 1964	51	16:19:19	16:36:24	00h17m06s	16:19:44	16:42:00	00h22m16s
	41	16:36:22	23:27:23	06h51m01s	16:33:53	23:53:02	07h19m09s
	51	18:43:20	07 07 13[d]	12h23m53s	18:43:25	07:30:51	12h47m26s
Jan 31, 1964	11	05:56:56	16:43:42	10h46m46s	05:58:38	17:07:00	11h08m22s
	12	05:56:56	16:43:42	10h46m46s	05:31:21	17:06:50	11h35m29s
	41	12:48:46	00:05:16[d]	11h16m30s	12:25:00	00:33:00	12h08m00s
	51	20:13:14	07:26:08[d]	11h12m54s	20:12:20	07:51:04	11h38m44s
Feb 1, 1964	11	06:02:53	17:06:41	11h03m48s	06:08:45	17:25:50	11h17m15s
	12	06:02:53	17:06:41	11h03m48s	05:37:40	17:25:50	11h48m10s
	41	13:08:21	00:10:41[d]	11h02m20s	12:46:10	00:37:30	11h51m20s
	51	20:26:14	07 30 00[d]	11h03m46s	20:27:23	07:53:37	11h26m14s
Feb 2, 1964	11	06:01:56	09:24:33	03h22m37s	06:10:55	09:24:33.1[e]	03h13m38s
	12	06:01:56	09:24:33	03h22m37s	05:36:00	09:24:33.145[e]	03h48m33s

[a]Based on 5-deg elevation angle at station.
[b]Station 39 data not used in orbit determination; hence, the station is not included in table.
[c]Refers to time that station first heard spacecraft signal.
[d]Set occurs on day after rise. Time of lunar impact observed at station—not corrected for signal transit time.

Table 35. Ground station tracking modes (GM)

Mode*	Transmit/receive	Mode*	Feed
0.	No receiving. Transmitting only.	0.	Not used
	One-way doppler (receiving only)	1.	Horn feed diplexer combination (receiving and transmitting up to 10 kw)
2.	Two-way, 1-station doppler (transmitting/receiving)	2.	Tracking feed diplexer combination (receiving and transmitting up to 200 w)
3.	Two-way, 2-station, non-coherent doppler (receiving only)	3.	Acquisition antenna
4.	Two-way, 2-station, coherent doppler (receiving only with reference signal from transmitter station)	4.	Dipole (receiving and transmitting up to 25 w)
5.	Receiving only (no doppler)	5.	Horn feed, no diplexer (receiving only)

*Example GM 21; transmitting to spacecraft and receiving two-way doppler using a horn feed and diplexer.

Notes: 1. Telemetry will be available in all receiving modes except zero.
2. Angular data will be available only with feed mode 2.

Ref.: Jet Propulsion Laboratory Tracking Instruction Manual No. 332-17, Ranger VI Mission, Volume 1, (EPD-145 Rev. 1), January 6, 1964.

at 09:24:33.143 and 09:24:33.145 GMT, respectively, on February 2. Note that these are ground station observed times; that is, they are not corrected for signal transit time.

Only two-way, one station doppler data were used to determine the *Ranger VI* spacecraft orbit. Table 36 is a summary of the time intervals during which the two-way doppler was taken. In the Table, the time of transition from $q = 0$ to $q \neq 0$ is chosen to be the time when the first valid two-way doppler was received at the transmitting station; the transition from $q \neq 0$ to $q = 0$ is chosen to be the time of the last valid two-way doppler point in that interval. For an example of how to interpret Table 36, consider the first time $q = 51$ appears in the left-hand column. From t_1 to t_2 Station 51 was transmitting; the Station reported good two-way doppler data at the time indicated to the right of 51 in the receiving station column. The time from t_2 to t_3 was spent in transferring the transmitting assignment to Station 41.

Table 36 also shows that in some cases no time was lost in changing from one transmitter to another. This is the result of a new operational procedure whereby an attempt is made to transfer transmitters without losing two-way lock with the spacecraft. The normal method requires that both stations go to the one-way doppler mode; then the new transmitting station achieves two-way lock while the other station goes to the pseudo two-way mode.

D. Determination of Lunar Impact Time

The primary evidence of lunar impact by *Ranger VI* is the loss of received signal at the ground stations when the tracking antennas are pointed toward the Moon. Various functions related to this signal are continuously recorded by the DSIF stations during their respective tracking periods. Two recording methods are used: magnetic tapes and direct-write oscillographs.

Goldstone Stations 11 and 12 were tracking the spacecraft transponder on February 2 when an abrupt loss of signal occurred at approximately 09:24:33. Figure 50

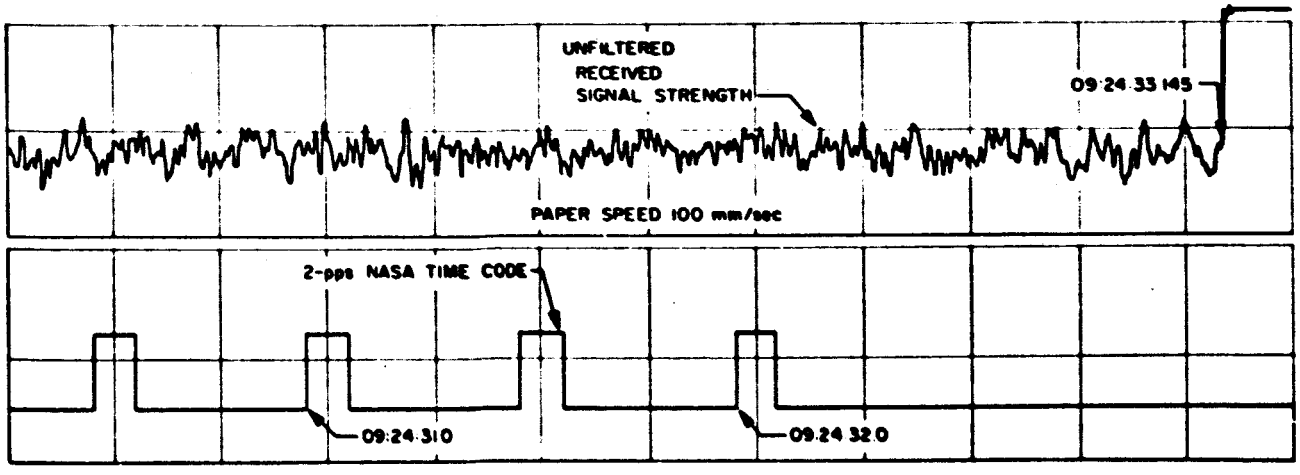

Fig. 50. Station 12 receiver functions just prior to impact

Table 36. Two-way doppler intervals

Transmitter, q	Time interval	Receiving station and ground mode (GM)	Time of first good two-way doppler date/GMT	Remarks
0	Launch to f_1 = 16h20m07s			
51	f_1 to f_2 = 16h41m56s	51 (GM 22)	30/16:20:07	rise + 48s
0	f_2 to f_3 = 16h47m02s			$f_2 - f_3$ = 5m6s
41	f_3 to f_4 = 19h08m02s	41 (GM 22 & 23)	30/16:47:02	
0	f_4 to f_5 = 19h11m02s			$f_5 - f_4 = 3^m$
51	f_5 to f_6 = 19h59m02s	51 (GM 22)	30/19:11:02	
0	f_6 to f_7 = 20h06m02s			$f_7 - f_6 = 7^m$
41	f_7 to f_8 = 20h35m02s	41 (GM 22 & 23)	30/20:06:02	
0	f_8 to f_9 = 20h39m02s			$f_9 - f_8 = 4^m$
51	f_9 to f_{10} = 06h25m02s	51 (GM 22)	30/20:39:02	
0	f_{10} to f_{11} = 06h25m02s			$f_{11} - f_{10} = 0$
12	f_{11} to f_{12} = 16h02m02s	12 (GM 21) 11 (GM 45)	31/06:25:02 31/09:07:02	
0	f_{12} to f_{13} = 16h08m02s			$f_{13} - f_{12} = 6^m$
41	f_{13} to f_{14} = 21h04m02s	41 (GM 22)	31/16:08:02	
0	f_{14} to f_{15} = 21h04m02s			$f_{15} - f_{14} = 0$
51	f_{15} to f_{16} = 06h12m02s	51 (GM 22)	31/21:04:02	
0	f_{16} to f_{17} = 06h12m02s			$f_{17} - f_{16} = 0$
12	f_{17} to f_{18} = 17h25m02s	12 (GM 21) 11 (GM 45)	01/06:12:02 01/06:13:02	
0	f_{18} to f_{19} = 17h31m02s			$f_{19} - f_{18} = 6^m$
41	f_{19} to f_{20} = 21h48m02s	41 (GM 22)	01/17:31:02	
0	f_{20} to f_{21} = 23h55m02s			$f_{21} - f_{20} = 2h7^m$ During this period both tracking stations were having minor equipment problems. Station 41 was continuously transmitting to the spacecraft but the received doppler was arbitrarily labeled bad.
51	f_{21} to f_{22} = 06h00m02s	51 (GM 22)	01/23:55:02	
0	f_{22} to f_{23} = 06h00m02s			$f_{23} - f_{22} = 0$
12	f_{23} to f_{24} = 09h24m33s	12 (GM 21) 11 (GM 45)	02/06:00:02 02/06:14:02	

shows the *unfiltered* received signal strength recorded at Station 12 during the last few seconds prior to impact. This is an example of a direct-write oscillograph record. High-speed recording rate (100 mm/sec) was not used until shortly before predicted impact. At the time noted by the arrow, 09:24:33.145 GMT, the transponder signal was lost. The time associated with the event is derived from the station secondary standard which is synchronized to WWV. This appears as the 2 pps time code trace in the Figure.

Figure 51 is a playback of the receiver functions recorded on magnetic tape at Station 11 just prior to impact. It is included to illustrate both types of records from which impact time was determined. Note that in this Figure the *filtered* received signal strength is shown. The rate of signal strength decay is characteristic of the time constant of the receiver. The drastic change seen in the telemetry channels (traces labeled CH2, CH3 and CH6) is further verification of loss of signal at the time noted by the arrow. Shown at the bottom of Fig. 51 is the 2 pps NASA time code. It is a binary-coded-decimal time code recording of days, hours, and minutes, also derived from the station secondary standard.

The conclusion is that, neglecting signal transit time, the *Ranger VI* spacecraft impacted the Moon at 09:24:33.145 +0.02 or −0.03 sec GMT.

Fig. 51. Station 11 receiver functions just prior to impact

V. ANALYSIS OF ETR TRACKING DATA

A. Introduction

After the first *Agena* burnout, Bermuda and Antigua tracked the *Agena* transponder simultaneously. Four minutes after the *Agena* had set at Antigua, the Twin Falls Victory Ship (TFV) and Ascension Island acquired and continued tracking for 3½ min until set. The last ETR station to acquire was Pretoria, which tracked the *Agena* through the second burn, spacecraft separation and *Agena* retrorocket burn. The orbit analysis was divided into three segments: (1) Parking orbit; (2) Post second burn and preretrorocket burn; and (3) Postretrorocket burn. Figure 52 illustrates the elevation angles of the various ETR stations, and the associated spacecraft events.

B. Parking Orbit

1. Bermuda (Station 7) Tracking

Data were received from the NASA Bermuda Station FPS-16 radar geocentrically located at 32.1709 deg latitude, 295.3465 deg longitude. Data were received from

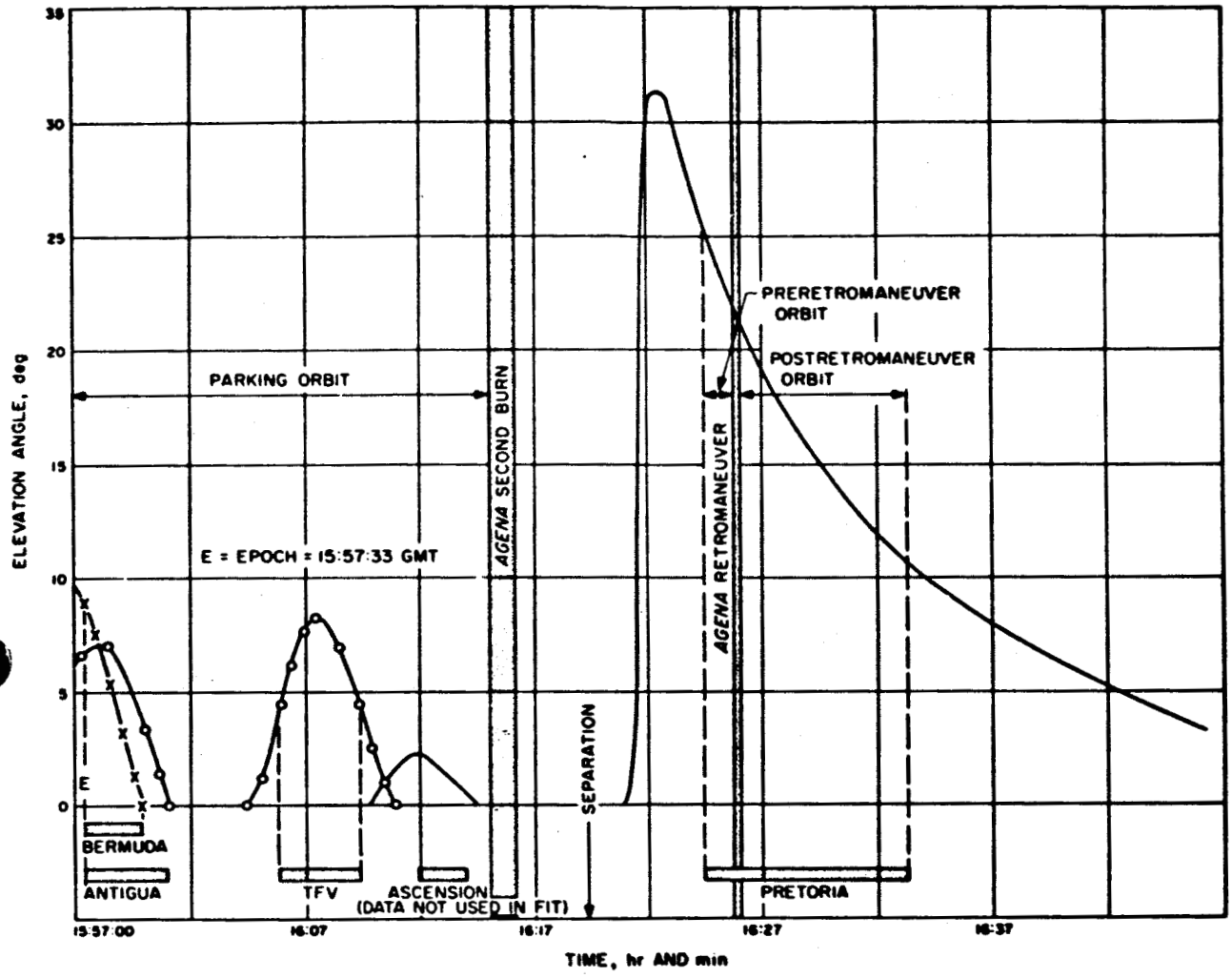

Fig. 52. Rise–set time of the spacecraft and associated events

15:57:42 to 15:59:54 GMT. The maximum elevation and minimum range occurred at the beginning of the received data. At closest approach, the range was 845 km. At spacecraft set, it was 1602 km.

In attempting to fit the data, very small biases in the angles appeared amounting to about −0.02 deg in both azimuth and elevation. The range measurements appeared to be slightly noisier than for the other stations. This was due to a 0.9-sec time biasing in the real-time Antigua data. Upon receipt of corrected Antigua data, which simultaneously corrected the reference crystal oscillator frequency for all radars from which metric data were received, a consistent solution resulted (Fig. 53). The station location of Bermuda was readjusted in the light of the new data, and the geocentric coordinates found are: 32.17025 ±0.0004 deg latitude, 295.34705 ±0.0007 deg longitude.

2. Antigua (Station 6) Real-Time Data Tracking

Data from the Antigua FPQ-6 radar geocentrically located at 17.0355 deg latitude, 298.2072 deg longitude, were received from 15:57:35 to 16:00:47 GMT. These data were utilized in real time to solve for the parking orbit. (For a comparison between the real-time orbit, the orbit reported by ETR, and the fitted orbit see Table 37.) The maximum elevation was about 7.3 deg, the minimum range was 948 km, the maximum range when the probe set was 1454 km. The data appear to be quite smooth with no biases.

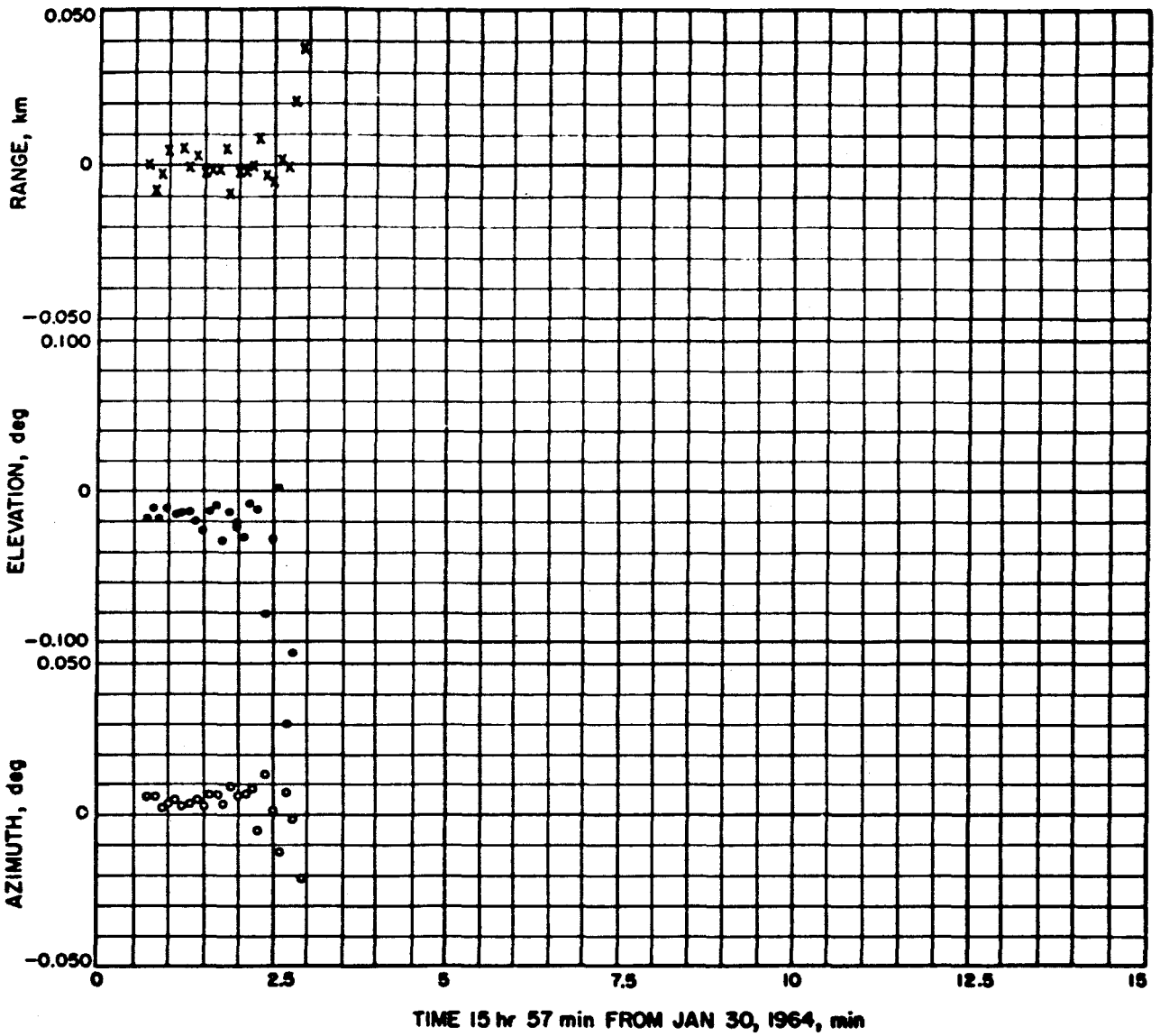

Fig. 53. Station 7 residuals (15:57 GMT)

3. Antigua (Station 6) High Density Tracking Data

These data were received after the mission—after attention was called to the fact that the real-time data were time biased by 900 msec. The high density data sample was 2 pt/sec in contrast to the usual 1 pt/6 sec sample, and the data were included for a multiple station solution. The statistics of the data are given in Table 38 and the residual plots are shown in Fig. 54.

4. TFV Ship (Station 8) Tracking

Data from the TFV FPS-16 radar was received from 16:05:45 to 16:09:20 GMT. The geocentric location of the ship was adjusted and found to be: 4.2073438 deg latitude, 332.60907 deg longitude. The ship sample rate was 1 pt/3 sec as contrasted to 1 pt/6 sec sample rate for the other radars. Only data above about 4 deg elevation were received. The maximum elevation for the spacecraft

Table 37. Parking orbit conditions

Epoch 15h57m32s			
	Orbit reported by ETR*	Real-time orbit	Postanalysis orbit
r_a, km	6561	6561.2415	6561.3092
ϕ_a, deg	25.250	25.590848	25.605173
λ_a, deg	299.457	297.97334	297.1152
V_a, km/sec	7.381	7.3800438	7.3804438
γ_a, deg	9.7×10^{-4}	5.5452152×10^{-4}	−0.0156590
σ_a, deg	104.607	103.91322	103.0978
a, km	6571.1	6570.1577	6570.0978
e	2.2×10^{-3}	1.3647876×10^{-3}	$-1.4975395 \times 10^{-3}$
i, deg	28.599	28.568242	28.568809
Ω, deg	187.21	187.87249	187.87625
ω, deg	163.562	119.27617	125.33142

*Epoch from ETR = 15h57m54.5s.

Table 38. Data statistics

	Number of points	Standard deviation	Mean	Sample rate
Parking orbit:				
Bermuda				
Azimuth, deg	23	0.00760	0.00240	1 pt/6 sec
Elevation, deg	20	0.0163	−0.0198	1 pt/6 sec
Range, m	21	6.21	0.477	1 pt/6 sec
Antigua (high density)				
Azimuth, deg	366	0.00491	-0.938×10^{-3}	2 pt/sec
Elevation, deg	367	0.0171	0.720×10^{-3}	2 pt/sec
Range, m	363	6.17	0.571	2 pt/sec
TFV				
Azimuth, deg	70	0.00886	0.05	1 pt/3 sec
Elevation, deg	70	0.00133	−0.05	1 pt/3 sec
Range, m	70	2.33	−0.678	1 pt/3 sec
Preretromaneuver transfer orbit from Pretoria:				
Azimuth, deg	14	0.00518	0.147×10^{-4}	1 pt/6 sec
Elevation, deg	15	0.00716	0.149×10^{-4}	1 pt/6 sec
Range, m	13	3.84	0.0822	1 pt/6 sec
Postretromaneuver transfer orbit from Pretoria:				
Azimuth, deg	52	0.0105	0.548×10^{-4}	1 pt/6 sec
Elevation, deg	52	0.0125	0.341×10^{-4}	1 pt/6 sec
Range, m	49	3.98	0.171	1 pt/6 sec

was about 8 deg. The range varied from 879 km at the closest in the middle of the pass to 1200 km at the extremes. Random fluctuations in the data were very small. Figure 55 shows the residuals in the angles to be biased about 0.04 deg in azimuth and −0.01 deg in elevation.

5. Ascension Island Tracking

The pass over Ascension Island was very low (2 deg maximum elevation), and all the data with the exception of two points were out of lock, so that these data were not used in the fit but merely verified the orbit.

C. *Transfer Orbit*

Data received from the FPS-16 radar at Pretoria (Station 9) geocentric coordinator −25.7904 deg latitude 28.3580 deg longitude, from 16:23:06 to 16:49:42 GMT indicated separation into a preretrorocket orbit and a postretrorocket orbit. Fifteen points of the preretrorocket *Agena* orbit were compared to the spacecraft orbit determined by the DSIF data and a range bias of 100 m appeared. However, 80 m accounts for the spacecraft and the *Agena* drifting apart at a nominal rate of 50 cm/sec. (The data for the *Agena* were taken 163 sec after spring separation.) The fifteen points of preretrorocket data show very little noise. Figure 56 shows, for a short time, the angular difference between the spacecraft and the *Agena*, and Fig. 57 shows the residuals from Pretoria of the *Agena* orbit by itself.

The postretrorocket orbit, comprising the remainder of the seventy points to be processed, was used in real time for the determination of the *Agena* transfer orbit. It was noted in the real-time operations that the pulse repetition rate had been modified, resulting in a small range bias.

Table 39. Transfer orbit conditions

Epoch = 16h16m41s			
	DSIF orbit*	Postanalysis ETR orbit**	Postanalysis ETR orbit†
R_a, km	6567.3686	6565.0991	6563.2105
Φ_a, deg	−6.8772584	−6.8803346	−6.9204227
λ_a, deg	7.4794263	7.4769013	7.5205535
V_a, km/sec	10.551019	10.551146	10.542166
γ_a, deg	1.2455507	1.2725385	1.3484279
σ_a, deg	118.91971	118.91135	118.89797
a, km	376043.76	361774.30	298509.55
e	0.98254333	0.98186141	0.97802479
i, deg	28.493096	28.486388	28.482310
Ω, deg	187.75066	187.73859	187.70312
ω, deg	192.11965	192.07620	192.01192
Impact conditions			
B, km	4792.3735	2977.0868	8317.4258
B • RT, km	1612.1795	869.69613	−4803.2555
B • TT, km	−4513	−2847.2217	6992.5757

*Spacecraft orbit.
**Agena preretromaneuver orbit.
†Agena postretromaneuver orbit.

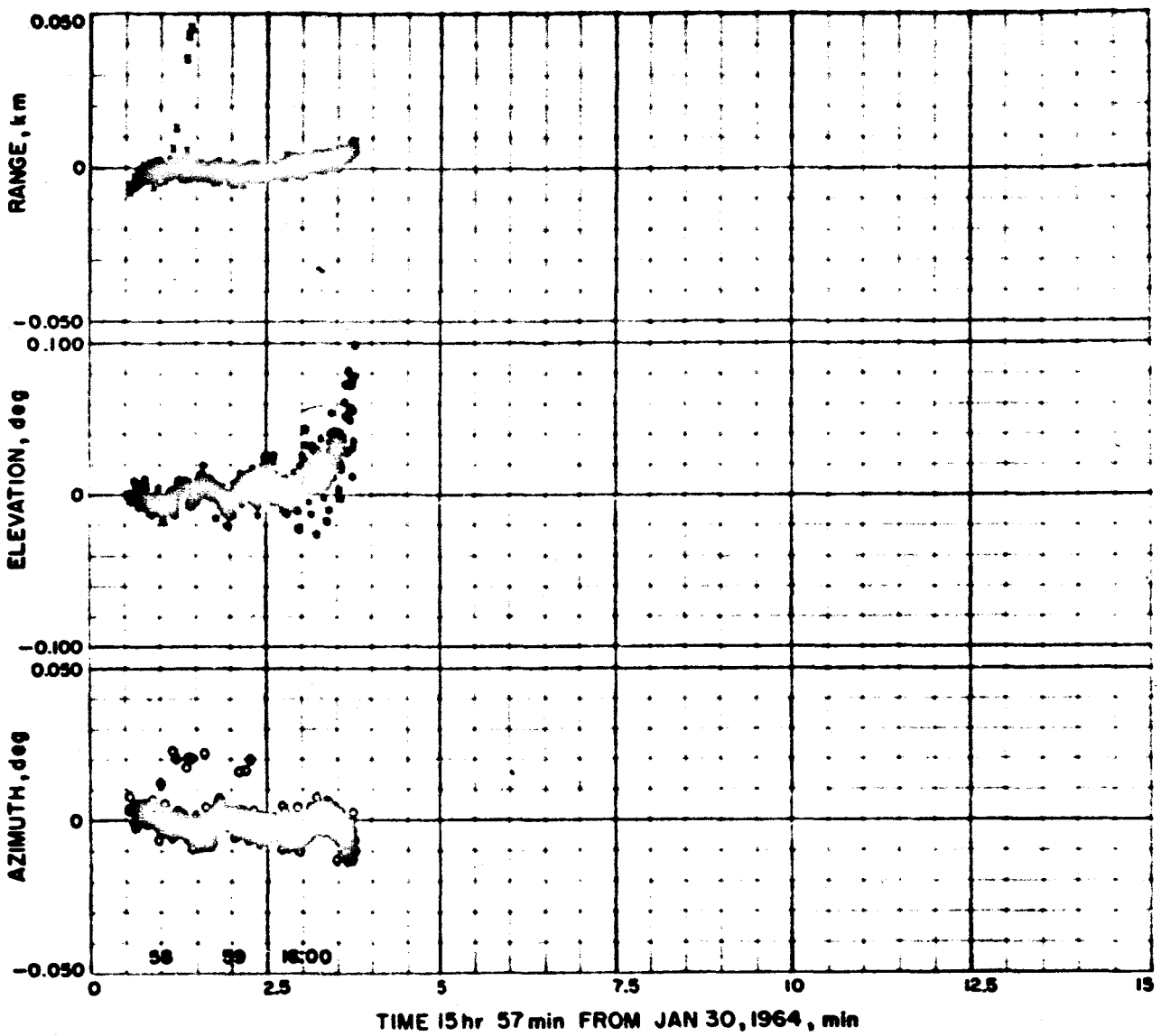

Fig. 54. Station 6 residuals (15:57 GMT)

This bias was later removed in the postanalysis phase and the resulting orbit compared to a DSIF orbit in order to verify the retromaneuver velocity. By comparing the energy difference between the two orbits, it was determined that the retromaneuver velocity amounted to 10 m/sec. This maneuver was sufficient to cause a miss at the Moon of about 4,000 km. Figure 58 shows a plot of residuals of the postretromaneuver orbit.

The data from ETR were extremely free from noise. Typical standard deviations for range were approximately 4 m, and for angles about 0.01 deg. The data were used effectively in the real-time mission to obtain both the parking orbit and the postretrorocket transfer orbit of *Agena*. Table 36 compares the parking orbit determined by the ETR data during real time with the postflight orbit obtained from data of various stations. Differences in the initial conditions as well as differences in the orbital elements were insignificant, with the lone exception of ω, the argument of perigee. Because of the small eccentricity, ω is not well defined, and the poor determination of this parameter is to be expected.

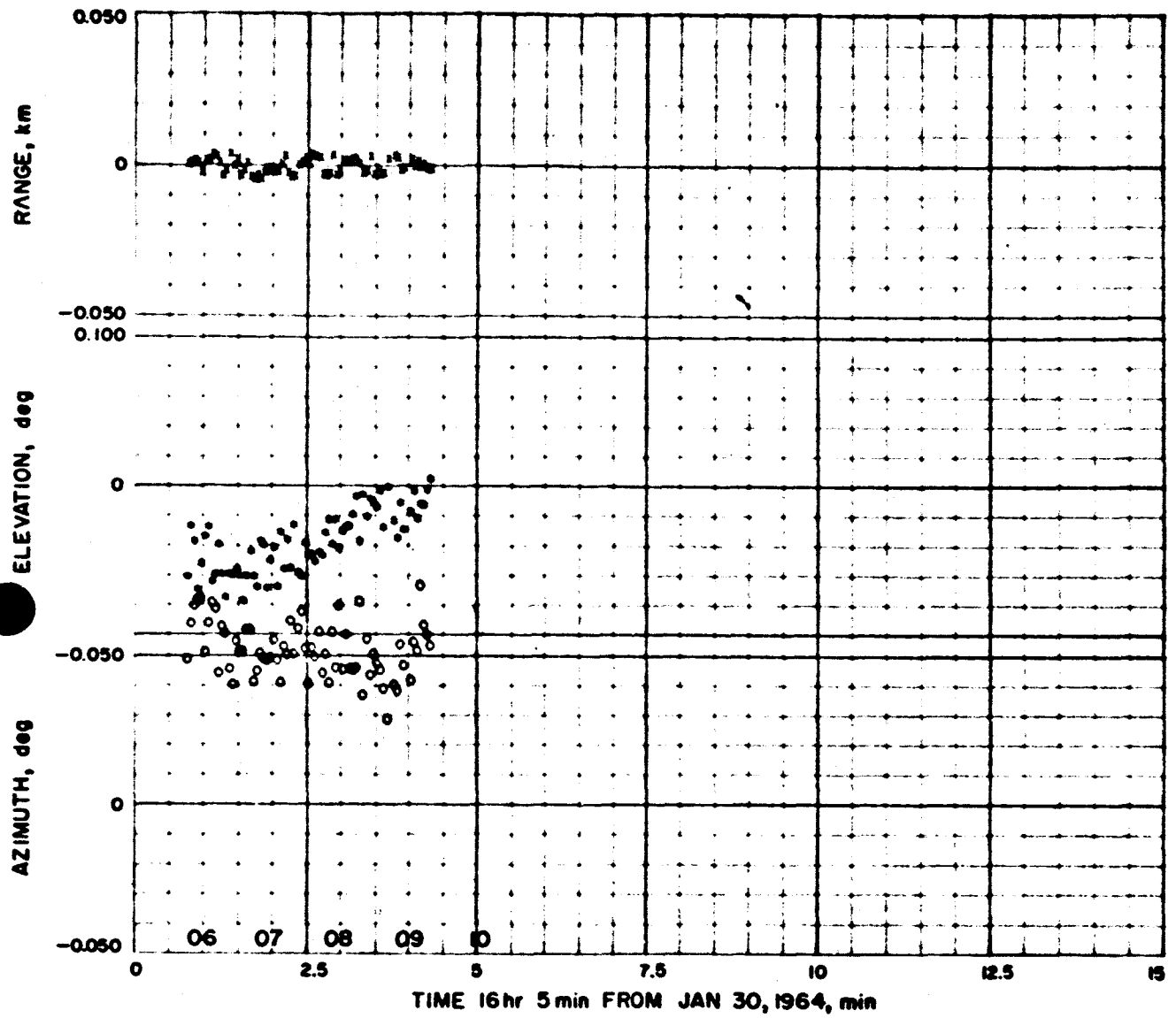

Fig. 55. Station 8 residuals (16:05 GMT)

Table 39 summarizes the postflight initial conditions of classical elements, and impact parameters of three different orbits. They are: spacecraft orbit as determined by DSIF data, *Agena* preretromaneuver, and *Agena* postretromaneuver orbits as determined by Pretoria. The uncorrected spacecraft orbit would have missed the Moon by approximately 800 km. For the *Agena* preretromaneuver orbit, the miss parameter **B**, indicates an impact; however, because of the small amount of data available (Table 38), the uncertainty in **B** was ±4,000 km. The *Agena* postretromaneuver was much better determined, resulting in a miss uncertainty of 247 km in **B**.

In general, the ETR data were quite useful for determining the various orbits in real time and for checking the DSIF data for possible errors. The ETR data revealed no large inconsistencies with DSIF stations or with the ETR stations themselves.

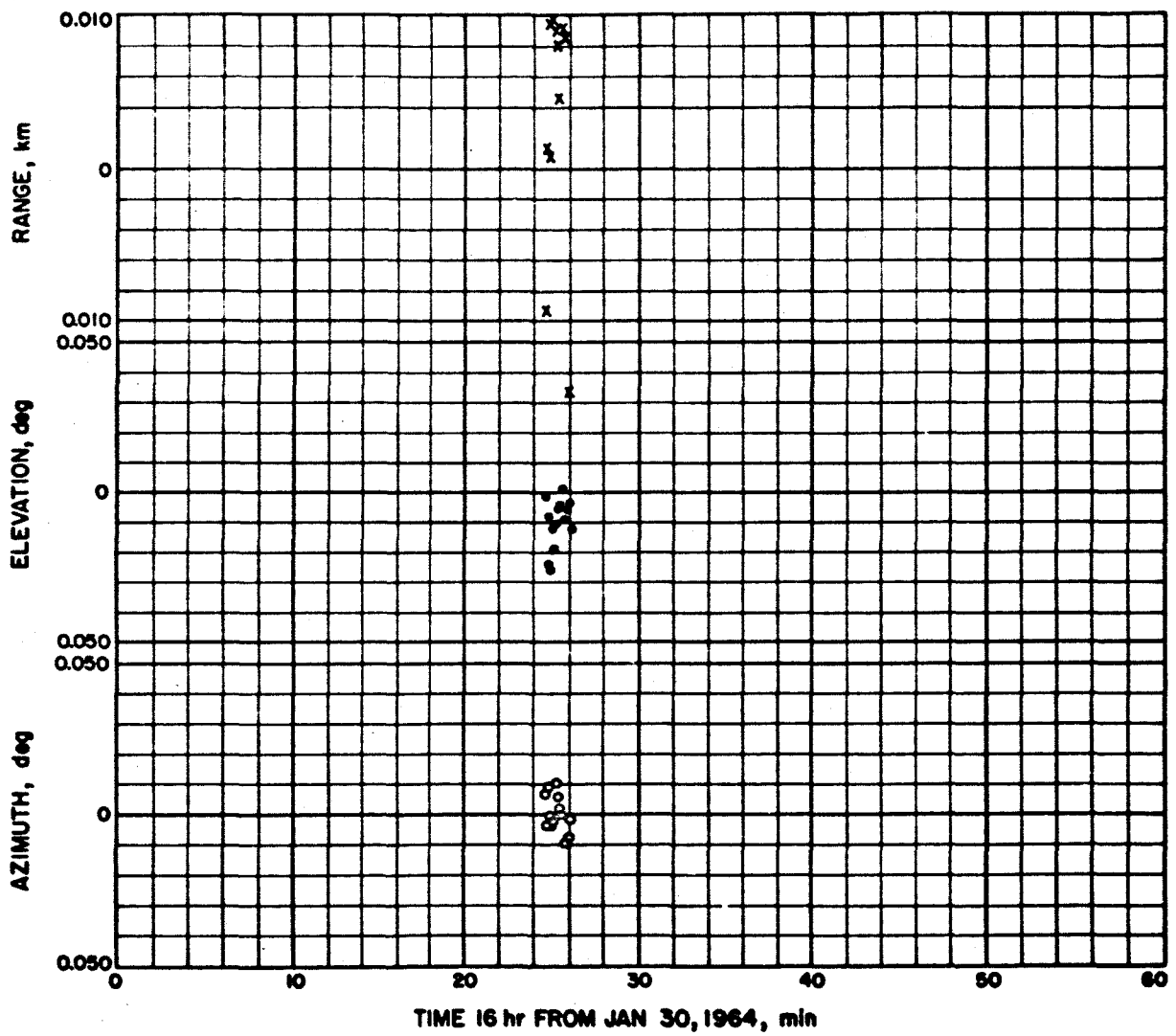

Fig. 56. Station 9 Agena prerotromaneuver orbit residuals (DSIF comparison)

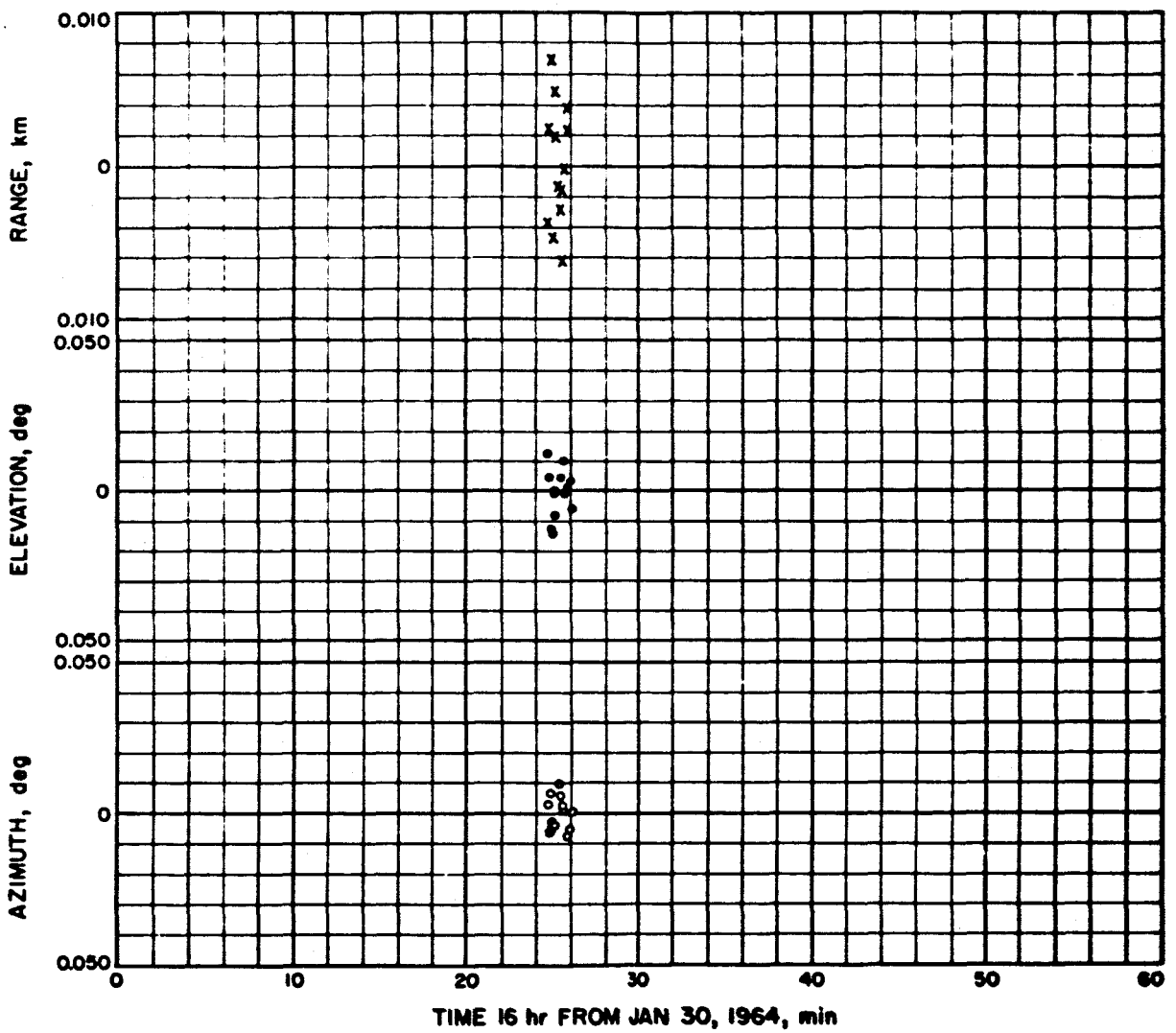

Fig. 57. Station 9 *Agena* preretromaneuver orbit residuals (Pretoria data only)

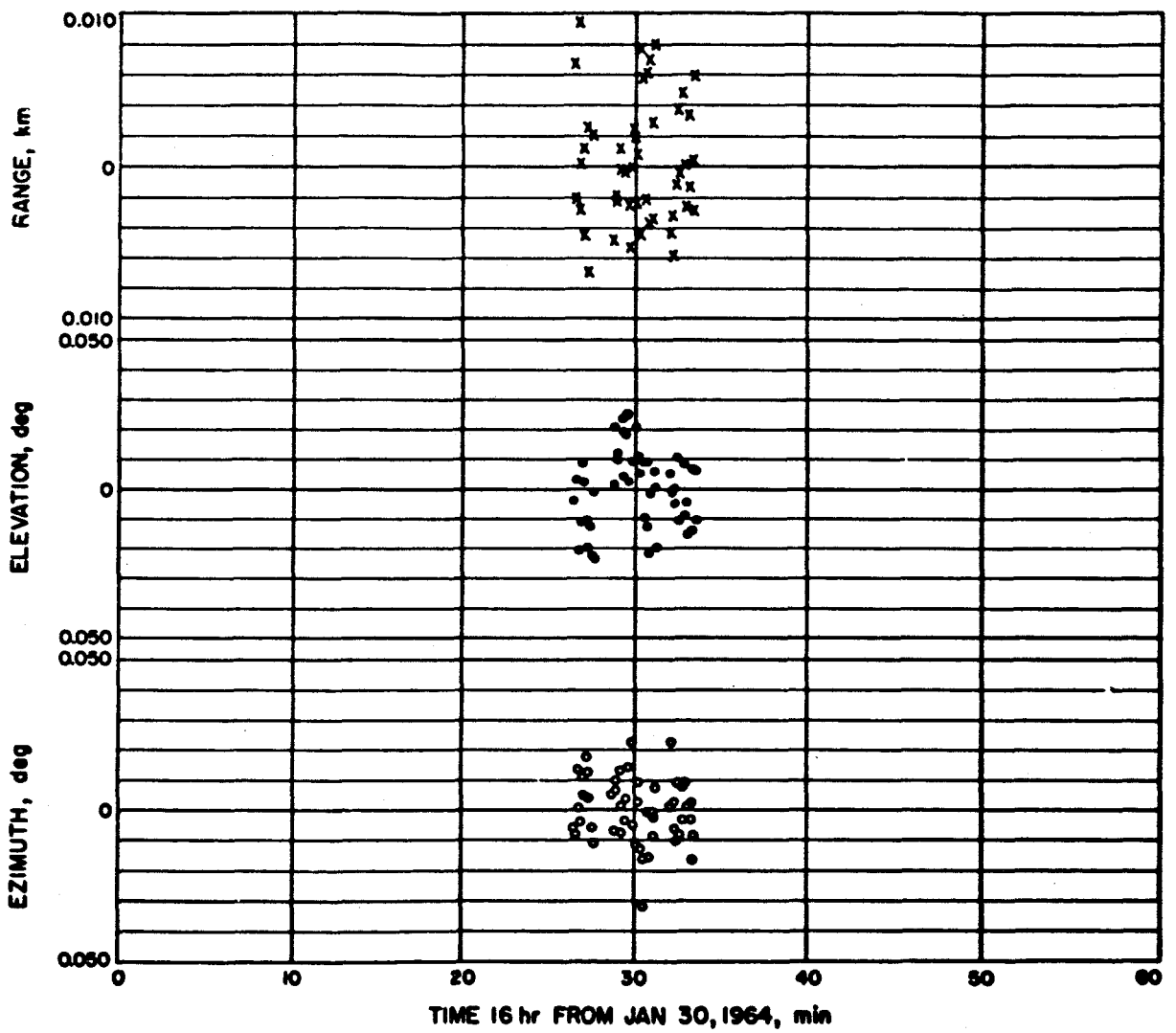

Fig. 58. Station 9 *Agena* postretromaneuver orbit residuals (Pretoria data only)

VI. TRAJECTORY DESCRIPTION

A. Launch Phase

Ranger VI was launched at 15:49:09.09 GMT, January 30, 1964, from the Air Force Eastern Test Range using the *Atlas D–Agena B* boost vehicle. After liftoff, the booster rolled to a launch azimuth of 95.0 deg (East of North) and performed a programmed pitch maneuver until booster cutoff. During the sustainer and vernier stages, adjustments in vehicle attitude and engine cutoff times were commanded as required by the ground guidance computer to adjust the altitude and velocity at *Atlas* vernier engine cutoff. After *Atlas–Agena* separation, there was a short coast period prior to the first ignition of the *Agena* engine. At a preset value of sensed velocity increase, the *Agena* engine was cut off. At this time the *Agena* and spacecraft combination was coasting in a nearly circular parking orbit. After a prescribed coast time in the parking orbit, the *Agena* engine was again ignited. The parking orbit coast time, as determined by the ground guidance computer, was transmitted to the *Agena* during the *Atlas* vernier stage. The ascent trajectory profile is shown in Fig. 59; a sequence of events from launch to acquisition of the Earth by the spacecraft is shown in Fig. 60.

B. Cruise Phase

Injection into lunar orbit (termination of the boost phase) occurred at 16:16:48.4 GMT, at which time the *Agena* and spacecraft were traveling at a speed of 10.968 km/sec (inertial). The geocentric latitude and longitude were −7.21 and 8.08 deg, respectively, with injection taking place near the western coast of South Africa. The *Agena* and spacecraft separated 2.6 min after injection occurred. The *Agena* then performed a programmed 180-deg yaw maneuver and ignited its retrorocket. The retrorocket impulse was designed to eliminate interference with the spacecraft operation and reduce the chance of the *Agena* impacting the Moon. Tracking data indicated that the *Agena* missed the Moon by approximately 3630 km on the northern trailing edge.

Within 1 hr after injection, the spacecraft was receding from the Earth in an almost radial direction with decreasing speed. This reduced the geocentric angular rate of the spacecraft (in inertial coordinates) until, at 1.5 hr after injection, the angular rate of the Earth exceeded that of the spacecraft. This caused the Earth track of the spacecraft to reverse its direction from increasing to decreasing

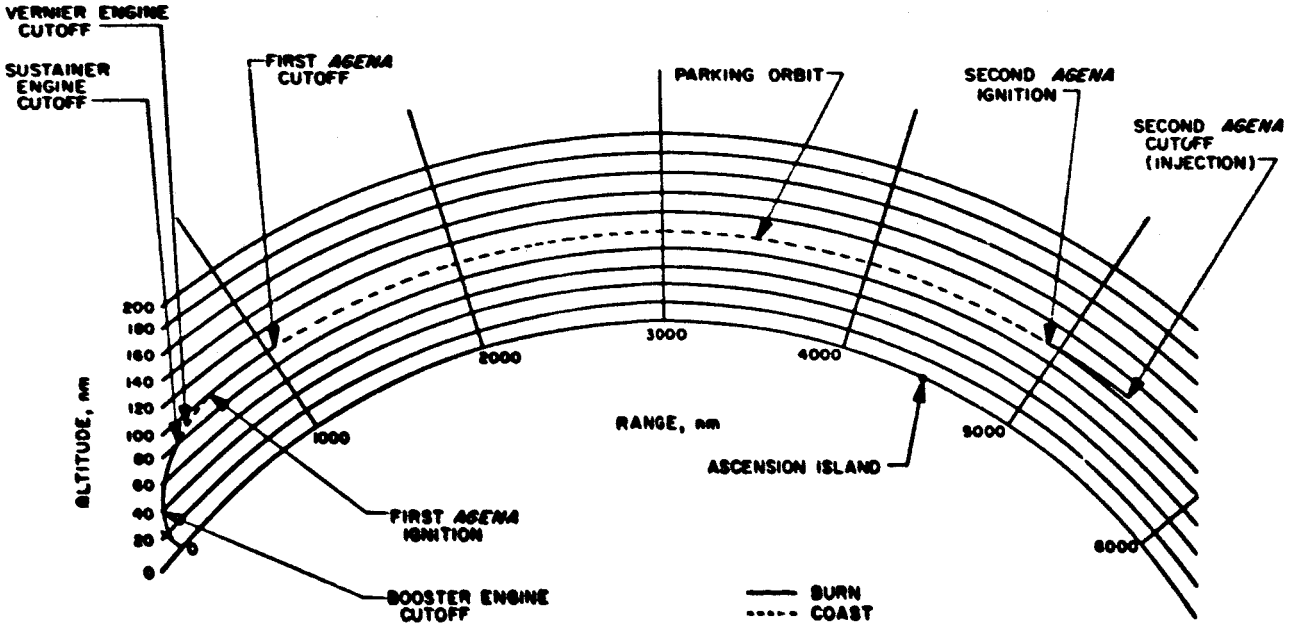

Fig. 59. Ascent trajectory profile

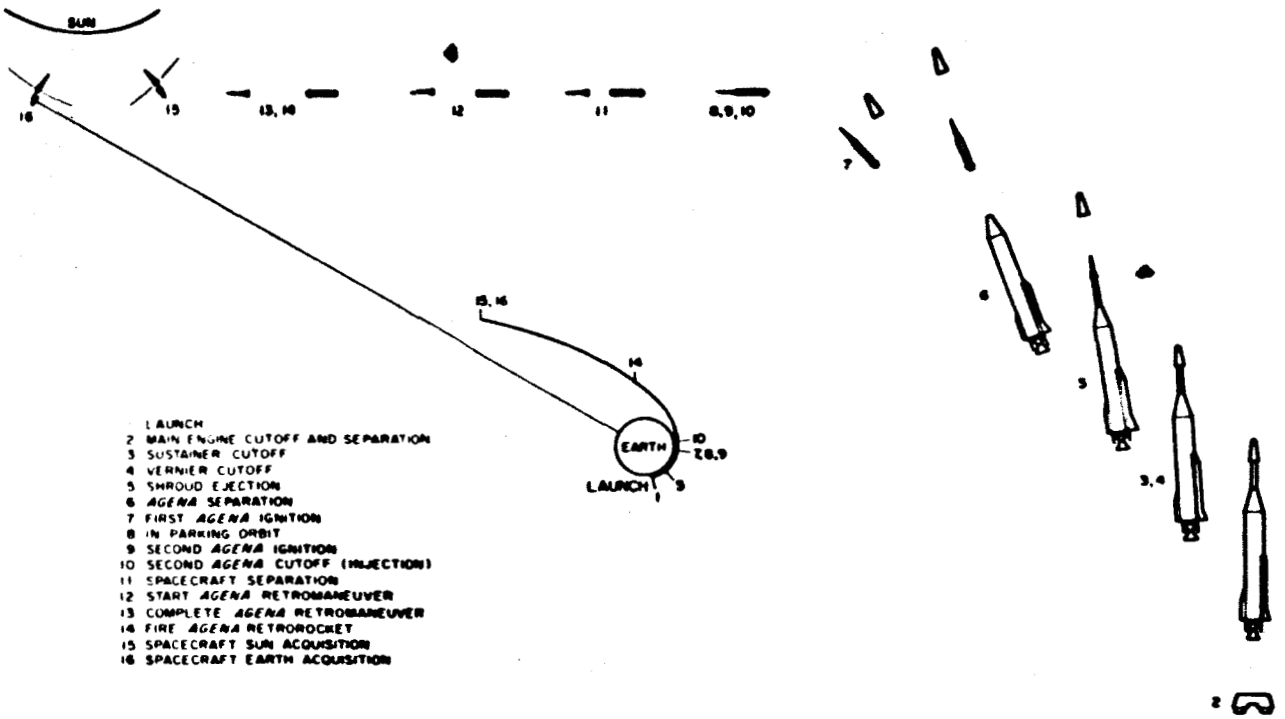

Fig. 60. Sequence of events to Earth acquisition

Earth longitude (Fig. 61). Plots of the geocentric distance and speed of the probe as well as the Earth–probe–Sun (EPS), Sun–probe–Moon (SPM), and Earth–probe–Moon (EPM) angles versus time launch are presented in Figs. 62 through 64.

The premidcourse orbit (Appendix D) shows that the spacecraft would have missed the Moon on the leading edge, with a closest-approach altitude of 784 km at a selenographic latitude and longitude of −9.32 and 192.40 deg, respectively. The lunar transit time from injection was then 64.62 hr. The initial and encounter conditions for the premidcourse orbit are given in Table 40.

C. *Midcourse Maneuver Phase*

The midcourse maneuver was calculated to adjust the trajectory to impact at a selenographic latitude of 8.5 deg and a selenographic longitude of 21.0 deg, with a flight time from injection to impact of 65.129 hr. The adjustment of impact time was made to utilize the TV camera backup turn-on clock as designed. The commanded speed change was 41.27 m/sec. To properly align the thrust direction of the midcourse motor for the maneuver, a −11.96-deg roll turn and −70.98-deg pitch turn were commanded. The midcourse motor was ignited at 08:57:09 GMT on January 31, 1964, when the spacecraft was at a geocentric distance of 170,000 km, traveling with an inertial speed of 1.891 km/sec relative to Earth. At the end of the 67-sec burn duration of the midcourse motor, the geocentric distance had increased to 170,125 km and the inertial speed relative to Earth was reduced to 1.852 km/sec. Analog data received at the Goldstone tracking station and relayed to the JPL Space Flight Operations Facility gave every indication that the midcourse maneuver was executed exactly as commanded. This was further verified by the observed doppler data, which were essentially the same as those predicted for the maneuver. Initial and encounter conditions for the postmidcourse orbit are given in Table 41. The postmidcourse trajectory printout is presented in Appendix E.

D. *Postmidcourse Maneuver Cruise Phase*

Following the midcourse maneuver, the spacecraft reacquired the Sun and Earth, thus returning to the cruise

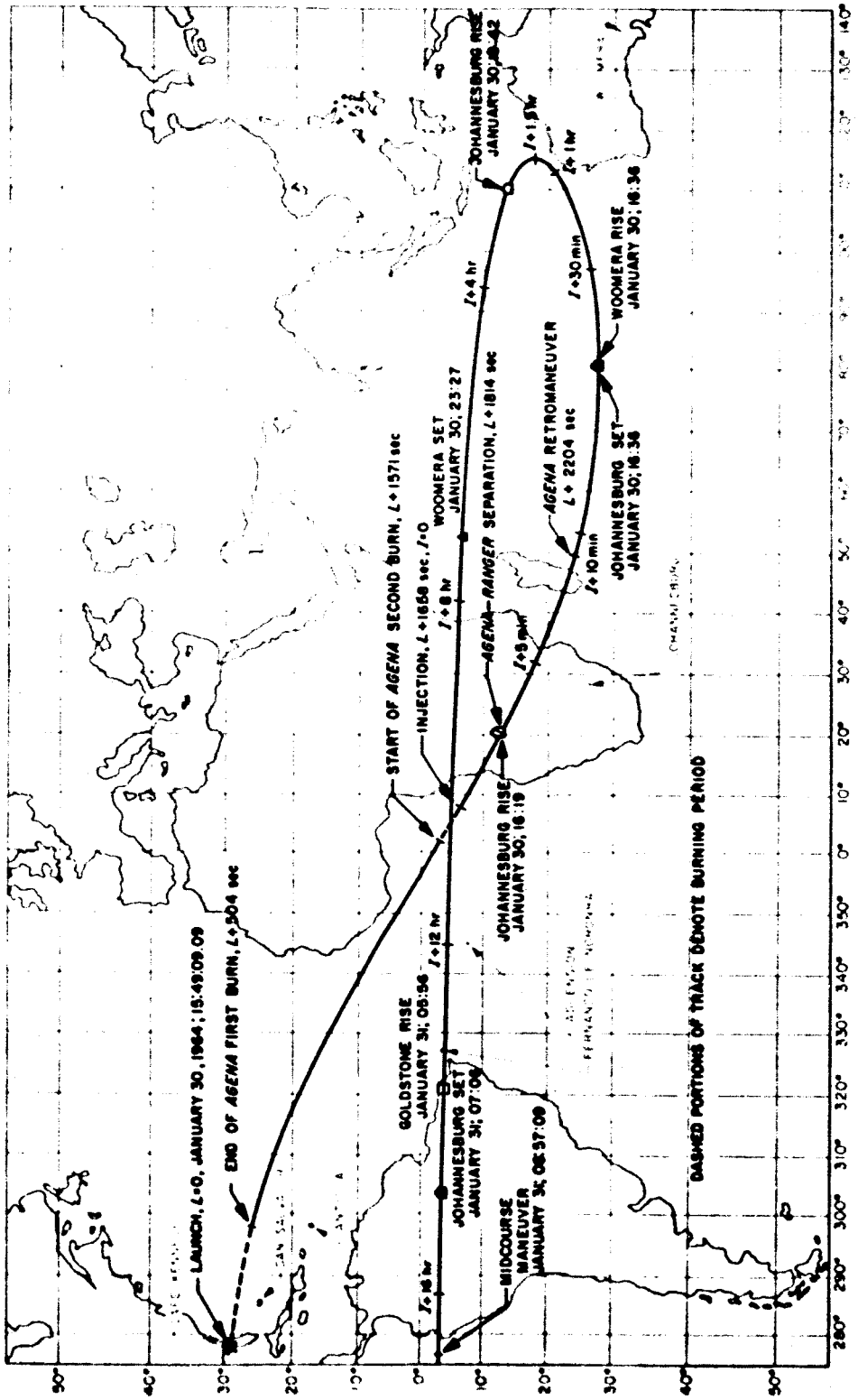

Fig. 61. Earth track of Ranger VI trajectory

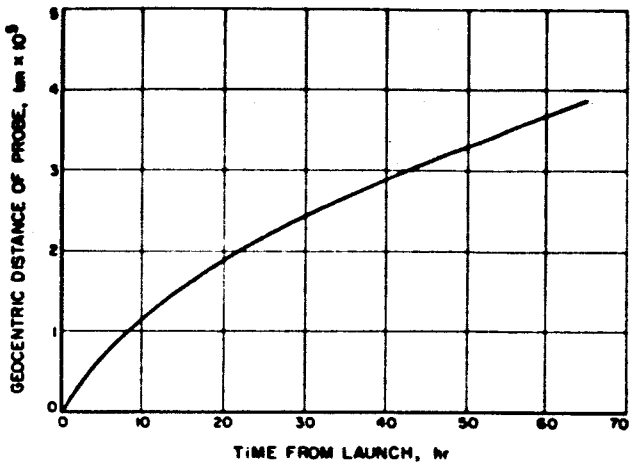

Fig. 62. Geocentric distance of probe vs time from launch

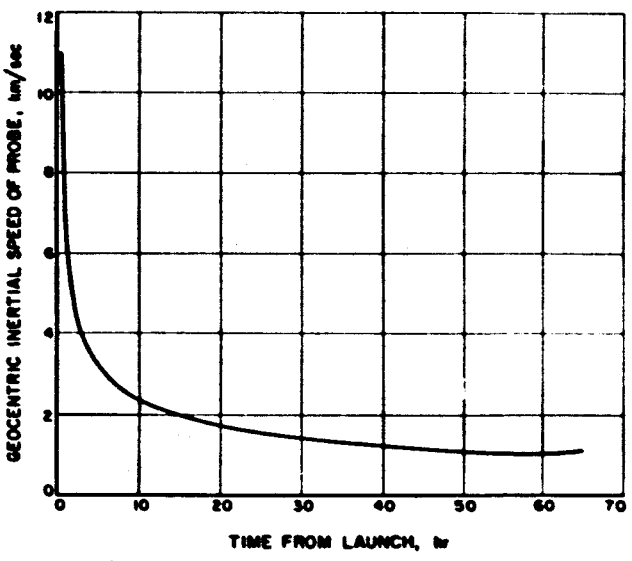

Fig. 63. Geocentric inertial speed of probe vs time from launch

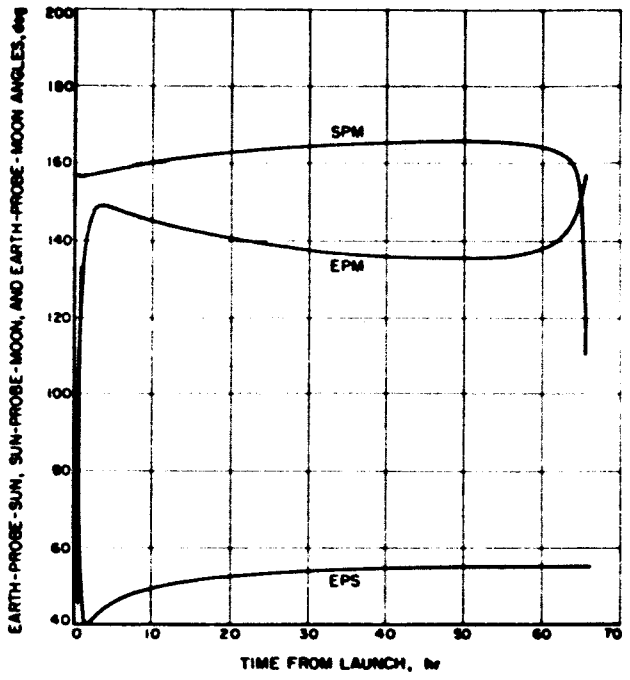

Fig. 64. Earth–probe–Sun, Sun–probe–Moon, and Earth–probe–Moon angles vs time from launch

mode on its way to lunar impact. About 59 hr after injection, the spacecraft experienced a minimum inertial velocity of 1.029 km sec relative to the Earth, indicating that the spacecraft was being accelerated towards the Moon by lunar gravity. The *Ranger VI* transfer trajectory is illustrated in Fig. 65. The trace on the lunar surface of the trajectory from injection to impact is shown in Fig. 66.

E. Encounter Phase

Ranger VI lunar impact, as determined by accurate recordings of telemetry signal termination, was at 09:24:31.86 GMT on February 2, 1964. Lunar impact occurred at a selenocentric latitude and longitude of 9.33 and 21.52 deg, respectively.

The spacecraft descended upon the Moon in a somewhat grazing trajectory with an impact angle of 47 deg from the vertical. The traces of the final portions of the premidcourse and postmidcourse trajectories are illustrated in Fig. 67. Figures 68 through 72 present *Ranger VI* trajectory parameters plotted versus GMT for the lunar encounter phase.

A study of the *Ranger VI* trajectory can be made by examining the detailed trajectory printout presented in Appendixes D and E. Appendix D contains the trajectory listing for the premidcourse orbit from the initial epoch to the midcourse epoch and finally a lunar closest approach printout. Appendix E contains the trajectory listing for the postmidcourse orbit from midcourse to lunar

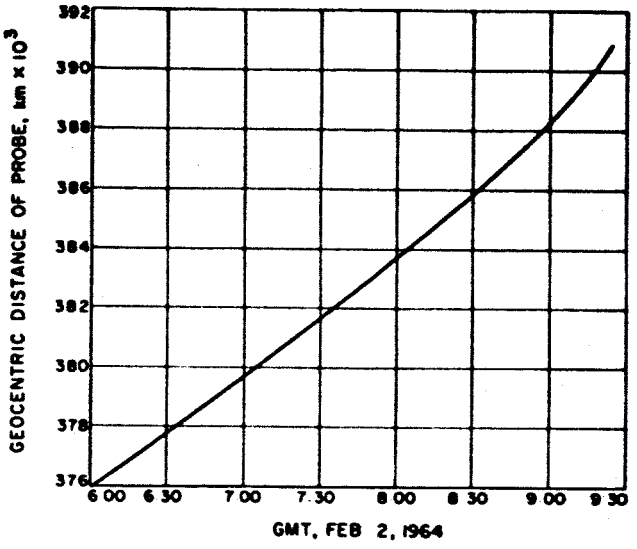

Fig. 68. Geocentric distance of probe vs GMT of lunar encounter

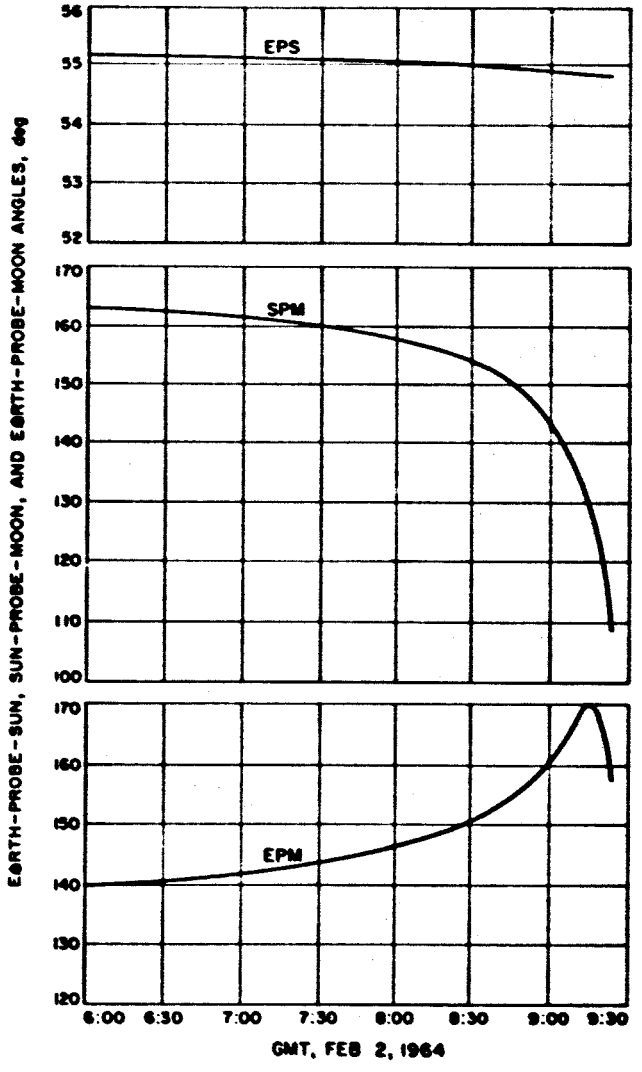

Fig. 70. Earth–probe–Sun, Sun–probe–Moon, and Earth–probe–Moon angles vs GMT of lunar encounter

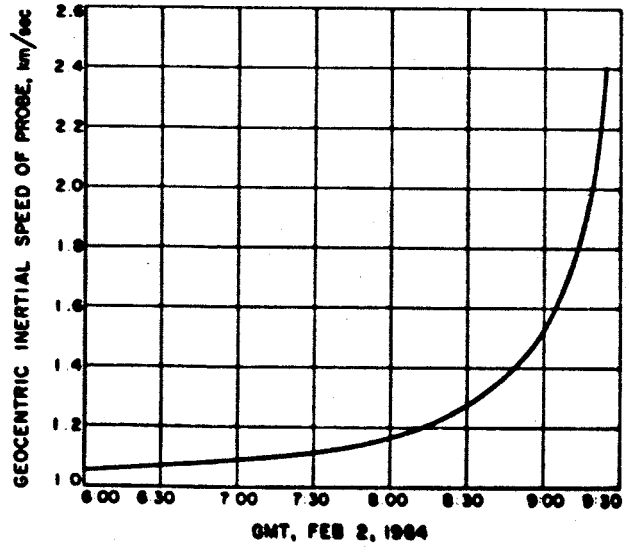

Fig. 69. Geocentric inertial speed of probe vs GMT of lunar encounter

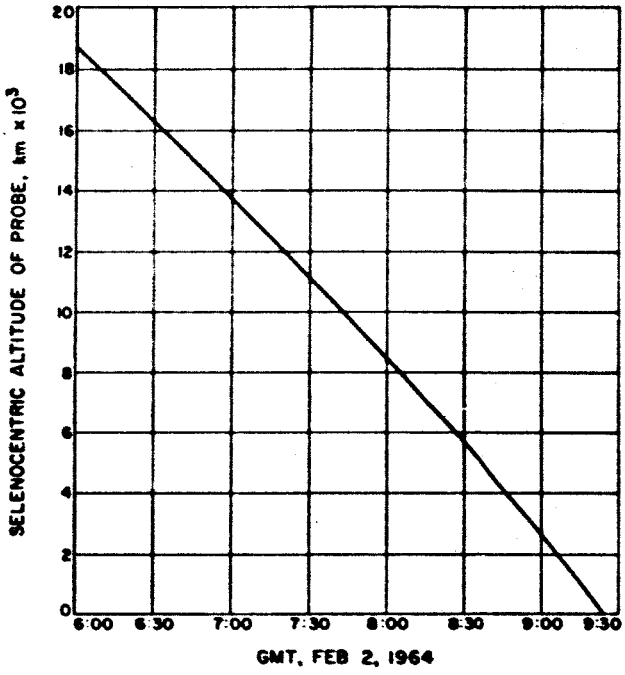

Fig. 71. Selenocentric altitude of probe vs GMT of lunar encounter

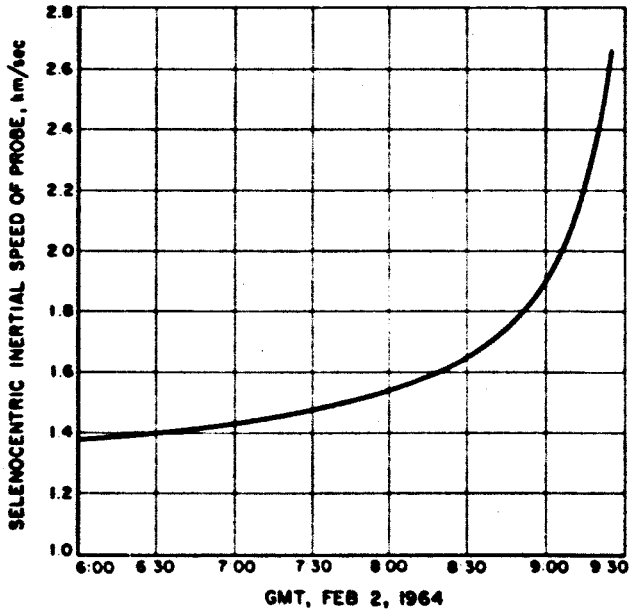

Fig. 72. Selenocentric interial speed of probe vs GMT of lunar encounter

Table 40. *Ranger VI* premidcourse maneuver

Initial conditions*	
Epoch	January 30, 1964; 16:16:41.0 GMT
Earth-fixed sphericals	
R	6567.4806 km
ϕ	−6.8816657 deg
θ	7.4791014 deg
V	10.550846 km/sec
γ	1.2448711 deg
σ	118.91900 deg
Inertial Cartesians	
x	6103.7175 km
y	2292.8608 km
z	−786.90994 km
$\dot{x}$	−3.7731653 km/sec
$\dot{y}$	8.9534882 km/sec
$\dot{z}$	−5.0916144 km/sec
Encounter conditions and miss parameters	
Closest approach	February 2, 1964; 08:54:01.6 GMT
Selenocentric altitude	784.33727 km
Selenocentric latitude	−9.3212615 deg
Selenocentric longitude	192.39852 deg
Time of flight from injection	64.620321 hr**
B	4774.4322 km*
B • T**	−4505.0348 km
B • R**	1581.0957 km

*See Table 41 for definition of terms.

**1σ uncertainty of 66 sec.

*1σ uncertainty of 79.5 km.

**B • T and B • R are referenced to the true lunar equator (Appendix C). (For *Ranger VI* work, the true lunar equator is used as the reference plane. If N is a unit vector in the lunar north direction, then $T = S_r \times N$ and $R = S_r \times T$.)

Table 41. Postmidcourse orbit of *Ranger VI*

Postmidcourse conditions	
Epoch	January 31, 1964; 08:57:09 GMT
Earth-fixed sphericals	
R	170001.25 km
ϕ	−3.6006656 deg
θ	277.07800 deg
V	12.144976 km/sec
γ	8.5448065 deg
σ	271.02194 deg
Inertial Cartesians	
x	−169640.40 km
y	−2928.6339 km
z	−10676.441 km
$\dot{x}$	−1.8078720 km/sec
$\dot{y}$	−0.39522410 km/sec
$\dot{z}$	0.10045334 km/sec
Impact parameters	
Impact epoch	February 2, 1964; 09:24:31.94 GMT
Selenocentric latitude	9.3313754 deg
Selenocentric longitude	21.519691 deg
Time of flight from injection	65.128761 hr*
B	2855.6255 km**
B • T*	2751.4109 km
B • R*	−764.41801 km

*1σ uncertainty of 1.6 sec.

**1σ uncertainty of 21.3 km.

*B • T and B • R are referenced to the true lunar equator (Appendix C). (For *Ranger VI* work, the true lunar equator is used as the reference plane. If N is a unit vector in the lunar north direction, then $T = S_r \times N$ and $R = S_r \times T$.)

Parameter	Definition of terms (Earth as central body)
x, y, z	Vernal equinox Cartesian coordinates in a geocentric equatorial system. The origin is the center of the central body. The principal direction (x) is the vernal equinox direction of date, and the principal plane (x, y) is the Earth equatorial plane of date. z is along the direction of the Earth's spin axis of date, km
$\dot{x}, \dot{y}, \dot{z}$	First time derivatives of x, y, and z, respectively; i.e., Cartesian components of the probe space-fixed velocity vector, km/sec
R	Probe radius distance, km
ϕ	Probe geocentric latitude, deg
θ	Probe East longitude, deg
V	Probe Earth-fixed velocity, km/sec
γ	Path angle of the probe Earth-fixed velocity vector with respect to the local horizontal, deg
σ	Azimuth angle of the probe Earth-fixed velocity vector measured East of true North, deg

encounter. Appendix F, Table F-1 is a key to the trajectory printout. Table F-2 contains the definitions of the trajectory printed quantities. Constants and conversion factors used in *Ranger VI* trajectory computations are listed in Table F-3. The miss parameter B, used to measure the miss distance for the lunar trajectory, is defined in Appendix C.

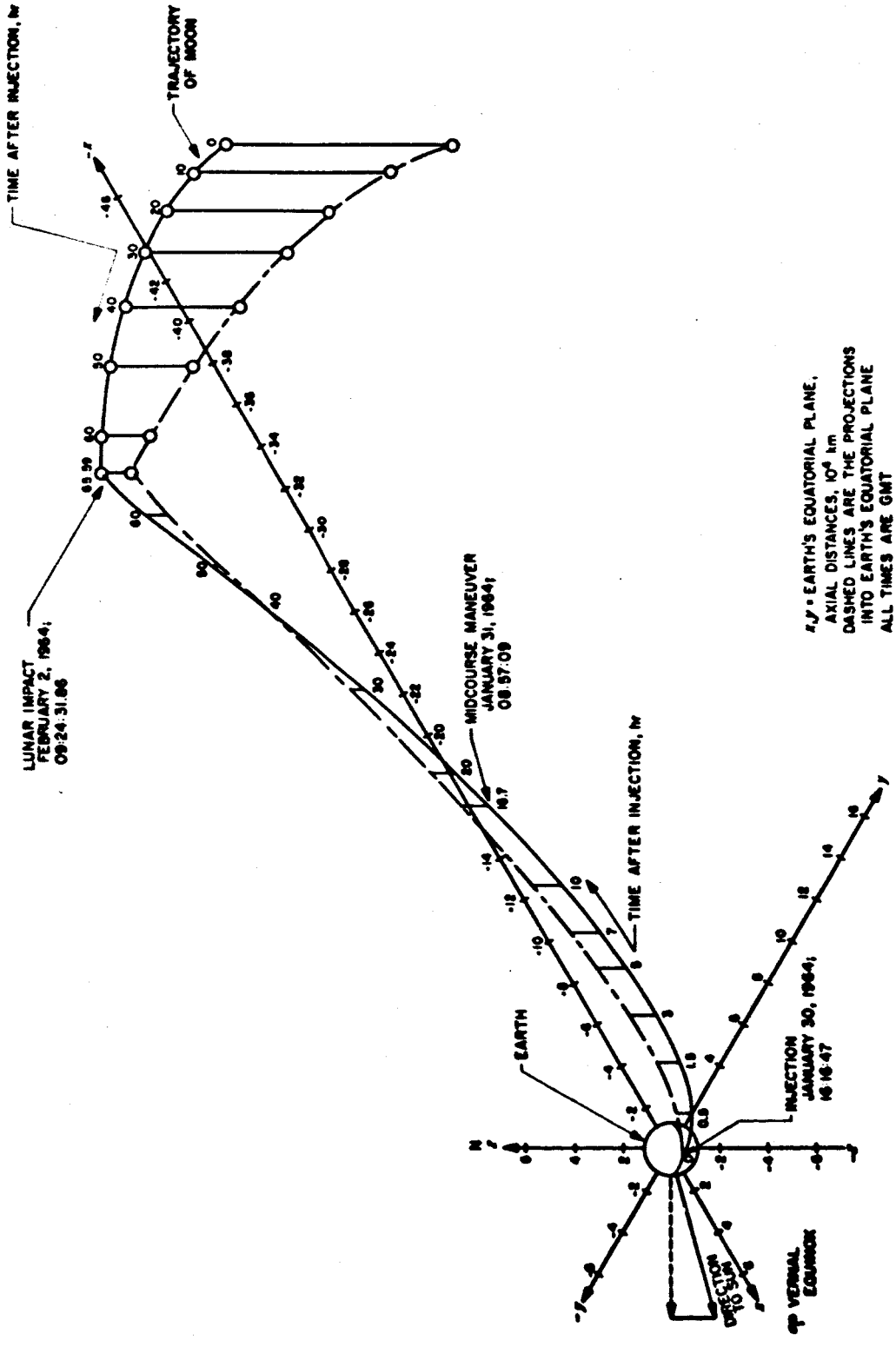

Fig. 65. Ranger VI transfer trajectory

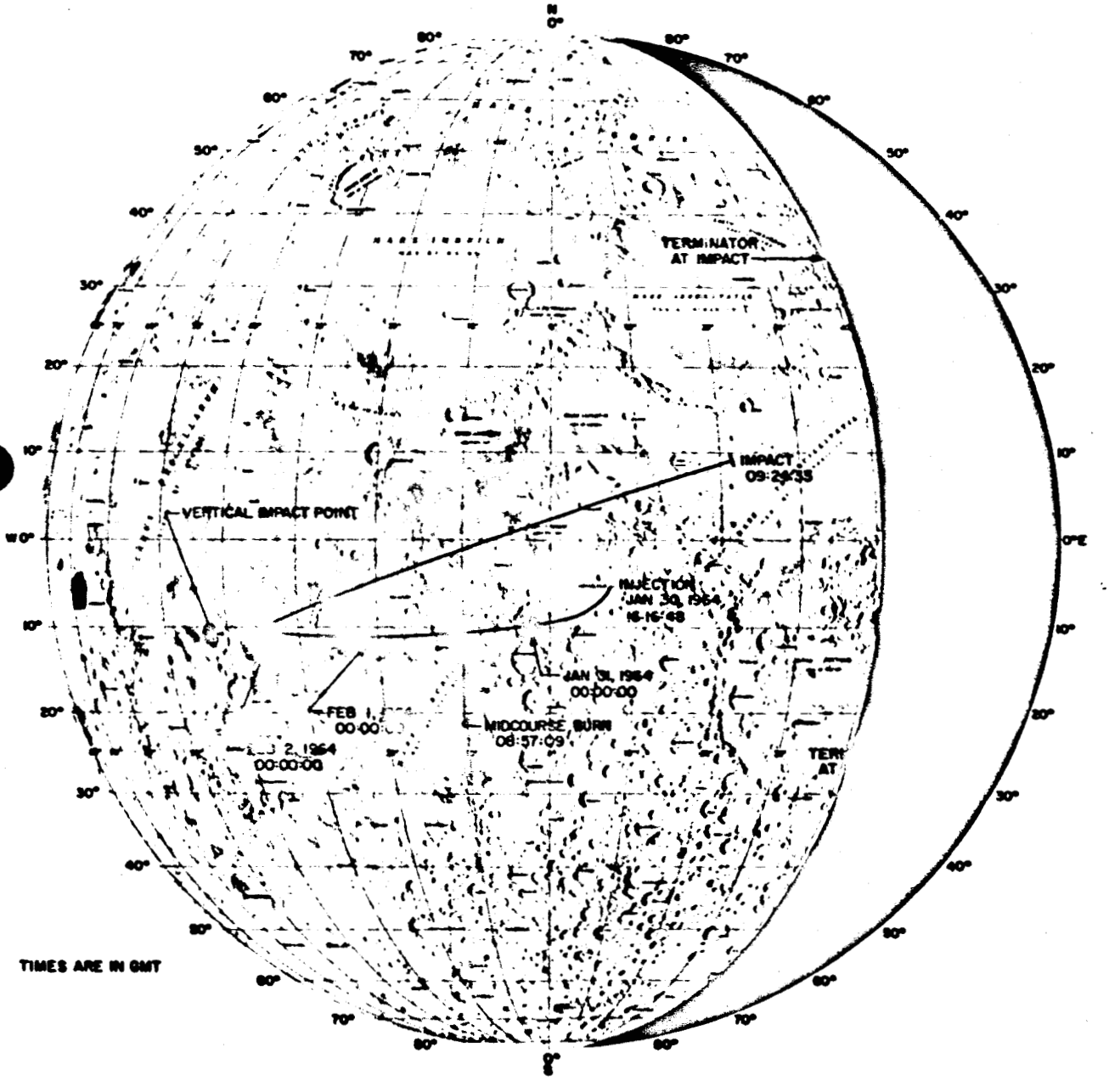

Fig. 66. Lunar track of Ranger VI trajectory

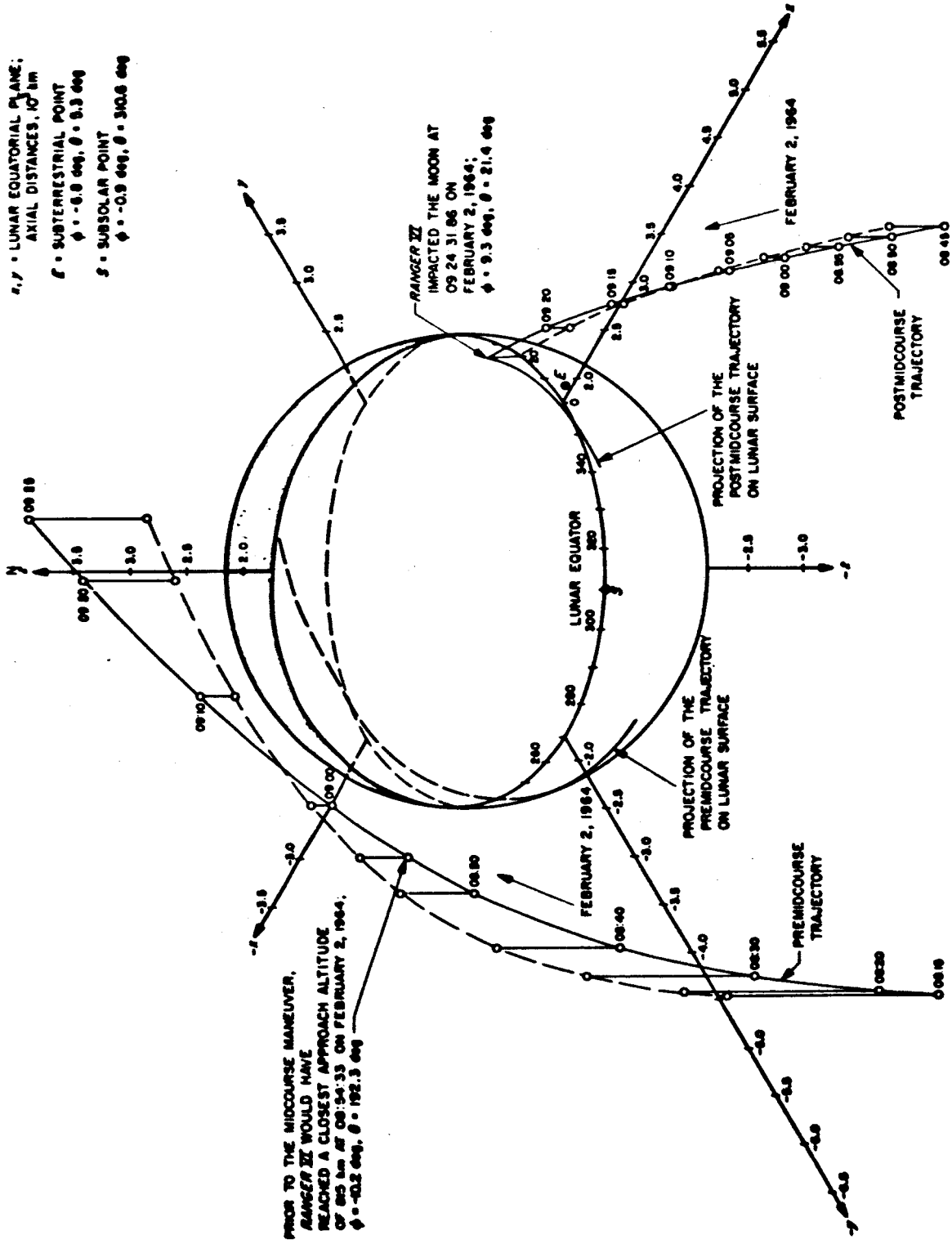

Fig. 67. Ranger VI premidcourse and postmidcourse maneuver encounter trajectories

APPENDIX A

Data Compression

In processing data during postflight analysis it is usually desirable to compress them. The benefits of data compression are two-fold: first, computer time is significantly reduced, and second, data noise is reduced, so that characteristics of other error sources are not masked out and can be observed. Figure A-1 presents a representative plot of the standard deviation on doppler data taken during the *Ranger VI* mission as a function of sample count time for a portion of one pass over Goldstone, California. The lower curve in Fig. A-1 indicates the data standard deviation if round off were the only error source, and the middle curve indicates the data noise from other error sources.

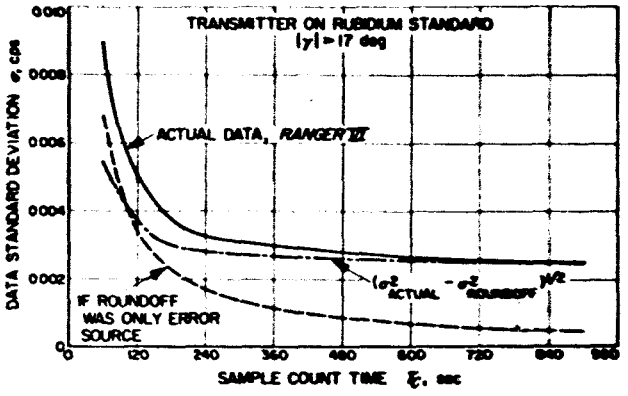

Fig. A-1. Station 12 postmaneuver pass No. 02, data standard deviation as a function of count time

The maximum compression interval that may presently be employed is determined by both the number of digits transmitted internally in the computer (Ref. 11) and the fifth derivative of range, which becomes significant when there are high accelerations (i.e., a few hours at launch and encounter). The maximum compression interval used during *Ranger VI* postflight analysis was 600 sec.

APPENDIX B

Description of Weights Used in ODP

The expression[1] used to compute the "effective variance" σ^2 for weighting a given data point is

$$\sigma^2 \triangleq \sum_{i=1}^{6} s_i^2 g_i^2 \quad \text{Max}\left\{1, \frac{T_{correlation}}{T_{sample}}\right\}$$

where i = basic error source

$s_i^2 \triangleq$ variance of the basic error source

$g_i^2 \triangleq$ sensitivity coefficient

$T_{correlation} \triangleq$ correlation width, in seconds, of the basic error source

$T_{sample} \triangleq$ sample spacing, in seconds

and Max a,b means: the larger of the two numbers a, b (Ref. 12).

The error sources for two-way doppler are:

1. Errors due to trajectory computations caused by round-off error in the Cowell integrations method.
2. Rounding error caused by the start and stop count pulses not necessarily occurring at times such that an integral number of cycles has passed.
3. Transmitter drift arising from an unstable oscillator. Drift in the voltage controlled oscillator (VCO), which provides the transmitter reference frequency, is 1 part in 10^8 cycles/15 min when not on the rubidium standard and for the rubidium standard VCO the drift rate is 3 parts in 10^{11} cycles/hr.

[1] W. Hamilton, "*Mariner R* ODP-TDEP: A Priori Weighting Coefficients," April 12, 1962 (internal communication).

4. Dropped or added cycles which are caused by low signal to noise ratio where it is possible for the counter to accept a noise pulse as a cycle count.
5. Variation in refraction correction which is due to differences between the atmospheric model used in the calculations and that which actually exists.
6. Spacecraft tumbling caused by antenna motion (zero for *Ranger VI*).

The physical error sources for hour angle and declination are:

1. Angle jitter in electrical axes or variations about the aiming point caused by the antenna drive mechanism.
2. Angle correction variation which is due to systematic and random variations between the optical and electrical axes.
3. Readout error caused by the encoder system reading out plus or minus one count where one count corresponds to about 0.002 deg.
4. Variation in refraction correction which is due to differences between the atmospheric model which is used and that which actually exists.

The contribution to the total weight due to spacecraft tumbling was considered to be zero since the only tumbling occurred between injection at 16:16:41 and Sun acquisition at 16:55:30 GMT. In the postflight analysis there was only 1 min 40 sec usable data from Station 51, and 4 min of usable data from Station 41 during this time span. The tumbling rates before Sun acquisition were 5.0, −9.6, and 2.6 mrad/sec in pitch, yaw, and roll, respectively; and, assuming that the spacecraft orientation was such that the yaw had its maximum effect on doppler, the maximum change in doppler would have been ±0.098 cps. However, analysis of the usable data taken during the above time span indicated that the effect on doppler due to tumbling was appreciably less than 0.1 cps (Fig. 3) so that it may be concluded that the spacecraft orientation was such that the tracking stations "saw" very little spacecraft antenna motion.

During orientation maneuver, prior to firing the midcourse velocity increment, the change in doppler due to the pitch turn rate was a maximum of 0.037 cps, and during Sun reacquisition the change in doppler due to the pitch turn rate was a maximum of −0.047 cps. Each pitch turn would affect, at most, five 1 min samples with a small skew bias at the same level as the existing noise (i.e., note noise before and during pitch at 08:45:00 Station 12 residual plot (Fig. 2).

When the spacecraft was in the cruise mode maintaining Sun and Earth lock, the maximum change in doppler due to limit cycle velocity increment was ± 0.00068 cps.

Table B-1 shows the functional form of the sensitivity coefficients associated with HA, Dec, and two-way doppler. Table B-2 presents values of the sensitivity coefficient, variance of the error source, correlation width, and the resulting contribution to the total weight from each assumed basic error source at two different times along the trajectory. The first set was computed for a range of about 55,000 km, and the second set for doppler was computed at a range of about 383,000 km. The second set for angles was computed just before the midcourse maneuver, where the range was about 165,000 km. A nominal sample rate of 60 sec was used to develop Table B-2.

The doppler data type at present requires the use of two weight codes. One code is used when the tracking station is not using the rubidium standard for the transmitter frequency voltage controlled oscillator $(VCO)_T$, and the other code is used when the station is using the rubidium standard $(VCO)_R$ which is about three magnitudes more stable than the $(VCO)_T$.

Early in the mission the predominant error sources affecting doppler are the computing error (error source 1), oscillator drift (error source 3), dropped or added cycles (error source 4), and possibly refraction correction (error source 5), depending on the elevation angle rate. As the mission progresses, the oscillator drift rate becomes the sole predominant error source if the station is using the $(VCO)_T$, but if the station is using $(VCO)_R$ this error

Table B-1. Sensitivity coefficients, g_i, for hour angle, declination and two-way doppler

Error Source	Sensitivity coefficient		
	HA	Dec	Two-way doppler
1	1/cos (Dec)	1	1
2	1	1	$1/T_r$
3	1	1	ρ ($g = 1$, when $\rho = 400{,}000$ km)
4	Δ_r (HA)*,**	Δ_r (Dec)*,**	$1/(3T_r)^{1/2}$
5	0	0	$6400\,\Delta_r\,\dot{\rho}$*,**
6	0	0	1

*See Ref. 4.
**D. L. Cain, "Refraction Corrections," July 6, 1960 (internal communication).

Table B-2. Contribution from individual error sources to total weight for *Ranger VI* mission*

Error source	Early doppler (range ≈ 55,000 km)				Late doppler (range ≈ 383,000 km)			
	g_i^2	s_i^2	Correlation width, sec	σ_i^2 (cps)^2	g_i^2	s_i^2	Correlation width, sec	σ_i^2 (cps)^2
(1) Computing error	1	1.1×10^{-6}	36,000	65.6×10^{-6}	1	1.1×10^{-6}	36,000	65.6×10^{-6}
(2) Rounding error	2.78×10^{-6}	0.16	1	0.5×10^{-6}	2.78×10^{-6}	0.16	1	0.5×10^{-6}
(3) Oscillator drift rate	0.0189	0.41×10^{-3}	600	VCO_T 7.76×10^{-6}	0.917	$(0.41 \times 10^{-3})_{VCO_T}$ $(0.41 \times 10^{-3})_{VCO_R}$	600	$(376.1 \times 10^{-6})_{VCO_T}$ $(0.03761 \times 10^{-6})_{VCO_R}$
(4) Dropped or added cycles	5.56×10^{-3}	0.96	1	5.43×10^{-6}	5.56×10^{-3}	0.96	1	5.34×10^{-6}
(5) Refraction correction	1.11×10^{-6}	0.04	1000	0.007×10^{-6}	3.92×10^{-6}	0.04	1000	0.026×10^{-6}
(6) Spacecraft tumbling		Zero for *Ranger VI*				Zero for *Ranger VI*		
Total				$\sum_{i=1}^{6} \sigma_i^2 = 79.21 \times 10^{-6}$ $\sigma = 0.089$				$\sum_{i=1}^{6} \sigma_i^2 \begin{cases} = (446.6 \times 10^{-6})_{VCO_T} \\ = (71.5 \times 10^{-6})_{VCO_R} \end{cases}$ $\sigma \begin{cases} = (0.211)_{VCO_T} \\ = (0.085)_{VCO_R} \end{cases}$

*Sample rate.

Error source	Early angles (range ≈ 55,000 km)				Late angles (range ≈ 165,000 km)			
	g_i^2	s_i^2	Correlation width, sec	σ_i^2 (deg)^2	g_i^2	s_i^2	Correlation width, sec	σ_i^2 (deg)^2
(1) Angle jitter in electrical axes	Dec = 1 HA = 1.026	9.0×10^{-6}	1	Dec = 0.09×10^{-6} HA = 0.0924×10^{-6}	Dec = 1 HA = 1.008	9.0×10^{-6}	1	Dec = 0.09×10^{-6} HA = 0.0907×10^{-6}
(2) Angle correction variation	1	1.0×10^{-6}	20,000	333.33×10^{-6}	1	1.0×10^{-6}	20,000	333.33×10^{-6}
(3) Readout error	1	1.44×10^{-6}	1	0.0144×10^{-6}	1	1.44×10^{-6}	1	0.0144×10^{-6}
(4) Refraction correction	Dec = 1.26×10^{-6} HA = 2.48×10^{-6}	4.0×10^{-3}	1000	Dec = 0.84×10^{-6} HA = 1.65×10^{-6}	Dec = 4.12×10^{-6} HA = 2.44×10^{-6}	4.0×10^{-3}	1000	Dec = 2.75×10^{-6} HA = 1.63×10^{-6}
Total				$\sum_{i=1}^{6} \sigma_i^2 \begin{cases} = (334.27 \times 10^{-6})_{Dec} \\ = (335.06 \times 10^{-6})_{HA} \end{cases}$ $\sigma \begin{cases} = (0.183)_{Dec} \\ = (0.183)_{HA} \end{cases}$				$\sum_{i=1}^{6} \sigma_i^2 \begin{cases} = (336.18 \times 10^{-6})_{Dec} \\ = (335.06 \times 10^{-6})_{HA} \end{cases}$ $\sigma \begin{cases} = (0.183)_{Dec} \\ = (0.183)_{HA} \end{cases}$

source contributes a relatively negligible amount to the total weight. For example, near encounter where the contribution from this error source is a maximum, the error attributed to oscillator drift rate for the $(VCO)_R$ is $\sigma^2 = 0.03756 \times 10^{-4}$, and for the $(VCO)_T$ it is $\sigma^2 = 375.6 \times 10^{-4}$.

For the angular data types (HA, Dec), the predominant source of error is angle correction variation (error source 2). Angle jitter may contribute heavily to HA for declination angles near 270 or 90 deg, but during the *Ranger VI* mission the declination ranged between 290 and 2 deg. The contribution due to refraction correction was relatively small and was essentially cut off for elevation angles greater than 17 deg.

It is felt that the total weight applied to HA, Dec, and CC3 is on the conservative side and that all error sources which contribute a measurable amount to the total weight have been taken into account.

APPENDIX C

Definition of the Miss Parameter B

The miss parameter **B** is used at JPL to measure miss distances for lunar and interplanetary trajectories and is described by W. Kizner in Ref. 14. **B** has the desirable feature of being very nearly a linear function of changes in injection conditions.

The osculating conic at closest approach to the target body is used in defining **B**. **B** is the vector from the target's center of mass perpendicular to the incoming asymptote. Let S_I be a unit vector in the direction of the incoming asymptote. The orientation of **B** in the plane normal to S_I is described in terms of two unit vectors **R** and **T**, normal to S_I. **T** is taken parallel to a fixed *reference plane* and **R** completes a right-handed orthogonal system. Figure C-1 illustrates the situation.

The *Ranger VI* work has used the orbital plane of the Moon as the reference plane. If **W** is a unit vector normal to the orbital plane (**W** in direction of $\mathbf{R}_M \times \mathbf{V}_M$, where $\mathbf{R}_M$ is radius vector to Moon from Earth and $\mathbf{V}_M$ is the space-fixed velocity of the Moon relative to the Earth's center), then $\mathbf{T} = \mathbf{S}_I \times \mathbf{W}$ defines our coordinate system.

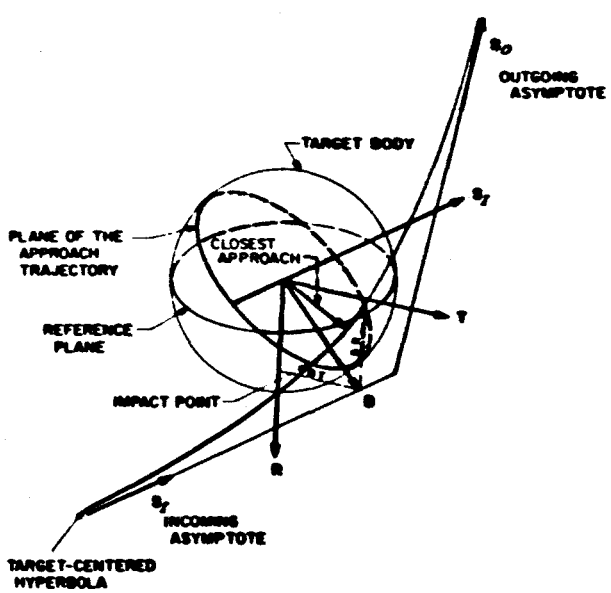

Fig. C-1. Definition of B•T, B•R system

APPENDIX D

Ranger VI Premidcourse Trajectory

SPACE TRAJECTORY
RA-6 PREMIDCOURSE ORBIT

GAE	.39860075 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	AE	.63781650 04	REM	.63783036 04
G	.66709999-19	A	.00782497 29	B	.08800499 29	C	.88817498 29	OME	.41780741-02	AU	.14959999 09
GMM	.49026664 04	GMS	.13271544 12	GMV	.32476950 06	GMA	.42977799 05	GMC	.37918700 08	GMJ	.12671000 09
EGM	.39860320 06	MGM	.49027779 04	JA	.29200000-02	HA	.00000000 00	DA	.00000000 00	RA	.30170000 04
ARA	.35670000 01	GA	.30157546 00	HAS	.37410000 03	GA1	.00000000 00	GA2	.00000000 00	SC	.18200000 09

INJECTION CONDITIONS MOON 23564757457220220000000 J.D.= 2438425.17025231 JAN. 30,1964 16 16 41.000

GEOCENTRIC CARTESIAN XO .61037175 04 YO .22920608 04 ZO-.70690994 03 DXO-.37731653 01 DYO .09534882 01 DZO-.50916164 01
GMC .00000000 00 SGC .00000000 00 TO .58600999 05 GHA .13109582 02 GHD .12827026 03

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. 23564757457220220000000 J.D.= 2438425.17025231 JAN. 30,1964 16 16 41.000
TFL 0 DAYS 0 HRS. 27 MIN. 31.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.61037173 04	Y	.22920606 04	Z	-.70690992 03	DX	-.37731652 01	DY	.09534877 01	DZ	-.50916161 01
R	.65674806 04	DEC	-.60816657 01	RA	.20588604 02	V	.10969332 02	PTH	.11973723 01	AZ	.11771772 03
R	.65674806 04	LAT	-.60816657 01	LON	.74791014 01	VE	.10550046 02	PTE	.12448711 01	AZE	.11801900 03
XS	.94350000 08	YS	-.10305150 09	ZS	-.45033760 08	DXS	.23361195 02	DYS	.17507676 02	DZS	.76279424 01
XM	-.33256866 06	YM	.15330977 06	ZM	.95501977 05	DXM	-.51866657 00	DYM	-.04740503 00	DZM	-.29570705 00
XT	-.33256866 06	YT	.15330977 06	ZT	.95501977 05	DXT	-.51866657 00	DYT	-.04740503 00	DZT	-.29570705 00
RS	.14736612 09	VS	.30220058 02	RM	.37836360 06	VM	.10627257 01	RT	.37836360 06	VT	.10627257 01
GED	-.69281084 01	ALT	.10990423 03	LOS	.29914052 01	RAS	.31225611 03	RAM	.15520210 03	LOM	.14217260 03
GUT	.35600000 02	DT	.15000000 02	DR	.22922162 00	SHA	-.60593999 04	DES	-.17793725 02	DEM	.14620066 02

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 235647574563202741531100 J.D.= 2438425.17796021 JAN. 30,1964 16 16 15.763

SMA	.37605733 06	ECC	.98254365 00	B	.69958774 05	SLR	.13014501 05	APO	.74555007 06	RCA	.65665073 04
VH	.96600714-01	C3	-.10599667 01	C1	.72025146 05	TFP	.25236921 02	TF	-.70102550-02	PER	.30250011 05
TA	.24160235 01	RTA	.00000000 00	EA	.22674000 00	MA	.39506606-02	C3J	-.13411178 01	TFI	.00000000 00

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	.61037173 04	Y	.22920606 04	Z	-.70690992 03	DX	-.37731652 01	DY	.09534877 01	DZ	-.50916161 01
INC	.20493382 02	LAN	.18774204 03	APF	.19213031 03	WX	-.36347633 00	WY	.00911024 00	WZ	-.46170512 00
UX	-.64266069-01	UY	.47270071 00	UZ	.87887221 00	PX	.94380101 00	PY	.31470990 00	PZ	-.10026401 00
QX	-.32397297 00	QY	.82310829 00	QZ	-.46640561 00	RX	-.95100214-01	RY	-.31707920-01	RZ	-.99496257 00
BX	.32397298 00	BY	-.82310832 00	BZ	.46640563 00	TX	.31629623 00	TY	-.94669961 00	TZ	.00000000 00
DAP	-.57533093 01	RAP	.18430204 02								
BTQ	.61796114 05	BRQ	-.32796365 05	B	.69958776 05	THA	.33204571 03				

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.96352706 08	Y	.10305370 09	Z	.45032901 08	DX	-.27136350 02	DY	-.06361000 01	DZ	-.12710207 02
R	.14736359 09	LAT	.17793720 02	LON	.13225563 03	V	.31100550 02	PTH	.13729175 02	AZ	.12120011 03
XE	-.96358888 08	YE	.10305150 09	ZE	.45033768 08	DXE	-.23361195 02	DYE	-.17507676 02	DZE	-.76279426 01
XT	-.96091456 08	YT	.10606459 09	ZT	.45129269 08	DXT	-.23099061 02	DYT	-.10430001 02	DZT	-.70233002 01
LTE	.17793725 02	LOE	.13225011 03	LTT	.17789048 02	LOT	.13231644 03	RST	.14771620 09	VST	.31203560 02
EPS	.11264297 03	ESP	.27453512-10	SEP	.67314675 02	EPM	.44403274 02	EMP	.69507466 00	MEP	.13490000 03
MPS	.15698545 03	MSP	.57674930-01	SMP	.22956461 02	SEM	.15767963 03	EMS	.22264029 02	ESM	.56380367-01
RPM	.38302772 06	SPM	.36479517 02								
GCE	.24018344 03	GCT	.25291583 03	SIP	.15672592 03	CPT	.04742102 02	SIN	.04402647 02	D1	.13500296 00
REP	.65674806 04	VEP	.10969332 02	CPE	.10442240 03	CPS	.10278292 01	D2	.12535005 00	D3	.16532323-02

0 DAYS 0 HRS. 0 MIN. 7.400 SEC. 235647574574202063140000 J.D.= 2438425.17833796 JAN. 30,1964 16 16 48.400
TFL 0 DAYS 0 HRS. 27 MIN. 39.310 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.60755606 04	Y	.23590271 04	Z	-.82455608 03	DX	-.38366396 01	DY	.09292436 01	DZ	-.50031901 01
R	.65694265 04	DEC	-.72104599 01	RA	.21220266 02	V	.10967681 02	PTH	.15476380 01	AZ	.11764013 03
R	.65694264 04	LAT	-.72104599 01	LON	.80797661 01	VE	.10549120 02	PTE	.16090593 01	AZE	.11800820 03
XS	.94359061 08	YS	-.10305137 09	ZS	-.45033712 08	DXS	.23361166 02	DYS	.17507700 02	DZS	.76276661 01
XM	-.33257264 06	YM	.15308354 06	ZM	.95499789 05	DXM	-.51862835 00	DYM	-.04241328 00	DZM	-.29570505 00
XT	-.33257264 06	YT	.15308356 06	ZT	.95499789 05	DXT	-.51862835 00	DYT	-.04241328 00	DZT	-.29570505 00
RS	.14736612 09	VS	.30220098 02	RM	.37836403 06	VM	.10427244 01	RT	.37836403 06	VT	.10427244 01
GED	-.72590752 01	ALT	.19155835 03	LOS	.29911769 03	RAS	.31225620 03	RAM	.15520333 03	LOM	.14214203 03
GUT	.35000000 02	DT	.73999938 01	DR	.29621631 00	SHA	-.60036410 04	DES	-.17793702 02	DEM	.14619687 02

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 235647574563202741040160 J.D.= 2438425.17796036 JAN. 30,1964 16 16 15.774

SMA	.37594429 06	ECC	.98253048 00	B	.69946370 05	SLR	.13014552 05	APO	.74532790 06	RCA	.65665900 04
VH	.96635393-01	C3	-.10602590 01	C1	.72025067 05	TFP	.32626064 02	TF	-.70072610-02	PER	.30233070 05
TA	.31227009 01	RTA	.00000000 00	EA	.29314104 00	MA	.51199729-02	C3J	-.13415003 01	TFI	.20999520-02

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	.60755606 04	Y	.23590271 04	Z	-.82455608 03	DX	-.38366396 01	DY	.09292436 01	DZ	-.50031901 01
INC	.20493270 02	LAN	.18774190 03	APF	.19213141 03	WX	-.37692771 00	WY	.00473662 00	WZ	-.46026700 00
UX	-.64265313-01	UY	.47270705 00	UZ	.87887316 00	PX	.94307516 00	PY	.31471985 00	PZ	-.10025909 00
QX	-.32399030 00	QY	.82310353 00	QZ	-.46640190 00	RX	-.95107844-01	RY	-.31712168-01	RZ	-.99496169 00
BX	.32399031 00	BY	-.82310355 00	BZ	.46640200 00	TX	.31631353 00	TY	-.94665470 00	TZ	.00000000 00
DAP	-.57538845 01	RAP	.18440129 02								
BTQ	.61787044 05	BRQ	-.32789259 05	B	.69946370 05	THA	.33200592 03				

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.96352985 08	Y	.10305373 09	Z	.45032806 08	DX	-.27197869 02	DY	-.06504644 01	DZ	-.12710790 02
R	.14736364 09	LAT	.17793675 02	LON	.13225571 03	V	.31145061 02	PTH	.13752280 02	AZ	.12122535 03
XE	-.96359061 08	YE	.10305137 09	ZE	.45033712 08	DXE	-.23361166 02	DYE	-.17507700 02	DZE	-.76276661 01
XT	-.96091633 08	YT	.10600465 09	ZT	.45129211 08	DXT	-.23099794 02	DYT	-.10430121 02	DZT	-.70233901 01
LTE	.17793702 02	LOE	.13225820 03	LTT	.17789025 02	LOT	.13231653 03	RST	.14771620 09	VST	.31203561 02
EPS	.11217464 03	ESP	.27453512-10	SEP	.67823190 02	EPM	.44927271 02	EMP	.70240663 00	MEP	.13437016 03
PPS	.15697866 03	MSP	.58516955-01	SMP	.22963267 02	SEM	.15767036 03	EMS	.22265099 02	ESM	.55316057-01
RPM	.38296676 06	SPM	.36039665 02								
GCE	.24765005 03	GCT	.25209370 03	SIP	.15671909 03	CPT	.04752639 02	SIN	.04493075 02	D1	.13590000 00
REP	.65694265 04	VEP	.10967681 02	CPE	.10566351 03	CPS	.10210293 01	D2	.12535725 00	D3	.16530632-02

0 DAYS 0 HRS. 43 MIN. 19.000 SEC. 2356475760006020000000000 J.D.= 2438425.20833333 JAN. 30,1964 17 00 00.000
TFL 0 DAYS 1 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.11004063 05	Y	.12767616 05	Z	-.76659716 04	DX	-.61925537 01	DY	.16766696 01	DZ	-.32144791 01
R	.18552201 05	DEC	-.24406372 02	RA	.13001175 03	V	.66491565 01	PTH	.51120104 02	AZ	.76664277 02
R	.18552290 05	LAT	-.24406372 02	LON	.10694335 03	VE	.58478001 01	PTE	.62345979 02	AZE	.60030295 02
XS	.94415592 08	YS	-.10316037 09	ZS	-.45011357 08	DXS	.23351190 02	DYS	.17599832 02	DZS	.76326270 01
XM	-.33194027 06	YM	.15026661 06	ZM	.94730650 05	DXM	-.51221450 00	DYM	-.04725101 00	DZM	-.29760011 00
XT	-.33196027 06	YT	.15026661 06	ZT	.94730659 05	DXT	-.51221450 00	DYT	-.04725101 00	DZT	-.29760011 00
RS	.14736672 09	VS	.30219970 02	RM	.37851446 06	VM	.10527700 01	RT	.37851446 06	VT	.10622700 01
GED	-.24551026 02	ALT	.12177771 05	LOS	.20032061 03	RAS	.31126901 03	RAM	.15568444 03	LOM	.13171626 03
GUT	.35000000 02	DT	.12000000 03	DR	.31753537 01	SHA	.12465102 05	DES	-.17705451 02	DEM	.14683007 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.90430636 00	Y	.10381054 00	Z	.05006271 00	DE	-.29563656 02	DV	-.16176222 02	DZ	-.00670670 01
R	.16730047 00	LAT	.17760700 02	LON	.13220000 03	V	.36623000 02	PTH	.70795203 01	AZ	.10032702 03
[illegible]	-.90419592 00	VE	.10380571 00	ZE	.05013937 00	DXE	-.23351100 02	DVE	-.17500052 02	DZE	-.76326220 01
XT	-.90751552 00	VT	.10395667 00	ZT	.05106667 00	DXT	-.23601336 02	DVT	-.18444116 02	DZT	-.79100260 01
LTE	.17705551 02	LOE	.13220901 03	LTT	.17700002 02	LOT	.13214070 03	RST	.16771000 00	VST	.31200710 02
EPS	.62200665 02	ESP	.27651512-10	SEP	.13770651 03	EPM	.13211175 03	EMP	.26037151 01	MEP	.65006511 02
MPS	.15669116 03	MSP	.50300367-01	SMP	.23652250 02	SEM	.15730257 03	EMS	.22660770 02	ESM	.50300367-01
RPM	.30582317 00	SPM	.22100490 02								
GCE	.16016009 03	GCT	.24011260 03	SIP	.15621030 03	CPT	.86609705 02	SIN	.00337565 02	D1	.16220330 00
REP	.10552201 05	VEP	.64603565 01	CPE	.16127700 03	CPS	.10278332 03	SZ	.13077501 00	D3	.15555100-02

0 DAYS 1 HRS. 43 MIN. 10.000 SEC.   2356437177610202000000000 J.D.= 2438425.25000000 JAN. 30,1964 18 00 00.000

TFL 0 DAYS 2 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	[illegible]	Y	[illegible]	Z	[illegible]	DE	[illegible]	DV	[illegible]	DZ	[illegible]
R	[illegible]	DEC	[illegible]	RA	[illegible]	V	[illegible]	PTH	[illegible]	AZ	[illegible]
E	[illegible]	LAT	[illegible]	LON	[illegible]	VE	[illegible]	PTE	[illegible]	AZE	[illegible]
XS	[illegible]	VS	[illegible]	ZS	[illegible]	DXS	[illegible]	DVS	[illegible]	DZS	[illegible]
XM	[illegible]	VM	[illegible]	ZM	[illegible]	DXM	[illegible]	DVM	[illegible]	DZM	[illegible]
XT	[illegible]	VT	[illegible]	ZT	[illegible]	DXT	[illegible]	DVT	[illegible]	DZT	[illegible]
RS	[illegible]	WS	[illegible]	RM	[illegible]	VM	[illegible]	RT	[illegible]	VT	[illegible]
GED	[illegible]	ALT	[illegible]	LOS	[illegible]	RAS	[illegible]	RAM	[illegible]	LOM	[illegible]
GUT	[illegible]	DT	[illegible]	BR	[illegible]	SHA	[illegible]	DES	[illegible]	DEM	[illegible]

HELIOCENTRIC — EQUATORIAL COORDINATES

[illegible]

0 DAYS 2 HRS. 43 MIN. 10.000 SEC.   [illegible] J.D.= 2438425.29166666 JAN. 30,1964 19 00 00.000

TFL 0 DAYS 3 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

[illegible]

HELIOCENTRIC — EQUATORIAL COORDINATES

[illegible]

0 DAYS 3 HRS. 43 MIN. 10.000 SEC.   [illegible] J.D.= 2438425.33333333 JAN. 30,1964 20 00 00.000

TFL 0 DAYS 4 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

[illegible]

HELIOCENTRIC — EQUATORIAL COORDINATES

[illegible]

0 DAYS 4 HRS. 43 MIN. 10.000 SEC.   [illegible] J.D.= 2438425.37500000 JAN. 30,1964 21 00 00.000

TFL 0 DAYS 5 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

[illegible]

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.96825906 08	Y	.10906955 09	Z	.44091616 08	DX	-.26622687 02	DY	-.17956100 02	DZ	-.77276667 01
R	.14762102 09	LAT	.17720704 02	LON	.13247751 03	V	.32066770 02	PTH	.35405190 01	AZ	.10560151 03
XE	-.96755455 08	YE	.10355190 09	ZE	.44903037 08	DXE	-.23249055 02	DYE	-.17660557 02	DZE	-.76501510 01
XT	-.95096821 08	YT	.10369051 09	ZT	.44994212 08	DXT	-.23791426 02	DYT	-.18520951 02	DZT	-.70665062 01
LTE	.17760100 02	LOE	.13266016 03	LTT	.17734230 02	LOT	.13252661 03	AST	.16771661 09	VST	.31105296 02
EPS	.65199085 02	ESP	.10546685-01	SEP	.13658081 03	EPM	.14013127 03	EMP	.57955156 01	MEP	.26075283 02
MPS	.15815196 03	MSP	.65327687-01	SMP	.21602040 02	SEM	.15521956 03	EMS	.24710762 02	ESM	.61770341-01
RPM	.31582402 06	SPM	.46356186 02								
GCE	.10279003 03	GCT	.24125596 01	SIP	.15803719 03	CPT	.08146351 02	SIN	.07081571 02	D1	.16400965 00
REP	.72529732 05	VEP	.31421240 01	CPE	.10799138 03	CPS	.10276495 03	D2	.15354116 00	D3	.22064501-02

0 DAYS 5 HRS. 43 MIN. 10.000 SEC. 2350676066302020000000 J.D.= 2438425.4166666 JAN. 30,1964 22 00 00.000
TFL 0 DAYS 6 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.80966153 05	Y	.12519051 05	Z	-.12593689 05	DX	-.20960179 01	DY	-.33301000 00	DZ	-.29936959-01
R	.82890654 05	DEC	-.07367292 01	RA	.17120993 03	V	.29153617 01	PTH	.72661533 02	AZ	.62776607 02
R	.82890652 05	LAT	-.07307292 01	LON	.72036203 02	VE	.59127609 01	PTE	.20077097 02	AZE	.27636962 03
XS	.96839293 08	YS	-.10368629 09	ZS	-.44876255 08	DXS	.23281016 02	DYS	.17675966 02	DZS	.76658230 01
XM	-.36313755 06	YM	.13551614 06	ZM	.89263782 05	DXM	-.44731016 00	DYM	-.86395087 00	DZM	-.30970977 00
XT	-.36313755 06	YT	.13551614 06	ZT	.89263782 05	DXT	-.44731016 00	DYT	-.86395087 00	DZT	-.30970977 00
RS	.14737096 09	VS	.30219360 02	RM	.37957133 06	VM	.10391392 01	RT	.37957133 06	VT	.10391392 01
GED	-.87973532 01	ALT	.76512966 05	LOS	.21332925 03	RAS	.31256293 03	RAM	.15865019 03	LOM	.50276661 02
GUT	.35000000 02	UT	.60000000 03	UM	.27820899 01	SHA	.00123100 05	DES	-.17720820 02	DEM	.13601662 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.96920259 08	Y	.10350081 09	Z	.44863661 08	DX	-.26177012 02	DY	-.18009905 02	DZ	-.76057608 01
R	.14762802 09	LAT	.17716591 02	LON	.13252103 03	V	.32692788 02	PTH	.32759706 01	AZ	.10561406 03
XE	-.96839291 08	YE	.10368629 09	ZE	.44876255 08	DXE	-.23281016 02	DYE	-.17675966 02	DZE	-.76656230 01
XT	-.95102630 08	YT	.10362383 09	ZT	.44965519 08	DXT	-.23760557 02	DYT	-.18519916 02	DZT	-.79755396 01
LTE	.17728820 02	LOE	.13250293 03	LTT	.17722605 02	LOT	.13256666 03	AST	.16771670 09	VST	.31101264 02
EPS	.66672960 02	ESP	.22117129-01	SEP	.13350366 03	EPM	.16759861 03	EMP	.67200611 01	MEP	.25601366 02
MPS	.15876630 03	MSP	.62563512-01	SMP	.21190570 02	SEM	.15670020 03	EMS	.25230001 02	ESM	.61770361-01
RPM	.36697777 06	SPM	.62059997 02								
GCE	.99731931 02	GCT	.24014617 03	SIP	.15066260 03	CPT	.08270707 02	SIN	.07956076 02	D1	.16055006 00
REP	.82890654 05	VEP	.29153612 01	CPE	.10570212 03	CPS	.10275907 03	D2	.15061505 00	D3	.26719969-02

0 DAYS 6 HRS. 43 MIN. 10.000 SEC. 23564761043626200000000 J.D.= 2438425.4583333 JAN. 30,1964 23 00 00.000
TFL 0 DAYS 7 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.91050710 05	Y	.11260500 05	Z	-.12650041 05	DX	-.27130801 01	DY	-.09935066 00	DZ	-.20517620-02
R	.92613170 05	DEC	-.78505613 01	RA	.17296685 03	V	.27367706 01	PTH	.73693161 02	AZ	.62519561 02
R	.92613168 05	LAT	-.78505613 01	LON	.50710062 02	VE	.65507066 01	PTE	.23562907 02	AZE	.27362222 03
XS	.96921606 08	YS	-.10362462 09	ZS	-.44646644 08	DXS	.23266961 02	DYS	.17691367 02	DZS	.76726626 01
XM	-.36687556 06	YM	.13299366 06	ZM	.88144635 05	DXM	-.47023562 00	DYM	-.86761071 00	DZM	-.31203070 00
XT	-.36687556 06	YT	.13299366 06	ZT	.88144635 05	DXT	-.47023562 00	DYT	-.86761071 00	DZT	-.31203070 00
RS	.14737179 09	VS	.30219750 02	RM	.37970508 06	VM	.10305025 01	RT	.37970508 06	VT	.10305025 01
GED	-.79033073 01	ALT	.86235566 05	LOS	.19033601 03	RAS	.31256570 03	RAM	.15690070 03	LOM	.66703000 02
GUT	.35000000 02	UT	.95999999 03	UM	.26290022 01	SHA	.00156719 05	DES	-.17717665 02	DEM	.13620190 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.95016136 08	Y	.10363509 09	Z	.44815996 08	DX	-.25900641 02	DY	-.18050717 02	DZ	-.76756662 01
R	.14763651 09	LAT	.17706608 02	LON	.13256096 03	V	.32553005 02	PTH	.36724950 01	AZ	.10536670 03
XE	-.96923006 08	YE	.10362662 09	ZE	.44646644 08	DXE	-.23266961 02	DYE	-.17691367 02	DZE	-.76726626 01
XT	-.95267050 08	YT	.10355702 09	ZT	.44936789 08	DXT	-.23765196 02	DYT	-.18550705 02	DZT	-.79065721 01
LTE	.17717665 02	LOE	.13256570 03	LTT	.17710961 02	LOT	.13261271 03	AST	.16771176 09	VST	.31177162 02
EPS	.67359151 02	ESP	.26160577-01	SEP	.13261636 03	EPM	.16608250 03	EMP	.76350332 01	MEP	.25301576 02
MPS	.15915611 03	MSP	.62563552-01	SMP	.20802659 02	SEM	.15610161 03	EMS	.25756631 02	ESM	.66236780-01
RPM	.29876060 06	SPM	.63610260 02								
GCE	.97612669 02	GCT	.23912112 03	SIP	.15002336 03	CPT	.08383005 02	SIN	.08050267 02	D1	.17622060 00
REP	.92613170 05	VEP	.27367706 01	CPE	.10601162 03	CPS	.10275675 03	D2	.16319002 00	D3	.26431782-02

0 DAYS 7 HRS. 43 MIN. 10.000 SEC. 23564761226202020000000 J.D.= 2438425.5000000 JAN. 31,1964 00 00 00.000
TFL 0 DAYS 8 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.10093990 06	Y	.09620733 06	Z	-.12623216 05	DX	-.25633167 01	DY	-.37900682 00	DZ	.16912016-01
R	.10101592 06	DEC	-.71219005 01	RA	.17615205 03	V	.25607071 01	PTH	.75156062 02	AZ	.62330162 02
R	.10101591 06	LAT	-.71219005 01	LON	.65096151 02	VE	.71963966 01	PTE	.20260666 02	AZE	.27270990 03
XS	.95006819 08	YS	-.10336091 09	ZS	-.44021016 08	DXS	.23252097 02	DYS	.17706750 02	DZS	.76795577 01
XM	-.36650081 06	YM	.12926682 06	ZM	.87017262 05	DXM	-.46912205 00	DYM	-.87070760 00	DZM	-.31631770 00
XT	-.36650081 06	YT	.12926682 06	ZT	.87017262 05	DXT	-.46912205 00	DYT	-.87070760 00	DZT	-.31631770 00
RS	.14737266 09	VS	.30219152 02	RM	.37999951 06	VM	.10370629 01	RT	.37999951 06	VT	.10370629 01
GED	-.71699312 01	ALT	.95630061 05	LOS	.16333256 03	RAS	.31256066 03	RAM	.15956900 03	LOM	.30290001 02
GUT	.35000000 02	UT	.95999999 03	UM	.26023705 01	SHA	.75026399 05	DES	-.17706666 02	DEM	.13237707 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.95107350 08	Y	.10337005 09	Z	.44800101 08	DX	-.25016216 02	DY	-.18082725 02	DZ	-.76622650 01
R	.14764061 09	LAT	.17602602 02	LON	.13261591 03	V	.32637190 02	PTH	.29006503 01	AZ	.10533902 03
XE	-.95006819 08	YE	.10336091 09	ZE	.44021016 08	DXE	-.23252097 02	DYE	-.17706750 02	DZE	-.76795577 01
XT	-.95353390 08	YT	.10349017 09	ZT	.44908036 08	DXT	-.23722019 02	DYT	-.18577555 02	DZT	-.79936755 01
LTE	.17706064 02	LOE	.13250066 03	LTT	.17690310 02	LOT	.13265674 03	AST	.16771329 09	VST	.31172901 02
EPS	.68105625 02	ESP	.30606656-01	SEP	.11106691 03	EPM	.16636956 03	EMP	.05392519 01	MEP	.23115409 02
MPS	.15952407 03	MSP	.39566682-01	SMP	.20630636 02	SEM	.15366319 03	EMS	.26271609 02	ESM	.66351990-01
RPM	.29103616 06	SPM	.64516125 02								
GCE	.95572516 02	GCT	.23015900 03	SIP	.15910250 03	CPT	.08467260 02	SIN	.08125677 02	D1	.17806694 00
REP	.10101592 06	VEP	.25607071 01	CPE	.10250101 03	CPS	.10276906 03	D2	.16703602 00	D3	.20613760-02

0 DAYS 8 HRS. 43 MIN. 10.000 SEC. 23564761606420200000000 J.D.= 2438425.5416666 JAN. 31,1964 01 00 00.000
TFL 0 DAYS 9 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.10993510 06	Y	.05602090 06	Z	-.12513068 05	DX	-.26179157 01	DY	-.30705314 00	DZ	.32006360-01
R	.11056232 06	DEC	-.65061320 01	RA	.17552723 03	V	.26601661 01	PTH	.76701602 02	AZ	.62103306 02
R	.11056232 06	LAT	-.65061320 01	LON	.31230265 02	VE	.78135956 01	PTE	.17739301 02	AZE	.27230621 03
XS	.95090508 08	YS	-.10320711 09	ZS	-.44703136 08	DXS	.23230620 02	DYS	.17722162 02	DZS	.76650106 01
XM	-.36025321 06	YM	.12612399 06	ZM	.85081508 05	DXM	-.45991089 00	DYM	-.87066705 00	DZM	-.31657120 00
XT	-.36025321 06	YT	.12612399 06	ZT	.85081508 05	DXT	-.45991089 00	DYT	-.87066705 00	DZT	-.31657120 00
RS	.14737340 09	VS	.30219015 02	RM	.38021668 06	VM	.10372210 01	RT	.38021668 06	VT	.10372210 01
GED	-.65521000 01	ALT	.10420639 06	LOS	.16813625 03	RAS	.31263122 03	RAM	.16009155 03	LOM	.15706577 02
GUT	.35000000 02	UT	.95999999 03	UM	.23007067 01	SHA	.03175360 05	DES	-.17696670 02	DEM	.13056620 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.95200043 00	Y	.10380970 00	Z	.04700025 00	DE	[illegible]	DV	[illegible]	DZ	[illegible]
R	.14744639 09	LAT	.17600522 02	LON	.13766172 03	V	[illegible]	PTH	[illegible]	AZ	[illegible]
AE	-.95090500 00	VE	.10329711 00	ZE	.04793358 00	DVE	[illegible]	DVE	[illegible]	DZE	[illegible]
AT	-.95430761 00	VT	.10342925 00	ZT	.04879240 00	DAT	[illegible]	DVT	[illegible]	DZT	[illegible]
LTE	.17694670 02	LOE	.13763127 03	LTT	.17687640 02	LUT	[illegible]	RST	[illegible]	VST	[illegible]
EPS	.40745306 02	ESP	.32805301-01	SEP	.13122737 03	EPM	[illegible]	EMP	[illegible]	MEP	[illegible]
MPS	.15987248 03	MSP	.37666656-01	SMP	.20089666 02	SEM	[illegible]	EMS	[illegible]	ESM	[illegible]
RPH	.28370989 06	SPH	.65430051 02								
GCE	.94603573 02	GCT	.23774900 03	SIP	.15952209 03	CPT	[illegible]	SIN	[illegible]	D1	[illegible]
HEP	.11050232 06	VEP	.24661641 01	CPE	.10130662 03	CPS	[illegible]	DZ	[illegible]	D3	[illegible]

0 DAYS 9 HRS. 43 MIN. 19.000 SEC. 2156476154560207000000 J.D.- 2438425.90133 JAN. 31,1964 02 00 00.000

TFL 0 DAYS 10 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.11011068 06	Y	.71605460 06	Z	-.12790090 05	DE	[illegible]	DV	[illegible]	DZ	[illegible]
R	.11097500 06	DEC	-.59005392 01	RA	.17653066 03	V	[illegible]	PTH	[illegible]	AZ	[illegible]
R	.11097507 06	LAT	-.59005392 01	LON	.17167610 02	VE	[illegible]	PTE	[illegible]	AZE	[illegible]
RS	.95174140 06	VS	-.10323330 09	ZS	-.44769677 06	DBS	[illegible]	DVS	[illegible]	DZS	[illegible]
AR	[illegible]	VR	[illegible]	ZR	[illegible]	DAR	[illegible]	DVR	[illegible]	DZR	[illegible]
AT	[illegible]	VT	[illegible]	ZT	[illegible]	DAT	[illegible]	DVT	[illegible]	DZT	[illegible]
RS	[illegible]	VS	[illegible]	RR	[illegible]	VR	[illegible]	RT	[illegible]	VT	[illegible]
GED	[illegible]	ALT	[illegible]	LOS	[illegible]	RAS	[illegible]	RAR	[illegible]	LON	[illegible]
DUT	[illegible]	DT	[illegible]	RR	[illegible]	SHA	[illegible]	DES	[illegible]	DER	[illegible]

HELIOCENTRIC — EQUATORIAL COORDINATES

X	[illegible]	Y	[illegible]	Z	[illegible]	DE	[illegible]	DV	[illegible]	DZ	[illegible]
R	[illegible]	LAT	[illegible]	LON	[illegible]	V	[illegible]	PTH	[illegible]	AZ	[illegible]
AE	[illegible]	VE	[illegible]	ZE	[illegible]	DAE	[illegible]	DVE	[illegible]	DZE	[illegible]
AT	[illegible]	VT	[illegible]	ZT	[illegible]	DAT	[illegible]	DVT	[illegible]	DZT	[illegible]
LTE	[illegible]	LOE	[illegible]	LTT	[illegible]	LOT	[illegible]	RST	[illegible]	VST	[illegible]
EPS	[illegible]	ESP	[illegible]	SEP	[illegible]	EPM	[illegible]	EMP	[illegible]	MEP	[illegible]
MPS	[illegible]	MSP	[illegible]	SMP	[illegible]	SEM	[illegible]	EMS	[illegible]	ESM	[illegible]
RPH	[illegible]	SPH	[illegible]								
GCE	[illegible]	GCT	[illegible]	SIP	[illegible]	CPT	[illegible]	SIN	[illegible]	D1	[illegible]
HEP	[illegible]	VEP	[illegible]	CPE	[illegible]	CPS	[illegible]	DZ	[illegible]	D3	[illegible]

0 DAYS 10 HRS. 43 MIN. 19.000 SEC. [illegible] J.D.- 2438425.62500000 JAN. 31,1964 03 00 00.000

TFL 0 DAYS 11 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	[illegible]	Y	[illegible]	Z	[illegible]	DE	[illegible]	DV	[illegible]	DZ	[illegible]
R	[illegible]	DEC	[illegible]	RA	[illegible]	V	[illegible]	PTH	[illegible]	AZ	[illegible]
R	[illegible]	LAT	[illegible]	LON	[illegible]	VE	[illegible]	PTE	[illegible]	AZE	[illegible]
RS	[illegible]	VS	[illegible]	ZS	[illegible]	DBS	[illegible]	DVS	[illegible]	DZS	[illegible]
AR	[illegible]	VR	[illegible]	ZR	[illegible]	DAR	[illegible]	DVR	[illegible]	DZR	[illegible]
AT	[illegible]	VT	[illegible]	ZT	[illegible]	DAT	[illegible]	DVT	[illegible]	DZT	[illegible]
RS	[illegible]	VS	[illegible]	RR	[illegible]	VR	[illegible]	RT	[illegible]	VT	[illegible]
GED	[illegible]	ALT	[illegible]	LOS	[illegible]	RAS	[illegible]	RAR	[illegible]	LON	[illegible]
DUT	[illegible]	DT	[illegible]	RR	[illegible]	SHA	[illegible]	DES	[illegible]	DER	[illegible]

HELIOCENTRIC — EQUATORIAL COORDINATES

X	[illegible]	Y	[illegible]	Z	[illegible]	DE	[illegible]	DV	[illegible]	DZ	[illegible]
R	[illegible]	LAT	[illegible]	LON	[illegible]	V	[illegible]	PTH	[illegible]	AZ	[illegible]
AE	[illegible]	VE	[illegible]	ZE	[illegible]	DAE	[illegible]	DVE	[illegible]	DZE	[illegible]
AT	[illegible]	VT	[illegible]	ZT	[illegible]	DAT	[illegible]	DVT	[illegible]	DZT	[illegible]
LTE	[illegible]	LOE	[illegible]	LTT	[illegible]	LOT	[illegible]	RST	[illegible]	VST	[illegible]
EPS	[illegible]	ESP	[illegible]	SEP	[illegible]	EPM	[illegible]	EMP	[illegible]	MEP	[illegible]
MPS	[illegible]	MSP	[illegible]	SMP	[illegible]	SEM	[illegible]	EMS	[illegible]	ESM	[illegible]
RPH	[illegible]	SPH	[illegible]								
GCE	[illegible]	GCT	[illegible]	SIP	[illegible]	CPT	[illegible]	SIN	[illegible]	D1	[illegible]
HEP	[illegible]	VEP	[illegible]	CPE	[illegible]	CPS	[illegible]	DZ	[illegible]	D3	[illegible]

0 DAYS 11 HRS. 43 MIN. 19.000 SEC. [illegible] J.D.- 2438425.66666666 JAN. 31,1964 04 00 00.000

TFL 0 DAYS 12 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	[illegible]	Y	[illegible]	Z	[illegible]	DE	[illegible]	DV	[illegible]	DZ	[illegible]
R	[illegible]	DEC	[illegible]	RA	[illegible]	V	[illegible]	PTH	[illegible]	AZ	[illegible]
R	[illegible]	LAT	[illegible]	LON	[illegible]	VE	[illegible]	PTE	[illegible]	AZE	[illegible]
RS	[illegible]	VS	[illegible]	ZS	[illegible]	DBS	[illegible]	DVS	[illegible]	DZS	[illegible]
AR	[illegible]	VR	[illegible]	ZR	[illegible]	DAR	[illegible]	DVR	[illegible]	DZR	[illegible]
AT	[illegible]	VT	[illegible]	ZT	[illegible]	DAT	[illegible]	DVT	[illegible]	DZT	[illegible]
RS	[illegible]	VS	[illegible]	RR	[illegible]	VR	[illegible]	RT	[illegible]	VT	[illegible]
GED	[illegible]	ALT	[illegible]	LOS	[illegible]	RAS	[illegible]	RAR	[illegible]	LON	[illegible]
DUT	[illegible]	DT	[illegible]	RR	[illegible]	SHA	[illegible]	DES	[illegible]	DER	[illegible]

HELIOCENTRIC — EQUATORIAL COORDINATES

X	[illegible]	Y	[illegible]	Z	[illegible]	DE	[illegible]	DV	[illegible]	DZ	[illegible]
R	[illegible]	LAT	[illegible]	LON	[illegible]	V	[illegible]	PTH	[illegible]	AZ	[illegible]
AE	[illegible]	VE	[illegible]	ZE	[illegible]	DAE	[illegible]	DVE	[illegible]	DZE	[illegible]
AT	[illegible]	VT	[illegible]	ZT	[illegible]	DAT	[illegible]	DVT	[illegible]	DZT	[illegible]
LTE	[illegible]	LOE	[illegible]	LTT	[illegible]	LOT	[illegible]	RST	[illegible]	VST	[illegible]
EPS	[illegible]	ESP	[illegible]	SEP	[illegible]	EPM	[illegible]	EMP	[illegible]	MEP	[illegible]
MPS	[illegible]	MSP	[illegible]	SMP	[illegible]	SEM	[illegible]	EMS	[illegible]	ESM	[illegible]
RPH	[illegible]	SPH	[illegible]								
GCE	[illegible]	GCT	[illegible]	SIP	[illegible]	CPT	[illegible]	SIN	[illegible]	D1	[illegible]
HEP	[illegible]	VEP	[illegible]	CPE	[illegible]	CPS	[illegible]	DZ	[illegible]	D3	[illegible]

0 DAYS 12 HRS. 43 MIN. 19.000 SEC. [illegible] J.D.- 2438425.70833333 JAN. 31,1964 05 00 00.000

TFL 0 DAYS 13 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	[illegible]	Y	[illegible]	Z	[illegible]	DE	[illegible]	DV	[illegible]	DZ	[illegible]
R	[illegible]	DEC	[illegible]	RA	[illegible]	V	[illegible]	PTH	[illegible]	AZ	[illegible]
R	[illegible]	LAT	[illegible]	LON	[illegible]	VE	[illegible]	PTE	[illegible]	AZE	[illegible]
RS	[illegible]	VS	[illegible]	ZS	[illegible]	DBS	[illegible]	DVS	[illegible]	DZS	[illegible]
AR	[illegible]	VR	[illegible]	ZR	[illegible]	DAR	[illegible]	DVR	[illegible]	DZR	[illegible]
AT	[illegible]	VT	[illegible]	ZT	[illegible]	DAT	[illegible]	DVT	[illegible]	DZT	[illegible]
RS	[illegible]	VS	[illegible]	RR	[illegible]	VR	[illegible]	RT	[illegible]	VT	[illegible]
GED	[illegible]	ALT	[illegible]	LOS	[illegible]	RAS	[illegible]	RAR	[illegible]	LON	[illegible]
DUT	[illegible]	DT	[illegible]	RR	[illegible]	SHA	[illegible]	DES	[illegible]	DER	[illegible]

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.95540570 00	Y	.10304431 09	Z	.44670712 00	DX	-.29260022 02	DY	-.10187030 02	DZ	-.76440820 01
R	.14744720 00	LAT	.17633040 02	LON	.13204302 03	V	.32051650 02	PTH	.24052901 01	AZ	.10520701 03
RE	-.95424750 00	VE	.10304148 09	ZE	.44602492 00	DXE	-.23102395 02	DYE	-.17703500 02	DZE	-.77124242 01
RT	-.95779362 00	VT	.10315493 09	ZT	.44763751 00	DXT	-.23005525 02	DYT	-.10440940 02	DZT	-.00370405 01
LTE	.17044410 02	LOE	.13200210 03	LTT	.17640907 02	LOT	.13207671 03	AST	.14771050 09	VST	.31151114 02
EPS	.50413523 02	LSP	.42543532-01	SEP	.12554310 03	EPM	.14340174 03	EMP	.32807516 02	MEP	.23730735 02
MPS	.16110466 03	MSP	.32805301-01	SMP	.10063020 02	SEM	.15140107 03	EMS	.20047643 02	ESM	.70402504-01
RPM	.25723235 06	SPM	.40045626 02								
GCE	.09921606 02	GCT	.23391094 03	SIP	.16071070 03	CPT	.08719700 02	SIN	.00333253 02	B1	.20209005 00
REP	.14230440 06	VEP	.21176905 01	CPE	.07074309 02	CPS	.10272359 03	B2	.19100795 00	B3	.30040670-02

0 DAYS 13 HRS. 43 MIN. 19.000 SEC.   2356476244702020000000 J.D.= 2430425.7500000   JAN. 31,1964 06 00 00.000
TFL   0 DAYS 14 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.14910490 06	Y	.13760701 06	Z	-.11524501 05	DX	-.20164144 01	DY	-.40522013 00	DZ	.73509404-01
R	.14963572 06	DEC	-.44171610 01	RA	.17047122 03	V	.20523547 01	PTH	.76443677 02	AZ	.61744200 02
R	.14963572 06	LAT	-.44171610 01	LON	.31944091 03	VE	.10646510 02	PTE	.10001170 02	AZE	.27126776 03
RS	.95508182 00	VS	-.10297763 09	ZS	-.44654718 00	DXS	.23168259 02	DYS	.17790927 02	DZS	.77190404 01
RM	-.35611070 06	VM	.11025097 06	ZM	.00085214 05	DXM	-.41305337 00	DYM	-.08920710 00	DZM	-.32732717 00
RT	-.35611070 06	VT	.11025097 06	ZT	.00085214 05	DXT	-.41305337 00	DYT	-.08920710 00	DZT	-.32732717 00
RS	.14737777 09	VS	.30218439 02	RM	.38129967 06	VM	.10339761 01	RT	.38129967 06	VT	.10339763 01
GED	-.44471426 01	ALT	.14525764 06	LOS	.93342607 02	RAS	.31284491 03	RAM	.16279797 03	LOM	.30329564 03
OUT	.35000000 02	DT	.19200000 04	DR	.19951761 01	SMA	.11630444 06	DES	-.17637576 02	DEM	.12124240 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.95057366 00	Y	.10297881 09	Z	.44665193 00	DX	-.25170874 02	DY	-.10204140 02	DZ	-.76456767 01
R	.14747196 00	LAT	.17621241 02	LON	.13208911 03	V	.31997235 02	PTH	.23309615 01	AZ	.10530127 03
RE	-.95508182 00	VE	.10297763 09	ZE	.44654718 00	DXE	-.23168259 02	DYE	-.17790927 02	DZE	-.77190404 01
RT	-.95864300 00	VT	.10308760 09	ZT	.44799804 00	DXT	-.23582113 02	DYT	-.10480135 02	DZT	-.00463935 01
LTE	.17637576 02	LOE	.13284491 03	LTT	.17629241 02	LOT	.13292067 03	AST	.14770907 09	VST	.31144530 02
EPS	.50944544 02	LSP	.44234650-01	SEP	.12889047 03	EPM	.14288187 03	EMP	.13698258 02	MEP	.23417865 02
MPS	.16157075 03	MSP	.30444434-01	SMP	.10590137 02	SEM	.15056447 03	EMS	.29360844 02	ESM	.72000811-01
RPM	.25113247 06	SPM	.48521458 02								
GCE	.09174919 02	GCT	.23314475 03	SIP	.16090290 03	CPT	.08750103 02	SIN	.00394336 02	B1	.20720607 00
REP	.14963572 06	VEP	.20523547 01	CPE	.07339376 02	CPS	.10271037 03	B2	.19448055 00	B3	.42574493-02

0 DAYS 14 HRS. 43 MIN. 19.000 SEC.   2356476204742070000000 J.D.= 2430425.7916666   JAN. 31,1964 07 00 00.000
TFL   0 DAYS 15 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.15631105 06	Y	-.02376390 02	Z	-.11251006 05	DX	-.19497362 01	DY	-.40930520 00	DZ	.70036355-01
R	.15671631 06	DEC	-.41172236 01	RA	.10003020 03	V	.19929561 01	PTH	.76676227 02	AZ	.61600940 02
R	.15671632 06	LAT	-.41172236 01	LON	.30540602 03	VE	.11165961 02	PTE	.10001096 02	AZE	.27113910 03
RS	.95591566 00	VS	-.10291332 09	ZS	-.44626916 00	DXS	.23154112 02	DYS	.17814250 02	DZS	.77257061 01
RM	-.35759103 06	VM	.10704483 06	ZM	.78903136 05	DXM	-.40455367 00	DYM	-.09196442 00	DZM	-.32937565 00
RT	-.35759103 06	VT	.10704483 06	ZT	.78903136 05	DXT	-.40455367 00	DYT	-.09196442 00	DZT	-.32937565 00
RS	.14737063 09	VS	.30218325 02	RM	.30151031 06	VM	.10333211 01	RT	.30151031 06	VT	.10333211 01
GED	-.41451039 01	ALT	.15033822 06	LOS	.78344261 02	RAS	.31200763 03	RAM	.16333607 03	LOM	.28070160 03
OUT	.35000000 02	DT	.19200000 04	DR	.19303124 01	SMA	.12235790 06	DES	-.17626126 02	DEM	.11095670 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.95747077 00	Y	.10291326 09	Z	.44615664 00	DX	-.25103065 02	DY	-.10219626 02	DZ	-.76470670 01
R	.14747660 00	LAT	.17609447 02	LON	.13293436 03	V	.31947520 02	PTH	.22704561 01	AZ	.10530650 03
RE	-.95591566 00	VE	.10291332 09	ZE	.44626916 00	DXE	-.23154112 02	DYE	-.17814259 02	DZE	-.77257061 01
RT	-.95949157 00	VT	.10302037 09	ZT	.44705819 00	DXT	-.23558665 02	DYT	-.10706223 02	DZT	-.00550796 01
LTE	.17626126 02	LOE	.13208763 03	LTT	.17617406 02	LOT	.13296461 03	AST	.14770935 09	VST	.31141097 02
EPS	.51282713 02	LSP	.44917962-01	SEP	.12866975 03	EPM	.14230666 03	EMP	.14518567 02	MEP	.23042767 02
MPS	.10104126 03	MSP	.28037660-01	SMP	.10120001 02	SEM	.15005249 03	EMS	.20073630 02	ESM	.73256000-01
RPM	.26510920 06	SPM	.48950261 02								
GCE	.08502136 02	GCT	.23230732 03	SIP	.16123579 03	CPT	.08776563 02	SIN	.00371125 02	B1	.21220029 00
REP	.15671631 06	VEP	.19929561 01	CPE	.06762472 02	CPS	.10271313 03	B2	.20196665 00	B3	.46567081-02

0 DAYS 15 HRS. 43 MIN. 19.000 SEC.   2356476303002020000000 J.D.= 2430425.8333333   JAN. 31,1964 08 00 00.000
TFL   0 DAYS 16 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.16322922 06	Y	-.15411013 04	Z	-.10961523 05	DX	-.10940517 01	DY	-.40495718 00	DZ	.02021412-01
R	.16360426 06	DEC	-.38424100 01	RA	.10054093 03	V	.19305967 01	PTH	.76884700 02	AZ	.61630775 02
R	.16360425 06	LAT	-.38424100 01	LON	.29095650 03	VE	.11671965 02	PTE	.93089390 01	AZE	.27103976 03
RS	.95676095 00	VS	-.10284916 09	ZS	-.44590095 00	DXS	.23139952 02	DYS	.17829500 02	DZS	.77323305 01
RM	-.35903165 06	VM	.10382092 06	ZM	.77713753 05	DXM	-.39523102 00	DYM	-.09463329 00	DZM	-.33130923 00
RT	-.35903165 06	VT	.10382092 06	ZT	.77713753 05	DXT	-.39523102 00	DYT	-.09463329 00	DZT	-.33130923 00
RS	.14737969 09	VS	.30210212 02	RM	.30173741 06	VM	.10326601 01	RT	.30173741 06	VT	.10326601 01
GED	-.38405159 01	ALT	.15722615 06	LOS	.61345900 02	RAS	.31293036 03	RAM	.16307057 03	LOM	.27620613 03
OUT	.35000000 02	DT	.19200000 04	DR	.10000200 01	SMA	.12025637 06	DES	-.17614672 02	DEM	.11746342 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.95830129 00	Y	.10284762 09	Z	.44580131 00	DX	-.25034003 02	DY	-.10234536 02	DZ	-.76503171 01
R	.14748112 00	LAT	.17597660 02	LON	.13297046 03	V	.31901834 02	PTH	.22256616 01	AZ	.10531316 03
RE	-.95676095 00	VE	.10284916 09	ZE	.44590095 00	DXE	-.23139952 02	DYE	-.17029500 02	DZE	-.77323305 01
RT	-.96013920 00	VT	.10295290 09	ZT	.44676809 00	DXT	-.23535103 02	DYT	-.10724216 02	DZT	-.00637277 01
LTE	.17614672 02	LOE	.13293034 03	LTT	.17605750 02	LOT	.13300054 03	AST	.14770067 09	VST	.31137192 02
EPS	.51573171 02	LSP	.46950790-01	SEP	.12837700 03	EPM	.14191401 03	EMP	.15320077 02	MEP	.22790213 02
MPS	.10184209 03	MSP	.27000084-01	SMP	.10070244 02	SEM	.14953013 03	EMS	.30305000 02	ESM	.74300452-01
RPM	.23930465 06	SPM	.49330970 02								
GCE	.07891255 02	GCT	.23164454 03	SIP	.16147702 03	CPT	.08799512 02	SIN	.00304242 02	B1	.21762019 00
REP	.16360426 06	VEP	.19305967 01	CPE	.06256676 02	CPS	.10270709 03	B2	.20716456 00	B3	.40279708-02

0 DAYS 16 HRS. 40 MIN. 20.000 SEC.   2356476320112022000000 J.D.= 2430425.8702083   JAN. 31,1964 08 57 00.000
TFL   0 DAYS 17 HRS. 7 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.16963904 06	Y	-.29204526 04	Z	-.10676901 05	DX	-.10451650 01	DY	-.40416072 00	DZ	.05312902-01
R	.16999990 06	DEC	-.36007152 01	RA	.10009009 03	V	.18900300 01	PTH	.77064454 02	AZ	.61500005 02
R	.16999990 06	LAT	-.36007152 01	LON	.27701794 03	VE	.12142207 02	PTE	.87294404 01	AZE	.27094177 03
RS	.95754222 00	VS	-.10277060 09	ZS	-.44572569 00	DXS	.23126453 02	DYS	.17844167 02	DZS	.77384530 01
RM	-.36037165 06	VM	.10075490 06	ZM	.76576173 05	DXM	-.38635129 00	DYM	-.09709276 00	DZM	-.33327910 00
RT	-.36037165 06	VT	.10075490 06	ZT	.76576173 05	DXT	-.38635129 00	DYT	-.09709276 00	DZT	-.33327910 00
RS	.14730031 09	VS	.30210109 02	RM	.30194653 06	VM	.10320106 01	RT	.30194653 06	VT	.10320106 01
GED	-.36251060 01	ALT	.16342178 06	LOS	.49059976 02	RAS	.31297102 03	RAM	.16437963 03	LOM	.26000030 03
OUT	.35000000 02	DT	.19200000 04	DR	.10420533 01	SMA	.11370481 06	DES	-.17603756 02	DEM	.11560206 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.99921861 00	Y	.10278587 00	Z	.44561892 00	DX	-.29071619 02	DY	-.16240137 02	DZ	-.70433990 01
R	.16740532 00	LAT	.17586452 02	LON	.13102262 03	V	.31061531 02	PTH	.21790326 01	RA	.10532096 03
RX	-.99756222 00	VX	.10278000 00	ZX	.44572569 00	DRX	-.28112655 02	DPX	-.15700407 02	DRX	-.27100590 00
RY	-.96115593 00	VY	.10288075 00	ZY	.44649167 00	DRY	-.27312706 02	DPY	-.15741760 02	DRY	-.80710209 01
LTE	.17601750 02	LOE	.13297102 03	LTI	.17596581 02	LOI	.11353538 03	OSI	.16772068 00	VSI	.26132050 02
EPS	.51027251 02	ESP	.52604601-01	SEP	.12012079 03	EPM	.14146215 03	SMP	.16692117 02	MSP	.22435730 02
MPS	.16212316 03	MSP	.27008066-01	SMP	.17040979 02	SEM	.19996376 03	EMS	.20407009 02	ESM	.75075625-01
RPM	.23397251 00	SPM	.49677163 02								
GLE	.07356197 02	GLT	.23094906 03	SIP	.16169828 03	EPT	.00010000 02	SIN	.00391001 02	DS	.22267005 00
RIP	.16999990 00	VEP	.18908380 01	CPE	.05771119 02	EPS	.10272209 03	DZ	.21227000 00	DD	.56250621-02

2 DAYS 16 HRS. 37 MIN. 20.550 SEC. 2350477562522623073660703 J.D.- 2450427.07005137 FEB. 2,1996 00 56 01.950

TFL 2 DAYS 17 HRS. 4 MIN. 52.000 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.39012793 00	Y	-.50223260 03	Z	.12561359 03	DX	-.61333241 00	DY	.67750996 00	DZ	.81542957 01
R	.39476739 00	DEC	.18232493 01	RA	.10063186 03	V	.16723930 01	PTH	.21566612 02	RZ	.56450951 03
R	.39479738 00	LAT	.18232493 01	LON	.20353271 03	VX	.29563370 02	PTX	.13000000 00	DEZ	.27270000 03
RX	-.99484315 00	VX	-.99065362 00	ZX	-.63209629 00	DRX	.22432429 02	DPX	.18767017 02	DRX	-.80710209 01
RY	-.16772493 00	VY	-.50853694 03	ZY	.13239668 03	DRY	.68946179-01	DPY	-.91996313 00	DRY	-.80710210 00
RZ	.16772493 00	VZ	-.50853694 03	ZZ	.13239668 03	DRZ	.68946179-01	DPZ	-.91996313 00	DRZ	-.80710210 00
RS	.16762337 00	VS	.30213226 02	RM	.39219963 00	VM	.10000010 01	RT	.39219963 00	VT	.10000000 01
GEO	.10357163 01	ALT	.38863920 00	LOS	.49912826 02	RAS	.31511190 03	DAM	.10863127 03	LOM	.20353491 03
LOT	.35000000 02	DT	.59999999 02	DR	.94116310 00	SMA	.52269122 00	DES	-.17240572 02	DEO	.19315081 00

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.10007686 00	Y	.99585019 00	Z	.43222190 00	DX	-.23044261 02	DY	-.17008167 02	DZ	-.60975083 01
R	.16765118 00	LAT	.17521572 02	LON	.13516041 03	V	.29979516 02	PTH	.21965632 01	RZ	.13048016 03
RX	.99484735 00	VX	.99465142 00	ZX	.43220629 00	DRX	-.22432429 02	DPX	-.18767037 02	DRX	-.80710209 01
RY	.10007666 00	VY	.99586189 00	ZY	.43222869 00	DRY	-.22844025 02	DPY	-.19407003 02	DRY	-.80741262 01
LTE	.17365572 02	LOE	.13503198 03	LTI	.17021908 02	LOI	.13514.12 03	OSI	.16765406 00	VSI	.26065036 02
EPS	.54006470 02	ESP	.12472204 00	SEP	.12517871 03	EPM	.17467866 02	SMP	.16240009 03	MSP	.22092186 00
MPS	.02130616 02	MSP	.27653517-18	SMP	.11780472 03	SEM	.12521866 03	EMS	.39459118 02	ESM	.22413522 00
RPM	.25193978 00	SPM	.51770612 02								
GLE	.76951232 02	GLT	.95522574 02	SIP	.18600201 02	EPT	.10259177 03	SIN	.57006706 02	DS	.20409006 02
RIP	.39479739 00	VEP	.16723906 01	CPE	.00025257 02	EPS	.10244562 03	DZ	.24405240 02	DD	.19300007 02

SELENOCENTRIC — EQUATORIAL COORDINATES

X	-.23979976 04	Y	-.36954594 03	Z	-.67830946 03	DX	-.66223650 00	DY	.19975330 01	DZ	.15415370 01
R	.25193373 04	DEC	-.33019119 02	RA	.10876071 03	V	.23226765 01	PTH	-.27971209-05	RZ	.38190002 03
R	.25193370 04	LAT	-.93212615 01	LON	.19799852 03	DP	.23270057 01	PTP	-.28707957-05	DEP	.20009345 03
LTS	-.00072604 00	LOS	.31083727 03	LTE	-.07589587 01	LOE	.53352163 01				
ALT	.70433727 03	SMA	.22272290 04	ALP	.17015495 03	DR	-.60344677-00	DP	.57001001-01	DAD	.40320000 02
MAE	.30536399 03	SML	-.18953090 02	MAG	.29915047 03	SIA	-.29002204 02				

SELENOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2350477562522623073650139 J.D.- 2450427.07005137 FEB. 2,1996 00 56 01.950

SMA	-.32663776 04	ECC	.17717665 01	Q	.47744314 04	SLR	.69030146 04	APD	.00000000 00	DEA	.25109573 00
WM	.12255075 01	CI	.15018406 01	CI	.50511017 04	TPP	.25295939-04	TP	.00427375 02	LTP	.00109042 02
TE	-.66321001-05	MYE	.12436122 03	EE	-.15472178-05	RE	.63314148-06	CIJ	-.14102349 01	WI	.00427375 02
ZAE	.13532120 03	ZAP	.16679621 03	ZOC	.00595066 02	DEP	.00722469 02	DD	.19006003 00	DP	.00299993 01
GP1	.35303529 02	DY	-.69952234 02	GP2	.11095711 03						

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	-.23979976 04	Y	-.36954594 03	Z	-.67830946 03	DX	-.66223650 00	DY	.19975330 01	DZ	.15415370 01
IMC	.13425211 03	LAN	.17205594 03	APF	.33792063 03	AE	.29375168 00	DV	.66785755 00	DZ	.66336761 00
XE	.07830670-01	VY	.71066978 00	VZ	-.64701697 00	PX	-.95183667 00	PY	-.19466370 00	PZ	-.20426122 00
QX	-.29375307 00	QY	.66785754 00	QZ	.66337671 00	RX	-.33621516 00	RY	.20916726 00	RZ	-.90626034 00
SX	-.61995987 00	SY	-.50951994 00	SZ	-.59660211 00	TX	.52820490 00	TY	.09911609 00	TZ	.00000000 00
SXI	-.27971721 00	SYI	.68503304 00	SZI	.39595048 00	DAI	.23125772 02	DAI	.19011595 03		
SXO	.29473212 00	SYO	.65061297 00	SZO	.60988262 00	DAO	.60417986 02	DAO	.03629040 02		
ETE	.15763036 03	ETS	.25003491 02	ETC	.26130936 03						
DTC	-.36282190 04	DAC	.31034201 04	Q	.47744314 04	TMA	.19965896 03				

ALL VECTORS REFERENCED TO ECLIPTIC PLANE

X	-.23979976 04	Y	-.60000285 03	Z	-.67520987 03	DX	-.66223650 00	DY	.20709590 01	DZ	.17071787 00
IMC	.15737313 03	LAN	.16660219 03	APF	.33063515 03	AE	-.29624227 00	DV	.98222554 00	DZ	-.90360168 00
XE	.07830621-01	VY	.37456449 00	VZ	-.92302997 00	PX	-.95183666 00	PY	-.24169168 00	PZ	-.16045869 00
QX	-.29375300 00	QY	.09514527 00	QZ	.33524625 00	RX	-.33621516 00	RY	.12011000 00	RZ	-.90360180 00
SX	-.61995987 00	SY	-.70476404 00	SZ	-.36408090 00	TX	.61145623 00	TY	.29812672 00	TZ	.00000000 00
SXI	-.27971724 00	SYI	.60252566 00	SZI	.17030502 00	DAI	.90055566 01	DAI	.19220000 03		
SXO	.29473215 00	SYO	.87595134 00	SZO	.50320615 00	DAO	.27536162 02	DAO	.71300150 02		
ETE	.17767964 03	ETS	.45052965 02	ETC	.26135062 03						
DTC	-.44722272 04	DAC	.16715064 04	Q	.47744315 04	TMA	.19950605 03				

ALL VECTORS REFERENCED TO ORBIT PLANE OF TARGET

X	-.26100396 04	Y	.11636226 03	Z	-.69757112 03	DX	-.11060315 00	DY	.21951002 01	DZ	.20000003 00
IMC	.15462779 03	LAN	.15962888 03	APF	.31950467 03	AE	-.21976761 00	DV	.95925612 00	DZ	.20000000 00
XE	.27643756 00	VY	.32500821 00	VZ	-.90501332 00	PX	-.95979180 00	PY	-.14107555-01	PZ	-.27000075 00
QX	-.67657667-01	QY	.94526108 00	QZ	.32287667 00	RX	-.66456401-01	RY	.09950169-01	RZ	-.00100100 00
SX	-.76560569 00	SY	-.49537461 00	SZ	-.41080202 00	TX	.61130726 00	TY	.50441995 00	TZ	.00000000 00
SXI	-.50105575 00	SYI	.00036105 00	SZI	.11025436 00	DAI	.63299793 01	DAI	.12597016 03		
SXO	.50237370 00	SYO	.75472364 00	SZO	.62780006 00	DAO	.29012050 02	DAO	.00000000 00		
ETE	.17655855 03	ETS	.71206796 02	ETC	.27614076 03						
DTC	-.62475259 04	DAC	.19733770 04	Q	.47744317 04	TMA	.19950631 03				

ALL VECTORS REFERENCED TO TRUE EARTH EQUA. PLANE

X	-.26280082 04	Y	-.53370498 03	Z	-.60005701 03	DX	-.59456210 00	DY	.21602300 00	DZ	.70000103 00
IMC	.15791511 03	LAN	.16051700 03	APF	.33448200 03	AE	-.23513137 00	DV	.90215436 00	DZ	.00017200 00
XE	.76720342-01	VY	.36464031 00	VZ	-.92667706 00	PX	-.96378163 00	PY	-.21107512 00	PZ	-.46196497 00
QX	-.23601212 00	QY	.90516913 00	QZ	.33930309 00	RX	-.10511390 00	RY	.12050422 00	RZ	-.00202936 00
SX	-.65110179 00	SY	-.60570729 00	SZ	-.32521110 00	TX	.67910766 00	TY	.70411729 00	TZ	.00000000 00
SXI	-.75530366 00	SYI	.62762000 00	SZI	.10867591 00	DAI	.10475522 02	DAI	.14027000 00		
SXO	.31760975 00	SYO	.66670719 00	SZO	.37151043 00	DAO	.21000700 02	DAO	.00000002 02		
ETE	.15594061 03	ETS	.72233793 02	ETC	.30019062 03						
DTC	-.45905348 04	DAC	.19010957 04	Q	.47744322 04	TMA	.10000000 03				

2350770000000 2350420000000 0120194000000 0007400230000 0000000000000 0000000000000 0000000000000

0000100016 1041000

APPENDIX E

Ranger VI Postmidcourse Trajectory

SPACE TRAJECTORY
RA-6 POST MIDCOURSE ORBIT

GME	.39860061 06	J	.16234500-02	H	-.57499000-05	D	.78749999-96	RE	.63781650 04	REM	.63783004 04
L	.0n7.9999-19	A	.00702497 29	B	.07800049 29	C	.0aa17a90 29	LMR	.41180761-02	AU	.14959900 09
LMM	[illegible]	GMS	.13271544 12	GMV	.32476950 06	GMA	.42977799 05	GML	.37910700 00	GMJ	.12671000 09
[illegible]	[illegible]	MGN	.49027779 04	JA	.29200000-02	MA	[illegible]	UA	.00000000 00	RA	.36170000 04
AMA	[illegible]	LG	.30679560 00	MAS	.37610000 01	GB1	[illegible]	GB2	.00000000 00	SC	.19700000 09

INJECTION CONDITIONS   MOON   2356476320312022000000000 J.D.= 2438425.87902083 JAN. 31,1964 00 57 09.000

0 DAYS 0 HRS. 0 MIN. 0.000 SEC.   2356476320312022000000000 J.D.= 2438425.87902083 JAN. 31,1964 00 57 09.000
TFL 9 DAYS 17 HRS. 7 MIN. 59.910 SEC.

GEOCENTRIC   EQUATORIAL COORDINATES

GEOCENTRIC CONIC

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

HELIOCENTRIC   EQUATORIAL COORDINATES

0 DAYS 0 HRS. 2 MIN. 51.000 SEC.
TFL 9 DAYS 17 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC   EQUATORIAL COORDINATES

HELIOCENTRIC   EQUATORIAL COORDINATES

0 DAYS 1 HRS. 2 MIN. 51.000 SEC.   JAN. 31,1964 10 00 00.000
TFL 0 DAYS 16 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC   EQUATORIAL COORDINATES

HELIOCENTRIC   EQUATORIAL COORDINATES

0 DAYS 2 HRS. 2 MIN. 51.000 SEC.   JAN. 31,1964 11 00 00.000
TFL 0 DAYS 15 HRS. 10 MIN. 50.900 SEC.

GEOCENTRIC | EQUATORIAL COORDINATES

X	-.10261170 00	Y	-.56327060 04	Z	-.09187723 04	DX	-.17160000 01	DY	-.39250930 00	DZ	.10621962 00
R	.10297300 00	DEC	-.31050667 01	RA	.10182966 03	V	.17615976 01	PTH	.77130656 02	AZ	.59910904 02
R	.10297363 00	LAT	-.31050667 01	LON	.26712103 03	VE	.13099972 02	PTE	.75330275 01	AZE	.27000040 03
RS	.05926506 00	YS	-.11265615 09	ZS	-.64515677 00	DXS	.23097601 02	DYS	.17079695 02	DZS	.77522175 01
RM	-.36316076 00	YM	.94125065 05	ZM	.74101023 05	DXM	-.36713060 00	DYM	-.90210013 00	DZM	-.33722207 00
RT	-.36316076 00	YT	.94125065 05	ZT	.74101023 05	DXT	-.36713060 00	DYT	-.90210013 00	DZT	-.33722207 00
RS	.16736409 09	VS	.32117677 02	RR	.38239762 06	VR	.10306638 01	RT	.38239762 06	VT	.10300858 01
GED	-.31272160 01	ALT	.17650550 06	LOS	.18350819 02	RAS	.31305065 01	RAM	.16966906 03	LOM	.23076163 03
GUT	.35000000 02	BT	.05999999 03	JA	.17173756 01	SHA	.14404750 06	DES	-.17900748 02	MER	.11173771 02

HELIOCENTRIC | EQUATORIAL COORDINATES

X	-.90107195 00	Y	.16265652 09	Z	.64505563 08	DX	-.24011606 02	DY	-.10760004 02	DZ	-.76659970 01
R	.19760195 09	LAT	.17562440 02	LON	.13311666 03	V	.31765709 02	PTH	.26660906 01	AZ	.10532009 03
RE	-.05924506 00	YE	-.11265615 09	ZE	.64515677 08	DXE	-.23097601 02	DYE	-.17079695 02	DZE	-.77522175 01
RT	-.90707742 00	YT	-.11275560 09	ZT	.64589580 08	DXT	-.23666510 02	DYT	-.10777603 02	DZT	-.00009605 01
LTE	.17562268 02	LGE	.13313065 03	LTT	.17570527 02	LGT	.13316027 03	VST	.14770653 09	VST	.31122692 02
EPS	.52201671 02	ESP	.55516557-01	SEP	.12766186 03	EPH	.14070601 03	EMP	.17638590 02	MEP	.21652506 02
MPS	.16255136 03	MSP	.26708259-01	SMP	.17622716 02	SEM	.14080262 03	EMS	.31918576 02	ESM	.77560677-01
EPM	.22206970 00	SPM	.50286181 02								
GLE	.06318909 02	GET	.22987507 03	SIP	.16210570 03	CPT	.88036599 02	SIN	.88390657 02	DI	.23361651 03
HEP	.18297306 00	HEP	.17615976 01	CPE	.94068506 02	CPS	.10269211 03	BZ	.22361081 00	DJ	.57969910-02

0 DAYS 3 HRS. 2 MIN. 51.000 SEC. 2356476371202020000000000 J.D.= 2438426.00008000 JAN. 31,1964 12 00 00.000
TFL 0 DAYS 20 HRS. 10 MIN. 50.999 SEC.

GEOCENTRIC | EQUATORIAL COORDINATES

X	-.10875718 00	Y	-.72432437 04	Z	-.05271556 04	DX	-.16720035 01	DY	-.39096286 00	DZ	.10051918 00
R	.10906030 00	DEC	-.20001011 01	RA	.10219813 03	V	.17213376 01	PTH	.77264173 02	AZ	.59366707 02
R	.10908030 00	LAT	-.20000011 01	LON	.23244943 03	VE	.13550172 02	PTE	.71176262 01	AZE	.27002990 03
RS	.06017713 00	YS	-.11259197 09	ZS	-.64487559 08	DXS	.23083193 02	DYS	.17090781 02	DZS	.77560865 01
RM	-.36665352 00	YM	.96876805 05	ZM	.72845637 05	DXM	-.35773571 00	DYM	-.90442235 00	DZM	-.33909707 00
RT	-.36665352 00	YT	.96876805 05	ZT	.72845637 05	DXT	-.35773571 00	DYT	-.90442235 00	DZT	-.33909707 00
RS	.16736495 09	VS	.32717766 02	RR	.38261832 06	VR	.10500706 01	RT	.38261832 06	VT	.10500706 01
GED	-.20277311 01	ALT	.18270615 06	LOS	.35928675 02	RAS	.31311115 01	RAM	.16599917 03	LOM	.21625067 03
GUT	.35000000 02	BT	.05999999 03	GR	.16709581 01	SHA	.15008831 06	DES	-.17568756 02	MER	.10901605 02

HELIOCENTRIC | EQUATORIAL COORDINATES

X	-.90190617 00	Y	.10250673 09	Z	.64478032 08	DX	-.24755997 02	DY	-.10281746 02	DZ	-.76503171 01
R	.19760600 09	LAT	.17550722 02	LON	.13315979 03	V	.31711337 02	PTH	.20500667 01	AZ	.10533130 03
RE	-.06017718 00	YE	-.11259197 09	ZE	.64487559 08	DXE	-.23083193 02	DYE	-.17090781 02	DZE	-.77560865 01
RT	-.90572163 00	YT	-.11268286 09	ZT	.64560665 08	DXT	-.23660929 02	DYT	-.10795206 02	DZT	-.00979062 01
LTE	.17560756 02	LGE	.13313316 03	LTT	.17558766 02	LGT	.13318045 03	VST	.14770576 09	VST	.31117736 02
EPS	.52679572 02	ESP	.57676959-01	SEP	.12766212 03	EPH	.14035766 03	EMP	.18370335 02	MEP	.21206017 02
MPS	.16276657 03	MSP	.26169777-01	SMP	.17728595 02	SEM	.14740198 03	EMS	.32428247 02	ESM	.79795169-01
EPM	.21749665 00	SPM	.50566581 02								
GLE	.05865591 02	GET	.22900338 03	SIP	.16220952 03	CPT	.88041937 02	SIN	.88306079 02	DI	.23031967 00
HEP	.10900636 00	HEP	.17213376 01	CPE	.94471936 02	CPS	.10260666 03	BZ	.22911566 00	DJ	.61565090-02

0 DAYS 4 HRS. 2 MIN. 51.000 SEC. 2356476411242020000000000 J.D.= 2438426.00166666 JAN. 31,1964 13 00 00.000
TFL 0 DAYS 21 HRS. 10 MIN. 50.999 SEC.

GEOCENTRIC | EQUATORIAL COORDINATES

X	-.11465982 00	Y	-.86675902 04	Z	-.01327501 04	DX	-.16341816 01	DY	-.38917309 00	DZ	.11050966 00
R	.11502602 00	DEC	-.26035155 01	RA	.10256366 03	V	.16835561 01	PTH	.77302791 02	AZ	.58816951 02
R	.11500091 00	LAT	-.26035155 01	LON	.21775367 03	VE	.13990556 02	PTE	.67435876 01	AZE	.27077905 03
RS	.06096780 00	YS	-.11252751 09	ZS	-.64459615 08	DXS	.23068573 02	DYS	.17906060 02	DZS	.77656511 01
RM	-.36572661 00	YM	.07616110 05	ZM	.71661557 05	DXM	-.34831528 00	DYM	-.90664617 00	DZM	-.34093607 00
RT	-.36572661 00	YT	.07616110 05	ZT	.71661557 05	DXT	-.34831528 00	DYT	-.90664617 00	DZT	-.34093607 00
RS	.16736582 09	VS	.32117655 02	RR	.38261936 06	VR	.10293557 01	RT	.38261936 06	VT	.10293557 01
GED	-.27117761 01	ALT	.16669676 06	LOS	.34835607 03	RAS	.31316345 01	RAM	.16652793 03	LOM	.20175817 03
GUT	.35000000 02	BT	.15920000 03	GR	.16628560 01	SHA	.15521617 06	DES	-.17557256 02	MER	.13700515 02

HELIOCENTRIC | EQUATORIAL COORDINATES

X	-.90285667 00	Y	.10251008 09	Z	.64450482 08	DX	-.24763155 02	DY	-.10795233 02	DZ	-.76549015 01
R	.19752235 09	LAT	.17539005 02	LON	.13320610 03	V	.31670990 02	PTH	.19951687 01	AZ	.10536726 03
RE	-.06096780 00	YE	-.11252751 09	ZE	.64459615 08	DXE	-.23068573 02	DYE	-.17906060 02	DZE	-.77656511 01
RT	-.90436512 00	YT	-.10261515 09	ZT	.64531276 08	DXT	-.23617266 02	DYT	-.10812706 02	DZT	-.01063000 01
LTE	.17557556 02	LGE	.13316183 03	LTT	.17566996 02	LGT	.13327032 03	VST	.14770696 09	VST	.31112713 02
EPS	.52663559 02	ESP	.61570032-01	SEP	.12727616 03	EPH	.14022231 03	EMP	.19160767 02	MEP	.20660940 02
MPS	.16295131 03	MSP	.26169777-01	SMP	.17362518 02	SEM	.14660179 03	EMS	.32937200 02	ESM	.81206261-01
EPM	.21226707 00	SPM	.51700017 02								
GLE	.05661519 02	GET	.22850606 03	SIP	.16266699 03	CPT	.88065539 02	SIN	.88377070 02	DI	.24921702 00
HEP	.11500092 00	HEP	.16835561 01	CPE	.94099903 02	CPS	.10260157 03	BZ	.23500092 00	DJ	.66587107-02

0 DAYS 5 HRS. 2 MIN. 51.000 SEC. 2356476421353020000000000 J.D.= 2438426.00333333 JAN. 31,1964 14 00 00.000
TFL 0 DAYS 22 HRS. 10 MIN. 50.999 SEC.

GEOCENTRIC | EQUATORIAL COORDINATES

X	-.12049605 00	Y	-.10051130 05	Z	-.07316757 04	DX	-.15970636 01	DY	-.38725210 00	DZ	.11239936 00
R	.12091137 00	DEC	-.26547656 01	RA	.10286049 03	V	.16479565 01	PTH	.77406006 02	AZ	.58262306 02
R	.12091137 00	LAT	-.26547656 01	LON	.20301766 03	VE	.14421060 02	PTE	.64050505 01	AZE	.27072020 03
RS	.06173607 00	YS	-.11246006 09	ZS	-.64431651 08	DXS	.23054762 02	DYS	.17921320 02	DZS	.77770623 01
RM	-.36696136 00	YM	.06366310 05	ZM	.70430975 05	DXM	-.33887676 00	DYM	-.90876561 00	DZM	-.34276328 00
RT	-.36696136 00	YT	.06366310 05	ZT	.70430975 05	DXT	-.33887676 00	DYT	-.90876561 00	DZT	-.34276328 00
RS	.16736669 09	VS	.32117566 02	RR	.38306066 06	VR	.10286040 01	RT	.38306066 06	VT	.10286040 01
GED	-.25536977 01	ALT	.19657026 06	LOS	.33317548 03	RAS	.31318651 01	RAM	.16705536 03	LOM	.18722493 03
GUT	.35000000 02	BT	.16000000 03	GR	.16000371 01	SHA	.16024307 06	DES	-.17545746 02	MER	.16996087 02

HELIOCENTRIC | EQUATORIAL COORDINATES

X	-.90379203 00	Y	.10251300 09	Z	.64422920 08	DX	-.24634606 02	DY	-.10300500 02	DZ	-.76597118 01
R	.19750550 09	LAT	.17527296 02	LON	.13324605 03	V	.31646679 02	PTH	.19421500 01	AZ	.10535500 03
RE	-.06173607 00	YE	-.11246006 09	ZE	.64431651 08	DXE	-.23054762 02	DYE	-.17921320 02	DZE	-.77770623 01
RT	-.90560760 00	YT	-.10254139 09	ZT	.64502002 08	DXT	-.23559620 02	DYT	-.10830116 02	DZT	-.01140055 01
LTE	.17545746 02	LGE	.13318831 03	LTT	.17535218 02	LGT	.13327107 03	VST	.14770617 09	VST	.31107631 02
EPS	.52035701 02	ESP	.61779961-01	SEP	.12710255 03	EPH	.13970227 03	EMP	.19629090 02	MEP	.20607020 02
MPS	.16311176 03	MSP	.26902361-01	SMP	.16006690 02	SEM	.14647223 03	EMS	.33445695 02	ESM	.81506609-01
EPM	.20716016 00	SPM	.51316676 02								
GLE	.05061060 02	GET	.22279100 03	SIP	.16263197 03	CPT	.88097106 02	SIN	.88367190 02	DI	.25132077 00
HEP	.12091137 00	HEP	.16479565 01	CPE	.93749769 02	CPS	.10267629 03	BZ	.24109935 00	DJ	.69956100-02

0 DAYS 6 HRS. 2 MIN. 51.000 SEC. 2356476441553020000000000 J.D.= 2438426.12500000 JAN. 31,1964 15 00 00.000
TFL 0 DAYS 23 HRS. 10 MIN. 50.999 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.20610612 06	Y	-.11035620 05	Z	-.03240749 06	DX	-.15636131 01	DY	-.30522540 00	DZ	.11309401 00
R	.20665075 06	DEC	-.23085476 01	RA	.18317403 03	V	.16143967 01	PTH	.77509919 02	AZ	.90200055 02
R	.20665074 06	LAT	-.23085476 01	LON	.18830293 03	VE	.14063901 02	PTE	.60972510 01	AZE	.27060906 03
XS	.96296703 00	YS	-.10239049 09	ZS	-.44403650 08	DXS	.23040499 02	DYS	.17936590 02	DZS	.77700492 01
XM	-.36816432 06	YM	.81070957 05	ZM	.69191067 05	DXM	-.32962552 00	DYM	-.91083606 00	DZM	-.34451368 00
XT	-.36816432 06	YT	.81070957 05	ZT	.69191067 05	DXT	-.32962552 00	DYT	-.91083606 00	DZT	-.34451368 00
RS	.14730596 09	VS	.30217437 02	RM	.38328221 06	VM	.10280220 01	RT	.38328221 06	VT	.10280220 01
GAD	-.23267626 01	ALT	.20027257 06	LOS	.31835770 03	RAS	.31322918 03	RAM	.16798147 03	LOM	.17270950 03
GUT	.35000000 02	DT	.19200000 06	DM	.15766736 01	SHA	.16516839 06	DES	-.17534227 02	DEM	.10400419 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.96602949 08	Y	.10238706 09	Z	.44395534 08	DX	-.24604112 02	DY	-.10321039 02	DZ	-.76647164 01
R	.14750985 09	LAT	.17519504 02	LON	.13329356 03	V	.31619599 02	PTH	.19313213 01	AZ	.10590953 03
XE	-.96296703 08	YE	.10239049 09	ZE	.44403650 08	DXE	-.23040499 02	DYE	-.17936590 02	DZE	-.77700492 01
XT	-.96626967 08	YT	.10267956 09	ZT	.44472852 08	DXT	-.23169924 02	DYT	-.10047425 02	DZT	-.01231027 01
LTE	.17534227 02	LOE	.13322918 03	LTT	.17523429 02	LOT	.13331572 03	RST	.14770333 09	VST	.31102409 02
EPS	.52995665 02	ESP	.63719410-01	SEP	.12694010 03	EPM	.13930604 03	EMP	.20542035 02	MEP	.20061119 02
MPS	.16328200 03	MSP	.22117329-01	SMP	.16694577 02	SEM	.14596331 03	EMS	.33953660 02	ESM	.03050504-01
RPM	.20231004 06	SPM	.51227027 02								
GCE	.04669548 02	GCT	.22719742 03	SIP	.16279070 03	CPT	.08847508 02	SIN	.08355617 02	D1	.29766410 00
REP	.20665075 06	VEP	.16143967 01	CPE	.03419199 02	CPS	.10267101 03	D2	.24760677 00	D3	.73709970-02

0 DAYS 7 HRS. 2 MIN. 51.000 SEC. 2356476463407070000000000 J.D.= 2438426.16666666 JAN. 31,1964 16 00 00.000
TFL 1 DAYS 0 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.21173630 06	Y	-.12810666 05	Z	-.79112070 04	DX	-.15312206 01	DY	-.30111303 00	DZ	.11539030 00
R	.21227144 06	DEC	-.21350667 01	RA	.18366649 03	V	.15026407 01	PTH	.77601516 02	AZ	.50151457 02
R	.21227144 06	LAT	-.21350667 01	LON	.17355153 03	VE	.15257976 02	PTE	.50161877 01	AZE	.27065353 03
XS	.96339704 00	YS	-.10233309 09	ZS	-.44375662 08	DXS	.23026265 02	DYS	.17951041 02	DZS	.77052722 01
XM	-.36933322 06	YM	.77788188 05	ZM	.67950662 05	DXM	-.31995008 00	DYM	-.91279590 00	DZM	-.34620067 00
XT	-.36933322 06	YT	.77788188 05	ZT	.67950662 05	DXT	-.31995008 00	DYT	-.91279590 00	DZT	-.34620067 00
RS	.14730644 09	VS	.30217329 02	RM	.38350601 06	VM	.10273540 01	RT	.38350601 06	VT	.10273540 01
GAD	-.21504086 01	ALT	.20589327 06	LOS	.30335088 03	RAS	.31127105 03	RAM	.16010670 03	LOM	.15019332 03
GUT	.35000000 02	DT	.19200000 06	DM	.15662033 01	SHA	.16999905 06	DES	-.17522690 02	DEM	.10205732 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.96551440 08	Y	.10232107 09	Z	.44367731 08	DX	-.24557672 02	DY	-.10334094 02	DZ	-.76640010 01
R	.14751366 09	LAT	.17503076 02	LON	.13313071 03	V	.31542199 02	PTH	.19024510 01	AZ	.10537769 03
XE	-.96339704 08	YE	.10233309 09	ZE	.44375662 08	DXE	-.23026265 02	DYE	-.17951041 02	DZE	-.77052722 01
XT	-.96709037 08	YT	.10241168 09	ZT	.44443592 08	DXT	-.23346201 02	DYT	-.10066437 02	DZT	-.01315700 01
LTE	.17522690 02	LOE	.13327185 03	LTT	.17511631 02	LOT	.13335955 03	RST	.14770240 09	VST	.31007207 02
EPS	.53145973 02	ESP	.65610602-01	SEP	.12678799 03	EPM	.13910538 03	EMP	.21245994 02	MEP	.19660221 02
MPS	.16344640 03	MSP	.24228320-01	SMP	.16531025 02	SEM	.14545506 03	EMS	.34460602 02	ESM	.04510202-01
RPM	.19698076 06	SPM	.51624180 02								
GCE	.04316104 02	GCT	.22680935 03	SIP	.16294173 03	CPT	.08846570 02	SIN	.08341054 02	D1	.20420020 00
REP	.21227144 06	VEP	.15020407 01	CPE	.93106315 02	CPS	.10266572 03	D2	.25309233 00	D3	.70410117-02

0 DAYS 8 HRS. 2 MIN. 51.000 SEC. 2356476501662070000000000 J.D.= 2438426.20833333 JAN. 31,1964 17 00 00.000
TFL 1 DAYS 1 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.21719290 06	Y	-.14193962 05	Z	-.74934395 04	DX	-.15005355 01	DY	-.30093104 00	DZ	.11660023 00
R	.21770525 06	DEC	-.19717902 01	RA	.18373906 03	V	.15525236 01	PTH	.77766123 02	AZ	.90092110 02
R	.21770525 06	LAT	-.19717902 01	LON	.15878503 03	VE	.15664094 02	PTE	.55505564 01	AZE	.27062104 03
XS	.96422576 00	YS	-.10226924 09	ZS	-.44347600 08	DXS	.23011977 02	DYS	.17967004 02	DZS	.77010717 01
XM	-.37046800 06	YM	.74498926 05	ZM	.66700900 05	DXM	-.31047691 00	DYM	-.91466909 00	DZM	-.34794082 00
XT	-.37046800 06	YT	.74498926 05	ZT	.66700900 05	DXT	-.31047691 00	DYT	-.91466909 00	DZT	-.34794082 00
RS	.14730731 09	VS	.30217221 02	RM	.38372599 06	VM	.10266850 01	RT	.38372599 06	VT	.10266850 01
GAD	-.19052160 01	ALT	.21140707 06	LOS	.28016048 03	RAS	.31331451 03	RAM	.16662900 03	LOM	.14367577 03
GUT	.35000000 02	DT	.19200000 06	DM	.15172670 01	SHA	.17473940 06	DES	-.17511162 02	DEM	.10010747 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.96639766 08	Y	.10225905 09	Z	.44340116 08	DX	-.24512512 02	DY	-.10360015 02	DZ	-.76751919 01
R	.14751740 09	LAT	.17492169 02	LON	.13330283 03	V	.31546144 02	PTH	.18753990 01	AZ	.10590015 03
XE	-.96422576 08	YE	.10226924 09	ZE	.44347600 08	DXE	-.23011977 02	DYE	-.17967004 02	DZE	-.77010717 01
XT	-.96793042 08	YT	.10234174 09	ZT	.44414300 08	DXT	-.23122456 02	DYT	-.10081753 02	DZT	-.01390204 01
LTE	.17511162 02	LOE	.13331451 03	LTT	.17499026 02	LOT	.13340336 03	RST	.14770161 09	VST	.31002026 02
EPS	.53287001 02	ESP	.68170191-01	SEP	.12664515 03	EPM	.13882732 03	EMP	.21940167 02	MEP	.19232504 02
MPS	.16360706 03	MSP	.18504685-01	SMP	.16176135 02	SEM	.14494761 03	EMS	.34967099 02	ESM	.05376062-01
RPM	.19200119 06	SPM	.51608014 02								
GCE	.03981627 02	GCT	.22635750 03	SIP	.16300500 03	CPT	.08844362 02	SIN	.08320660 02	D1	.27110316 00
REP	.21770525 06	VEP	.15525236 01	CPE	.92009413 02	CPS	.10266043 03	D2	.26075062 00	D3	.03366301-02

0 DAYS 9 HRS. 2 MIN. 51.000 SEC. 2356476517502070000000000 J.D.= 2438426.25000000 JAN. 31,1964 18 00 00.000
TFL 1 DAYS 2 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.22294400 06	Y	-.15561305 05	Z	-.70712636 04	DX	-.14713076 01	DY	-.37069220 00	DZ	.11700405 00
R	.22319745 06	DEC	-.18155276 01	RA	.18399991 03	V	.15230969 01	PTH	.77044675 02	AZ	.90020920 02
R	.22319745 06	LAT	-.18155276 01	LON	.14400461 03	VE	.16062594 02	PTE	.53215642 01	AZE	.27050156 03
XS	.96505396 00	YS	-.10220453 09	ZS	-.44319566 08	DXS	.22997697 02	DYS	.17982318 02	DZS	.77006672 01
XM	-.37156066 06	YM	.71202069 05	ZM	.65445272 05	DXM	-.30098290 00	DYM	-.91645435 00	DZM	-.34961306 00
XT	-.37156066 06	YT	.71202069 05	ZT	.65445272 05	DXT	-.30098290 00	DYT	-.91645435 00	DZT	-.34961306 00
RS	.14730819 09	VS	.30217112 02	RM	.38394815 06	VM	.10260161 01	RT	.38394815 06	VT	.10260161 01
GAD	-.18270915 01	ALT	.21681976 06	LOS	.27336207 03	RAS	.31335717 03	RAM	.16915204 03	LOM	.12015605 03
GUT	.35000000 02	DT	.19200000 06	DM	.14097306 01	SHA	.17939577 06	DES	-.17499615 02	DEM	.09161036 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.96727036 08	Y	.10218097 09	Z	.44312672 08	DX	-.24469000 02	DY	-.10361010 02	DZ	-.76600231 01
R	.14752109 09	LAT	.17480461 02	LON	.13342741 03	V	.31541316 02	PTH	.18490026 01	AZ	.10540706 03
XE	-.96505396 08	YE	.10220453 09	ZE	.44319566 08	DXE	-.22997697 02	DYE	-.17982318 02	DZE	-.77006672 01
XT	-.96876962 08	YT	.10227573 09	ZT	.44384908 08	DXT	-.23290600 02	DYT	-.10096772 02	DZT	-.01466009 01
LTE	.17499615 02	LOE	.13335717 03	LTT	.17488013 02	LOT	.13344716 03	RST	.14770070 09	VST	.31006706 02
EPS	.53410522 02	ESP	.69238196-01	SEP	.12651060 03	EPM	.13856215 03	EMP	.22626542 02	MEP	.18011302 02
MPS	.16375245 03	MSP	.20982361-01	SMP	.16227741 02	SEM	.14444463 03	EMS	.35472951 02	ESM	.06796676-01
RPM	.18707111 06	SPM	.51762059 02								
GCE	.03643696 02	GCT	.22580183 03	SIP	.16322109 03	CPT	.08841157 02	SIN	.08300757 02	D1	.27024030 00
REP	.22319745 06	VEP	.15230969 01	CPE	.92527856 02	CPS	.10265516 03	D2	.26780962 00	D3	.08678730-02

0 DAYS 10 HRS. 2 MIN. 51.000 SEC. 2356476533542070000000000 J.D.= 2438426.29166666 JAN. 31,1964 19 00 00.000
TFL 1 DAYS 3 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.22770063 06	Y	-.16920502 05	Z	-.66450900 04	DX	-.10436300 01	DY	-.37640000 00	DZ	.11000071 00
R	.22051285 06	DEC	-.16663817 01	RA	.10424871 03	V	.16966370 01	PTH	.77917216 02	AZ	.50961220 02
R	.22051284 06	LAT	-.16663817 01	LON	.12971205 03	VE	.16451949 02	PTE	.51020479 01	AZE	.27056470 03
XS	.96508162 08	YS	-.10213976 09	ZS	-.44291456 08	DXS	.22981606 02	DYS	.17997544 02	DZS	.70050506 01
XM	-.37263507 06	YM	.67900541 05	ZM	.64183714 05	DXM	-.29147703 00	DYM	-.91815189 00	DZM	-.35124372 00
XT	-.37263507 06	YT	.67900541 05	ZT	.64183714 05	DXT	-.29147703 00	DYT	-.91815189 00	DZT	-.35124372 00
RS	.14730907 09	VS	.30217006 02	RM	.38417044 06	VM	.10253457 01	RT	.38417044 06	VT	.10253457 01
GEO	-.16777313 01	ALT	.22213466 06	LOS	.25836565 03	RAS	.31339982 03	RAM	.16967302 03	LOM	.11463685 03
DUT	.35000000 02	DT	.19200000 06	DR	.14634766 01	SHA	.18390566 06	DES	-.17600000 02	DEM	.96175619 00

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.96015958 08	Y	.10212204 09	Z	.44204818 08	DX	-.24427043 02	DY	-.10373050 02	DZ	-.76061900 01
R	.14752473 09	LAT	.17440793 02	LON	.13347194 03	V	.31517607 02	PTH	.10250769 01	AZ	.10941577 03
XE	-.96508162 08	YE	.10213976 09	ZE	.44291456 08	DXE	-.22981606 02	DYE	-.17997544 02	DZE	-.70050506 01
XT	-.96960797 08	YT	.10220766 09	ZT	.44355639 08	DXT	-.23276883 02	DYT	-.10915695 02	DZT	-.81563022 01
LTE	.17400960 02	LOE	.13339902 03	LTT	.17476189 02	LOT	.13349095 03	RST	.14769970 09	VST	.31081328 02
EPS	.53544723 02	ESP	.70982504-01	SEP	.12630453 03	EPM	.13830937 03	EMP	.23304607 02	MEP	.10385933 02
MPS	.16309550 03	MSP	.20982341-01	SMP	.16004096 02	SEM	.14393410 03	EMS	.39970160 02	ESM	.07914051-01
RPM	.10210622 06	SPM	.51944838 02								
GCE	.01361334 02	GCT	.22530239 03	SIP	.16394905 03	CPT	.08837011 02	SIN	.00291363 02	D1	.20570064 00
REP	.22051285 06	VEP	.14966320 01	CPE	.92257909 02	CPS	.10264904 03	D2	.27523852 00	D3	.96364627-02

0 DAYS 11 HRS. 2 MIN. 51.000 SEC. 2356476551602020000000 J.D.= 2438426.33333333 JAN. 31,1964 20 00 00.000
TFL 1 DAYS 4 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.23293775 06	Y	-.10271391 05	Z	-.62153085 04	DX	-.14171050 01	DY	-.37400207 00	DZ	.11905002 00
R	.23373509 06	DEC	-.15237400 01	RA	.10448503 03	V	.14706100 01	PTH	.77904917 02	AZ	.50092703 02
R	.23373509 06	LAT	-.15237400 01	LON	.11640781 03	VE	.16830442 02	PTE	.49003092 01	AZE	.27094016 03
XS	.96670876 08	YS	-.10207494 09	ZS	-.44263349 08	DXS	.22969103 02	DYS	.18012759 02	DZS	.70116465 01
XM	-.37366726 06	YM	.64592271 05	ZM	.62916359 05	DXM	-.28196029 00	DYM	-.91976184 00	DZM	-.35283065 00
XT	-.37366726 06	YT	.64592271 05	ZT	.62916359 05	DXT	-.28196029 00	DYT	-.91976184 00	DZT	-.35283065 00
RS	.14730995 09	VS	.30216099 02	RM	.38439283 06	VM	.10246740 01	RT	.38439283 06	VT	.10246740 01
GEO	-.15961190 01	ALT	.22735770 06	LOS	.24356526 03	RAS	.31364266 03	RAM	.17019274 03	LOM	.10011951 03
DUT	.35000000 02	DT	.19200000 06	DR	.14384018 01	SHA	.18045059 06	DES	-.17476497 02	DEM	.96206033 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.96903813 08	Y	.10209667 09	Z	.44257134 08	DX	-.24386289 02	DY	-.10380042 02	DZ	-.76917076 01
R	.14752833 09	LAT	.17457067 02	LON	.13351643 03	V	.31494930 02	PTH	.10032220 01	AZ	.10942087 03
XE	-.96670876 08	YE	.10207494 09	ZE	.44263349 08	DXE	-.22969103 02	DYE	-.18012759 02	DZE	-.70116465 01
XT	-.97064563 08	YT	.10213956 09	ZT	.44326266 08	DXT	-.23251063 02	DYT	-.10932521 02	DZT	-.81644068 01
LTE	.17476497 02	LOE	.13344246 03	LTT	.17464359 02	LOT	.13353473 03	RST	.14769883 09	VST	.31075892 02
EPS	.53661694 02	ESP	.73354886-01	SEP	.12626511 03	EPM	.13806650 03	EMP	.23974737 02	MEP	.17996677 02
MPS	.16603222 03	MSP	.18504685-01	SMP	.15998848 02	SEM	.14342861 03	EMS	.36482739 02	ESM	.00192423-01
RPM	.17734252 06	SPM	.52090060 02								
GCE	.03072963 02	GCT	.22491930 03	SIP	.16367167 03	CPT	.00832012 02	SIN	.00271458 02	D1	.29391386 00
REP	.23373509 06	VEP	.14706100 01	CPE	.92080914 02	CPS	.10264454 03	D2	.28294294 00	D3	.10040588-01

0 DAYS 12 HRS. 2 MIN. 51.000 SEC. 2356476571642020000000 J.D.= 2438426.37500000 JAN. 31,1964 21 00 00.000
TFL 1 DAYS 5 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.23799301 06	Y	-.19613066 05	Z	-.57822152 04	DX	-.15919244 01	DY	-.37172665 00	DZ	.12073707 00
R	.23807065 06	DEC	-.13070637 01	RA	.10471120 03	V	.14457564 01	PTH	.78046103 02	AZ	.50017433 02
R	.23807065 06	LAT	-.13070637 01	LON	.99592997 02	VE	.17216172 02	PTE	.47124590 01	AZE	.27051766 03
XS	.96753541 08	YS	-.10201007 09	ZS	-.44235215 08	DXS	.22954787 02	DYS	.10027967 02	DZS	.70182302 01
XM	-.37466510 06	YM	.61270352 05	ZM	.61643320 05	DXM	-.27243352 00	DYM	-.92170639 00	DZM	-.35439707 00
XT	-.37466510 06	YT	.61270352 05	ZT	.61643320 05	DXT	-.27243352 00	DYT	-.92170630 00	DZT	-.35439707 00
RS	.14739082 09	VS	.30216793 02	RM	.38461530 06	VM	.10240033 01	RT	.38461530 06	VT	.10240033 01
GEO	-.13965125 01	ALT	.23249246 06	LOS	.22830681 03	RAS	.31348510 03	RAM	.17071123 03	LOM	.09592932 02
DUT	.35000000 02	DT	.19200000 06	DR	.14144151 01	SHA	.19287574 06	DES	-.17664023 02	DEM	.02227240 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.96991536 08	Y	.10199065 09	Z	.44229633 08	DX	-.24346712 02	DY	-.10599696 02	DZ	-.76974951 01
R	.14753187 09	LAT	.17445337 02	LON	.13356089 03	V	.31473203 02	PTH	.17810872 01	AZ	.10944211 03
XE	-.96753541 08	YE	.10201007 09	ZE	.44235215 08	DXE	-.22954787 02	DYE	-.10027967 02	DZE	-.70182302 01
XT	-.97128206 08	YT	.10707134 09	ZT	.44296858 08	DXT	-.23227221 02	DYT	-.10949251 02	DZT	-.01726201 01
LTE	.17464923 02	LOE	.13340510 03	LTT	.17452518 02	LOT	.13357049 03	RST	.14769786 09	VST	.31070400 02
EPS	.53772475 02	ESP	.75328913-01	SEP	.12615262 03	EPM	.13783910 03	EMP	.24636816 02	MEP	.17523705 02
MPS	.16416203 03	MSP	.20982341-01	SMP	.15818905 02	SEM	.14292327 03	EMS	.36966673 02	ESM	.00112050-01
RPM	.17253642 06	SPM	.52242440 02								
GCE	.02797366 02	GCT	.22447273 03	SIP	.16358866 03	CPT	.08826239 02	SIN	.00290071 02	D1	.30109869 00
REP	.23807065 06	VEP	.14457564 01	CPE	.91755065 02	CPS	.10263923 03	D2	.29104024 00	D3	.10700120-01

0 DAYS 13 HRS. 2 MIN. 51.000 SEC. 2356476607782020000000 J.D.= 2438426.41666666 JAN. 31,1964 22 00 00.000
TFL 1 DAYS 6 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.24296093 06	Y	-.20947796 05	Z	-.53460082 04	DX	-.13677619 01	DY	-.36936307 00	DZ	.12154665 00
R	.24392089 06	DEC	-.12550686 01	RA	.10492770 03	V	.14219583 01	PTH	.78107233 02	AZ	.50736687 02
R	.24392089 06	LAT	-.12550686 01	LON	.84760429 02	VE	.17580018 02	PTE	.45379661 01	AZE	.27049090 03
XS	.96836151 08	YS	-.10194514 09	ZS	-.44207061 08	DXS	.22940461 02	DYS	.18043165 02	DZS	.70240101 01
XM	-.37562878 06	YM	.57959121 05	ZM	.60364735 05	DXM	-.26289773 00	DYM	-.92271969 00	DZM	-.35592229 00
XT	-.37562878 06	YT	.57959121 05	ZT	.60364735 05	DXT	-.26289773 00	DYT	-.92271969 00	DZT	-.35592229 00
RS	.14739171 09	VS	.30214687 02	RM	.38483700 06	VM	.10233316 01	RT	.38483700 06	VT	.10233316 01
GEO	-.12644263 01	ALT	.23754770 06	LOS	.21136036 03	RAS	.31352773 03	RAM	.17122049 03	LOM	.71060132 02
DUT	.35000000 02	DT	.19200000 06	DR	.13914360 01	SHA	.19722005 06	DES	-.17653364 02	DEM	.98249606 00

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.97070113 08	Y	.10192419 09	Z	.44201716 08	DX	-.24308225 02	DY	-.10612500 02	DZ	-.77032095 01
R	.14753537 09	LAT	.17431626 02	LON	.13360531 03	V	.31452353 02	PTH	.17613475 01	AZ	.10945940 03
XE	-.96836153 08	YE	.10194514 09	ZE	.44207061 08	DXE	-.22940461 02	DYE	-.18043165 02	DZE	-.70240101 01
XT	-.97211701 08	YT	.10200119 09	ZT	.44267425 08	DXT	-.23703359 02	DYT	-.10965806 02	DZT	-.01807324 01
LTE	.17453364 02	LOE	.13352773 03	LTT	.17440669 02	LOT	.13362224 03	RST	.14769668 09	VST	.31064051 02
EPS	.53877036 02	ESP	.75975525-01	SEP	.12604617 03	EPM	.13762165 03	EMP	.25291029 02	MEP	.17087916 02
MPS	.16428798 03	MSP	.19639311-01	SMP	.15694870 02	SEM	.14241099 03	EMS	.37409961 02	ESM	.09604001-01
RPM	.16776463 06	SPM	.52378706 02								
GCE	.02533679 02	GCT	.22404289 03	SIP	.16369694 03	CPT	.08819761 02	SIN	.08227206 02	D1	.31087269 00
REP	.24392089 06	VEP	.14219583 01	CPE	.91519606 02	CPS	.10263303 03	D2	.29952046 00	D3	.11420704-01

0 DAYS 14 HRS. 2 MIN. 51.000 SEC. 2356476625762020000000 J.D.= 2438426.45833333 JAN. 31,1964 23 00 00.000
TFL 1 DAYS 7 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

R	-.20704293 06	V	-.22273110 05	Z	-.40071609 04	DR	-.13666296 01	DV	-.26009501 00	DZ	.12220646 00
G	.20809011 06	DEC	-.11707278 01	RA	.10513525 03	V	.15991471 01	PTH	.70162732 02	AZ	.50050405 02
G	.20809011 06	LAT	-.11707278 01	LON	.09951627 02	VE	.17953630 02	PTE	.43704177 01	AZE	.47047792 03
RS	.06910716 08	VS	-.10108615 09	ZS	-.44172879 08	DRS	.22424177 02	DVS	.10058355 02	DZS	.70311062 04
RM	-.37655809 06	VM	.9563406 05	ZM	.59068719 05	DRM	-.25135378 00	DVM	-.92406703 00	DZM	-.30741136 00
RT	-.37655809 06	VT	.5663406 05	ZT	.59068719 05	DRT	-.25135378 00	DVT	-.92406703 00	DZT	-.30741136 00
RS	.16739539 09	VS	.50716507 02	RM	.30506032 06	VM	.17225595 01	DT	.50506012 06	VT	.30226995 04
LON	-.11374246 01	ALT	.24251191 06	LOS	.19036994 03	RAS	.31357036 03	RAM	.17170655 03	LOM	.06506120 02
DUT	.39000000 02	DT	.19200000 04	DM	.13603930 01	DMA	.20104475 06	DES	-.17041751 02	DEM	.00230409 04

HELIOCENTRIC — EQUATORIAL COORDINATES

R	-.97106550 08	V	.10105700 09	Z	.44173972 08	DR	-.24270766 02	DV	-.10425290 02	DZ	-.77000047 04
G	.16753003 09	LAT	.17671012 02	LON	.13364970 03	V	.31632317 02	PTH	.17623670 01	AZ	.50557409 02
RE	-.96918716 08	VE	.16180015 09	ZE	.44178879 08	DRE	-.22726127 02	DVE	-.10058355 02	DZE	-.70311062 04
RT	-.97295376 08	VT	.16195670 09	ZT	.44237950 08	DRT	-.23117975 02	DVT	-.10542522 02	DZT	-.01307979 04
LTE	.17441751 02	LOE	.13357036 03	LTT	.17428813 02	LOT	.13364590 03	RST	.16769586 09	VST	.31050247 02
EPS	.53975799 02	RSP	.70196577-01	SEP	.12590595 03	EPM	.13761440 03	EMP	.25937650 02	MEP	.16440061 02
RPS	.16440642 03	RSP	.10504685-01	SMP	.15576572 02	SLM	.16191525 03	EMS	.37902600 02	ESM	.06903210-04
RPM	.16562612 06	SPM	.5/527301 02								
GCE	.02280353 02	GCT	.22363099 03	SIP	.16379663 03	CPT	.00012636 02	SIN	.00202066 02	DI	.31029990 00
REP	.26400011 06	VEP	.13991471 01	CPE	.01293198 02	CPS	.10262861 03	DZ	.30043305 00	DD	.12190646-04

0 DAYS 19 HRS. 2 MIN. 51.000 SEC. 2436476.00000000 J.D.- 2430426.00000000 FEB. 1,1964 00 00 00.000
TPL 1 DAYS 0 HRS. 16 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

R	-.25204337 06	V	-.23509712 05	Z	-.44456536 04	DR	-.13324357 01	DV	-.30450770 00	DZ	.12700644 00
G	.25378157 06	DEC	-.10062537 01	RA	.10513635 03	V	.13772536 01	PTH	.70213006 02	AZ	.50557409 02
G	.25378156 06	LAT	-.10062537 01	LON	.95092797 02	VE	.18313676 02	PTE	.42210056 01	AZE	.27044032 03
RS	.07001223 08	VS	-.10101512 09	ZS	-.44150676 08	DRS	.22911771 02	DVS	.10073534 02	DZS	.70379502 04
RM	-.37765791 06	VM	.5130598 05	ZM	.57791416 05	DRM	-.25366280 00	DVM	-.92532911 00	DZM	-.39066512 00
RT	-.37765791 06	VT	.5130598 05	ZT	.57791416 05	DRT	-.25366280 00	DVT	-.92532911 00	DZT	-.39066512 00
RS	.16739540 09	VS	.50216477 02	RM	.30526281 06	VM	.12219013 01	DT	.30520281 06	VT	.30219073 04
LON	-.10151233 01	ALT	.24740337 06	LOS	.18137165 03	RAS	.31361290 03	RAM	.17225941 03	LOM	.42017074 02
DUT	.39000000 02	DT	.19200000 04	DM	.13602226 01	DMA	.20570609 06	DES	-.17430152 02	DEM	.00267704 04

HELIOCENTRIC — EQUATORIAL COORDINATES

R	-.97253006 08	V	.10179152 09	Z	.44144218 08	DR	-.24234207 02	DV	-.10430042 02	DZ	-.77149717 04
G	.16754225 09	LAT	.17410196 02	LON	.13369405 03	V	.31413030 02	PTH	.17241344 01	AZ	.50562756 03
RE	-.97001223 08	VE	.16181512 09	ZE	.44150676 08	DRE	-.22911771 02	DVE	-.10073534 02	DZE	-.70379502 04
RT	-.97370675 08	VT	.10186662 09	ZT	.44708667 08	DRT	-.23155574 02	DVT	-.10590863 02	DZT	-.01906752 04
LTE	.17430152 02	LOE	.13361290 03	LTT	.17416947 02	LOT	.13370970 03	RST	.16769483 09	VST	.31052547 02
EPS	.54269140 02	RSP	.79745169-01	SEP	.12565040 03	EPM	.13721021 03	EMP	.26576151 02	MEP	.16700631 02
RPS	.16451976 03	RSP	.13968227-01	SMP	.15963068 02	SLM	.16162216 03	EMS	.30494610 02	ESM	.05311329-04
RPM	.15831210 06	SPM	.52679062 02								
GCE	.02371143 02	GCT	.22323067 03	SIP	.16309101 03	CPT	.00004986 02	SIN	.00170067 02	DI	.31000067 00
REP	.25378157 06	VEP	.13772536 01	CPE	.01876103 02	CPS	.10262330 03	DZ	.31700735 00	DD	.10020490-04

0 DAYS 20 HRS. 2 MIN. 51.000 SEC. 2436476.08333333 J.D.- 2430426.08333333 FEB. 1,1964 01 00 00.000
TPL 1 DAYS 9 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

R	-.25730553 06	V	-.24097547 05	Z	-.40217211 04	DR	-.13011361 01	DV	-.30200657 00	DZ	.12363760 00
G	.25859829 06	DEC	-.09109977 00	RA	.10552560 03	V	.13562168 01	PTH	.70244417 02	AZ	.50457160 02
G	.25859829 06	LAT	-.09109977 00	LON	.00243001 02	VE	.18667756 02	PTE	.40709047 01	AZE	.27044404 03
RS	.07081687 08	VS	-.10175002 09	ZS	-.44122444 08	DRS	.22897408 02	DVS	.10088707 02	DZS	.70445263 04
RM	-.37811340 06	VM	.4707259 05	ZM	.54496032 05	DRM	-.23424519 00	DVM	-.92650378 00	DZM	-.36420360 00
RT	-.37811340 06	VT	.4707259 05	ZT	.54496032 05	DRT	-.23424519 00	DVT	-.92650378 00	DZT	-.36420360 00
RS	.16739436 09	VS	.50716512 02	RM	.30550526 06	VM	.12213151 01	DT	.30550526 06	VT	.30213151 04
LON	-.09717142 00	ALT	.25722.089 06	LOS	.18037299 03	RAS	.31365560 03	RAM	.17277909 03	LOM	.27099400 02
DUT	.39000000 02	DT	.19200000 04	DM	.13278076 01	DMA	.20904235 06	DES	-.17418543 02	DEM	.00272100 04

HELIOCENTRIC — EQUATORIAL COORDINATES

R	-.97361047 08	V	.10172512 09	Z	.44118426 08	DR	-.24198942 02	DV	-.10450767 02	DZ	-.77200007 04
G	.16754564 09	LAT	.17390477 02	LON	.13373837 03	V	.31394443 02	PTH	.17066523 01	AZ	.50564022 03
RE	-.97002602 08	VE	.10175002 09	ZE	.44122444 08	DRE	-.22897408 02	DVE	-.10088707 02	DZE	-.70445263 04
RT	-.97401995 08	VT	.10179799 09	ZT	.44179943 08	DRT	-.23112653 02	DVT	-.10515210 02	DZT	-.02040100 04
LTE	.17418543 02	LOE	.13365560 03	LTT	.17405072 02	LOT	.13373361 03	RST	.16769377 09	VST	.31047076 02
EPS	.54157400 02	RSP	.81264261-01	SEP	.12571111 03	EPM	.13723264 03	EMP	.27207156 02	MEP	.15760590 02
RPS	.16442762 03	RSP	.15639313-01	SMP	.15396570 02	SLM	.16490973 03	EMS	.30999009 02	ESM	.00194071-04
RPM	.15362601 06	SPM	.52744130 02								
GCE	.01803090 02	GCT	.22295795 03	SIP	.16390053 03	CPT	.00190616 02	SIN	.00149521 02	DI	.30003162 00
REP	.25859829 06	VEP	.13562168 01	CPE	.00066077 02	CPS	.10261790 03	DZ	.32709216 00	DD	.13034607-04

0 DAYS 21 HRS. 2 MIN. 51.000 SEC. 2436476.08333333 J.D.- 2430426.08333333 FEB. 1,1964 02 00 00.000
TPL 1 DAYS 10 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

R	-.26201232 06	V	-.24190539 05	Z	-.39795125 04	DR	-.12006037 01	DV	-.29995527 00	DZ	.12452720 00
G	.26339315 06	DEC	-.07794005 00	RA	.10570957 03	V	.13159816 01	PTH	.70511312 02	AZ	.50360001 02
G	.26339312 06	LAT	-.07794005 00	LON	.25385904 02	VE	.19016697 02	PTE	.39444041 01	AZE	.27042004 03
RS	.07106090 08	VS	-.10104047 09	ZS	-.44096193 08	DRS	.22803033 02	DVS	.10103070 02	DZS	.70510904 04
RM	-.37913948 06	VM	.4443187 05	ZM	.55197605 05	DRM	-.22468250 00	DVM	-.92759190 00	DZM	-.36166406 00
RT	-.37913948 06	VT	.4443187 05	ZT	.55197605 05	DRT	-.22468250 00	DVT	-.92759190 00	DZT	-.36166406 00
RS	.16739525 09	VS	.50216269 02	RM	.30572761 06	VM	.10206429 01	DT	.30572761 06	VT	.10206429 04
LON	-.70325136 00	ALT	.25604493 06	LOS	.15.37644 03	RAS	.31369021 03	RAM	.17329561 03	LOM	.12.21036 02
DUT	.39000000 02	DT	.19200000 04	DM	.13002772 01	DMA	.21392004 06	DES	-.17404025 02	DEM	.02272309 04

HELIOCENTRIC — EQUATORIAL COORDINATES

R	-.97420102 08	V	.10163000 09	Z	.44090017 08	DR	-.24103006 02	DV	-.10462665 02	DZ	-.77200302 04
G	.16754899 09	LAT	.17306756 02	LON	.13370765 03	V	.31376048 02	PTH	.16904662 01	AZ	.50560004 03
RE	-.97160090 08	VE	.10166007 09	ZE	.44090193 08	DRE	-.22463033 02	DVE	-.10103070 02	DZE	-.70510904 04
RT	-.97545279 08	VT	.10172951 09	ZT	.44149300 08	DRT	-.23107715 02	DVT	-.10631642 02	DZT	-.02127974 04
LTE	.17404025 02	LOE	.13369021 03	LTT	.17393109 02	LOT	.13379711 03	RST	.16769270 09	VST	.31042107 02
EPS	.54264401 02	RSP	.82755475-01	SEP	.12567605 03	EPM	.13726490 03	EMP	.27036492 02	MEP	.15318525 02
RPS	.16472019 03	RSP	.95111702-02	SMP	.15296623 02	SLM	.16908799 03	EMS	.30906605 02	ESM	.04072702-04
RPM	.16405946 06	SPM	.52653379 02								
GCE	.01577540 02	GCT	.22249376 03	SIP	.16408280 03	CPT	.00707796 02	SIN	.00120040 02	DI	.30003024 00
REP	.26339315 06	VEP	.13159816 01	CPE	.00069460 02	CPS	.10261293 03	DZ	.33013952 00	DD	.14004700-04

0 DAYS 22 HRS. 2 MIN. 51.000 SEC. 2436476.16666667 J.D.- 2430426.16666667 FEB. 1,1964 03 00 00.000
TPL 1 DAYS 11 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.26658726 06	Y	-.27400615 05	Z	-.31278417 06	DE	-.12609744 01	DY	-.35711209 00	DZ	.12403704 00
R	.26601874 06	DEC	-.66852012 00	RA	.10580671 03	V	.13164991 01	PTH	.70356634 02	AZ	.50781732 02
R	.26601679 06	LAT	-.66852012 00	LON	.10571900 02	VR	.19360495 02	PTE	.30187177 01	AZE	.27061492 03
RS	.97248441 00	VS	-.10161967 09	ZS	-.44065971 08	DAS	.22864646 02	DYS	.10119022 02	DES	.70576511 04
RR	-.37991111 06	VR	.41294030 05	ZR	.53092970 05	DRR	-.21511515 00	DYR	-.92459360 00	DZR	-.36301490 00
RT	-.37991111 06	VT	.41294030 05	ZT	.51892970 05	DRT	-.21511513 00	DYT	-.92459360 00	DZT	-.36301490 00
RS	.16735616 09	VS	.30216165 02	[illegible]	.38594906 06	VR	.10199709 01	RT	.38594906 06	VT	.10199700 01
GED	-.67307552 00	ALT	.20164054 06	LOS	.13037600 03	RAS	.31374401 03	RAR	.17379697 03	LON	.35043724 03
GUT	.35000000 02	DT	.19200000 04	DR	.12094065 03	SMA	.21793046 06	DES	-.17395290 02	DEN	.06260952 04

HELIOCENTRIC — EQUATORIAL COORDINATES

[illegible]

0 DAYS 19 HRS. 2 MIN. 51.000 SEC. J.D.= 2438426.666666 FEB. 1,1964 04 00 00.000
TPL 1 DAYS 12 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

[illegible]

HELIOCENTRIC — EQUATORIAL COORDINATES

[illegible]

0 DAYS 20 HRS. 2 MIN. 51.000 SEC. J.D.= 2438426.7083333 FEB. 1,1964 05 00 00.000
TPL 1 DAYS 13 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

[illegible]

HELIOCENTRIC — EQUATORIAL COORDINATES

[illegible]

0 DAYS 21 HRS. 2 MIN. 51.000 SEC. J.D.= 2438426.7500000 FEB. 1,1964 06 00 00.000
TPL 1 DAYS 14 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

[illegible]

HELIOCENTRIC — EQUATORIAL COORDINATES

[illegible]

0 DAYS 22 HRS. 2 MIN. 51.000 SEC. J.D.= 2438426.7916666 FEB. 1,1964 07 00 00.000
TPL 1 DAYS 15 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC | EQUATORIAL COORDINATES

X	-.20421981 06	Y	-.32556533 05	Z	-.13136432 06	DX	-.11092063 01	DY	-.34690452 00	DZ	.12700957 00
R	.28607740 06	DEC	-.26309088 00	RA	.18653467 03	V	.12452876 01	PTH	.78519485 02	AZ	.57652737 02
R	.28607740 06	LAT	-.26309088 00	LON	.31100567 03	VE	.20687911 02	PTE	.33818170 01	AZE	.27036702 03
RS	.97577149 00	VS	-.10135837 09	ZS	-.63952507 00	DAS	.22810978 02	DVS	.18179540 02	AZS	.70030535 01
RM	-.38275307 06	VM	.27097960 05	ZM	.48628585 05	DAM	-.17681808 00	DVM	-.93174215 00	AZM	-.36009429 00
RT	-.38275307 06	VT	.27097960 05	ZT	.48628585 05	DAT	-.17681808 00	DVT	-.93174215 00	AZT	-.36009429 00
HS	.16739971 09	VS	.30215755 02	HM	.30683710 06	VM	.10172066 01	HT	.30683710 06	VT	.10172066 01
GED	.26489182 00	ALT	.27469920 06	LOS	.78582167 02	RAS	.31391111 03	RAM	.17583122 03	LOM	.30036222 03
OUT	.35000000 02	DT	.19700000 04	DR	.12203725 01	SHA	.23363704 00	DES	-.17360702 02	DEM	.72216940 00

HELIOCENTRIC | EQUATORIAL COORDINATES

X	-.97061960 00	Y	.10132576 09	Z	.43951267 00	DX	-.24000184 02	DY	-.10526533 02	DZ	-.77560439 01
R	.14756527 09	LAT	.17320087 02	LON	.13600363 03	V	.31295525 02	PTH	.16200005 01	AZ	.10557017 03
RE	-.97577545 00	VE	.10135832 09	ZE	.43952502 00	DAE	-.22810978 02	DVE	-.18179549 02	AZE	-.70030535 01
RT	-.97960098 00	VT	.10158621 09	ZT	.44001218 00	DAT	-.22987796 02	DVT	-.19111291 02	AZT	-.82519077 01
LTE	.17360702 02	LOE	.13391117 03	LTT	.17333649 02	LOT	.13401537 03	RST	.14760700 09	VST	.31012404 02
EPS	.54595261 02	ESP	.90112050-01	SEP	.12531410 03	EPM	.13613100 03	EMP	.30030460 02	MEP	.13030326 02
MPS	.16516554 03	MSP	.13988227-01	SMP	.14821951 02	SEM	.13790076 03	EMS	.41990843 02	ESM	.99099033-01
RPM	.12593070 06	SPM	.53317767 02								
GLE	.00557667 02	GLT	.22099054 03	SIP	.16437612 03	CPT	.08736279 02	SIN	.07944066 02	D1	.61336258 00
REP	.28607740 06	VEP	.12452876 01	CPE	.89755788 02	CPS	.10258597 03	D2	.44098245 00	D3	.21523560-01

0 DAYS 23 HRS. 2 MIN. 51.000 SEC. 2356477024402070000000000 J.D.= 2438426.83333333 FEB. 1,1964 08 00 00.000
TFL 1 DAYS 16 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC | EQUATORIAL COORDINATES

X	-.28044733 06	Y	-.33801019 05	Z	-.85545161 05	DX	-.11720449 01	DY	-.34439306 00	DZ	.12754057 00
R	.29044214 06	DEC	-.16875490 00	RA	.18644113 03	V	.12209992 01	PTH	.78550092 02	AZ	.57473667 02
R	.29044214 06	LAT	-.16875490 00	LON	.29611307 03	VE	.21008494 02	PTE	.32869610 01	AZE	.27035010 03
RS	.97659433 00	VS	-.10129284 09	ZS	-.43924191 00	DAS	.22796532 02	DVS	.18194657 02	AZS	.70003961 01
RM	-.38337238 06	VM	.24542619 05	ZM	.47301474 05	DAM	-.16726138 00	DVM	-.93231572 00	AZM	-.36922601 00
RT	-.38337238 06	VT	.24542619 05	ZT	.47301474 05	DAT	-.16726138 00	DVT	-.93231572 00	AZT	-.36922601 00
HS	.16760060 09	VS	.30215654 02	HM	.38709833 06	VM	.10166170 01	HT	.38709833 06	VT	.10166170 01
GED	-.16996093 00	ALT	.28400394 06	LOS	.63383676 02	RAS	.31395374 03	RAM	.17633705 03	LOM	.20576099 03
OUT	.35000000 02	DT	.19200000 04	DR	.12045765 01	SHA	.23717842 00	DES	-.17337832 02	DEM	.70195207 00

HELIOCENTRIC | EQUATORIAL COORDINATES

X	-.97947900 00	Y	.10125904 09	Z	.43923336 00	DX	-.23969377 02	DY	-.10519051 02	DZ	-.77620535 01
R	.14756043 09	LAT	.17316345 02	LON	.13404770 03	V	.31280414 02	PTH	.16000109 01	AZ	.10550107 03
RE	-.97659433 00	VE	.10129284 09	ZE	.43924191 00	DAE	-.22796532 02	DVE	-.18194657 02	AZE	-.70003961 01
RT	-.98042805 00	VT	.10131738 09	ZT	.43971492 00	DAT	-.22961773 02	DVT	-.19126973 02	AZT	-.82596201 01
LTE	.17337632 02	LOE	.13395374 03	LTT	.17321717 02	LOT	.13405097 03	RST	.14760580 09	VST	.31000407 02
EPS	.54656934 02	ESP	.91995710-01	SEP	.12525297 03	EPM	.13601606 03	EMP	.31606640 02	MEP	.12577277 02
MPS	.16523741 03	MSP	.98911782-02	SMP	.14750500 02	SEM	.13741006 03	EMS	.42607513 02	ESM	.10111276 00
RPM	.12136737 06	SPM	.53396641 02								
GLE	.00372039 02	GLT	.22076420 03	SIP	.16441031 03	CPT	.08720491 02	SIN	.07905396 02	D1	.42000706 00
REP	.29044214 06	VEP	.12209992 01	CPE	.89590755 02	CPS	.10258062 03	D2	.41624436 00	D3	.23290150-01

1 DAYS 0 HRS. 2 MIN. 51.000 SEC. 2356477042442020000000000 J.D.= 2438426.87500000 FEB. 1,1964 09 00 00.000
TFL 1 DAYS 17 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC | EQUATORIAL COORDINATES

X	-.29266099 06	Y	-.35036132 05	Z	-.30536200 05	DX	-.11570634 01	DY	-.34177330 00	DZ	.12007900 00
R	.29475098 06	DEC	-.76050726-01	RA	.18682672 03	V	.12132638 01	PTH	.78596466 02	AZ	.57277636 02
R	.29475097 06	LAT	-.76050726-01	LON	.28121559 03	VE	.21325331 02	PTE	.31970416 01	AZE	.27036094 03
RS	.97741479 00	VS	-.10122731 09	ZS	-.43895773 00	DAS	.22782073 02	DVS	.18209757 02	AZS	.70960300 01
RM	-.38395720 06	VM	.21185360 05	ZM	.45970200 05	DAM	-.15766536 00	DVM	-.93280439 00	AZM	-.37036200 00
RT	-.38395720 06	VT	.21185360 05	ZT	.45970200 05	DAT	-.15766536 00	DVT	-.93280439 00	AZT	-.37036260 00
HS	.16760150 09	VS	.30215552 02	HM	.38727925 06	VM	.10159402 01	HT	.38727925 06	VT	.10159402 01
GED	-.27374465-01	ALT	.28837277 06	LOS	.46385181 02	RAS	.31399630 03	RAM	.17684182 03	LOM	.27125070 03
OUT	.35000000 02	DT	.19200000 04	DR	.11893127 01	SHA	.24000040 00	DES	-.17325351 02	DEM	.68178090 00

HELIOCENTRIC | EQUATORIAL COORDINATES

X	-.98036139 00	Y	.10119220 09	Z	.43895378 00	DX	-.23939136 02	DY	-.10591930 02	DZ	-.77680520 01
R	.14757159 09	LAT	.17304597 02	LON	.13409182 03	V	.31266541 02	PTH	.15966754 01	AZ	.10546097 03
RE	-.97741479 00	VE	.10122731 09	ZE	.43895773 00	DAE	-.22782073 02	DVE	-.18209757 02	AZE	-.70960300 01
RT	-.98125436 00	VT	.10124850 09	ZT	.43941743 00	DAT	-.22939730 02	DVT	-.19142561 02	AZT	-.82672936 01
LTE	.17325351 02	LOE	.13399631 03	LTT	.17309776 02	LOT	.13410257 03	RST	.14760450 09	VST	.31000200 02
EPS	.54711267 02	ESP	.93513123-01	SEP	.12519523 03	EPM	.13591165 03	EMP	.31974169 02	MEP	.12116340 02
MPS	.16530417 03	MSP	.13908227-01	SMP	.14606329 02	SEM	.13691361 03	EMS	.42965767 02	ESM	.10279207 00
RPM	.11681446 06	SPM	.53671351 02								
GLE	.00191665 02	GLT	.22055450 03	SIP	.16445315 03	CPT	.08712160 02	SIN	.07861145 02	D1	.44562753 00
REP	.29475098 06	VEP	.12132638 01	CPE	.89630614 02	CPS	.10257527 03	D2	.43205367 00	D3	.23260065-01

1 DAYS 1 HRS. 2 MIN. 51.000 SEC. 2356477860562020000000000 J.D.= 2438426.91666666 FEB. 1,1964 10 00 00.000
TFL 1 DAYS 18 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC | EQUATORIAL COORDINATES

X	-.29679000 06	Y	-.36201757 05	Z	.64727329 05	DX	-.11610417 01	DY	-.33911042 00	DZ	.12063190 00
R	.29900502 06	DEC	.12786356-01	RA	.18696966 03	V	.11900000 01	PTH	.78636903 02	AZ	.57061046 02
R	.29900501 06	LAT	.12786356-01	LON	.26631346 03	VE	.21637991 02	PTE	.31110992 01	AZE	.27030041 03
RS	.97823670 00	VS	-.10116173 09	ZS	-.43867331 00	DAS	.22767602 02	DVS	.18224048 02	AZS	.70036630 01
RM	-.38450757 06	VM	.17826510 05	ZM	.44634898 05	DAM	-.14809092 00	DVM	-.93320038 00	AZM	-.37166377 00
RT	-.38450757 06	VT	.17826510 05	ZT	.44634898 05	DAT	-.14809092 00	DVT	-.93320038 00	AZT	-.37166377 00
HS	.16740240 09	VS	.30215451 02	HM	.38749985 06	VM	.10152803 01	HT	.38749985 06	VT	.10152803 01
GED	.12073691-01	ALT	.29262761 06	LOS	.33386677 02	RAS	.31403807 03	RAM	.17734535 03	LOM	.25660736 03
OUT	.35000000 02	DT	.19200000 04	DR	.11745688 01	SHA	.24450971 00	DES	-.17313062 02	DEM	.66144059 00

HELIOCENTRIC | EQUATORIAL COORDINATES

X	-.98120260 00	Y	.10112967 09	Z	.43867390 00	DX	-.23909444 02	DY	-.10563966 02	DZ	-.77740329 01
R	.14757671 09	LAT	.17292856 02	LON	.13411588 03	V	.31252665 02	PTH	.15959910 01	AZ	.10542086 03
RE	-.97823670 00	VE	.10116173 09	ZE	.43867331 00	DAE	-.22767602 02	DVE	-.18224048 02	AZE	-.70036630 01
RT	-.98207977 00	VT	.10117955 09	ZT	.43911966 00	DAT	-.22915093 02	DVT	-.19158056 02	AZT	-.82749276 01
LTE	.17313062 02	LOE	.13403687 03	LTT	.17297825 02	LOT	.13414615 03	RST	.14760136 09	VST	.30990105 02
EPS	.54764320 02	ESP	.94616423-01	SEP	.12514070 03	EPM	.13581742 03	EMP	.32532916 02	MEP	.11660465 02
MPS	.16536576 03	MSP	.139[illegible]77-01	SMP	.14623291 02	SEM	.13641701 03	EMS	.43679940 02	ESM	.10597090 00
RPM	.11227057 06	SPM	.5[illegible]6 02								
GLE	.00016205 02	GLT	.22037090 03	SIP	.16448027 03	CPT	.08699270 02	SIN	.07813001 02	D1	.46366750 00
REP	.29900502 06	VEP	.11900000 01	CPE	.89275096 02	CPS	.10256991 03	D2	.45055129 00	D3	.27060060-01

1 DAYS 2 HRS. 2 MIN. 51.000 SEC. 2356477076542020000000000 J.D.= 2438426.95833333 FEB. 1,1964 11 00 00.000
TFL 1 DAYS 19 HRS. 10 MIN. 50.900 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.30080291 06	Y	-.37677760 05	Z	.93002623 03	DX	-.11271650 01	DY	-.33642336 00	DZ	.12920677 00
R	.30320848 06	DEC	.10030016 00	RA	.18710015 03	V	.11031716 01	PTH	.78673900 02	AZ	.56626700 02
R	.30320847 06	LAT	.10030016 00	LON	.25140689 03	VE	.21944018 02	PTE	.30306409 01	AZE	.27013267 03
XS	.97905407 00	YS	-.10109609 09	ZS	-.63030070 08	DXS	.22753119 02	DYS	.10239929 02	DZS	.79099020 01
XM	-.30502347 06	YM	.14466364 05	ZM	.63295702 05	DXM	-.11051695 00	DYM	-.93352793 00	DZM	-.37252909 00
XT	-.30502347 06	YT	.14466364 05	ZT	.63295702 05	DXT	-.11051695 00	DYT	-.93352793 00	DZT	-.37252909 00
RS	.14740331 09	VS	.30219151 02	RM	.38772009 06	VM	.10146136 01	RT	.38772009 06	VT	.10146136 01
GED	.10099173 00	ALT	.29683027 06	LOS	.18308160 02	RAS	.31600163 03	RAM	.17706025 03	LOM	.26219609 03
OUT	.35000000 02	DT	.19200000 04	DR	.11603700 01	SMA	.29610219 06	DES	-.17301965 02	DEM	.66116067 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.98206209 00	Y	.10105061 09	Z	.63019401 08	DX	-.23060283 02	DY	-.10576352 02	DZ	-.77007000 01
R	.14757701 09	LAT	.17201070 02	LON	.13417991 03	V	.31239279 02	PTH	.15759264 01	AZ	.10563673 03
XE	-.97905407 00	VE	.10109609 09	ZE	.63030070 08	DXE	-.22753119 02	DYE	-.10239929 02	DZE	-.79099020 01
XT	-.98290430 00	VT	.10111056 09	ZT	.63882165 08	DXT	-.22091630 02	DYT	-.19177657 02	DZT	-.02025226 01
LTE	.17301965 02	LOE	.13408143 03	LTT	.17205868 02	LOT	.13418972 03	RST	.14760200 09	VST	.30907000 02
EPS	.54014277 02	ESP	.97165361-01	SEP	.12508960 03	EPM	.13573627 03	EMP	.33002514 02	MEP	.11108203 02
MPS	.16562190 03	MSP	.13900227-01	SMP	.14567686 02	SEM	.13592105 03	EMS	.63974306 02	ESM	.10607082 00
RPM	.10773621 06	SPM	.93600970 02								
GCE	.79045350 02	GCT	.22021519 03	SIP	.16449923 03	CPT	.08605740 02	SIM	.07762991 02	D1	.46319612 00
REP	.30320848 06	VEP	.11033736 01	CPE	.09123960 02	CPS	.10256455 03	D2	.46950368 00	D3	.29967503-01

1 DAYS 3 HRS. 2 MIN. 51.000 SEC. 23564771146020200000000 J.D.= 2438427.0000000 FEB. 1,1964 12 00 00.000
TFL 1 DAYS 20 HRS. 10 MIN. 50.909 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.30491500 06	Y	-.38683956 05	Z	.99703390 03	DX	-.11130172 01	DY	-.33360157 00	DZ	.12900672 00
R	.30736070 06	DEC	.18566656 00	RA	.18723037 03	V	.11691080 01	PTH	.70713927 02	AZ	.56561714 02
R	.30736077 06	LAT	.18566056 00	LON	.23669606 03	VE	.22251955 02	PTE	.29515915 01	AZE	.27032900 03
XS	.97907296 00	YS	-.10103060 09	ZS	-.63010381 08	DXS	.22730676 02	DYS	.10255003 02	DZS	.79165100 01
XM	-.30550492 06	YM	.11105204 05	ZM	.61952725 05	DXM	-.12095020 00	DYM	-.93376336 00	DZM	-.37356005 00
XT	-.30550492 06	YT	.11105204 05	ZT	.61952723 05	DXT	-.12095020 00	DYT	-.93376336 00	DZT	-.37356005 00
RS	.14740621 09	VS	.30215251 02	RM	.38793996 06	VM	.10139677 01	RT	.38793996 06	VT	.10139677 01
GED	.10712783 00	ALT	.30090257 06	LOS	.33696561 01	RAS	.31612398 03	RAM	.17036996 03	LOM	.22761961 03
OUT	.35000000 02	DT	.19200000 04	DR	.11665706 01	SMA	.25106000 06	DES	-.17290250 02	DEM	.62002000 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.98292211 00	Y	.10099171 09	Z	.63011370 08	DX	-.23051641 02	DY	-.10500604 02	DZ	-.77067112 01
R	.14758090 09	LAT	.17269312 02	LON	.13622392 03	V	.31226156 02	PTH	.15665001 01	AZ	.10564056 03
XE	-.97907296 00	VE	.10103060 09	ZE	.63010381 08	DXE	-.22730676 02	DYE	-.10255003 02	DZE	-.79165100 01
XT	-.98372000 00	VT	.10104150 09	ZT	.63052333 08	DXT	-.22067574 02	DYT	-.19180766 02	DZT	-.02000700 01
LTE	.17290250 02	LOE	.13612390 03	LTT	.17279902 02	LOT	.13623327 03	RST	.14760000 09	VST	.30901600 02
EPS	.54061195 02	ESP	.97017601-01	SEP	.12504110 03	EPM	.13566204 03	EMP	.33622504 02	MEP	.10715062 02
MPS	.16567273 03	MSP	.15639013-01	SMP	.14517223 02	SEM	.13542573 03	EMS	.64460636 02	ESM	.10630136 00
RPM	.10320392 06	SPM	.53672176 02								
GCE	.79670096 02	GCT	.22000926 03	SIP	.16450966 03	CPT	.08671535 02	SIM	.07700270 02	D1	.50661257 00
REP	.30736070 06	VEP	.11601000 01	CPE	.08976077 02	CPS	.10259019 03	D2	.46030505 00	D3	.32753237-01

1 DAYS 4 HRS. 2 MIN. 51.000 SEC. 23564771326420200000000 J.D.= 2438427.0416666 FEB. 1,1964 13 00 00.000
TFL 1 DAYS 21 HRS. 10 MIN. 50.909 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.30089725 06	Y	-.39000190 05	Z	.14654716 04	DX	-.10901937 01	DY	-.33000006 00	DZ	.12000976 00
R	.31146643 06	DEC	.26950615 00	RA	.18735660 03	V	.11556665 01	PTH	.70755206 02	AZ	.56270667 02
R	.31146642 06	LAT	.26950615 00	LON	.22158109 03	VE	.22553530 02	PTE	.20003109 01	AZE	.27031025 03
XS	.98069130 00	YS	-.10096665 09	ZS	-.61781060 08	DXS	.22726117 02	DYS	.10270067 02	DZS	.79230390 01
XM	-.30595192 06	YM	.77433680 04	ZM	.60606097 05	DXM	-.11930556 00	DYM	-.93391690 00	DZM	-.37655600 00
XT	-.30595192 06	YT	.77433680 04	ZT	.60606097 05	DXT	-.11930556 00	DYT	-.93391600 00	DZT	-.37655660 00
RS	.14740511 09	VS	.30215151 02	RM	.38815936 06	VM	.10132031 01	RT	.38815936 06	VT	.10132031 01
GED	.27142120 00	ALT	.30500622 06	LOS	.36039113 03	RAS	.31616052 03	RAM	.17005065 03	LOM	.21307523 03
OUT	.35000000 02	DT	.19200000 04	DR	.11333120 01	SMA	.29514900 06	DES	-.17270541 02	DEM	.60060000 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.98370027 00	Y	.10092677 09	Z	.63703333 08	DX	-.23023510 02	DY	-.10600952 02	DZ	-.77029922 01
R	.14758356 09	LAT	.17257541 02	LON	.13626790 03	V	.31213651 02	PTH	.15577302 01	AZ	.10566260 03
XE	-.98069130 00	VE	.10096665 09	ZE	.63781060 08	DXE	-.22726117 02	DYE	-.10270067 02	DZE	-.79230390 01
XT	-.98455081 00	VT	.10097230 09	ZT	.63822676 08	DXT	-.22063502 02	DYT	-.19203902 02	DZT	-.02079956 01
LTE	.17270541 02	LOE	.13616633 03	LTT	.17261920 02	LOT	.13627601 03	RST	.14767951 09	VST	.30970700 02
EPS	.54905163 02	ESP	.99150609-01	SEP	.12499578 03	EPM	.13560260 03	EMP	.34152304 02	MEP	.10265212 02
MPS	.16551771 03	MSP	.90911702-02	SMP	.14672707 02	SEM	.13493105 03	EMS	.64962332 02	ESM	.10060000 00
RPM	.98678325 05	SPM	.53731810 02								
GCE	.79516630 02	GCT	.21999569 03	SIP	.16451026 03	CPT	.08650552 02	SIM	.07049106 02	D1	.52750301 00
REP	.31146643 06	VEP	.11556665 01	CPE	.08833961 02	CPS	.10255302 03	D2	.51290726 00	D3	.35062601-01

1 DAYS 5 HRS. 2 MIN. 51.000 SEC. 23564771507026260000000 J.D.= 2438427.0833333 FEB. 1,1964 14 00 00.000
TFL 1 DAYS 22 HRS. 10 MIN. 50.909 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.31203133 06	Y	-.41000251 05	Z	.19362961 04	DX	-.10062092 01	DY	-.32002373 00	DZ	.13113063 00
R	.31552119 06	DEC	.35161643 00	RA	.18747861 03	V	.11422060 01	PTH	.70790560 02	AZ	.55946166 02
R	.31552110 06	LAT	.35161643 00	LON	.20666215 03	VE	.22851716 02	PTE	.20100060 01	AZE	.27031192 03
XS	.98150911 00	YS	-.10009005 09	ZS	-.63753336 08	DXS	.22709599 02	DYS	.10285120 02	DZS	.79299561 01
XM	-.30630650 06	YM	.63011122 04	ZM	.59255955 05	DXM	-.10982504 00	DYM	-.93390282 00	DZM	-.37951767 00
XT	-.30630650 06	YT	.63011122 04	ZT	.59255955 05	DXT	-.10982504 00	DYT	-.93390282 00	DZT	-.37951767 00
RS	.14740002 09	VS	.30215052 02	RM	.38837036 06	VM	.10126190 01	RT	.38837036 06	VT	.10126190 01
GED	.35401256 00	ALT	.30916799 06	LOS	.11330260 03	RAS	.31420900 03	RAM	.17935033 03	LOM	.19053307 03
OUT	.35000000 02	DT	.19200000 04	DR	.11205260 01	SMA	.25060706 06	DES	-.17266019 02	DEM	.50011090 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.98463762 00	Y	.10085770 09	Z	.63755272 08	DX	-.23795000 02	DY	-.10613164 02	DZ	-.77096267 01
R	.14758701 09	LAT	.17245766 02	LON	.13631105 03	V	.31201101 02	PTH	.15490150 01	AZ	.10567610 03
XE	-.98150911 00	VE	.10009005 09	ZE	.63753336 08	DXE	-.22709599 02	DYE	-.10285120 02	DZE	-.79299561 01
XT	-.98517275 00	VT	.10090173 09	ZT	.63792592 08	DXT	-.22019426 02	DYT	-.19219103 02	DZT	-.03000735 01
LTE	.17266019 02	LOE	.13620906 03	LTT	.17269945 02	LOT	.13632033 03	RST	.14767019 09	VST	.30960070 02
EPS	.54966230 02	ESP	.00009613-01	SEP	.12695316 03	EPM	.13555505 03	EMP	.34671200 02	MEP	.07737709 02
MPS	.16555602 03	MSP	.27653512-10	SMP	.16636260 02	SEM	.13663701 03	EMS	.65655107 02	ESM	.10767302 00
RPM	.96135976 05	SPM	.53767676 02								
GCE	.79351066 02	GCT	.21993737 03	SIP	.16650070 03	CPT	.08666600 02	SIM	.07906667 02	D1	.58700001 00
REP	.31552119 06	VEP	.11422060 01	CPE	.08666663 02	CPS	.10256066 03	D2	.55702677 00	D3	.39000010-01

1 DAYS 6 HRS. 2 MIN. 51.000 SEC. 23564771667626260000000 J.D.= 2438427.1250000 FEB. 1,1964 15 00 00.000
TFL 1 DAYS 23 HRS. 10 MIN. 50.909 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.31671916 06	Y	-.42241881 05	Z	.24096066 06	DX	-.10737044 01	DY	-.32500629 00	DZ	.13107402 00
R	.31953279 06	DEC	.43200801 00	RA	.10759689 03	V	.11295633 01	PTH	.70044364 02	AZ	.95503406 02
R	.31953279 06	LAT	.43200801 00	LON	.19173937 03	VE	.23144624 02	PTE	.27442709 01	AZE	.27630610 03
XS	.98232641 08	YS	-.10083300 09	ZS	-.43724777 08	DXS	.22695067 02	DYS	.18300167 02	DZS	.79360094 01
XM	-.38674267 06	YM	.10187667 06	ZM	.37902611 05	DXM	-.10027182 00	DYM	-.93396744 00	DZM	-.37044317 00
XT	-.38674267 06	YT	.10187667 06	ZT	.37902611 05	DXT	-.10027182 00	DYT	-.93396744 00	DZT	-.37044317 00
RS	.14740692 09	VS	.30214953 02	RM	.30859686 06	VM	.10119500 01	RT	.30859686 06	VT	.10119500 01
GED	.43301248 00	ALT	.31319459 06	LOS	.31839407 03	RAS	.31425160 03	RAM	.17064907 03	LOM	.18390154 03
OUT	.35000000 02	DT	.19200000 04	GM	.11062209 01	SMA	.26202137 06	DES	-.17255004 02	DEM	.35073830 06

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.98549360 08	Y	.10079075 09	Z	.43727187 08	DX	-.23760772 02	DY	-.10629253 02	DZ	-.70041068 01
R	.14759004 09	LAT	.17233986 02	LON	.13435570 03	V	.31189100 02	PTH	.15422183 01	AZ	.10940990 03
XE	-.98232641 08	VE	.10083300 09	ZE	.43724777 08	DXE	-.22695067 02	DVE	-.18300167 02	DZE	-.79360094 01
XT	-.98619383 08	YT	.10083401 09	ZT	.43762679 08	DXT	-.22795339 02	DYT	-.10234134 02	DZT	-.03125125 01
LTE	.17255084 02	LOE	.13425160 03	LTT	.17237954 02	LOT	.13436384 03	AST	.14767689 09	VST	.30962513 02
EPS	.54984476 02	ESP	.10159538 00	SEP	.12491380 03	EPM	.13552104 03	EMP	.35178340 02	MEP	.95000051 04
MPS	.16558902 03	MSP	.27453512-10	SMP	.14402319 02	SEM	.13394360 03	EMS	.45947036 02	ESM	.10012650 00
RPM	.09635427 05	SPM	.53040755 02								
GCE	.79202919 02	GCT	.21991770 03	SIP	.16447992 03	CPT	.00623620 02	SIN	.07514723 02	D1	.30070439 00
REP	.31953279 06	VEP	.11295633 01	CPE	.08550964 02	CPS	.10256306 03	D2	.56515735 00	D3	.43705405-04

1 DAYS 7 HRS. 2 MIN. 51.000 SEC. 235647720500702600000000 J.D.= 2438427.1666666 FEB. 1,1964 16 00 00.000
TFL 2 DAYS 0 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.32056263 06	Y	-.43400763 05	Z	.20050706 06	DX	-.10616459 01	DY	-.32205007 00	DZ	.13260009 00
R	.32350096 06	DEC	.51112951 00	RA	.10771161 03	V	.11173270 01	PTH	.70003366 02	AZ	.95179910 02
R	.32350095 06	LAT	.51112951 00	LON	.17601201 03	VE	.23430413 02	PTE	.26811560 01	AZE	.27030079 03
XS	.98316316 08	YS	-.10076709 09	ZS	-.43696199 08	DXS	.22600526 02	DYS	.18315202 02	DZS	.79425705 01
XM	-.38708646 06	YM	-.23433538 04	ZM	.36545607 05	DXM	-.00724612-01	DYM	-.93386900 00	DZM	-.37733308 00
XT	-.38708646 06	YT	-.23433538 04	ZT	.36545607 05	DXT	-.00724612-01	DYT	-.93386900 00	DZT	-.37733300 00
RS	.14740703 09	VS	.30214054 02	RM	.38881487 06	VM	.10112977 01	RT	.38881487 06	VT	.10112977 01
GED	.51461256 00	ALT	.31712275 06	LOS	.30339555 03	RAS	.31429412 03	RAM	.18034685 03	LOM	.16944026 03
OUT	.35000000 02	DT	.19200000 04	GM	.10963999 01	SMA	.26539398 06	DES	-.17263343 02	DEM	.33932240 06

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.98634076 08	Y	.10072368 09	Z	.43699004 08	DX	-.23742171 02	DY	-.10637260 02	DZ	-.70000005 01
R	.14759105 09	LAT	.17222201 02	LON	.13439970 03	V	.31177436 02	PTH	.15355290 01	AZ	.10970956 03
XE	-.98316316 08	VE	.10076709 09	ZE	.43696199 08	DXE	-.22600526 02	DVE	-.18315202 02	DZE	-.79425705 01
XT	-.98701400 08	YT	.10076474 09	ZT	.43732744 08	DXT	-.22771250 02	DYT	-.10249071 02	DZT	-.03199123 01
LTE	.17243363 02	LOE	.13429612 03	LTT	.17225957 02	LOT	.13440733 03	AST	.14767550 09	VST	.30950057 02
EPS	.55019901 02	ESP	.10279207 00	SEP	.12487707 03	EPM	.13550152 03	EMP	.35672636 02	MEP	.00250321 04
MPS	.16561636 03	MSP	.27453512-10	SMP	.14377620 02	SEM	.13345083 03	EMS	.44630040 02	ESM	.10000700 00
RPM	.05115224 05	SPM	.53040210 02								
GCE	.79051383 02	GCT	.21994086 03	SIP	.16444635 03	CPT	.00605779 02	SIN	.07437773 02	D1	.44108500 00
REP	.32350096 06	VEP	.11173270 01	CPE	.00420683 02	CPS	.10253760 03	D2	.99510520 00	D3	.40000212-04

1 DAYS 8 HRS. 2 MIN. 51.000 SEC. 235647722304202000000000 J.D.= 2438427.2083333 FEB. 1,1964 17 00 00.000
TFL 2 DAYS 1 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.32436366 06	Y	-.44560570 05	Z	.33651673 06	DX	-.10501260 01	DY	-.31092182 00	DZ	.13350400 00
R	.32742747 06	DEC	.58886900 00	RA	.10702224 03	V	.11055075 01	PTH	.70944315 02	AZ	.94715406 02
R	.32742747 06	LAT	.58886900 00	LON	.16108250 03	VE	.23727234 02	PTE	.26211217 01	AZE	.27029900 03
XS	.98399941 08	YS	-.10070112 09	ZS	-.43667593 08	DXS	.22665971 02	DYS	.18330229 02	DZS	.79490037 01
XM	-.38739590 06	YM	-.57049911 04	ZM	.35185650 05	DXM	-.81104201-01	DYM	-.93360704 00	DZM	-.37810962 00
XT	-.38739590 06	YT	-.57049911 04	ZT	.35185650 05	DXT	-.81104201-01	DYT	-.93360704 00	DZT	-.37810962 00
RS	.14740074 09	VS	.30214756 02	RM	.38903233 06	VM	.10106390 01	RT	.38903233 06	VT	.10106390 01
GED	.59280261 00	ALT	.32104927 06	LOS	.28039690 03	RAS	.31433665 03	RAM	.18004370 03	LOM	.15400406 03
OUT	.35000000 02	DT	.19200000 04	GM	.10050766 01	SMA	.26072600 06	DES	-.17231902 02	DEM	.31098120 06

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.98720306 08	Y	.10065656 09	Z	.43670956 08	DX	-.23716090 02	DY	-.10640151 02	DZ	-.70150068 01
R	.14759605 09	LAT	.17210409 02	LON	.13444350 03	V	.31166106 02	PTH	.15296149 01	AZ	.10571714 03
XE	-.98399941 08	VE	.10070112 09	ZE	.43667593 08	DXE	-.22665971 02	DVE	-.18330229 02	DZE	-.79490037 01
XT	-.98783336 08	YT	.10069942 09	ZT	.43702770 08	DXT	-.22747155 02	DYT	-.19263917 02	DZT	-.03272704 01
LTE	.17231592 02	LOE	.13433465 03	LTT	.17213950 02	LOT	.13445081 03	AST	.14767413 09	VST	.30949956 02
EPS	.55052520 02	ESP	.10467032 00	SEP	.12484315 03	EPM	.13549700 03	EMP	.36152716 02	MEP	.03493063 04
MPS	.16563193 03	MSP	.96911702-02	SMP	.14360307 02	SEM	.13295070 03	EMS	.44930836 02	ESM	.10092184 00
RPM	.00593017 05	SPM	.53936907 02								
GCE	.78903057 02	GCT	.22001100 03	SIP	.16439030 03	CPT	.00506366 02	SIN	.07352024 02	D1	.04900000 00
REP	.32742747 06	VEP	.11055075 01	CPE	.00297672 02	CPS	.10251229 03	D2	.62901070 00	D3	.54330996-04

1 DAYS 9 HRS. 2 MIN. 51.000 SEC. 235647724110282000000000 J.D.= 2438427.2500000 FEB. 1,1964 18 00 00.000
TFL 2 DAYS 2 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.32812423 06	Y	-.45702055 05	Z	.30470422 06	DX	-.10391602 01	DY	-.31549500 00	DZ	.13490305 00
R	.33131415 06	DEC	.66544057 00	RA	.10702944 03	V	.10941613 01	PTH	.70004104 02	AZ	.94190862 02
R	.33131415 06	LAT	.66544057 00	LON	.16694872 03	VE	.24013250 02	PTE	.25640701 01	AZE	.27020160 03
XS	.98477512 08	YS	-.10063511 09	ZS	-.43638965 08	DXS	.22651404 02	DYS	.18345240 02	DZS	.79555050 01
XM	-.38767100 06	YM	-.90658172 04	ZM	.33822679 05	DXM	-.71652310-01	DYM	-.93342421 00	DZM	-.37901064 00
XT	-.38767100 06	YT	-.90658172 04	ZT	.33822679 05	DXT	-.71652310-01	DYT	-.93342421 00	DZT	-.37901064 00
RS	.14740965 09	VS	.30214657 02	RM	.38924923 06	VM	.10099820 01	RT	.38924923 06	VT	.10099820 01
GED	.66991698 00	ALT	.32493594 06	LOS	.27159044 03	RAS	.31437916 03	RAM	.18133963 03	LOM	.16035001 03
OUT	.35000000 02	DT	.19200000 04	GM	.10742700 01	SMA	.27261057 06	DES	-.17219034 02	DEM	.49060367 06

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.98805636 08	Y	.10058960 09	Z	.43642013 08	DX	-.23690573 02	DY	-.10660903 02	DZ	-.70209011 01
R	.14759906 09	LAT	.17198611 02	LON	.13448745 03	V	.31155103 02	PTH	.15269426 01	AZ	.10573064 03
XE	-.98477512 08	VE	.10063511 09	ZE	.43638965 08	DXE	-.22651404 02	DVE	-.18345240 02	DZE	-.79555050 01
XT	-.98865183 08	YT	.10062606 09	ZT	.43672780 08	DXT	-.22723094 02	DYT	-.19270672 02	DZT	-.03345994 01
LTE	.17219834 02	LOE	.13437916 03	LTT	.17201937 02	LOT	.13449427 03	AST	.14767273 09	VST	.30943011 02
EPS	.55082390 02	ESP	.10517696 00	SEP	.12481205 03	EPM	.13551186 03	EMP	.36616092 02	MEP	.70712382 04
MPS	.16564079 03	MSP	.27453512-10	SMP	.14351809 02	SEM	.13246719 03	EMS	.47421603 02	ESM	.11166704 00
RPM	.76069501 05	SPM	.53079303 02								
GCE	.78757751 02	GCT	.22013673 03	SIP	.16433306 03	CPT	.00565319 02	SIN	.07296390 02	D1	.00662001 00
REP	.33131415 06	VEP	.10941613 01	CPE	.00171791 02	CPS	.10252090 03	D2	.66661690 00	D3	.01000001-04

1 DAYS 10 HRS. 2 MIN. 51.000 SEC. 235647725714202000000000 J.D.= 2438427.2916666 FEB. 1,1964 19 00 00.000
TFL 2 DAYS 3 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.33106639 06	Y	-.46833106 05	Z	.43343730 04	DX	-.10200052 01	DY	-.31225241 00	DZ	.13072637 00
R	.33516207 06	DEC	.74097733 00	RA	.10003304 03	V	.10036767 01	PTH	.70066007 02	AZ	.53592613 02
R	.33516207 06	LAT	.74097733 00	LON	.13201129 03	VE	.24296634 02	PTE	.25099237 01	AZE	.27020702 03
XS	.90559032 08	YS	-.10056904 09	ZS	-.43610315 08	DXS	.22636025 02	DYS	.10360257 02	DZS	.79620023 01
XM	-.30791101 06	YM	-.12425551 05	ZM	.32456815 05	DXM	-.62129260-01	DYM	-.93307046 00	DZM	-.37079638 00
XT	-.30791101 06	YT	-.12425551 05	ZT	.32456815 05	DXT	-.62129260-01	DYT	-.93307046 00	DZT	-.37079638 00
RS	.14741056 09	VS	.30214560 02	RM	.30964554 06	VM	.10093269 01	RT	.30964554 06	VT	.10093269 01
GED	.74602636 00	ALT	.32878467 06	LOS	.25039988 03	RAS	.31442167 03	RAM	.10103466 03	LON	.12501200 03
DUT	.35000000 02	DT	.19200000 04	DM	.10640093 01	SMA	.27527277 06	DES	-.17200065 02	DEM	.47003022 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.98890078 08	Y	.10052221 09	Z	.43614649 08	DX	-.23663630 02	DY	-.18672409 02	DZ	-.70263560 01
R	.14760202 09	LAT	.17106810 02	LON	.13453129 03	V	.31144433 02	PTH	.15704018 01	AZ	.10576402 03
XE	-.90559032 08	YE	.10056904 09	ZE	.43610315 08	DXE	-.22636025 02	DYE	-.10360257 02	DZE	-.79620023 01
XT	-.98944943 08	YT	.10055461 09	ZT	.43642771 08	DXT	-.22690954 02	DYT	-.19293335 02	DZT	-.03418707 01
LTE	.17208065 02	LOE	.13442167 03	LTT	.17109914 02	LOT	.13453772 03	RST	.14767133 09	VST	.30930423 02
EPS	.55109334 02	ESP	.10653118 00	SEP	.12478301 03	EPM	.13556570 03	EMP	.37062906 02	MEP	.79013056 01
MPS	.16563970 03	MSP	.27453512-10	SMP	.14353416 02	SEM	.13197631 03	EMS	.47011369 02	ESM	.11160705 00
RPM	.71540772 05	SPM	.54018956 02								
GCE	.78615201 02	GCT	.22032329 03	SIP	.16425003 03	CPT	.00542313 02	SIN	.07152646 02	D1	.72777120 00
REP	.33516207 06	VEP	.10036767 01	CPE	.08040922 02	CPS	.10252150 03	D2	.70910972 00	D3	.60990440-01

1 DAYS 11 HRS. 2 MIN. 51.000 SEC. 2356477275202020000000 J.D.= 2438427.33333333 FEB. 1,1964 20 00 00.000
TFL 2 DAYS 4 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.33553230 06	Y	-.47950700 05	Z	.40252542 04	DX	-.10190613 01	DY	-.30061751 00	DZ	.13701534 00
R	.33897570 06	DEC	.01562106 00	RA	.10015303 03	V	.10735664 01	PTH	.70139097 02	AZ	.52900909 02
R	.33897570 06	LAT	.01562191 00	LON	.11707018 03	VE	.24577579 02	PTE	.24500444 01	AZE	.27020472 03
XS	.90640500 08	YS	-.10050291 09	ZS	-.43501640 08	DXS	.22622234 02	DYS	.10379257 02	DZS	.79605757 01
XM	-.30811034 06	YM	-.15783092 05	ZM	.31088104 05	DXM	-.52615925-01	DYM	-.93265009 00	DZM	-.30054750 00
XT	-.30811034 06	YT	-.15783092 05	ZT	.31088104 05	DXT	-.52615925-01	DYT	-.93265009 00	DZT	-.30054750 00
RS	.14741147 09	VS	.30214462 02	RM	.30960122 06	VM	.10046736 01	RT	.30960122 06	VT	.10046736 01
GED	.02117943 00	ALT	.33259750 06	LOS	.24340135 03	RAS	.31446410 03	RAM	.10732081 03	LON	.11120505 03
DUT	.35000000 02	DT	.19200000 04	DM	.10543362 01	SMA	.27040977 06	DES	-.17196200 02	DEM	.45750340 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.90976032 08	Y	.10045496 09	Z	.43506465 08	DX	-.23641315 02	DY	-.18683076 02	DZ	-.70315403 01
R	.14760490 09	LAT	.17175002 02	LON	.13457511 03	V	.31134101 02	PTH	.15173137 01	AZ	.10575727 03
XE	-.90640500 08	YE	.10050291 09	ZE	.43501640 08	DXE	-.22622234 02	DYE	-.10379257 02	DZE	-.79605757 01
XT	-.99020610 08	YT	.10048713 09	ZT	.43612728 08	DXT	-.22674050 02	DYT	-.19307907 02	DZT	-.03491231 01
LTE	.17196200 02	LOE	.13446410 03	LTT	.17177604 02	LOT	.13458116 03	RST	.14760990 09	VST	.30920701 02
EPS	.55133622 02	ESP	.10812639 00	SEP	.12475067 03	EPM	.13560225 03	EMP	.37400219 02	MEP	.60095159 01
MPS	.16562704 03	MSP	.27453512-10	SMP	.14366505 02	SEM	.13146605 03	EMS	.40400670 02	ESM	.11277678 00
RPM	.67065437 05	SPM	.54055310 02								
GCE	.70475466 02	GCT	.22050097 03	SIP	.16414329 03	CPT	.00516920 02	SIN	.07033170 02	D1	.77700310 00
REP	.33897570 06	VEP	.10735664 01	CPE	.07920944 02	CPS	.10251610 03	D2	.75737672 00	D3	.70502407-01

1 DAYS 12 HRS. 2 MIN. 51.000 SEC. 2356477313242020000000 J.D.= 2438427.37500000 FEB. 1,1964 21 00 00.000
TFL 2 DAYS 5 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.33910462 06	Y	-.49054074 05	Z	.53211117 04	DX	-.10100620 01	DY	-.30676639 00	DZ	.13049766 00
R	.34275407 06	DEC	.08952541 00	RA	.10022930 03	V	.10640916 01	PTH	.70219003 02	AZ	.52004720 02
R	.34275406 06	LAT	.08952541 00	LON	.10212947 03	VE	.24056305 02	PTE	.24102329 01	AZE	.27020212 03
XS	.90721915 08	YS	-.10043673 09	ZS	-.43552941 08	DXS	.22607631 02	DYS	.10390247 02	DZS	.79790650 01
XM	-.30829065 06	YM	-.19140547 05	ZM	.29716911 05	DXM	-.43113062-01	DYM	-.93214170 00	DZM	-.30126305 00
XT	-.30829065 06	YT	-.19140547 05	ZT	.29716911 05	DXT	-.43113062-01	DYT	-.93214170 00	DZT	-.30126305 00
RS	.14741239 09	VS	.30214364 02	RM	.30909624 06	VM	.10080224 01	RT	.30909624 06	VT	.10080224 01
GED	.09550634 00	ALT	.33637666 06	LOS	.22040275 03	RAS	.31450667 03	RAM	.10262207 03	LON	.96718153 02
DUT	.35000000 02	DT	.19200000 04	DM	.10453097 01	SMA	.20167073 06	DES	-.17104902 02	DEM	.43711703 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.99061699 08	Y	.10030760 09	Z	.43558263 08	DX	-.23617694 02	DY	-.18695013 02	DZ	-.70365675 01
R	.14760796 09	LAT	.17163180 02	LON	.13461092 03	V	.31124119 02	PTH	.15194320 01	AZ	.10577035 03
XE	-.90721915 08	YE	.10043673 09	ZE	.43552941 08	DXE	-.22607631 02	DYE	-.10390247 02	DZE	-.79790650 01
XT	-.99110205 08	YT	.10041759 09	ZT	.43582658 08	DXT	-.22650744 02	DYT	-.19322309 02	DZT	-.03563200 01
LTE	.17184502 02	LOE	.13450667 03	LTT	.17165846 02	LOT	.13462458 03	RST	.14760846 09	VST	.30923117 02
EPS	.55154523 02	ESP	.10880209 00	SEP	.12473616 03	EPM	.13560527 03	EMP	.37000975 02	MEP	.64257407 01
MPS	.16560064 03	MSP	.27453512-10	SMP	.14393335 02	SEM	.13099642 03	EMS	.40009392 02	ESM	.11309904 00
RPM	.62461305 05	SPM	.54088290 02								
GCE	.78338128 02	GCT	.22092191 03	SIP	.16400092 03	CPT	.00480606 02	SIN	.06094000 02	D1	.03363083 00
REP	.34275407 06	VEP	.10640916 01	CPE	.07011750 02	CPS	.10251069 03	D2	.01277083 00	D3	.00265207-01

1 DAYS 13 HRS. 2 MIN. 51.000 SEC. 2356477351302020000000 J.D.= 2438427.41666666 FEB. 1,1964 22 00 00.000
TFL 2 DAYS 6 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.34200579 06	Y	-.50144670 05	Z	.50227210 04	DX	-.10010410 01	DY	-.30062050 00	DZ	.14022047 00
R	.34650201 06	DEC	.06205774 00	RA	.10032204 03	V	.10553793 01	PTH	.70309500 02	AZ	.51149076 02
R	.34650200 06	LAT	.06205774 00	LON	.07177050 02	VE	.25133067 02	PTE	.23647055 01	AZE	.27020021 03
XS	.90803279 08	YS	-.10037050 09	ZS	-.43524219 08	DXS	.22593016 02	DYS	.10405229 02	DZS	.79015904 01
XM	-.30842077 06	YM	-.22495224 05	ZM	.28363122 05	DXM	-.33621440-01	DYM	-.93155150 00	DZM	-.30194550 00
XT	-.30842077 06	YT	-.22495224 05	ZT	.28363122 05	DXT	-.33621440-01	DYT	-.93155150 00	DZT	-.30194550 00
RS	.14741330 09	VS	.30214268 02	RM	.39011059 06	VM	.10073733 01	RT	.39011059 06	VT	.10073733 01
GED	.96961015 00	ALT	.34012461 06	LOS	.21360619 03	RAS	.31454917 03	RAM	.10331649 03	LON	.82160502 02
DUT	.35000000 02	DT	.19200000 04	DM	.10370129 01	SMA	.20401607 06	DES	-.17172700 02	DEM	.41600410 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.99146004 08	Y	.10032033 09	Z	.43530042 08	DX	-.23594057 02	DY	-.18705050 02	DZ	-.70418299 01
R	.14761092 09	LAT	.17151369 02	LON	.13466270 03	V	.31114507 02	PTH	.15149761 01	AZ	.10578323 03
XE	-.90803279 08	YE	.10037050 09	ZE	.43524219 08	DXE	-.22593016 02	DYE	-.10405229 02	DZE	-.79015904 01
XT	-.99191707 08	YT	.10034000 09	ZT	.43552562 08	DXT	-.22626618 02	DYT	-.19336781 02	DZT	-.03636958 01
LTE	.17172700 02	LOE	.13454917 03	LTT	.17153000 02	LOT	.13466790 03	RST	.14766700 09	VST	.30916401 02
EPS	.55172502 02	ESP	.11000761 00	SEP	.12471694 03	EPM	.13579973 03	EMP	.30260420 02	MEP	.99390301 01
MPS	.16555749 03	MSP	.94911702-02	SMP	.14436090 02	SEM	.13050162 03	EMS	.40017696 02	ESM	.11071201 00
RPM	.57906107 05	SPM	.54117611 02								
GCE	.78203093 02	GCT	.22136174 03	SIP	.16384052 03	CPT	.00456421 02	SIN	.06179081 02	D1	.00027267 00
REP	.34650201 06	VEP	.10553793 01	CPE	.07607270 02	CPS	.10250527 03	D2	.07703642 00	D3	.10610017 00

1 DAYS 14 HRS. 2 MIN. 51.000 SEC. 2356477389362020000000 J.D.= 2438427.45833333 FEB. 1,1964 23 00 00.000
TFL 2 DAYS 7 HRS. 10 MIN. 50.910 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	[illegible]	Y	[illegible]	Z	[illegible]	DX	[illegible]	DY	[illegible]	DZ	[illegible]
R	[illegible]	DEC	[illegible]	RA	[illegible]	V	[illegible]	PTH	[illegible]	AZ	[illegible]
R	[illegible]	LAT	[illegible]	LON	[illegible]	VE	[illegible]	PTE	[illegible]	AZE	[illegible]
RS	[illegible]	VS	[illegible]	ZS	[illegible]	DAS	[illegible]	DVS	[illegible]	DES	[illegible]
RR	[illegible]	VR	[illegible]	ZR	[illegible]	DAR	[illegible]	DVR	[illegible]	DER	[illegible]
RT	[illegible]	VT	[illegible]	ZT	[illegible]	DAT	[illegible]	DVT	[illegible]	DET	[illegible]
RS	[illegible]	WS	[illegible]	RR	[illegible]	VR	[illegible]	RT	[illegible]	VT	[illegible]
GED	[illegible]	ALT	[illegible]	LOS	[illegible]	RAS	[illegible]	RAR	[illegible]	LON	[illegible]
DUT	[illegible]	DT	[illegible]	DR	[illegible]	SHA	[illegible]	DES	[illegible]	DEN	[illegible]

HELIOCENTRIC — EQUATORIAL COORDINATES

X	[illegible]	Y	[illegible]	Z	[illegible]	DX	[illegible]	DY	[illegible]	DZ	[illegible]
R	[illegible]	LAT	[illegible]	LON	[illegible]	V	[illegible]	PTH	[illegible]	AZ	[illegible]
RE	[illegible]	VE	[illegible]	ZE	[illegible]	DAE	[illegible]	DVE	[illegible]	DZE	[illegible]
RT	[illegible]	VT	[illegible]	ZT	[illegible]	DAT	[illegible]	DVT	[illegible]	DZT	[illegible]
LTE	[illegible]	LOE	[illegible]	LTT	[illegible]	LOT	[illegible]	RST	[illegible]	VST	[illegible]
EPS	[illegible]	ESP	[illegible]	SEP	[illegible]	EPM	[illegible]	EMP	[illegible]	MEP	[illegible]
MPS	[illegible]	MSP	[illegible]	SMP	[illegible]	SEM	[illegible]	EMS	[illegible]	ESM	[illegible]
RPM	[illegible]	SPM	[illegible]								
GCE	[illegible]	GCT	[illegible]	SIP	[illegible]	CPT	[illegible]	SIN	[illegible]	D1	[illegible]
REP	[illegible]	VEP	[illegible]	CPE	[illegible]	CPS	[illegible]	D2	[illegible]	D3	[illegible]

1 DAYS 15 HRS. 2 MIN. 51.000 SEC. 2356477365402020000000000 J.D.= 2438427.5000000 FEB. 2,1964 00 00 00.000
TFL 2 DAYS 8 HRS. 10 MIN. 50.010 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	[illegible]	Y	[illegible]	Z	[illegible]	DX	[illegible]	DY	[illegible]	DZ	[illegible]
R	[illegible]	DEC	[illegible]	RA	[illegible]	V	[illegible]	PTH	[illegible]	AZ	[illegible]
R	[illegible]	LAT	[illegible]	LON	[illegible]	VE	[illegible]	PTE	[illegible]	AZE	[illegible]
RS	[illegible]	VS	[illegible]	ZS	[illegible]	DAS	[illegible]	DVS	[illegible]	DES	[illegible]
RR	[illegible]	VR	[illegible]	ZR	[illegible]	DAR	[illegible]	DVR	[illegible]	DER	[illegible]
RT	[illegible]	VT	[illegible]	ZT	[illegible]	DAT	[illegible]	DVT	[illegible]	DET	[illegible]
RS	[illegible]	WS	[illegible]	RR	[illegible]	VR	[illegible]	RT	[illegible]	VT	[illegible]
GED	[illegible]	ALT	[illegible]	LOS	[illegible]	RAS	[illegible]	RAR	[illegible]	LON	[illegible]
DUT	[illegible]	DT	[illegible]	DR	[illegible]	SHA	[illegible]	DES	[illegible]	DEN	[illegible]

HELIOCENTRIC — EQUATORIAL COORDINATES

X	[illegible]	Y	[illegible]	Z	[illegible]	DX	[illegible]	DY	[illegible]	DZ	[illegible]
R	[illegible]	LAT	[illegible]	LON	[illegible]	V	[illegible]	PTH	[illegible]	AZ	[illegible]
RE	[illegible]	VE	[illegible]	ZE	[illegible]	DAE	[illegible]	DVE	[illegible]	DZE	[illegible]
RT	[illegible]	VT	[illegible]	ZT	[illegible]	DAT	[illegible]	DVT	[illegible]	DZT	[illegible]
LTE	[illegible]	LOE	[illegible]	LTT	[illegible]	LOT	[illegible]	RST	[illegible]	VST	[illegible]
EPS	[illegible]	ESP	[illegible]	SEP	[illegible]	EPM	[illegible]	EMP	[illegible]	MEP	[illegible]
MPS	[illegible]	MSP	[illegible]	SMP	[illegible]	SEM	[illegible]	EMS	[illegible]	ESM	[illegible]
RPM	[illegible]	SPM	[illegible]								
GCE	[illegible]	GCT	[illegible]	SIP	[illegible]	CPT	[illegible]	SIN	[illegible]	D1	[illegible]
REP	[illegible]	VEP	[illegible]	CPE	[illegible]	CPS	[illegible]	D2	[illegible]	D3	[illegible]

1 DAYS 16 HRS. 2 MIN. 51.000 SEC. J.D.= 2438427.5416666 FEB. 2,1964 01 00 00.000
TFL 2 DAYS 9 HRS. 10 MIN. 50.010 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	[illegible]	Y	[illegible]	Z	[illegible]	DX	[illegible]	DY	[illegible]	DZ	[illegible]
R	[illegible]	DEC	[illegible]	RA	[illegible]	V	[illegible]	PTH	[illegible]	AZ	[illegible]
R	[illegible]	LAT	[illegible]	LON	[illegible]	VE	[illegible]	PTE	[illegible]	AZE	[illegible]
RS	[illegible]	VS	[illegible]	ZS	[illegible]	DAS	[illegible]	DVS	[illegible]	DES	[illegible]
RR	[illegible]	VR	[illegible]	ZR	[illegible]	DAR	[illegible]	DVR	[illegible]	DER	[illegible]
RT	[illegible]	VT	[illegible]	ZT	[illegible]	DAT	[illegible]	DVT	[illegible]	DET	[illegible]
RS	[illegible]	WS	[illegible]	RR	[illegible]	VR	[illegible]	RT	[illegible]	VT	[illegible]
GED	[illegible]	ALT	[illegible]	LOS	[illegible]	RAS	[illegible]	RAR	[illegible]	LON	[illegible]
DUT	[illegible]	DT	[illegible]	DR	[illegible]	SHA	[illegible]	DES	[illegible]	DEN	[illegible]

HELIOCENTRIC — EQUATORIAL COORDINATES

X	[illegible]	Y	[illegible]	Z	[illegible]	DX	[illegible]	DY	[illegible]	DZ	[illegible]
R	[illegible]	LAT	[illegible]	LON	[illegible]	V	[illegible]	PTH	[illegible]	AZ	[illegible]
RE	[illegible]	VE	[illegible]	ZE	[illegible]	DAE	[illegible]	DVE	[illegible]	DZE	[illegible]
RT	[illegible]	VT	[illegible]	ZT	[illegible]	DAT	[illegible]	DVT	[illegible]	DZT	[illegible]
LTE	[illegible]	LOE	[illegible]	LTT	[illegible]	LOT	[illegible]	RST	[illegible]	VST	[illegible]
EPS	[illegible]	ESP	[illegible]	SEP	[illegible]	EPM	[illegible]	EMP	[illegible]	MEP	[illegible]
MPS	[illegible]	MSP	[illegible]	SMP	[illegible]	SEM	[illegible]	EMS	[illegible]	ESM	[illegible]
RPM	[illegible]	SPM	[illegible]								
GCE	[illegible]	GCT	[illegible]	SIP	[illegible]	CPT	[illegible]	SIN	[illegible]	D1	[illegible]
REP	[illegible]	VEP	[illegible]	CPE	[illegible]	CPS	[illegible]	D2	[illegible]	D3	[illegible]

1 DAYS 17 HRS. 2 MIN. 51.000 SEC. J.D.= 2438427.5833333 FEB. 2,1964 02 00 00.000
TFL 2 DAYS 10 HRS. 10 MIN. 50.909 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	[illegible]	Y	[illegible]	Z	[illegible]	DX	[illegible]	DY	[illegible]	DZ	[illegible]
R	[illegible]	DEC	[illegible]	RA	[illegible]	V	[illegible]	PTH	[illegible]	AZ	[illegible]
R	[illegible]	LAT	[illegible]	LON	[illegible]	VE	[illegible]	PTE	[illegible]	AZE	[illegible]
RS	[illegible]	VS	[illegible]	ZS	[illegible]	DAS	[illegible]	DVS	[illegible]	DES	[illegible]
RR	[illegible]	VR	[illegible]	ZR	[illegible]	DAR	[illegible]	DVR	[illegible]	DER	[illegible]
RT	[illegible]	VT	[illegible]	ZT	[illegible]	DAT	[illegible]	DVT	[illegible]	DET	[illegible]
RS	[illegible]	WS	[illegible]	RR	[illegible]	VR	[illegible]	RT	[illegible]	VT	[illegible]
GED	[illegible]	ALT	[illegible]	LOS	[illegible]	RAS	[illegible]	RAR	[illegible]	LON	[illegible]
DUT	[illegible]	DT	[illegible]	DR	[illegible]	SHA	[illegible]	DES	[illegible]	DEN	[illegible]

HELIOCENTRIC — EQUATORIAL COORDINATES

X	[illegible]	Y	[illegible]	Z	[illegible]	DX	[illegible]	DY	[illegible]	DZ	[illegible]
R	[illegible]	LAT	[illegible]	LON	[illegible]	V	[illegible]	PTH	[illegible]	AZ	[illegible]
RE	[illegible]	VE	[illegible]	ZE	[illegible]	DAE	[illegible]	DVE	[illegible]	DZE	[illegible]
RT	[illegible]	VT	[illegible]	ZT	[illegible]	DAT	[illegible]	DVT	[illegible]	DZT	[illegible]
LTE	[illegible]	LOE	[illegible]	LTT	[illegible]	LOT	[illegible]	RST	[illegible]	VST	[illegible]
EPS	[illegible]	ESP	[illegible]	SEP	[illegible]	EPM	[illegible]	EMP	[illegible]	MEP	[illegible]
MPS	[illegible]	MSP	[illegible]	SMP	[illegible]	SEM	[illegible]	EMS	[illegible]	ESM	[illegible]
RPM	[illegible]	SPM	[illegible]								
GCE	[illegible]	GCT	[illegible]	SIP	[illegible]	CPT	[illegible]	SIN	[illegible]	D1	[illegible]
REP	[illegible]	VEP	[illegible]	CPE	[illegible]	CPS	[illegible]	D2	[illegible]	D3	[illegible]

HELIOCENTRIC — EQUATORIAL COORDINATES

R	.31986626 05	V	-.10462089 05	Z	-.16919386 05	DR	-.90675996 00	DV	.60968285 00	DZ	.53596090 00
R	.39501781 05	DEC	-.22182771 02	RA	.32972276 03	V	.12966879 01	PTH	-.86361708 02	AZ	.51401494 02
R	.39501777 05	LAT	-.10150409 02	LON	.32589118 03	VP	.12933318 01	PTP	-.80408958 02	ALP	.51408376 03
LTS	-.87427276 00	LNS	.31432844 03	LTE	-.67202726 01	LOE	.54613176 01				
ALT	.37766781 05	SMA	-.10154762 05	ALP	.37659193 02	DR	-.12928769 01	DP	.11923993-03	ASD	.25173904 04
MGE	.30476183 03	SVL	-.80583613 01	MMG	.16762511 03	SIA	.13625835 03				

1 DAYS 10 HRS. 2 MIN. 51.000 SEC. 2356477631532027777777777 J.D.= 2430427.62500000 FEB. 2,1964 02 00 00.000
TPL 2 DAYS 11 HRS. 10 MIN. 50.999 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

R	-.36057965 06	V	-.55321339 05	Z	.04632230 04	DR	-.97996829 00	DV	-.27129064 00	DZ	.15500004 00
R	.36408491 06	DEC	.13290054 01	RA	.10872249 03	V	.10206967 01	PTH	.00016000 02	AZ	.42091916 02
R	.36408491 06	LAT	.13290054 01	LON	.12972139 02	VE	.26501697 02	PTE	.21900617 01	AZE	.27020633 03
RS	.99709796 08	VS	-.10003853 09	ZS	-.63380261 08	DRS	.22519762 02	DVS	.10679999 02	DZS	.00139172 01
RH	-.38866806 06	VH	-.39278744 05	ZH	.21440795 05	DRH	.13641339-01	DVH	-.97739367 00	DZH	-.30403521 00
RT	-.38866806 06	VT	-.39278744 05	ZT	.21440795 05	DRT	.13641339-01	DVT	-.97739367 00	DZT	-.30403521 00
RS	.16761790 09	VS	.30213786 02	RR	.39117109 06	VR	.10041630 01	DT	.39117109 06	VT	.10041630 01
GLD	.15385590 01	ALT	.35851872 06	LOS	.13041119 03	RAS	.31676155 03	DRR	.10576629 03	LOR	.06129385 01
DUT	.35000000 02	DT	.40000000 03	DR	.10131106 01	SMA	.30007836 06	DES	-.17113602 02	DER	.31420506 01

HELIOCENTRIC — EQUATORIAL COORDINATES

R	-.99569876 08	V	.99983207 08	Z	.43188724 08	DR	-.23499730 02	DV	-.10751207 02	DZ	-.70501992 01
R	.16762582 09	LAT	.17071194 02	LON	.13468132 03	V	.31076076 02	PTH	.15501586 01	AZ	.10506205 03
RE	-.99209796 08	VE	.10003853 09	ZE	.43380261 08	DRE	-.22519762 02	DVE	-.10679999 02	DZE	-.00139172 01
RT	-.99569876 08	VT	.99999300 06	ZT	.43401102 08	DRT	-.22506121 02	DVT	-.10962393 02	DZT	-.03067526 03
LTE	.17113602 02	LOE	.13476155 03	LTT	.17093651 02	LOT	.13468677 03	DLT	.15765966 09	VLT	.30082218 02
LPS	.55205753 02	ESP	.11640527 00	SEP	.12466778 03	EPM	.13720913 03	EMP	.39132298 02	MEP	.30675501 01
MPS	.16485232 03	MSP	.27453512-10	SMP	.15144151 02	SEM	.12607159 03	EPS	.51000918 02	ESM	.11951568 00
MPM	.36427877 05	SPM	.56206234 02								
GCE	.77555646 02	GCT	.22608999 03	SIP	.16199686 03	CPT	.88108228 02	SIB	.05332776 02	DI	.16963903 01
DIP	.36408491 06	VIP	.10206967 01	CPE	.87163366 02	CPS	.10247012 03	DZ	.16416132 01	DD	.27576631 00

SELENOCENTRIC — EQUATORIAL COORDINATES

R	.28028416 05	V	-.16092595 05	Z	-.12077571 05	DR	-.99360963 00	DV	.65409504 00	DZ	.54064326 00
R	.34827876 05	DEC	-.21877304 02	RA	.33013759 03	V	.13076758 01	PTH	-.85063989 02	AZ	.51574075 02
R	.34827876 05	LAT	-.10720323 02	LON	.32581957 03	VP	.13065269 01	PTP	-.88791996 02	ALP	.35906657 03
LTS	-.87522300 00	LNS	.31302755 03	LTE	-.67275962 01	LNE	.54447910 01				
ALT	.33092877 05	SMA	-.90987270 04	ALP	.36187095 02	DR	-.13062371 01				
MGE	.30476624 03	SVL	-.78395502 01	MMG	.16699793 03	SIA	.13635367 03	DP	.19590752-03	ASD	.20554519 01

1 DAYS 19 HRS. 2 MIN. 50.999 SEC. 2356477655572027777777777 J.D.= 2430427.00000000 FEB. 2,1964 03 00 00.000
TPL 2 DAYS 12 HRS. 10 MIN. 50.999 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

R	-.36411156 06	V	-.56701682 05	Z	.00363890 04	DR	-.98291826 00	DV	-.26187017 00	DZ	.16170950 00
R	.36854663 06	DEC	.14066662 01	RA	.10870682 03	V	.10299982 01	PTH	.00228399 02	AZ	.36426051 02
R	.36854663 06	LAT	.14066662 01	LON	.35739939 03	VE	.26777701 02	PTE	.21727988 01	AZE	.27029524 03
RS	.99290160 08	VS	-.99671971 08	ZS	-.43351600 08	DRS	.22550375 02	DVS	.10666929 02	DZS	.00203786 01
RH	-.38854202 06	VH	-.62565461 05	ZH	.20054523 05	DRH	.23049735-01	DVH	-.52612315 00	DZH	-.30530998 00
RT	-.38854202 06	VT	-.62565461 05	ZT	.20054523 05	DRT	.23049735-01	DVT	-.52612315 00	DZT	-.30530998 00
RS	.16761883 09	VS	.30213691 02	RR	.39138076 06	VR	.10035286 01	DT	.39138076 06	VT	.10035286 01
GLD	.16162329 01	ALT	.36210824 06	LOS	.12361258 03	RAS	.31480400 03	DRR	.10629192 03	LOR	.35460849 01
DUT	.35000000 02	DT	.09999999 03	DR	.10150473 01	SMA	.30305237 06	DES	-.17101755 02	DER	.29371460 01

HELIOCENTRIC — EQUATORIAL COORDINATES

R	-.99654452 08	V	.99915689 08	Z	.43360434 08	DR	-.23487993 02	DV	-.10756795 02	DZ	-.70160900 01
R	.16762887 09	LAT	.17080344 02	LON	.13492500 03	V	.31068446 02	PTH	.15720427 01	AZ	.10565150 03
RE	-.99290160 08	VE	.99671971 08	ZE	.43351600 08	DRE	-.22550375 02	DVE	-.10666929 02	DZE	-.00203786 01
RT	-.99654452 08	VT	.99979404 06	ZT	.43371655 08	DRT	-.22482076 02	DVT	-.10962129 02	DZT	-.04056885 01
LTE	.17101755 02	LOE	.13480400 03	LTT	.17081359 02	LOT	.13492809 03	DLT	.16765757 09	VLT	.30075264 02
LPS	.55197161 02	ESP	.11706692 00	SEP	.12468522 03	EPM	.13782151 03	EMP	.39251470 02	MEP	.30605171 01
MPS	.16449965 03	MSP	.90911787-02	SMP	.15501219 02	SEM	.12758625 03	EPS	.52290905 02	ESM	.12012707 00
MPM	.36106890 05	SPM	.56235561 02								
GCE	.77430008 02	GCT	.22706635 03	SIP	.16119197 03	CPT	.88080896 02	SIB	.06706825 02	DI	.17217175 01
DIP	.36854663 06	VIP	.10299982 01	CPE	.87064212 02	CPS	.10247266 03	DZ	.16420126 01	DD	.36041903 00

SELENOCENTRIC — EQUATORIAL COORDINATES

R	.24430458 05	V	-.13710221 05	Z	-.11070134 05	DR	-.10056400 01	DV	.60465290 00	DZ	.54700849 00
R	.30106895 05	DEC	-.21471280 02	RA	.33068043 03	V	.13230283 01	PTH	-.85195296 02	AZ	.51595294 02
R	.30106895 05	LAT	-.10018718 02	LON	.32599581 03	VP	.13199409 01	PTP	-.88162040 02	ALP	.40742560 02
LTS	-.87616041 00	LNS	.31331663 03	LTE	-.67363959 01	LNE	.54279473 01				
ALT	.28571898 05	SMA	-.80463357 04	ALP	.36276526 02	DR	-.13193704 01	DP	.71136130-03	ASD	.30835707 01
MGE	.30408283 03	SVL	-.75552087 01	MMG	.16642147 03	SIA	.13652004 03				

1 DAYS 20 HRS. 2 MIN. 50.999 SEC. 2356477673532027777777777 J.D.= 2430427.08333333 FEB. 2,1964 04 00 00.000
TPL 2 DAYS 13 HRS. 10 MIN. 50.999 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

R	-.36766317 06	V	-.57203687 05	Z	.06306631 04	DR	-.99136219 00	DV	-.24094400 00	DZ	.16900071 00
R	.37221124 06	DEC	.14026428 01	RA	.10869357 03	V	.10363594 01	PTH	.00060165 02	AZ	.33326056 02
R	.37221124 06	LAT	.14026428 01	LON	.36241108 03	VE	.27058307 02	PTE	.21666601 01	AZE	.27030411 03
RS	.99371334 08	VS	-.99905362 08	ZS	-.43322514 08	DRS	.22475176 02	DVS	.10590902 02	DZS	.00260399 01
RH	-.38066232 06	VH	-.65898185 05	ZH	.18666602 05	DRH	.32441706-01	DVH	-.52517370 00	DZH	-.30575035 00
RT	-.38066232 06	VT	-.65898185 05	ZT	.18666602 05	DRT	.32441706-01	DVT	-.52517370 00	DZT	-.30575035 00
RS	.16761975 09	VS	.30213995 02	RR	.39158954 06	VR	.10020949 01	DT	.39158954 06	VT	.10020949 01
GLD	.16027621 01	ALT	.36583305 06	LOS	.10904397 03	RAS	.31484446 03	DRR	.10671000 03	LOR	.34030631 01
DUT	.35000000 02	DT	.40000000 03	DR	.10270272 01	SMA	.30000000 06	DES	-.17009000 02	DER	.27322590 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.99730998 00	Y	.99068158 00	Z	.43332145 00	DX	-.23481730 02	DY	-.10739507 02	DZ	-.99560262 01
R	.16763196 00	LAT	.17668490 02	LON	.13496066 03	V	.31065180 02	PTH	.16692623 01	AZ	.19585990 03
RE	-.99371334 00	VE	.99905362 00	ZE	.43372516 00	DRE	-.22490176 02	DVE	-.10509062 02	DZE	-.00260350 01
RT	-.99739777 00	VT	.99859664 00	ZT	.43341181 00	DRT	-.22457936 02	DVT	-.10435016 02	DZT	-.00125063 01
LTE	.17084900 02	LOE	.13486446 03	LTT	.17069740 02	LOT	.13497139 03	RST	.16765630 00	VST	.30068272 02
EPS	.55180787 02	ESP	.11889995 00	SEP	.12470645 01	EPM	.13669151 03	EMP	.30661977 02	MEP	.24469164 01
MPS	.16395806 03	MSP	.27453512-10	SMP	.16030273 02	SEM	.12710154 03	EMS	.52777302 02	ESM	.12116162 00
RPM	.25322635 05	SPM	.54158951 02								
SCE	.27304829 02	SCT	.23046322 03	SIP	.16080870 03	CPT	.07952015 02	SIN	.04424041 02	DI	.20603313 01
REP	.37221124 06	VEP	.10363594 01	CPE	.06497001 02	CPS	.10246770 03	DZ	.20130015 01	D3	.49222952 00

SELENOCENTRIC — EQUATORIAL COORDINATES

X	.20770946 05	Y	-.11305422 05	Z	-.90399587 04	DX	-.10230039 01	DY	.67562009 00	DZ	.95566006 00
R	.25322635 05	DEC	-.20906015 02	RA	.33155626 03	V	.13465276 01	PTH	-.06320323 02	AZ	.51412561 02
R	.25322633 05	LAT	-.97559006 01	LON	.32623601 03	VP	.13410669 01	PTP	-.00011622 02	AZP	.97036507 02
LTS	-.07710556 00	LNS	.31281069 03	LTE	-.67406975 01	LOE	.54094961 01				
ALT	.23587635 05	SMA	-.69960460 04	ALP	.31730011 02	DR	-.13399301 01	DP	.30104706-03	ASD	.30287734 01
MGE	.30481921 03	SVL	-.71673272 01	MMS	.16561157 03	SIA	.13476273 03				

1 DAYS 22 HRS. 2 MIN. 50.999 SEC. 2356477511167202777777777 J.D.= 2430427.70999999 FEB. 2,1964 05 59 59.000
TPL 2 DAYS 14 HRS. 10 MIN. 50.000 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.37126057 06	Y	-.58076511 05	Z	.10261935 05	DX	-.10093004 01	DY	-.23310670 00	DZ	.16157812 00
R	.37591537 06	DEC	.15642832 01	RA	.18809966 03	V	.10516433 01	PTH	.00670910 02	AZ	.25463031 02
R	.37591537 06	LAT	.15642832 01	LON	.32741640 03	VP	.27367771 02	PTP	.21747356 01	AZP	.27032162 03
RS	.99452273 00	VS	-.99038697 00	ZS	-.43293606 00	DRS	.2.415665 02	DVS	.10524750 02	DZS	.00332092 01
RM	-.38836846 06	VM	-.49226627 05	ZM	.17277157 05	DRM	.41816550-01	DVM	-.92394592 00	DZM	-.30615663 00
RT	-.38836846 06	VT	-.49226627 05	ZT	.17277157 05	DRT	.41816550-01	DVT	-.92394592 00	DZT	-.30615663 00
RS	.15762068 09	VS	.30213501 02	RM	.39179742 06	VM	.10022682 01	RT	.39179742 06	VT	.10022682 01
LTD	.15769381 01	ALT	.36953718 06	LOS	.93435350 02	RAS	.31408896 03	RAM	.18722496 03	LOM	.32575160 03
DUT	.35000000 02	DT	.60000000 03	DR	.10377716 01	SMA	.50895912 06	MES	-.17070034 02	DEM	.25274605 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.99673534 00	Y	.99780423 00	Z	.43303069 00	DX	-.23484965 02	DY	-.10757055 02	DZ	-.70517111 01
R	.16763534 09	LAT	.17096481 02	LON	.13501232 03	V	.31065255 02	PTH	.16576715 01	AZ	.10500476 03
RE	-.99452273 00	VE	.99818697 00	ZE	.43293606 00	DRE	-.22475665 02	DVE	-.10524750 02	DZE	-.00332092 01
RT	-.99806582 00	VT	.99789471 00	ZT	.43310086 00	DRT	-.22453848 02	DVT	-.10466696 02	DZT	-.00199450 01
LTE	.17078034 02	LOE	.13488890 03	LTT	.17097150 02	LOT	.13501466 03	RST	.16765471 09	VST	.30661266 02
EPS	.55150018 02	ESP	.12012787 00	SEP	.12472608 01	EPM	.13968767 03	EMP	.30009320 02	MEP	.19279627 01
MPS	.16309448 03	MSP	.27453512-10	SMP	.16903249 02	SEM	.12661736 03	EMS	.52260810 02	ESM	.12216490 00
RPM	.20448199 05	SPM	.54181850 02								
SCE	.37179607 02	SCT	.23190127 03	SIP	.15622716 03	CPT	.07755204 02	SIN	.02087086 02	DI	.25946609 01
REP	.37591537 06	VEP	.10516633 01	CPE	.06674463 02	CPS	.10246173 03	DZ	.24970096 01	D3	.71507095 00

SELENOCENTRIC — EQUATORIAL COORDINATES

X	.17047087 05	Y	-.08478065 04	Z	-.70152224 04	DX	-.10511169 01	DY	.00004133 00	DZ	.56773475 00
R	.20448199 05	DEC	-.20044250 02	RA	.33257060 03	V	.13608112 01	PTH	-.03103592 02	AZ	.51110640 02
R	.20448197 05	LAT	-.98454523 01	LON	.32609536 03	VP	.13748945 01	PTP	-.05177572 02	AZP	.60310323 02
LTS	-.07804065 00	LNS	.31230477 03	LTE	-.67468660 01	LOE	.53915715 01				
ALT	.18713199 05	SMA	-.59454320 04	ALP	.20240875 02	DR	-.13708272 01	DP	.60420910-03	ASD	.40673165 01
MGE	.30464599 03	SVL	-.65900606 01	MMS	.16468097 03	SIA	.13512035 03				

1 DAYS 22 HRS. 2 MIN. 50.999 SEC. 2356477527732027777777777 J.D.= 2430427.70166666 FEB. 2,1964 06 59 59.000
TPL 2 DAYS 15 HRS. 10 MIN. 50.999 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.37495240 06	Y	-.58071976 05	Z	.10945737 05	DX	-.10463083 01	DY	-.20704067 00	DZ	.19062000 00
R	.37970393 06	DEC	.16518949 01	RA	.18892326 03	V	.10654046 01	PTH	.00752054 02	AZ	.34314040 02
R	.37970393 06	LAT	.16518949 01	LON	.31260064 03	VE	.27655068 02	PTE	.22200650 01	AZP	.27039043 03
RS	.99533162 00	VS	-.99771980 00	ZS	-.43266676 00	DRS	.22460962 02	DVS	.10539649 02	DZS	.00397305 01
RM	-.38814107 06	VM	-.52550510 05	ZM	.15886310 05	DRM	.51173515-01	DVM	-.92763993 00	DZM	-.30652081 00
RT	-.38814107 06	VT	-.52550510 05	ZT	.15886310 05	DRT	.51173515-01	DVT	-.92763993 00	DZT	-.30652081 00
RS	.15762161 09	VS	.30213406 02	RM	.39700436 06	VM	.10016625 01	RT	.39700436 06	VT	.10016625 01
LTD	.15631659 01	ALT	.37352574 06	LOS	.79618729 02	RAS	.31491156 03	RAM	.18771040 03	LOM	.31119570 03
DUT	.35000000 02	DT	.60000000 03	DR	.10712967 01	SMA	.51191087 06	MES	-.17906162 02	DEM	.25229956 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.99900115 00	Y	.99713100 00	Z	.43275621 00	DX	-.23507130 02	DY	-.10767500 02	DZ	-.70399096 01
R	.16763046 09	LAT	.17044770 02	LON	.13505597 03	V	.31072990 02	PTH	.17477167 01	AZ	.10506521 03
RE	-.99533162 00	VE	.99771980 00	ZE	.43266676 00	DRE	-.22460962 02	DVE	-.10539649 02	DZE	-.00397305 01
RT	-.99921304 00	VT	.99719430 00	ZT	.43280542 00	DRT	-.22409768 02	DVT	-.10462709 02	DZT	-.00326476 01
LTE	.17066162 02	LOE	.13493134 03	LTT	.17045034 02	LOT	.13505793 03	RST	.16765910 09	VST	.30656170 02
EPS	.55112085 02	ESP	.12116162 00	SEP	.12470646 01	EPM	.14212750 03	EMP	.30407182 02	MEP	.19052964 01
MPS	.16139410 03	MSP	.27453512-10	SMP	.16463996 02	SEM	.12613301 03	EMS	.53793333 02	ESM	.12316410 00
RPM	.15637262 05	SPM	.54149626 02								
SCE	.27053014 02	SCT	.23080149 03	SIP	.15500097 03	CPT	.07635310 02	SIN	.00002106 02	DI	.25032100 01
REP	.37970393 06	VEP	.10654046 01	CPE	.06780910 02	CPS	.10245626 03	DZ	.33161096 01	D3	.11496452 01

SELENOCENTRIC — EQUATORIAL COORDINATES

X	.13180589 05	Y	-.03216661 04	Z	-.69405736 04	DX	-.10075610 01	DY	.71400020 00	DZ	.50635771 00
R	.15637262 05	DEC	-.18065469 02	RA	.33139900 03	V	.14350051 01	PTH	-.01172007 02	AZ	.50562949 02
R	.15637260 05	LAT	-.07159002 01	LON	.32059012 03	VP	.14290353 01	PTP	-.02000706 02	AZP	.00000402 02
LTS	-.07097021 00	LNS	.31170001 03	LTE	-.67510014 01	LOE	.53726289 01				
ALT	.13782762 05	SMA	-.60091149 04	ALP	.23299603 02	DR	-.14100016 01	DP	.01739630-03	ASD	.00351511 01
MGE	.30408791 03	SVL	-.56600079 01	MMS	.16239604 03	SIA	.13567037 03				

1 DAYS 23 HRS. 2 MIN. 50.999 SEC. 2356477545372027777777777 J.D.= 2430427.00333330 FEB. 2,1964 07 59 59.000
TPL 2 DAYS 16 HRS. 10 MIN. 50.000 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.37805197 06	Y	-.99549226 05	Z	.11717610 05	DX	-.11341472 01	DY	-.16376240 00	DZ	.23267957 00
R	.38366265 06	DEC	.17500772 01	RA	.18091285 03	V	.11092278 01	PTH	.80263060 02	AZ	.39578097 03
R	.38366265 06	LAT	.17500772 01	LON	.29737717 03	VE	.70004756 02	PTE	.23582176 01	AZE	.27904057 03
RS	.99613995 08	VS	-.99705211 08	ZS	-.63235720 08	DRS	.27564207 02	DVS	.10554538 02	DRS	.00461838 04
RR	-.38796003 06	VR	-.55869548 05	ZR	.14494187 05	DRR	.60511938-01	DVR	-.92127616 00	DZR	-.30666400 00
RT	-.38796003 06	VT	-.55869548 05	ZT	.14494187 05	DRT	.60511938-01	DVT	-.92127616 00	DRT	-.30666400 00
RS	.16762234 09	VS	.30213311 02	RR	.39221036 06	VR	.10010190 01	RT	.39221036 06	VT	.10010190 01
LED	.17619961 01	ALT	.37730476 06	LOS	.63418090 02	RAS	.31697378 03	RAR	.18819416 03	LOR	.29463947 03
DUT	.35000000 02	DT	.12000000 03	DR	.11523136 01	SMA	.31993666 06	DES	-.17056279 02	DER	.21179947 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.99992847 08	Y	.99645662 08	Z	.43267637 08	DX	-.23500354 02	DY	-.10717080 02	DZ	-.70125093 01
R	.16766203 09	LAT	.17032907 02	LON	.13509964 03	V	.11103699 02	PTH	.19318225 01	AZ	.10165560 03
RE	-.99613995 08	VE	.99705211 08	ZE	.43235720 08	DRE	-.27564207 02	DVE	-.10554538 02	DRE	-.00461838 04
RT	-.10000194 09	VT	.99649362 08	ZT	.43250215 08	DRT	-.27385695 02	DVT	-.10475704 02	DRT	-.00330500 01
LTE	.17594279 02	LOE	.13497378 03	LTT	.17032910 02	LOT	.13510110 03	RST	.16765148 09	VST	.30047070 02
RPS	.55.44656 02	RSP	.12214496 00	SEP	.12463202 03	EPR	.10639612 03	EMP	.32779956 02	REP	.02382956 00
RPR	.15825563 03	RSP	.27653512-10	SMP	.21945491 02	SER	.17569405 03	ERS	.54225675 02	ESR	.12354070 00
GCE	.76923800 02	GCT	.24670931 03	SIP	.10425809 03	CPT	.86808554 02	SIN	.77805620 02	DI	.51836019 01
RLP	.38366265 06	VEP	.11692228 01	CPE	.86701026 02	CPS	.10245873 03	DZ	.50599326 01	DD	.22220130 03

SELENOCENTRIC — EQUATORIAL COORDINATES

X	.99806507 06	Y	-.36796762 06	Z	-.27765768 06	DX	-.11946591 01	DY	.75793377 00	DZ	.61996154 00
R	.13196320 05	DEC	-.15811449 02	RA	.11795740 03	V	.11445377 01	PTH	-.77504884 02	AZ	.09535006 02
R	.13196299 05	LAT	-.73780068 01	LON	.33262086 03	VP	.15392419 01	PTP	-.78428004 02	AZP	.70490161 02
LTS	-.87989314 00	LNS	.31129785 03	LTE	-.67544770 01	LNE	.55530424 03				
ALT	.84552997 06	SMA	-.38083630 06	ALP	.15251529 02	DR	-.15079565 01	DP	.18780095-02	ASD	.90829362 01
HGE	.34495516 03	SVL	-.30002603 01	HMS	.19836852 03	SIA	.13659319 03				

2 DAYS 0 HRS. 2 MIN. 51.000 SEC. 2456477.5463702777777777 J.D.- 2430427.07499999 FEB. 2,1966 00 59 59.000
TPL 2 DAYS 17 HRS. 10 MIN. 58.989 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.38338155 06	Y	-.99977613 05	Z	.12647381 05	DX	-.14860070 01	DY	-.57155126-01	DZ	.30401373 00
R	.38825145 06	DEC	.18097054 01	RA	.18089149 03	V	.15178079 01	PTH	.78269990 02	AZ	.82540191 03
R	.38825145 06	LAT	.18097054 01	LON	.28279676 03	VE	.70509790 02	PTE	.29097481 01	AZE	.27091451 03
RS	.99999776 08	VS	-.99938584 08	ZS	-.63262743 08	DRS	.27531660 02	DVS	.10549418 02	DRS	.00526751 01
RR	-.38775341 06	VR	-.59183669 05	ZR	.13100906 05	DRR	.69831150-01	DVR	-.91979498 00	DZR	-.30717121 00
RT	-.38775341 06	VT	-.59183669 05	ZT	.13100906 05	DRT	.69831150-01	DVT	-.91979498 00	DRT	-.30717121 00
RS	.16762366 09	VS	.30213217 02	RR	.39741533 06	VR	.10044001 01	RT	.39741533 06	VT	.10044001 01
LED	.18826370 01	ALT	.36187326 06	LOS	.60419936 02	RAS	.31501621 03	RAR	.18867923 03	LOR	.28280240 03
DUT	.35000000 02	DT	.15000000 02	DR	.14061161 01	SMA	.31821553 06	DES	-.17042309 02	DER	.19130945 04

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.10007016 09	Y	.99570406 08	Z	.43219410 08	DX	-.27917947 02	DY	-.10626573 02	DZ	-.72406119 01
R	.16766429 09	LAT	.17021030 02	LON	.13514341 03	V	.31209542 02	PTH	.25209044 01	AZ	.10582000 03
RE	-.99613995 08	VE	.99705211 08	ZE	.43235720 08	DRE	-.27531660 02	DVE	-.10549418 02	DRE	-.00526751 01
RT	-.10000240 09	VT	.99579201 08	ZT	.43219844 08	DRT	-.27341629 02	DVT	-.10480213 02	DRT	-.00397964 01
LTE	.17062309 02	LOE	.13501621 03	LTT	.17020700 02	LOT	.13514042 03	RST	.16764984 09	VST	.30039942 02
EPS	.54422401 02	ESP	.12356078 00	SEP	.12495403 03	EPR	.10638232 03	EMP	.19601127 02	REP	.31613974 00
RPS	.10443214 03	RSP	.90911702-02	SMP	.35944836 02	SER	.17516048 03	ERS	.54787039 02	ESR	.12453067 00
RPR	.44175000 04	SPR	.51981213 02								
GCE	.76706532 02	GCT	.26138777 03	SIP	.12138684 03	CPT	.84422458 02	SIN	.61806399 02	DI	.12822240 02
RLP	.38825145 06	VEP	.15178629 01	CPE	.86630979 02	CPS	.10244518 03	DZ	.12422323 02	DD	.70522537 01

SELENOCENTRIC — EQUATORIAL COORDINATES

X	.43238523 06	Y	-.79416430 05	Z	-.63952462 05	DX	-.15558301 01	DY	.86263986 00	DZ	.40110494 00
R	.44175000 06	DEC	-.56111919 01	RA	.36499270 03	V	.19065377 01	PTH	-.66165100 02	AZ	.07306293 02
R	.44175000 06	LAT	-.25204388 01	LON	.34433336 03	VP	.19060996 01	PTP	-.66440200 02	AZP	.70660340 02
LTS	-.80081265 00	LNS	.31078490 03	LTE	-.67593157 01	LNE	.53329903 03				
ALT	.26825000 06	SMA	-.24604500 06	ALP	.14406040 01	DR	-.17457657 01	DP	.10003105-01	ASD	.37128009 02
HGE	.30503752 03	SVL	.26721621 01	HMS	.16451946 03	SIA	.13729622 03				

2 DAYS 0 HRS. 27 MIN. 22.962 SEC. 2456477.5716302777049170 J.D.- 2430427.00200030 FEB. 2,1966 00 26 30.962
TPL 2 DAYS 17 HRS. 35 MIN. 22.052 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.38683904 06	Y	-.60038309 05	Z	.13102830 05	DX	-.23926076 01	DY	-.10062051 00	DZ	.10160003 00
R	.39009951 06	DEC	.19700968 01	RA	.18004006 03	V	.24025310 01	PTH	.83270000 02	AZ	.29323074 00
R	.39009951 06	LAT	.19700968 01	LON	.27609342 03	VE	.70040101 02	PTE	.47418293 01	AZE	.27022277 00
RS	.99727792 08	VS	-.99611060 08	ZS	-.63194607 08	DRS	.27475427 02	DVS	.10575500 02	DRS	.00552570 01
RR	-.38759962 06	VR	-.60536900 05	ZR	.12530976 05	DRR	.73635790-01	DVR	-.91917536 00	DZR	-.30720505 00
RT	-.38759962 06	VT	-.60536900 05	ZT	.12530976 05	DRT	.73635790-01	DVT	-.91917536 00	DRT	-.30720505 00
RS	.16762305 09	VS	.30213178 02	RR	.39249087 06	VR	.10001670 01	RT	.39249087 06	VT	.10001670 01
LED	.19339773 01	ALT	.38452133 06	LOS	.62780410 02	RAS	.31543555 03	RAR	.18007607 03	LOR	.27011000 03
DUT	.35000000 02	DT	.09999999 02	DR	.23057700 01	SMA	.32006214 06	DES	-.17031524 02	DER	.18295361 04

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.10011303 09	Y	.99951010 08	Z	.43207990 08	DX	-.24017834 02	DY	-.10604130 02	DZ	-.70635606 01
R	.16766461 09	LAT	.17016114 02	LON	.13516130 03	V	.32044614 02	PTH	.26511537 01	AZ	.10599400 03
RE	-.99613995 08	VE	.99611060 08	ZE	.43194607 08	DRE	-.27475427 02	DVE	-.10575500 02	DRE	-.00552570 01
RT	-.10011539 09	VT	.99951012 08	ZT	.43207419 08	DRT	-.27351791 02	DVT	-.10496470 02	DRT	-.00429640 00
LTE	.17031524 02	LOE	.13503355 03	LTT	.17015617 02	LOT	.13516200 03	RST	.16764917 09	VST	.30031016 02
EPS	.54039016 02	ESP	.12452667 00	SEP	.12503670 03	EPR	.10711171 03	EMP	.22709757 02	REP	.00419912-01
RPS	.10044477 03	RSP	.27653512-10	SMP	.21954504 02	SER	.12407162 03	ERS	.54983572 02	ESR	.12472294 00
RPR	.17353999 04	SPR	.51904174 02								
GCE	.76767360 02	GCT	.27444204 03	SIP	.13076630 02	CPT	.81734151 02	SIN	-.70357033 01	DI	.13071005 04
RLP	.27999931 00	VEP	.24429310 01	CPE	.86421499 02	CPS	.10244400 03	DZ	.10119400 03	DD	.21490622 00

SELENOCENTRIC — EQUATORIAL COORDINATES

X	.15607737 04	Y	.49051136 03	Z	.57191312 03	DX	-.24660434 01	DY	.01094503 00	DZ	.57097420 00
R	.17353999 04	DEC	.19241006 02	RA	.17713490 02	V	.24590176 01	PTH	-.62432201 02	AZ	.50068206 02
R	.17353997 04	LAT	.93313794 01	LON	.21519691 02	DP	.24364126 01	PTP	-.64400409 02	ANP	.73110402 02
LTS	-.80110660 00	LNS	.31050002 03	LTE	-.67607106 01	LNE	-.53245967 03				
ALT	.39990124 00	SMA	-.16463170 04	ALP	.37191673 01	DR	-.17042130 01	DP	.60017071-06	ADD	.00700003 02
MGA	.30516090 03	SVL	.16926365 02	MMG	.10952247 03	SIA	.60341766 02				

SELENOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2456477574062075 3756640 J.D.= 2430427.09002810 PRD. 2.1964 DD 36 10.740

SMA	-.34442569 04	ECC	.12990000 01	B	.20556230 04	SLR	.28375016 04	APU	.00000000 00	ACA	.10700391 00
PM	.11930726 01	CI	.14236721 01	CI	.14000670 00	TPP	-.56660477 03	TP	.40619376 02	ETP	.40409597 02
IA	-.73711562 02	ANA	.14613795 03	IA	-.31169076 02	AA	-.11044316 02	CIA	-.13332210 01	WI	.40496373 02
ZAE	.13293576 03	ZAP	.16722170 03	ZAE	.00430045 02	DAY	.10007569 03	DA	.00000472 04	DP	.70016402 04
UP1	.35160903 02	UT	-.34600203 01	UP2	-.23104567 02						

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	.15607737 04	Y	.49051136 03	Z	.57191312 03	DX	-.24660434 01	DY	.01094503 00	DZ	.57097420 00
INC	.42932605 02	LAN	.35567471 03	ANP	.10744958 03	RX	-.43415445 00	RY	.67546325 00	RZ	.59120458 00
WX	-.51366709-01	WY	-.67919952 00	WZ	.73215539 00	PX	-.16451174 00	PY	.72805961 00	PZ	.60400476 00
UX	-.98503774 00	UY	-.46327882-01	UZ	-.16916083 00	QX	-.36597216 00	QY	.23175995 00	QZ	-.90017022 00
BX	.65330326 00	BY	.51165385 00	BZ	.53901674 00	TX	.55434727 00	TY	.83081534 00	TZ	.00000000 00
SXI	-.75535312 00	SYI	.50599621 00	SZI	.41842634 00	DXI	-.24409460 02	DXI	.14018263 03		
SXO	-.50206346 00	SYO	-.61618877 00	SZO	-.60483077 00	DXO	-.37366497 02	DXO	.23002324 03		
LTE	.15777817 03	LTS	.34322124 02	LTC	.24214411 03						
DTO	.22996357 04	DDO	-.16930041 04	D	.20556230 04	THA	.52363930 03				

ALL VECTORS REFERENCED TO ECLIPTIC PLANE

X	.15607737 04	Y	.60489330 03	Z	.37637303 03	DX	-.24660434 01	DY	.07597041 00	DZ	.26070999 00
INC	.19621078 02	LAN	.35129040 03	ANP	.10777365 03	RX	-.57994136 00	RY	.66467268 00	RZ	.28107664 00
WX	-.51366709-01	WY	-.33184915 00	WZ	.94193398 00	PX	-.16451174 00	PY	.93318301 00	PZ	.41977036 00
UX	-.98503774 00	UY	-.13854003 00	UZ	-.10750088 00	QX	-.13861303 00	QY	.11575571 00	QZ	-.90353054 00
BX	.65336325 00	BY	.70221232 00	BZ	.28300640 00	TX	.64544700 00	TY	.76008171 00	TZ	.00000000 00
SXI	-.75535315 00	SYI	.62989997 00	SZI	.18074183 00	DXI	.13412973 0.	DXI	.14417978 03		
SXO	-.50206347 00	SYO	-.80647855 00	SZO	-.31159497 00	DXO	-.16155135 02	DXO	.23810477 03		
LTE	.17761583 03	LTS	.53959785 02	LTC	.26118177 03						
DTC	.27340509 04	DDC	-.02169316 03	D	.20556230 04	THA	.36327404 03				

ALL VECTORS REFERENCED TO ORBIT PLANE OF TARGET

X	.15556655 04	Y	.20002094 03	Z	.47504365 03	DX	-.23055504 01	DY	.16444543 01	DZ	.43577104-02
INC	.21899497 02	LAN	.32190068 03	ANP	.12103655 03	RX	-.36330663 00	RY	.91018336 00	RZ	.10027567 00
WX	-.22972021 00	WY	-.29383462 00	WZ	.92781955 00	PX	.83407615-01	PY	.94307806 00	PZ	.31950332 00
UX	-.96966732 00	UY	.15080043 00	UZ	-.19730209 00	QX	-.60942127-01	QY	.10223193 00	QZ	-.99237142 00
BX	.79975043 00	BY	.46628336 00	BZ	.35701557 00	TX	.82424127 00	TY	.55800000 00	TZ	.00000000 00
SXI	-.55462725 00	SYI	.82791534 00	SZI	.12320370 00	DXI	.73816534 01	DXI	.12397082 00		
SXO	-.60316850 00	SYO	-.66051605 00	SZO	-.36676116 00	DXO	-.21634235 02	DXO	.22209066 00		
LTE	.17632703 03	LTS	.75625203 02	LTC	.27502703 03						
DTO	.26499707 04	DDO	-.10129515 04	D	.20556243 04	THA	.33502362 00				

ALL VECTORS REFERENCED TO THE LUNAR EQU. PLANE

X	.15936641 04	Y	.62015709 03	Z	.20138490 03	DX	-.24221795 01	DY	.10645607 01	DZ	.37005964 00
INC	.19202120 02	LAN	.35330830 03	ANP	.10324063 03	RX	-.57094406 00	RY	.80101446 00	RZ	.20291510 00
WX	-.37903643-01	WY	-.32670095 00	WZ	.94436420 00	PX	-.12152326 00	PY	.99942136 00	PZ	.12010515 00
UX	-.99106191 00	UY	-.10259088 00	UZ	-.75307040-01	QX	-.16753590 00	QY	.13311052 00	QZ	-.98013361 00
BX	.65599679 00	BY	.67065318 00	BZ	.26237049 00	TX	.67112946 00	TY	.74134618 00	TZ	.00000000 00
SXI	-.72661263 00	SYI	.65177854 00	SZI	.19813807 00	DXI	.31439701 02	DXI	.13704530 03		
SXO	-.53951665 00	SYO	-.70676559 00	SZO	-.20457195 00	DXO	-.17131070 02	DXO	.23862702 03		
LTE	.15704650 03	LTS	.75574873 02	LTC	.29978020 03						
DTT	.27514109 04	DDT	-.76441001 03	D	.20556255 04	THA	.36447324 03				

APPENDIX F

Tables Related to Trajectory Printout

Table F-1. *Ranger VI* trajectory key

COLUMN / ROW		1	2	3	4	5	6
GROUP A	1	GME	J	H	D	RE	REM
	2	G	A	B	C	OME	AU
	3	GMM	GMS	GMV	GMA	GMB	GMJ
	4	EGM	MGM	JA			RA
	5	ARA	GB	MAS			SC
		INJECTION CONDITIONS		TARGET	JULIAN DATE	MONTH, DAY, YEAR	hr min sec
GROUP B	6	GEOCENTRIC	XO	YO	ZO	DXO	DYO	DZO
	7	CARTESIAN			TO	GHA	GHO	
		TIME PAST INJECTION			JULIAN DATE	MONTH, DAY, YEAR	hr min sec
		GEOCENTRIC				EQUATORIAL COORDINATES	
GROUP C	8	X	Y	Z	DX	DY	DZ
	9	R	DEC	RA	V	PTH	AZ
	10	R	LAT	LON	VE	PTE	AZE
	11	XS	YS	ZS	DXS	DYS	DZS
	12	XM	YM	ZM	DXM	DYM	DZM
	13	XT	YT	ZT	DXT	DYT	DZT
	14	RS	VS	RM	VM	RT	VT
	15	GED	ALT	LOS	RAS	RAM	LOM
	16	DUT	DT	DR	SMA	DES	DEM
		GEOCENTRIC CONIC					
		EPOCH OF PERICENTER PASSAGE			JULIAN DATE	MONTH, DAY, YEAR	hr min sec
GROUP D	17	SMA	ECC	B	SLR	APO	RCA
	18	VH	C3	C1	TFP	TF	PER
	19	TA	MTA	EA	MA	C3J	TPI
					ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE		
GROUP E	20	X	Y	Z	DX	DY	DZ
	21	INC	LAN	APF	MX	MY	MZ
	22	WX	WY	WZ	PX	PY	PZ
	23	QX	QY	QZ	RX	RY	RZ
	24	BX	BY	BZ	TX	TY	TZ
	25	DAP	RAP				
	26	STQ	BRQ	B	THA		
		HELIOCENTRIC				EQUATORIAL COORDINATES	
GROUP F	27	X	Y	Z	DX	DY	DZ
	28	R	LAT	LON	V	PTH	AZ
	29	XE	YE	ZE	DXE	DYE	DZE
	30	XT	YT	ZT	DXT	DYT	DZT
	31	LTE	LOE	LTT	LOT	RST	VST
	32	EPS	ESP	SEP	EPM	EMP	MEP
	33	MPS	MSP	SMP	SEM	EMS	ESM
	34	EPT	ETP	TEP	TPS	TSP	STP
	35	SET	STE	EST	RPM	RPT	SPN
	36	OCE	OCT	SIP	CPT	SIN	D1
	37	BEP	VEP	CPE	CPS	D2	D3
		SELENOCENTRIC				EQUATORIAL COORDINATES	
GROUP G	38	X	Y	Z	DX	DY	DZ
	39	R	DEC	RA	V	PTH	AZ
	40	R	LAT	LON	VP	PTP	AZP
	41	LTS	LNS	LTE	LNE		
	42	ALT	SMA	ALP	DR	BP	ASB
	43	HOE	SVL	HNO	SIA		

Table F-1. *Ranger VI* trajectory key (Cont'd)

COLUMN / ROW		1	2	3	4	5	6
SELENOCENTRIC CONIC							
EPOCH OF PERICENTER PASSAGE				JULIAN DATE		MONTH, DAY, YEAR	hr min sec
GROUP H	44	SMA	ECC	B	SLR	APO	RCA
	45	VH	C3	C1	TFP	TF	LTF
	46	TA	MTA	EA	MA	C3J	TFI
	47	ZAE	ZAP	ZAC	DEP	IR	GP
	48	OP1	OY	OP2			
ALL VECTORS REFERENCED TO PRINCIPAL PLANE							
GROUP I	49	X	Y	Z	DX	DY	DZ
	50	INC	LAN	APF	MX	MY	MZ
	51	WX	WY	WZ	PX	PY	PZ
	52	QX	QY	QZ	RX	RY	RZ
	53	BX	BY	BZ	TX	TY	TZ
	54	SXI	SYI	SZI	DAI	RAI	
	55	SXO	SYO	SZO	DAO	RAO	
	56	ETE	ETS	ETC			
	57	BT —	BR —	B	THA		
GROUP J	58	XOCTAL	YOCTAL ZOCTAL	$\dot{X}$OCTAL	$\dot{Y}$OCTAL	$\dot{Z}$OCTAL	
	59		YYMMDDDHH	TTSSSSS		SOCTAL	

Table F-2. *Ranger VI* trajectory key definitions

Group A		
Row 1	GME	Universal gravitational constant times the mass of Earth, km^3/sec^2
	J	Coefficient of the second harmonic in the Earth's potential function
	H	Coefficient of the third harmonic in the Earth's potential function
	D	Coefficient of the fourth harmonic in the Earth's potential function
	RE	Earth radius used in the potential function, km
	REM	Conversion factor for converting lunar ephemerides into km
Row 2	G	Universal constant of gravitation, $km^3/kg\ sec^2$
	A, B, C	Moments of inertia about principal axis for the Moon, $kg\ km^2$
	OME	Sidereal rotation rate of the Earth, deg/sec
	AU	Astronomical unit, km
Row 3	GMM	Universal gravitational constant times the mass of Moon, km^3/sec^2
	GMS	Universal gravitational constant times the mass of Sun, km^3/sec^2
	GMV	Universal gravitational constant times the mass of Venus, km^3/sec^2
	GMA	Universal gravitational constant times the mass of Mars, km^3/sec^2
	GMB	Universal gravitational constant times the mass of Earth–Moon, km^3/sec^2
	GMJ	Universal gravitational constant times the mass of Jupiter, km^3/sec^2
Row 4	EGM	Universal gravitational constant times the mass of Earth used for scaling ephemeris, km^3/sec^2
	MGM	Universal gravitational constant times the mass of Moon used for scaling ephemeris, km^3/sec^2
	JA	Coefficient of second harmonic in Mars potential function
	RA	Mars radius used in the potential function
Row 5	ARA	Frontal area of spacecraft, m^2
	GB	Multiple of % of reflected radiant energy
	MAS	Mass of spacecraft, kg
	SC	Solar radiation constant ($kg \cdot km/sec^2$) 10^{-}
Group B		Injection conditions are vernal equinox Cartesian coordinates in a geocentric equatorial system. The principal direction X is the vernal equinox direction of date and the principal plane XY is the equatorial plane of date. Z is along the direction of the Earth's spin axis of date.
Row 6	XO, YO, ZO	Cartesian components of the probe radius vector, km
	DXO, DYO, DZO	Cartesian components of the probe space-fixed velocity vector, km/sec
Row 7	TO	Time of injection in seconds past midnight of day before launch, sec
	GHA	HA of Greenwich at injection epoch, deg
	GHO	HA of Greenwich at midnight of day before launch, deg
Group C		Inertial position and velocity of the probe, Sun, Moon and target body in a geocentric equatorial system. The principal direction X is the vernal equinox direction of date and the principal plane XY is the equatorial plane of date. Z is along the direction of the Earth's spin axis of date. Miscellaneous parameters are also included.
Row 8	X, Y, Z	Cartesian components of the probe radius vector, km
	DX, DY, DZ	Cartesian components of the probe space-fixed velocity vector, km/sec
Row 9	R	Probe radius distance, km
	DEC	Probe declination angle, deg
	RA	Probe right ascension angle, deg
	V	Probe space-fixed velocity, km/sec
	PTH	Pitch angle of the probe space-fixed velocity vector with respect to the local horizontal, deg
	AZ	Azimuth angle of the probe space-fixed velocity vector measured East of true North, deg
Row 10*	R	Probe radius distance, km
	LAT	Probe geocentric latitude, deg
	LON	Probe East longitude, deg
	VE	Probe Earth-fixed velocity, km/sec
	PTE	Pitch angle of the probe Earth-fixed velocity vector with respect to the local horizontal, deg
	AZE	Azimuth angle of the probe Earth-fixed velocity vector measured East of true North, deg
Row 11	XS, YS, ZS	Cartesian components of the Sun radius vector, km
	DXS, DYS, DZS	Cartesian components of the Sun space-fixed velocity vector, km/sec
Row 12	XM, YM, ZM	Cartesian components of the Moon radius vector, km
	DXM, DYM, DZM	Cartesian components of the Moon space-fixed velocity vector, km/sec

*These are Earth-fixed spherical coordinates in a geocentric equatorial system. The principal direction X is directed toward Greenwich and is the intersection of the meridian plane of Greenwich with the equatorial plane. The principal plane is the Earth's geometrical equatorial plane. X, Y, Z is along the direction of the Earth's geometrical North direction.

Table F-2. *Ranger VI* trajectory key definitions (Cont'd)

Row 13	XT, YT, ZT	Cartesian components of the target radius vector, km
	DXT, DYT, DZT	Cartesian components of the target space-fixed velocity vector, km/sec
Row 14	RS	Sun radius distance, km
	VS	Sun space-fixed velocity, km/sec
	RM	Moon radius distance, km
	VM	Moon space-fixed velocity, km/sec
	RT	Target radius distance, km
	VT	Target space-fixed velocity, km/sec
Row 15	GED	Geodetic latitude of the probe, deg
	ALT	Altitude of the probe above the Earth's surface, km
	LOS	East longitude of the Sun in coordinate system defined in Row 10, deg
	RAS	Right ascension of the Sun, deg
	RAM	Right ascension of the Moon, deg
	LOM	East longitude of the Moon in coordinate system defined in Row 10, deg
Row 16	DUT	Ephemeris time minus Universal Time, sec
	DT	Adams–Moulton step size, sec
	DR	Radial velocity of probe, km/sec
	SHA	Sun shadow parameter, km
	DES	Declination of the Sun, deg
	DEM	Declination of the Moon, deg
Group D		General characteristics of the geocentric conic
Row 17	SMA	Semimajor axis, km
	ECC	Eccentricity
	B	Magnitude of the impact parameter,* km
	SLR	Semilatus rectum, km
	APO	Apogee distance, km
	RCA	Magnitude of the closest approach vector, km
Row 18	VH	Hyperbolic excess speed, km/sec
	C3	Twice the energy (*viz vive* energy integral, km^2/sec^2)
	CI	Angular momentum, km^2/sec
	TFP	Time from pericenter passage, sec
	TF	Time from injection to pericenter passage, hr
	PER	Period, min
Row 19	TA	True anomaly, deg
	MTA	Maximum true anomaly, deg
	EA	Eccentric anomaly, deg
	MA	Mean anomaly, deg
	C3J	Earth–Moon Jacobi constant, km^2/sec^2
	TFI	Time from injection, hr
Group E		Characteristics of the Earth conic in the geocentric equatorial system described under Group B
Row 20	X, Y, Z	Cartesian components of the probe radius vector, km
	DX, DY, DZ	Cartesian components of the probe space-fixed velocity vector, km/sec
Row 21	INC	Inclination of the orbit plane to the equatorial plane, deg
	LAN	Longitude of the ascending node, deg
	APF	Argument of pericenter, deg
	MX, MY, MZ	Components of a unit vector which lies in the orbit plane and is normal to the radius vector R $\mathbf{M} = \mathbf{W} \times \frac{\mathbf{R}}{\lvert\mathbf{R}\rvert}$
Row 22	WX, WY, WZ	Components of a unit vector normal to the conic $\mathbf{W} = \frac{\mathbf{R} \times \mathbf{V}}{\lvert\mathbf{R} \times \mathbf{V}\rvert}$
	PX, PY, PZ	Components of a unit vector in the direction of perigee
Row 23	QX, QY, QZ	Components of a unit vector perpendicular to the perigee direction, vector P, and being in the orbit plane $\mathbf{Q} = \mathbf{W} \times \mathbf{P}$
	RX, RY, RZ	Components of the unit vector R*
Row 24	BX, BY, BZ	Components of the impact parameter B,* km
	TX, TY, TZ	Components of the unit vector T*
Row 25	DAP	Declination of the asymptote, deg
	RAP	Right ascension of the asymptote, deg
Row 26	BTQ	Projection of the impact parameter B* upon the vector T, km
	BRQ	Projection of the impact parameter B* upon the vector R, km
	B	The magnitude of the impact parameter,* km
	THA	Angle between the parameter B* and the vector T measured clockwise from T, deg
Group F		Inertial position and velocity of the probe, Sun, Moon, and target body in a heliocentric equatorial system. The principal direction X is the vernal equinox direction of date and the principal plane XY is the equatorial plane of date. Z is along the direction of the Earth's spin axis of date. Miscellaneous parameters are also included.

* Appendix C.

Table F-2. *Ranger VI* trajectory key definitions (Cont'd)

Row 27	X, Y, Z	Cartesian components of the probe radius vector, km
	DX, DY, DZ	Cartesian components of the probe space-fixed velocity vector, km/sec
Row 28	R	Sun–probe radius distance, km
	LAT	Probe celestial declination, deg
	LON	Probe celestial right ascension, deg
	V	Probe space-fixed velocity, km/sec
	PTH	Pitch angle of the probe space-fixed velocity vector with respect to the local horizontal, deg
	AZ	Azimuth angle of the probe space-fixed velocity vector measured East of true North, deg
Row 29	XE, YE, ZE	Cartesian components of the Earth radius vector, km
	DXE, DYE, DZE	Cartesian components of the Earth space-fixed velocity vector, km/sec
Row 30	XT, YT, ZT	Cartesian components of the target radius vector, km
	DXT, DYT, DZT	Cartesian components of the target space-fixed velocity vector, km/sec
Row 31	LTE	Celestial latitude of the Earth, deg
	LOE	Celestial longitude of the Earth, deg
	LTT	Celestial latitude of the target, deg
	LOT	Celestial longitude of the target, deg
	RST	Sun–target range, km
	VST	Sun–target velocity, km/sec
Row 32	EPS	Earth–probe–Sun angle, deg
	ESP	Earth–Sun–probe angle, deg
	SEP	Sun–Earth–probe angle, deg
	EPM	Earth–probe–Moon angle, deg
	EMP	Earth–Moon–probe angle, deg
	MEP	Moon–Earth–probe angle, deg
Row 33	MPS	Moon–probe–Sun angle, deg
	MSP	Moon–Sun–probe angle, deg
	SMP	Sun–Moon–probe angle, deg
	SEM	Sun–Earth–Moon angle, deg
	EMS	Earth–Moon–Sun angle, deg
	ESM	Earth–Sun–Moon angle, deg
Row 34***	EPT	Earth–probe–target angle, deg
	ETP	Earth–target–probe angle, deg
	TEP	Target–Earth–probe angle, deg
	TPS	Target–probe–Sun angle, deg
	TSP	Target–Sun–probe angle, deg
	STP	Sun–target–probe angle, deg
Row 35	SET***	Sun–Earth–target angle, deg
	STE***	Sun–target–Earth angle, deg
	EST***	Earth–Sun–target angle, deg
	RPM	Moon–probe radius distance, km
	RPT***	Target–probe radius distance, km
	SPN	Sun–probe–near limb of Earth angle, deg
Row 36	GCE	Clock angle of Earth, deg
	GCT	Clock angle of target, deg
	SIP	Sun–probe–near limb of target angle, deg
	CPT	Canopus–probe–near limb of target angle, deg
	SIN	Canopus–probe–near limb of target angle, deg
	D1	Radius of a circle (target) used in construction of visible planet, cm
Row 37	REP	Earth probe distance, km
	VEP	Velocity of the probe with respect to Earth, km/sec
	CPE	Canopus–probe–Earth angle, deg
	CPS	Canopus–probe–Sun angle, deg
	D2	Semi-minor axis of ellipse used in construction of visible planet, cm
	D3	Distance from intersection of ellipse with circle to the diameter (of the circle) that is perpendicular to D1, in construction of visible planet, cm
Group G		
Row 38, 39		Inertial position of probe in a selenocentric equatorial system. The principal direction X is the vernal equinox direction of date and the principal plane XY is the geocentric equatorial plane of date. Z is along the direction of the Earth's spin axis of date.
Row 40, 41, 42		Selenocentric-fixed spherical coordinates of the probe, Sun, and Earth in a selenocentric equatorial system. The principal direction X is in the direction of the mean Moon–Earth line. The principal plane XY is the mean selenocentric equatorial plane. Z is along the direction of the Moon's mean spin axis. Miscellaneous parameters are also included.
Row 38	X, Y, Z	Cartesian components of the probe radius vector, km
	DX, DY, DZ	Cartesian components of the probe velocity vector, km/sec
Row 39	R	Probe radius distance, km
	DEC	Probe declination angle, deg
	RA	Probe right ascension angle, deg
	V	Probe space-fixed velocity, km/sec
	PTH	Pitch angle of the probe space-fixed velocity vector with respect to the local horizontal, deg
	AZ	Azimuth angle of the probe space-fixed velocity vector measured East of true North, deg
Row 40	R	Probe radius distance, km
	LAT	Probe selenocentric latitude, deg
	LON	Probe selenocentric East longitude, deg
	VR	Probe selenocentric-fixed velocity, km/sec
	PTR	Pitch angle of the probe selenocentric-fixed velocity vector with respect to the local horizontal, deg
	AZR	Azimuth angle of the probe selenocentric-fixed velocity vector measured East of the Moon's mean spin axis, deg

***Not printed out in lunar trajectories.

Table F-2. *Ranger VI* trajectory key definitions (Cont'd)

Row 41	LTS	Selenocentric latitude of the Sun, deg
	LNS	Selenocentric longitude of the Sun, deg
	LTE	Selenocentric latitude of the Earth, deg
	LNE	Selenocentric longitude of the Earth, deg
Row 42	ALT	Altitude of the probe above the Moon's surface, km
	SHA	Sun shadow parameter, km
	ALP	Illuminated crescent orientation viewing angle, deg
	DR	First time derivative of the probe radius distance, km/sec
	DP	First time derivative of the probe radius direction, deg/sec
	ASD	Angular semidiameter of Moon as seen from the probe, deg
Row 43	HGE	Right ascension of Earth in probe coordinate system,* deg
	SVL	Declination of the Moon in probe coordinate system,* deg
	HNG	Right ascension of the Moon in probe coordinate system,* deg
	SIA	Earth–probe–Moon angle minus ASD, deg
Group H		Characteristics of the selenocentric conic in the geocentric equatorial system described under Group B except centered at the Moon.
Row 44	SMA	Semimajor axis, km
	ECC	Eccentricity
	B	The magnitude of the impact parameter,** km
	SLR	Semilatus rectum, km
	APO	Apogee distance, km
	RCA	Magnitude of the closest approach vector, km
Row 45	VH	Hyperbolic excess speed, km/sec
	C3	Twice the energy (vis viva energy integral, km^2/sec^2)
	C1	Angular momentum, km^2/sec
	TFP	Time from pericenter passage, sec
	TF	Time from injection to pericenter passage, hr
	LTF	Linearized time-of-flight, hr
Row 46	TA	True anomaly, deg
	MTA	Maximum true anomaly, deg
	EA	Eccentric anomaly, deg
	MA	Mean anomaly, deg
	C3J	Earth–Moon Jacobi constant, km^2/sec^2
	TFI	Time from injection, hr
Row 47	ZAE	Angle between the incoming asymptote and the Moon–Earth vector, deg
	ZAP	Angle between the incoming asymptote and the Moon–Sun vector, deg
	ZAC	Angle between the incoming asymptote and the Moon–Canopus vector, deg
	DEP	Angle between the incoming and outgoing asymptotes, deg
	IR	Maximum B vector magnitude for lunar impact, km
	OP	Angle between the incoming asymptote and its projection on the lunar orbital plane.
Row 48	OPI	Spacecraft nominal terminal maneuver first pitch turn, deg
	OY	Spacecraft nominal terminal maneuver yaw turn, deg
	OP2	Spacecraft nominal terminal maneuver second pitch turn, deg
Group I		Characteristics of the selenocentric conic in the specified "principal plane" coordinate system
Row 49	X, Y, Z	Cartesian components of the probe radius vector, km
	DX, DY, DZ	Cartesian components of the probe space-fixed velocity vector, km/sec
Row 50	INC	Inclination of the orbit plane to the equatorial plane, deg
	LAN	Longitude of the ascending node, deg
	APF	Argument of pericenter, deg
	MX, MY, MZ	Components of a unit vector which lies in the orbit plane and is normal to the radius vector R. $\mathbf{M} = \mathbf{W} \times \frac{\mathbf{R}}{\lvert\mathbf{R}\rvert}$
Row 51	WX, WY, WZ	Components of a unit vector normal to the conic $\mathbf{W} = \frac{\mathbf{R} \times \mathbf{V}}{\lvert\mathbf{R} \times \mathbf{V}\rvert}$
	PX, PY, PZ	Components of a unit vector in the direction of perigee
Row 52	QX, QY, QZ	Components of a unit vector perpendicular to the perigee direction, vector P, and being in the orbit plane $\mathbf{Q} = \mathbf{W} \times \mathbf{P}$
	RX, RY, RZ	Components of the unit vector R**
Row 53	BX, BY, BZ	Components of the impact parameter B,** km
	TX, TY, TZ	Components of the unit vector T**
Row 54	SXI, SYI, SZI	Components of the unit vector S_I** along the direction of the incoming asymptote
	DAI	Declination of the outgoing asymptote,** deg
	RAI	Right ascension of the outgoing asymptote,** deg
Row 55	SXO, SYO, SZO	Components of the unit vector S_O** along the direction of the outgoing asymptote
	DAO	Declination of the outgoing asymptote,** deg
	RAO	Right ascension of the outgoing asymptote,** deg
Row 56	ETE	Angle between the T vector and the projection of the Moon–Earth vector on the R–T plane, deg
	ETS	Angle between the T vector and the projection of the Moon–Sun vector on the R–T plane, deg
	ETC	Angle between the T vector and the projection of the Moon–Canopus vector on the R–T plane, deg

*The coordinate system as defined under Group B except centered at the probe.

Table F-2. *Ranger VI* trajectory key definitions (Cont'd)

Row 57	BT**	Projection of the impact parameter B** upon the vector T, km
	BR**	Projection of the impact parameter B** upon the vector R, km
	B	The magnitude of the impact parameter,** km
	THA	Angle between the parameter B and the vector T, measured clockwise from T, deg
Group J		Cartesian coordinates and epoch of injection conditions in the geocentric equatorial system described under Group B.
Row 58	XOCTAL, YOCTAL, ZOCTAL	Cartesian components of the probe radius vector at injection in octal representation, km
	$\dot{X}$OCTAL, $\dot{Y}$OCTAL, $\dot{Z}$OCTAL	Cartesian components of the probe space-fixed velocity vector at injection in octal representation, km/sec
Row 59		Epoch of injection
	YY	Years past 1900
	MM	Month
	DDD	Day of month
	HH	Hours
	TT	Min
	SSSSS	msec
	SOCTAL	Sec in octal representation
		The time past midnight GMT on (DD), month (MM) and year (YY + 1900) at which the injection epoch occurs is the time determined by the sum of HH, TT, SSSSS, and SOCTAL.
**Principal planes:		Q Earth equatorial plane C Ecliptic plane O Lunar orbital plane T True lunar equator

APPENDIX G

Ranger VI Premidcourse ODP Printout

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PAGE HEADING                                                          123
IBM6  POST AS ORBIT1 ON PRE   JULY 10 1964 )
EPOCH                                                                 101
0.0103076,1.0001885
PRINT POSITION AND VELOCITY AT EPOCH                                  102
R=.6125667216,Y=.2292739466,Z=-.7069491269
TH=-.3773400001,DY=.8953600001,DZ=-.5091000001
STATISTICS,PLOT AND/OR PRINT RESIDUALS FOR THESE PARAMETERS           116
CC(3)=.2,DEC(3)=.2,MA(3)=.2
CC(4)=.2,DEC(4)=.2,MA(4)=.2
CC(5)=.2,DEC(5)=.2,MA(5)=.2
WEIGHTS BY DATA TYPE AND STATION                                      116
MA(6)=-1.
DEC(6)=-1.
MA(5)=-1.
DEC(5)=-1.
REJECTION SIGMAS                                                      106
CC(6)=.5
OTHER PARAMETER VALUES                                                103
TOM=0.
LOMOON=.6   OMMOON=3.567   HSMOON=376.1
R=1398073.75,H=6376.3167,LOMOON=2.0045495
RM=402.6372,H(3)=6371.0792,L(3)=35.117409
L(3)=763.19661,H(4)=6372.6632,L(4)=-31.212164
L(5)=136.88775,H(5)=6375.6930,L(5)=-25.790014
L(6)=27.685576
MAP COVARIANCE MATRIX TO                                              120
0.0000100,0.000000
ESTIMATE THESE PARAMETERS                                             104
R Y Z DR DY DZ
RE
PM
G
RP
H(3),L(3),L(4)
H(5) L(5) L(6)
H(5) L(5) L(5)
NOMINAL VALUES CORRESPONDING TO COVARIANCE MATRIX                     119
.8103037966,.2287299660,-.7094000003
-.3776001134001,.8950113500001,-.5090076716001
1398073.75,6376.3167,.4045495,402.6372,6372.6632,35.117409
763.19661,6372.6632,-31.212164,136.88775,6375.6930,-25.790014
27.685576
INVERSE COVARIANCE MATRIX OF ESTIMATED PARAMETERS                     109
0.1   2265772365957335955127336      2256355C2673113223017670337/0   S
      0235566213265377556216557/0    0375720636,7606472210061/0   S
      2676116175052572623227371/0    0377.2C1170604553906013/0   S
      0236623637662565566100624/0    0236637707725712546706607/0   S
      2155767720511626612745516/0    2156656C1116116131317534161/0   S
      0177222771111566537500630/0    2265127535C1173706127042/0   S
      0235333159373532271177576/0    2111733257341160323325257/0   S
      2276552553715165172657672/0    0255562057255720612365656/0   S
      2165576631061616732373590/0    2226759116C2167573347770/0   S
      0225217572373677622751127/0   S
0.2   2256555160C1C1772632556630/0    2237311234107625623706/0   S
      0227605060656766655566/0       0157726103116076716371167/0   S
      2376657036662706636602/0       0365613250617023115652233/0   S
      0175256255556C1675466767/0     0227500 903367616166035/0   S
      2166567023351612715636346/0    2154436250C5167676155237/0   S
      0167767FC7555322752.7621/0     2256163010621772052676760/0   S
      0276152562667657722730C2/0     2162426616676157722362777/0   S
      2171613367613166636113565/0    0266C7705571571121275625/0   S
      2136616600C2171C1216276267/0   2237574166633616155767106/0   S
      0276022466305655271370277/0   S
0.3   0235555C6T2570155121646/0      0226466205127677157166667/0   S
      2255622676666165166636266/0    2366637146362017366757366/0   S
      0355735566676029137701137/0    2366666975712016651905556/0   S
      2156C2266252167735562151/0     2216667735550166566255666/0   S
      0125622773755571370636367/0    6136:1563332566136167577/0   S
      2136366276666167331657226/0    0356127355215717127671116/0   S
      2255232365571721115276107/0    0566466160765955375276702/0   S
      0156605066615672661115526/0    2225121716156167156467004/0   S
      0115552316762556661610706/0    0167611117716566656315565/0   S
      2165552666075136356721664/0   S
0.4   0375.2577231665652501110/0    0357726507216026361736110/0   S
      2366637725732216661555/0       2566250006117146666536767/0   S
      0515137146066066566466167/0    2565727067527215156615975/0   S
      2115555761001761205.75C6/0     2356C7617515232136467161/0   S
      0265017266656573227266623/0    0276667675266657665736266/0   S
      2575536666765176175C6365/0     0176066566C6566627555656/0   S
      2016132551217266266/0935117/0  0226735265156136756661077/0   S
      0115756236625756266756202/0    2365255662762620115625365/0   S
      0256627C1525072761722232/0     0135166756366665176267676/0   S
      2336555556062C0C6622775/0   S
0.5   2676116057266725556325661/0    2376665C7166667565561956/0   S
      0155756225236266266227/0       0515115176515165756115117/0   S
      2526276C0737521776177756/0     0117160657726165737276775/0   S
      0327676375416367751676316C/0   0566776756666036266106617/0   S
      2276126637751676772C0066/0     2565761056257151662657156/0   S
      0117671126755576175556066/0    2665107127C2355956027262/0   S
      0625666550666C7356556227/0     2266016176005117607966165/0   S
      2376661612271777575271575/0    0375551566566066156266115/0   S
      2266720712721356271335115/0    2365955365765115115115/0   S
      0166752266256165221775117/0   S
0.6   0177C2010657C665776660675/0    0365613611716032766126666/0   S
      2366655166C1620167156.7133/0   2565726675725215066156666/0   S
      0617166307666616051766753/0    2516161315617216752376161/0   S
      2317765562632176322061625/0    2155557732656707501626565/0   S
      0267016622703573075066660/0    0276627706215974257275562/0   S
      2116226210161766666262570/0    0176066617777066156666118/0   S
      2016576211077206511106623/0    0236555562665975625665756/0   S
      0117721116235756215666156/0    2366615156666205666571766/0   S
      0265176077225727111177671/0    0135621176275665115656665/0   S
      2335667777366120155566335065/0   S
0.7   0206626025735565577666310/0    0175756116061066756121755/0   S
      2156601155571627156766611/0    2115557615661176665565716/0   S
      0326762737765777C675720/0      2317763365561766117766116/0   S
      2127755167761157656167576/0    2165566151756165665225572/0   S
      0676615362726556610756265/0    0165111676765315066117756/0   S
      2126112657556115656566/0       0265756276561565165121166/0   S
      2226116331251567256665352/0    0066357757017751131257665/0   S
      0127716655115576565756076/0    2176176115115166056771116/0   S
      0066715075525551565057365/0    0165756265675611175165066/0   S
      2165370672111617236115551/0   S
0.8   0266677775555716661607611/0    0227561066165561715265116/0   S
      0216671115611165.5115675/0     2156067661656205165756/0   S
      0266777265026211266117656/0    2155566756165205165765765/0   S
      0116561015115156077166/0       2225177266656165765765266/0   S
      0156765765255C76666665/0       0166115277566561715115061/0   S
      2156666667116576661655116/0    0266116115675715115061/0   S
      2265651155266117575C.527/0     2066511571661115066115066/0   S
      0166651576655661656161756/0    2256566561115115115266/0   S
      0165251565255555115555555/0    0115756115115115115/0   S
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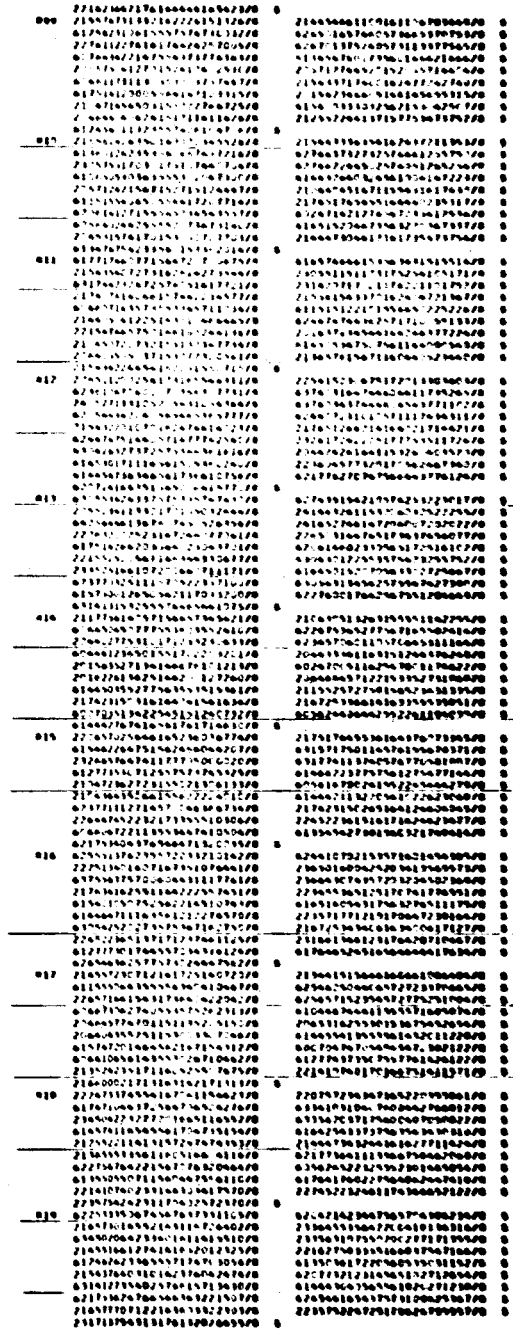

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WEIGHT TABLE(S)                                                    1/5
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COVARIANCE MATRIX OF ESTIMATED PARAMETERS

	X	Y	Z	DX	DY	DZ	DT	DG	G
X	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Y	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Z	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DZ	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DG	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
G	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CORRELATION MATRIX OF ESTIMATED PARAMETERS

	X	Y	Z	DX	DY	DZ	DT	DG	G
X	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Y	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Z	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DZ	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DG	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
G	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

STATION NUMBER 12 04/01/71 STATION NUMBER 3 PASS NUMBER 01/001
FREQUENCY 8449.1

TIME	TC	G	DOC	MB	CCD
062532	60	12			
062632	60	12			
062732	60	12			
062832	60	12			
062932	60	12			
063032	60	12			
063132	60	12			
063232	60	12			
063332	60	12			
063432	60	12			
063532	60	12			
063632	60	12			
063732	60	12			
063832	60	12			
063932	60	12			
064032	60	12			
064132	60	12			
064232	60	12			
064332	60	12			
064432	60	12			
064532	60	12			
064632	60	12			
064732	60	12			
064832	60	12			
064932	60	12			
065032	60	12			
065132	60	12			
065232	60	12			
065332	60	12			
065432	60	12			
065532	60	12			
065632	60	12			
065732	60	12			

STATION NUMBER 12 04/01/71 PASS NUMBER 01/002
FREQUENCY 8449.1

TIME	TC	G	DOC	MB	CCD
065832	60	12			
065932	60	12			
070032	60	12			
070132	60	12			
070232	60	12			
070332	60	12			
070432	60	12			
070532	60	12			
070632	60	12			
070732	60	12			
070832	60	12			
070932	60	12			
071032	60	12			
071132	60	12			
071232	60	12			
071332	60	12			
071432	60	12			
071532	60	12			
071632	60	12			
071732	60	12			
071832	60	12			
071932	60	12			
072032	60	12			
072132	60	12			
072232	60	12			
072332	60	12			
072432	60	12			
072532	60	12			
072632	60	12			
072732	60	12			
072832	60	12			
072932	60	12			
073032	60	12			
073132	60	12			
073232	60	12			
073332	60	12			
073432	60	12			
073532	60	12			
073632	60	12			
073732	60	12			
073832	60	12			
073932	60	12			
074032	60	12			
074132	60	12			
074232	60	12			
074332	60	12			
074432	60	12			
074532	60	12			
074632	60	12			
074732	60	12			
074832	60	12			
074932	60	12			
075032	60	12			

STATION NUMBER 12 04/01/31 STRATOSTATION NUMBER 5 PASS NUMBER 01/311

FREQUENCY 8300.1

TIME	TC	B	DEC	HR	CCD		
075232	60	12		.11E20000	06	.110 00	-.0180
075332	60	12		.11E27060	06	.110 00	-.0176
075432	60	12		.11E27261	06	.110 00	.0070
075532	60	12		.11E27318	06	.110 00	-.0273
075632	60	12		.11E27430	06	.110 00	.0127
075732	60	12		.11E27544	06	.110 00	.0204
075832	60	12		.11E27603	06	.110 00	-.0024
075932	60	12		.11E27627	06	.110 00	-.0026
000032	60	12		.11E27645	06	.110 00	.0037
000132	60	12		.11E27017	06	.110 00	-.0060
000232	60	12		.11E28254	06	.110 00	.0127
000332	60	12		.11E28404	06	.110 00	-.0256
000432	60	12		.11E28559	06	.110 00	.0157
000532	60	12		.11E28710	06	.110 00	-.0117
000632	60	12		.11E28881	06	.110 00	-.0060
000732	60	12		.11E29048	06	.110 00	-.0117
000832	60	12		.11E29219	06	.110 00	.0090
000932	60	12		.11E29394	06	.110 00	.0060
001032	60	12		.11E29574	06	.110 00	.0140
001132	60	12		.11E29757	06	.110 00	-.0361
001232	60	12		.11E29944	06	.110 00	-.0117
001332	60	12		.11E30136	06	.110 00	-.0090
001432	60	12		.11E30331	06	.110 00	.0106
001532	60	12		.11E30531	06	.110 00	-.0266
001632	60	12		.11E30734	06	.110 00	-.0279
001732	60	12		.11E30942	06	.110 00	-.0029
001832	60	12		.11E31153	06	.110 00	.0342
002139	60	12		.11E31837	06	.110 00	-.0264
002239	60	12		.11E32465	06	.110 00	.0470
002339	60	12		.11E32797	06	.110 00	-.0342
002439	60	12		.11E33512	06	.110 00	-.0129
002539	60	12		.11E33771	06	.110 00	-.0117
002639	60	12		.11E33816	06	.110 00	-.0090
002739	60	12		.11E33861	06	.110 00	.0060
002839	60	12		.11E33912	06	.110 00	.0156
002939	60	12		.11E33964	06	.110 00	-.0203
003039	60	12		.11E34020	06	.110 00	.0090
003139	60	12		.11E34084	06	.110 00	-.0117
003239	60	12		.11E34152	06	.110 00	.0127
003339	60	12		.11E34227	06	.110 00	-.0166
003439	60	12		.11E34305	06	.110 00	.0070
003539	60	12		.11E34377	06	.110 00	.0166
003639	60	12		.11E34452	06	.110 00	-.0090
003739	60	12		.11E34534	06	.110 00	-.0166
003839	60	12		.11E34624	06	.110 00	-.0273
003939	60	12		.11E34716	06	.110 00	.0244
004039	60	12		.11E34811	06	.110 00	-.0090
004139	60	12		.11E34910	06	.110 00	.0070
004239	60	12		.11E35012	06	.110 00	-.0361
004339	60	12		.11E35117	06	.110 00	.0196
004439	60	12		.11E35227	06	.110 00	.0182
004539	60	12		.11E35340	06	.110 00	.0313
004639	60	12		.11E35457	06	.110 00	-.0390
004739	60	12		.11E35577	06	.110 00	.0450
004839	60	12		.11E35701	06	.110 00	.0295
004939	60	12		.11E35829	06	.120 00	.0137
005039	60	12		.11E35960	06	.120 00	.0236
005139	60	12		.11E36093	06	.120 00	.0200

DATA STATISTICS STATION 5 STRATOSTATION 5

PASS	DATA TYPE	BEGINNING TIME	END TIME	NUMBER OF POINTS	STD DEV	MEAN	FIRST MOMENT	SECOND MOMENT
01/311	CCD	1/31-062532	1/31-063732	27	.219-01	.229-01	-.391-02	.483-03
01/312	CCD	1/31-065032	1/31-[illegible]	319	.203-01	.239-01	-.219-02	.560-03

STATION NUMBER 41 66/01/30 STRATION NUMBER 5 POIN NUMBER 01/001

FREQUENCY 8501.0

TIME	TC	B	DEC			RA			CCD		
165101	0	41	.34049317	03	.101 01	-.03220	.34995371	02 .107 01	-.15770		
165131	60	41							.12666495	06 .072-01	-.0225
165201	60	41	.34037009	03	.101 01	-.03110	.32991619	02 .107 01	-.03360		
165231	60	41							.12719401	06 .067-01	-.0060
165301	60	41	.34035983	03	.101 01	-.03040	.30974219	02 .107 01	-.12090		
165331	60	41							.12770726	06 .067-01	.0700
165401	60	41	.34034930	03	.101 01	-.04050	.49292367	02 .107 01	-.04480		
165431	60	41							.12810760	06 .059-01	-.0030
165501	60	41	.34039599	03	.101 01	-.04630	.40191365	02 .107 01	-.05290		
165531	60	41							.12850061	06 .050-01	.0195
165601	60	41	.34043336	03	.101 01	-.04920	.46910642	02 .107 01	-.06390		
165631	60	41	.34043014	03	.101 01	-.05200	.43907267	02 .107 01	-.06830		
165701	60	41							.12942175	06 .054-01	.0295
170031	60	41	.34071194	03	.101 01	-.04310	.42695751	02 .107 01	-.03670		
170131	60	41							.12961245	06 .054-01	.0160
170161	60	41	.34080030	03	.101 01	-.05260	.41540629	02 .107 01	-.03760		
170231	60	41							.12974641	06 .054-01	.0170
170301	60	41	.34089416	03	.101 01	-.04720	.40638534	02 .107 01	-.03940		
170331	60	41							.12986218	06 .054-01	.0025
170401	60	41	.34099750	03	.101 01	-.03870	.39786326	02 .106 01	-.04320		
170431	60	41							.12995996	06 .054-01	.0000
170461	60	41	.34109475	03	.101 01	-.03190	.38981059	02 .106 01	-.05190		
170531	60	41							.13003102	06 .054-01	-.0050
170601	60	41	.34119998	03	.101 01	-.02900	.38219984	02 .106 01	-.05000		
170631	60	41							.13009130	06 .054-01	.0000
170661	60	41	.34130164	03	.101 01	-.02890	.37501550	02 .106 01	-.05130		
170731	60	41							.13013607	06 .054-01	.0107
170761	60	41	.34141720	03	.100 01	-.03060	.36820295	02 .106 01	-.04590		
170831	60	41							.13016916	06 .054-01	.0000
170861	60	41	.34152021	03	.100 01	-.03490	.36177035	02 .106 01	-.04380		
170931	60	41							.13018977	06 .054-01	.0000
170961	60	41	.34164076	03	.100 01	-.03110	.35568056	02 .106 01	-.04350		
171031	60	41							.13019900	06 .054-01	.0059
171061	60	41	.34175301	03	.100 01	-.03250	.34993203	02 .106 01	-.04700		
171131	60	41							.13020056	06 .054-01	-.0070
171161	60	41	.34186016	03	.100 01	-.03020	.34448853	02 .106 01	-.03160		
171231	60	41							.13018277	06 .054-01	-.0137
171261	60	41	.34197946	03	.100 01	-.03000	.33933065	02 .106 01	-.03270		
171331	60	41							.13017737	06 .054-01	-.0070
171361	60	41	.34209268	03	.100 01	-.03900	.33446767	02 .105 01	-.03360		
171501	0	41	.34231813	03	.100 01	-.03020	.32360090	02 .105 01	-.03400		

FREQUENCY .0

171601	0	0	.34243067	03	.100 01	-.04200	.32137063	02 .105 01	-.03670		

FREQUENCY 8501.0

171701	0	41	.34254131	03	.100 01	-.04030	.31740040	02 .105 01	-.03400		
171731	60	41							.13061103	06 .057-01	-.0017
171801	60	41	.34265177	03	.100 01	-.04310	.31337963	02 .105 01	-.03050		
171831	60	41							.13066302	06 .057-01	-.0030
171901	60	41	.34278133	03	.100 01	-.04310	.31031209	02 .105 01	-.03020		
171931	60	41							.13071329	06 .057-01	.0050
172001	60	41	.34286998	03	.100 01	-.04410	.30707255	02 .105 01	-.03320		
172031	60	41							.13080953	06 .057-01	.0020
172101	60	41	.34297760	03	.100 01	-.02010	.30391517	02 .105 01	-.03640		
172131	60	41							.13080290	06 .057-01	-.0007
172201	60	41	.34309416	03	.100 01	-.03790	.30096273	02 .105 01	-.03320		
172231	60	41							.13076394	06 .057-01	-.0027
172301	60	41	.34319063	03	.100 01	-.04000	.29821404	02 .105 01	-.03050		

FREQUENCY .0

172401	0	0	.34329396	03	.100 01	-.03930	.29546393	02 .105 01	-.03370		

FREQUENCY 8501.0

172501	0	41	.34339716	03	.100 01	-.03000	.29314790	02 .105 01	-.03280		
172531	60	41							.13059669	06 .057-01	-.0050
172601	60	41	.34349915	03	.100 01	-.04320	.29083621	02 .105 01	-.02640		
172631	60	41							.13048036	06 .057-01	-.0020
172701	60	41	.34359998	03	.100 01	-.03010	.28865810	02 .105 01	-.03310		
172731	60	41							.13042068	06 .057-01	-.0029
172801	60	41	.34369960	03	.100 01	-.04400	.28661361	02 .105 01	-.03070		
172831	60	41							.13035190	06 .057-01	.0000
172901	60	41	.34379803	03	.100 01	-.03870	.28469581	02 .105 01	-.03290		
172931	60	41							.13026715	06 .057-01	-.0040
173001	60	41	.34389526	03	.100 01	-.04410	.28289691	02 .105 01	-.02710		
173031	60	41							.13021190	06 .057-01	-.0040
173101	60	41	.34399129	03	.100 01	-.03030	.28121410	02 .105 01	-.03000		
173131	60	41							.13010033	06 .057-01	.0020
173201	60	41	.34408611	03	.100 01	-.04530	.27964201	02 .105 01	-.02370		
173231	60	41							.13000050	06 .057-01	-.0030
173301	60	41	.34417975	03	.100 01	-.04320	.27817508	02 .104 01	-.02510		

FREQUENCY .0

173401	0	0	.34427221	03	.100 01	-.04500	.27681194	02 .104 01	-.01080		

FREQUENCY 8501.0

173501	0	41	.34436350	03	.100 01	-.05320	.27554463	02 .104 01	-.02610		
173531	60	41							.12985063	06 .057-01	.0040
173601	60	41	.34443362	03	.100 01	-.04330	.27437139	02 .104 01	-.01890		
173631	60	41							.12977751	06 .057-01	-.0060
173701	60	41	.34454250	03	.100 01	-.05070	.27328055	02 .104 01	-.02060		
173731	60	41							.12970426	06 .057-01	-.0030
173801	60	41	.34463044	03	.100 01	-.05460	.27229212	02 .104 01	-.02510		
173831	60	41							.12963007	06 .057-01	-.0000
173901	60	41	.34471715	03	.100 01	-.04330	.27137993	02 .104 01	-.01990		
173931	60	41							.12955760	06 .057-01	-.0040
174001	60	41	.34480276	03	.100 01	-.05110	.27054619	02 .104 01	-.02260		
174031	60	41							.12948047	06 .057-01	-.0000

STATION NUMBER 41 06/01/90 STRATION NUMBER 3 PASS NUMBER 06/304

FREQUENCY 8981.0

TIME	TC	Q	DEC			RA			DEC		
176101	60	41	.34608720	03	.100 01	-.04300	.26979902	02 .104 01	-.01710		
176131	60	41								.12041137	00 .059-01 -.0020
176201	60	41	.34697873	03	.100 01	-.03930	.26916900	02 .104 01	-.02110		
176231	60	41								.12013062	00 .059-01 .0060
176301	60	41	.34505310	03	.100 01	-.04500	.26849950	02 .104 01	-.02220		
176331	60	41								.12026360	00 .059-01 -.0100
176401	60	41	.34513499	03	.100 01	-.03920	.26795878	02 .104 01	-.01810		
176431	60	41								.12019110	00 .062-01 .0000
176501	60	41	.34521475	03	.100 01	-.04300	.26740402	02 .104 01	-.01000		
176531	60	41								.12012095	00 .062-01 -.0049
176601	60	41	.34529065	03	.100 01	-.03890	.26675723	02 .104 01	-.02190		
176631	0	41	.34544967	03	.100 01	-.03470	.26604276	02 .104 01	-.02450		
176701	60	41									
176731	60	41	.34552604	03	.100 01	-.05110	.26621071	02 .104 01	-.02570	.12790620	00 .062-01 -.0190
176801	60	41									
176831	60	41								.12785534	00 .062-01 -.0219
176901	60	41	.34560144	03	.100 01	-.03870	.26483710	02 .104 01	-.02760		
176931	60	41								.12770407	00 .062-01 -.0000
177001	60	41	.34567596	03	.100 01	-.03720	.26391786	02 .104 01	-.02660		
177031	60	41								.12789483	00 .062-01 .0205
177101	60	41	.34576952	03	.100 01	-.03630	.26305100	02 .104 01	-.02390		
177131	60	41								.12782521	00 .062-01 -.0150
177201	60	41	.34582270	03	.100 01	-.04350	.26203404	02 .104 01	-.02660		
177231	60	41								.12755605	00 .062-01 -.0140
177301	60	41	.34589399	03	.100 01	-.04930	.26106705	02 .104 01	-.02580		
177331	60	41								.12740734	00 .062-01 -.0035
177401	60	41	.34596497	03	.100 01	-.03630	.26004061	02 .104 01	-.02390		
177431	60	41								.12741910	00 .062-01 .0020
177501	60	41	.34603900	03	.100 01	-.04040	.25907546	02 .104 01	-.02670		
177531	60	41								.12735133	00 .064-01 -.0020
177601	60	41	.34610425	03	.100 01	-.04100	.25804041	02 .104 01	-.02590		
177631	60	41								.12720406	00 .065-01 -.0117
177701	60	41	.34617267	03	.100 03	-.03810	.25704183	02 .104 01	-.02540		
177731	60	41								.12721720	00 .064-01 .0020
177801	60	41	.34624079	03	.100 03	-.03900	.25601771	02 .104 01	-.02120		
177831	60	41								.12715100	00 .064-01 -.0209
177901	60	41	.34630712	03	.100 03	-.04090	.25501513	02 .104 03	-.02500		
177931	60	41								.12700323	00 .064-01 -.0020
180001	60	41	.34637317	03	.100 01	-.04000	.25395213	02 .104 01	-.02700		
180031	60	41								.12701997	00 .064-01 -.0170
180101	60	41	.34643046	03	.100 01	-.03800	.25272751	02 .104 01	-.02040		
180131	60	41								.12699522	00 .064-01 -.0010
180201	60	41	.34650508	03	.100 01	-.04290	.25014019	02 .104 01	-.01570		
180231	60	41								.12690890	00 .064-01 -.0010
180301	60	41	.34656680	03	.100 01	-.04270	.24908909	02 .103 01	-.02270		
180331	60	41								.12682727	00 .064-01 -.0030
180401	60	41	.34662908	03	.100 01	-.03790	.24807317	02 .103 01	-.02720		
180431	60	41								.12670407	00 .064-01 -.0099
180501	60	41	.34669276	03	.100 01	-.04170	.24709140	02 .103 01	-.03110		
180531	60	41								.12670160	00 .064-01 -.0130
180601	60	41	.34675303	03	.100 01	-.04330	.24614500	02 .103 01	-.02030		
180631	60	41								.12663904	00 .067-01 .0040
180701	60	41	.34681492	03	.100 01	-.04430	.24517701	02 .103 01	-.02600		
180731	0	41	.34683409	03	.100 01	-.04030	.24190044	02 .103 01	-.02720		
180801	60	41								.12649500	00 .067-01 -.0200
180831	60	41	.34699100	03	.100 01	-.04320	.24266427	02 .103 01	-.02290		
180901	60	41								.12639503	00 .067-01 .0060
180931	60	41	.34705227	03	.100 01	-.04990	.24350413	02 .103 01	-.02160		
181001	60	41								.12633676	00 .067-01 .0010
181031	60	41	.34711981	03	.100 01	-.04130	.24243223	02 .103 01	-.02900		

FREQUENCY .0

181101	0	0	.34716714	03	.100 01	-.04030	.24060200	02 .103 01	-.02000		

FREQUENCY 8981.0

181201	0	41	.34722367	03	.100 01	-.04000	.23969036	02 .103 01	-.02370		
181231	60	41								.12610004	00 .067-01 -.0070
181301	60	41	.34727959	03	.100 01	-.04000	.23866397	02 .103 01	-.02720		
181331	60	41								.12610314	00 .067-01 -.0040
181401	60	41	.34733696	03	.100 01	-.04200	.23765352	02 .103 01	-.01920		
181431	60	41								.12604612	00 .069-01 -.0040
181501	60	41	.34738971	03	.100 01	-.04000	.23664693	02 .103 01	-.01370		
181531	60	41								.12590060	00 .069-01 -.0030
181601	60	41	.34744392	03	.100 01	-.03200	.23565507	02 .103 01	-.02060		
181631	60	41								.12585950	00 .069-01 -.0060
181701	60	41	.34749757	03	.100 01	-.04050	.23466605	02 .103 01	-.02300		
181731	60	41								.12583800	00 .069-01 -.0070
181801	60	41	.34755068	03	.100 01	-.04150	.23369167	02 .103 01	-.01350		
181831	60	41								.12582302	00 .069-01 -.0040
181901	60	41	.34760325	03	.100 01	-.04200	.23269000	02 .103 01	-.02120		
181931	60	41								.12570047	00 .069-01 -.0029
182001	60	41	.34765320	03	.100 01	-.03500	.23170020	02 .103 01	-.02530		
182031	60	41								.12571440	00 .069-01 -.0010
182101	60	41	.34770683	03	.100 01	-.03900	.23069901	02 .103 01	-.02700		
182131	60	41								.12566001	00 .069-01 .0070
182201	60	41	.34775705	03	.100 01	-.03040	.22968062	02 .103 01	-.02700		
182231	60	41								.12560100	00 .069-01 -.0070
182301	60	41	.34780837	03	.100 01	-.03090	.22870279	02 .103 01	-.02290		
182331	60	41								.12559504	00 .069-01 .0030
182401	60	41	.34785839	03	.100 01	-.03200	.22769403	02 .103 01	-.02030		
182431	60	41								.12558207	00 .072-01 .0010
182501	60	41	.34790793	03	.100 01	-.02030	.22669603	02 .103 01	-.02090		
182531	60	41								.12560115	00 .072-01 -.0130
182601	60	41	.34795750	03	.100 01	-.03130	.22569700	02 .103 01	-.02070		
182631	60	41								.12550000	00 .072-01 -.0010
182701	60	41	.34800560	03	.100 01	-.03500	.22470661	02 .103 01	-.02670		
182731	60	41								.12530007	00 .072-01 -.0060
182801	60	41	.34805375	03	.100 01	-.03190	.22369390	02 .103 01	-.02650		
182831	60	41								.12520071	00 .072-01 0.00000
182901	60	41	.34810141	03	.100 01	-.03130	.22253927	02 .103 01	-.02010		
182931	60	41								.12520000	00 .072-01 .0010
183001	60	41	.34814604	03	.100 01	-.03060	.22173205	02 .103 01	-.02350		
183031	60	41								.12500002	00 .072-01 -.0060

STATION NUMBER 41 66/01/30 ITERATION NUMBER 3 PASS NUMBER 01/301

FREQUENCY 8901.0

TIME	TC	O	DOC			DOA			DCS		
183401	60	41	.34819344	03	.100 01	-.02940	.29997188	02 .103 01	-.02060		
183431	60	41								.12519020	06 .072-01 .0166
183501	60	41	.34824180	03	.100 01	-.02960	.29612899	02 .103 01	-.04160		
183531	60	41								.12510167	06 .072-01 -.0294
183601	60	41	.34828774	03	.100 01	-.01390	.29235173	02 .103 01	-.02770		
183631	60	41								.12505369	06 .074-01 -.0187
183701	60	41	.34833123	03	.100 01	-.03030	.28863061	02 .103 01	-.03160		
183731	60	41								.12500673	06 .074-01 -.0016
183801	60	41	.34837236	03	.100 01	-.03190	.28494441	02 .103 01	-.02920		
183831	60	41								.12495839	06 .074-01 .0070
183901	60	41	.34842306	03	.100 01	-.03440	.28111419	02 .103 01	-.02420		
183931	60	41								.12491166	06 .074-01 .0029
184001	60	41	.34846736	03	.100 01	-.02670	.27739006	02 .103 01	-.02460		
184031	60	41	.34855474	03	.100 01	-.03390	.27369190	02 .103 01	-.02430		
184101	60	41								.12477312	06 .074-01 -.0020
184131	60	41	.34859702	03	.100 01	-.02940	.27003901	02 .103 01	-.03120		
184201	60	41								.12472700	06 .074-01 -.0176
184231	60	41	.34864068	03	.100 01	-.01960	.26640165	02 .103 01	-.01940		
184301	60	41								.12468287	06 .074-01 .0060
184331	60	41	.34868167	03	.100 01	-.03590	.26280656	02 .103 01	-.03560		
184401	60	41								.12463836	06 .074-01 .0117
184431	60	41	.34872509	03	.100 01	-.04170	.25924497	02 .103 01	-.02070		
184501	60	41								.12459418	06 .074-01 -.0106
184531	60	41	.34876476	03	.100 01	-.03330	.25572632	02 .103 01	-.04270		
184601	60	41								.12455041	06 .074-01 .0059
184631	60	41	.34880607	03	.100 01	-.03450	.25225040	02 .102 01	-.03170		
184701	60	41								.12450701	06 .074-01 -.0117
184731	60	41	.34884903	03	.100 01	-.03160	.24880694	02 .102 01	-.03950		
184801	60	41								.12446390	06 .074-01 -.0016
184831	60	41	.34888955	03	.100 01	-.03390	.24540573	02 .102 01	-.02060		
184901	60	41								.12442132	06 .074-01 -.0029
184931	60	41	.34892453	03	.101 01	-.03010	.24204655	02 .102 01	-.02150		
185001	60	41								.12437902	06 .074-01 .0127
185031	60	41	.34896987	03	.101 01	-.03590	.23873911	02 .102 01	-.03190		
185101	60	41								.12433700	06 .074-01 -.0127
185131	60	41	.34900948	03	.101 01	-.04530	.23547328	02 .102 01	-.02160		
185201	60	41								.12429549	06 .074-01 -.0070
185231	60	41	.34904878	03	.101 01	-.03630	.23224881	02 .102 01	-.03610		
185301	60	41								.12425426	06 .074-01 -.0070
185331	60	41	.34908775	03	.101 01	-.03330	.22907513	02 .102 01	-.01780		
185401	60	41								.12421337	06 .074-01 -.0176
185431	60	41	.34912640	03	.101 01	-.03590	.22594201	02 .102 01	-.02460		
185501	60	41								.12417282	06 .074-01 .0112
185531	60	41	.34916475	03	.101 01	-.03610	.22284893	02 .102 01	-.03430		
185601	60	41								.12413261	06 .074-01 -.0137
185631	60	41	.34920278	03	.101 01	-.03080	.21979539	02 .102 01	-.02750		
185701	60	41								.12409274	06 .074-01 .0090
185731	60	41	.34924052	03	.101 01	-.03360	.21678095	02 .102 01	-.02360		
185801	60	41								.12405320	06 .074-01 .0010
185831	60	41	.34927795	03	.101 01	-.03380	.21381501	02 .102	-.02060		
185901	60	41								.12401398	06 .074-01 -.0176
185931	60	41	.34931510	03	.101 01	-.04200	.21088662	02 .102 01	-.03750		
190001	60	41								.12397509	06 .074-01 -.0060
190031	60	41	.34935195	03	.101 01	-.03470	.20799575	02 .102 01	-.02560		
190101	60	41								.12393652	06 .001-01 .0127
190131	60	41	.34938852	03	.101 01	-.03110	.20514199	02 .102 01	-.01560		
190201	60	41								.12389826	06 .001-01 -.0136
190231	60	41	.34942480	03	.101 01	-.03320	.20233140	02 .102 01	-.02020		
190301	60	41								.12386032	06 .001-01 .0090
190331	60	41	.34946081	03	.101 01	-.03710	.19956066	02 .102 01	-.02060		
190401	60	41								.12382269	06 .001-01 -.0060
190431	60	41	.34949654	03	.101 01	-.02070	.19681957	02 .102 01	-.02070		
190501	60	41								.12378536	06 .001-01 -.0117
190531	60	41	.34953200	03	.101 01	-.03390	.19410765	02 .102 01	-.02630		
190601	60	41								.12374833	06 .001-01 .0146
190631	60	41	.34956719	03	.101 01	-.03110	.19143365	02 .102 01	-.01460		

FREQUENCY .0

192301	0	0	.35004520	03	.101 01	-.03070	.36006001	02 .102 01	-.03190		
192331	0	0	.35009455	03	.101 01	-.03390	.37013661	02 .102 01	-.03270		
192401	0	0	.35012768	03	.101 01	-.03060	.37180705	02 .102 01	-.03990		
192431	0	0	.35015960	03	.101 01	-.03760	.37360596	02 .102 01	-.03950		
192501	0	0	.35018931	03	.101 01	-.03210	.37554130	02 .102 01	-.03620		
192531	0	0	.35021900	03	.101 01	-.03440	.37710299	02 .102 01	-.03360		
192601	0	0	.35025010	03	.101 01	-.03260	.37906000	02 .102 01	-.03520		
192631	0	0	.35028010	03	.101 01	-.03450	.38062676	02 .102 01	-.03770		
192701	0	0	.35031074	03	.101 01	-.03420	.38239476	02 .102 01	-.02780		
192731	0	0	.35033977	03	.101 01	-.03370	.38417076	02 .102 01	-.02490		
192801	0	0	.35036927	03	.101 01	-.03590	.38595266	02 .102 01	-.02670		
192831	0	0	.35039857	03	.101 01	-.03210	.38773995	02 .102 01	-.02560		
192901	0	0	.35042768	03	.101 01	-.03110	.38953116	02 .102 01	-.03390		
192931	0	0	.35045661	03	.101 01	-.03390	.39133180	02 .102 01	-.03090		
193001	0	0	.35048536	03	.101 01	-.03230	.39312617	02 .102 01	-.03160		
193031	0	0	.35051388	03	.101 01	-.03270	.39490506	02 .102 01	-.02960		
193101	0	0	.35054275	03	.101 01	-.02600	.39670000	02 .102 01	-.03200		
193131	0	0	.35057044	03	.101 01	-.03090	.39850116	02 .102 01	-.02750		
193201	0	0	.35059864	03	.101 01	-.03470	.40030694	02 .102 01	-.02770		
193231	0	0	.35062627	03	.101 01	-.03530	.40207710	02 .102 01	-.02770		
193301	0	0	.35065392	03	.101 01	-.03190	.40387260	02 .102 01	-.02950		
193331	0	0	.35068139	03	.101 01	-.03110	.40565325	02 .102 01	-.01860		
193401	0	0	.35070878	03	.101 01	-.02870	.40737062	02 .102 01	-.02050		
193431	0	0	.35073585	03	.101 01	-.03320	.40906893	02 .102 01	-.02350		
193501	0	0	.35076281	03	.101 01	-.03590	.41146190	02 .102 01	-.01260		
193531	0	0	.35079942	03	.101 01	-.03090	.41327338	02 .102 01	-.03090		
193601	0	0	.35081676	03	.101 01	-.02890	.41510785	02 .102 01	-.01560		
193631	0	0	.35084278	03	.101 01	-.03320	.41695669	02 .102 01	-.01060		
193701	0	0	.35086905	03	.101 01	-.02960	.41880805	02 .102 01	-.02520		
193731	0	0	.35089521	03	.101 01	-.03590	.42067360	02 .102 01	-.02360		
193801	0	0	.35092121	03	.101 01	-.02910	.42250995	02 .102 01	-.02000		
193831	0	0	.35094706	03	.101 01	-.03270	.42437630	02 .102 01	-.02070		
193901	0	0	.35097275	03	.101 01	-.02830	.42626698	02 .102 01	-.02000		
193931	0	0	.35099829	03	.101 01	-.03360	.42816193	02 .102 01	-.00190		
194001	0	0	.35102368	03	.101 01	-.03600	.43006000	02 .102 01	-.00750		

TIME	TC	B	DEC			MA			CCS		
195601	0	0	.35104092 C3 .101 01	-.02940	.45718386 02 .102 01	-.02970					
195601	0	0	.35103401 C3 .101 01	-.03270	.45607002 02 .102 01	-.03040					
200001	0	0	.35100095 C3 .101 01	-.03140	.45508195 02 .102 01	-.03160					
			FREQUENCY 8552.0								
200601	0	41	.35129593 C3 .101 01	-.03040	.45752835 02 .102 01	-.02960					
200631	60	41					.12199100 06 .001-01	.0030			
200701	60	41	.35126959 C3 .101 01	-.03290	.44966560 02 .102 01	-.02940					
200731	60	41					.12196786 06 .001-01	.0060			
200801	60	41	.35123342 C3 .101 01	-.03010	.45140054 02 .102 01	-.02890					
200831	60	41					.12194399 06 .001-01	.0090			
200901	60	41	.35121731 C3 .101 01	-.03100	.45335094 02 .102 01	-.02910					
200931	60	41					.12192027 06 .001-01	-.0020			
201001	60	41	.35134067 C3 .101 01	-.02890	.45529879 02 .102 01	-.03190					
201031	60	41					.12190669 06 .001-01	.0030			
201101	60	41	.35136409 C3 .101 01	-.03010	.45725007 02 .102 01	-.03110					
201131	60	41					.12187327 06 .001-01	.0000			
201201	60	41	.35138760 C3 .101 01	-.03250	.45920473 02 .102 01	-.04090					
201231	60	41					.12184990 06 .001-01	.0195			
201301	60	41	.35141130 C3 .101 01	-.03010	.46116274 02 .102 01	-.03650					
201331	60	41					.12182684 06 .001-01	-.0030			
201401	60	41	.35143360 C3 .101 01	-.03790	.46312399 02 .102 01	-.03060					
201431	0	41	.35145931 C3 .101 01	-.03610	.46505627 02 .102 01	-.01790					
201501	60	41					.12175024 06 .001-01	-.0020			
201531	60	41	.35150196 C3 .101 01	-.03260	.46702718 02 .102 01	-.03110					
201601	60	41					.12173364 06 .000-01	.0205			
201631	60	41	.35152652 C3 .101 01	-.03490	.46900173 02 .102 01	-.02450					
201701	60	41					.12171319 06 .000-01	-.0205			
201731	60	41	.35154695 C3 .101 01	-.03110	.47097835 02 .102 01	-.01830					
201801	60	41					.12169060 06 .000-01	.0020			
201831	60	41	.35156075 C3 .101 01	-.03120	.47295852 02 .102 01	-.04040					
201901	60	41					.12166806 06 .000-01	.0020			
201931	60	41	.35159143 C3 .101 01	-.03110	.47494171 02 .102 01	-.02670					
202001	60	41					.12164669 06 .000-01	-.0140			
202031	60	41	.35161349 C3 .101 01	-.03490	.47692786 02 .102 01	-.03940					
202101	60	41					.12162446 06 .000-01	.0230			
202131	60	41	.35163944 C3 .101 01	-.03660	.47891687 02 .102 01	-.03040					
202201	60	41					.12160205 06 .000-01	-.0140			
202231	60	41	.35165727 C3 .101 01	-.03020	.48090897 02 .102 01	-.03960					
202301	60	41					.12158116 06 .000-01	-.0107			
202331	60	41	.35167890 C3 .101 01	-.03970	.48290363 02 .102 01	-.03570					
202401	60	41					.12155960 06 .000-01	.0195			
202431	60	41	.35170050 C3 .101 01	-.03560	.48490151 02 .102 01	-.03500					
202501	60	41					.12153015 06 .000-01	-.0230			
202531	60	41	.35172207 C3 .101 01	-.03230	.48690291 02 .102 01	-.03110					
202601	60	41					.12151606 06 .000-01	-.0020			
202631	60	41	.35174365 C3 .101 01	-.03560	.48890523 02 .102 01	-.02550					
202701	60	41					.12149563 06 .000-01	-.0150			
202731	60	41	.35176472 C3 .101 01	-.03650	.49091116 02 .102 01	-.02610					
202801	60	41					.12147455 06 .000-01	-.0020			
202831	60	41	.35178587 C3 .101 01	-.02940	.49291986 02 .102 01	-.03300					
202901	60	41					.12145372 06 .000-01	-.0020			
202931	60	41	.35180691 C3 .101 01	-.03620	.49493110 02 .102 01	-.03210					
203001	0	41	.35180660 C3 .101 01	-.03790	.50090165 02 .102 01	-.02930					
203031	60	41					.12190130 06 .011-01	.0060			
203101	60	41	.35180960 C3 .101 01	-.03390	.50290073 02 .102 01	-.03930					
203131	60	41					.12190006 06 .011-01	8.11720			
203201	60	41	.35180962 C3 .101 01	-.03030	.50490239 02 .102 01	-.03940					
			FREQUENCY .0								
203701	0	0	.35183595 C3 .101 01	-.04270	.50883313 02 .102 01	-.04050					
203801	0	0	.35189125 C3 .101 01	-.03270	.51100714 02 .102 01	-.02590					
203901	0	0	.35197146 C3 .101 01	-.03800	.51311367 02 .102 01	-.01670					
204001	0	0	.35196156 C3 .101 01	-.03850	.51516755 02 .102 01	-.02610					
204101	0	0	.35201157 C3 .101 01	-.04630	.51718372 02 .102 01	-.03300					
204201	0	0	.35205178 C3 .101 01	-.04100	.52126313 02 .102 01	-.03300					
204401	0	0	.35237099 C3 .101 01	-.03800	.52330626 02 .102 01	-.03210					
204501	0	0	.35254063 C3 .101 01	-.03420	.52535150 02 .102 01	-.03670					
204601	0	0	.35211041 C3 .101 01	-.03750	.52739922 02 .102 01	-.03920					
204701	0	0	.35213451 C3 .101 01	-.03720	.52946859 02 .102 01	-.02050					
204801	0	0	.35214006 C3 .101 01	-.02570	.53150092 02 .102 01	-.02770					
204901	0	0	.35216029 C3 .102 01	-.03260	.53355504 02 .102 01	-.02510					
205001	0	0	.35219723 C3 .102 01	-.03550	.53561120 02 .102 01	-.02000					
205101	0	0	.35220627 C3 .102 01	-.03650	.53766955 02 .102 01	-.02060					
205201	0	0	.35222528 C3 .102 01	-.03090	.53972993 02 .102 01	-.02070					
205301	0	0	.35224059 C3 .102 01	-.03150	.54178734 02 .102 01	-.01900					
205401	0	0	.35226287 C3 .102 01	-.04000	.54385483 02 .102 01	-.02100					
205501	0	0	.35228155 C3 .102 01	-.04040	.54592329 02 .102 01	-.02410					
205601	0	0	.35230014 C3 .102 01	-.02400	.54799176 02 .102 01	-.02200					
205701	0	0	.35231869 C3 .102 01	-.04100	.55006212 02 .102 01	-.02000					
205801	0	0	.35233707 C3 .102 01	-.03710	.55213445 02 .102 01	-.02330					
205901	0	0	.35235566 C3 .102 01	-.03620	.55420869 02 .102 01	-.03270					
210001	0	0	.35237365 C3 .102 01	-.03320	.55628482 02 .102 01	-.02040					
210101	0	0	.35239161 C3 .102 01	-.03700	.55836280 02 .102 01	-.02040					
210201	0	0	.35240949 C3 .102 01	-.04000	.56044264 02 .102 01	-.03020					
210301	0	0	.35242728 C3 .102 01	-.03650	.56252430 02 .102 01	-.03230					
210401	0	0	.35244579 C3 .102 01	-.03420	.56460778 02 .102 01	-.02770					
210501	0	0	.35246361 C3 .102 01	-.03170	.56669302 02 .102 01	-.03130					
210601	0	0	.35251660 C3 .102 01	-.02700	.57299910 02 .103 01	-.03300					
210701	0	0	.35253610 C3 .102 01	-.03300	.57509152 02 .103 01	-.02310					
210801	0	0	.35255192 C3 .102 01	-.03420	.57716540 02 .103 01	-.02290					
210901	0	0	.35256666 C3 .102 01	-.03120	.57924097 02 .103 01	-.03000					
211001	0	0	.35258231 C3 .102 01	-.03350	.58131897 02 .103 01	-.02370					
211101	0	0	.35262741 C3 .102 01	-.03100	.58553761 02 .103 01	-.03970					
211201	0	0	.35263764 C3 .102 01	-.03660	.58763047 02 .103 01	-.03900					
211301	0	0	.35264939 C3 .102 01	-.03720	.58974507 02 .103 01	-.04030					
211401	0	0	.35267127 C3 .102 01	-.03780	.59184027 02 .103 01	-.03000					
211501	0	0	.35268067 C3 .102 01	-.03490	.59395497 02 .103 01	-.01790					
211601	0	0	.35270480 C3 .102 01	-.03900	.59606371 02 .103 01	-.03030					
211701	0	0	.35272145 C3 .102 01	-.03110	.59817366 02 .103 01	-.04130					
211801	0	0	.35273062 C3 .102 01	-.02930	.60028222 02 .103 01	-.03030					
211901	0	0	.35275455 C3 .102 01	-.03300	.60239494 02 .103 01	-.03900					

STATION NUMBER [illegible] [illegible] STATION NUMBER [illegible] PASS NUMBER [illegible]

FREQUENCY [illegible]

TIME	PC	G	DOC		DO		CCS
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

STATION NUMBER [illegible] [illegible] PASS NUMBER [illegible]

FREQUENCY [illegible]

TIME	PC	G	DOC		DO		CCS
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

DATA STATISTICS STATION [illegible] STATION [illegible]

PASS	DATA TYPE	ORIGINATING TIME	END TIME	NUMBER OF POINTS	STD DEV	DOC	FIRST ORDER	SECOND ORDER
[illegible]	CCS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

STATION NUMBER 91 06/01/30 ITERATION NUMBER 5 PAGE NUMBER 01/301

FREQUENCY .0

TIME	YC	G	DEC			MG			CCS		
162147	9	9	.27679691 02	.352	01	.02770	.33268054 03	.390 01	.03360		

FREQUENCY 7790.4

162147	9	91	.25925702 02	.352	01	-.00450	.33066026 03	.392	01	.02760				
162149	9	91									.11706670 06	.476	00	.0060
162152	9	91	.25302460 02	.352	01	.00060	.32262635 03	.387	01	.02870				
162154	9	91									.12031395 06	.414	00	.0040
162157	9	91	.22857966 02	.352	01	.01290	.32040062 03	.382	01	.02970				
162159	9	91									.12269576 06	.368	00	.0001
162202	9	91	.21599165 02	.352	01	.01720	.32462729 03	.378	01	.03500				
162204	9	91									.12408737 06	.337	00	.0032
162207	9	91	.19891966 02	.352	01	.00090	.32206277 03	.374	01	.03440				
162209	9	91									.12700946 06	.320	00	-.0009
162212	9	91	.18461256 02	.352	01	.01020	.32118329 03	.371	01	.03500				
162214	9	91									.12901006 06	.316	00	-.0009
162217	9	91	.17070060 02	.352	01	.01410	.31950476 03	.369	01	.03590				
162219	9	91									.13090035 06	.322	00	.0004
162222	9	91	.15723679 02	.352	01	.01270	.31906911 03	.366	01	.03670				
162224	9	91									.13267031 06	.334	00	-.0133
162227	9	91	.14421703 02	.352	01	.01590	.31661434 03	.364	01	.03650				
162229	9	91									.13434070 06	.348	00	.0057
162232	9	91	.13106433 02	.352	01	.01250	.31523041 03	.362	01	.03320				
162234	9	91									.13590004 06	.368	00	-.0071
162237	9	91	.11908355 02	.352	01	.00900	.31391947 03	.360	03	.03260				
162239	9	91									.13736966 06	.387	00	-.0064
162242	9	91	.10797657 02	.352	01	.00760	.31266502 03	.359	01	.03060				
162244	9	91									.13873257 06	.406	00	.0234
162247	9	91	.96008158 01	.352	01	.00040	.31144990 03	.358	01	.03670				
162249	9	91									.14000573 06	.425	00	-.0052
162252	9	91	.86167366 01	.352	03	.01270	.31032031 03	.356	01	.04060				
162254	9	91									.14118646 06	.442	00	.1307
162257	9	91	.75940418 01	.352	01	.01950	.30923707 03	.355	01	.04090				
162259	9	91									.14228731 06	.459	00	-.0130
162302	9	91	.66171250 01	.353	01	.01220	.30819551 03	.355	01	.03320				
162304	9	91									.14331079 06	.476	00	.0039
162307	9	91	.56022019 01	.353	01	.01090	.30719952 03	.355	01	.03420				
162309	9	91									.14426101 06	.490	00	.0904
162312	9	91	.47805039 01	.353	01	.01260	.30624390 03	.355	01	.04050				
162314	9	91									.14514500 06	.506	00	-.0020
162317	9	91	.39346073 01	.353	01	.01310	.30532943 03	.354	01	.04200				
162319	9	91									.14596516 06	.518	00	.0040
162322	9	91	.31199257 01	.353	01	.01190	.30445267 03	.354	01	.04140				
162324	9	91									.14672639 06	.529	00	.0500
162327	9	91	.23906809 01	.353	01	.00560	.30361143 03	.354	01	.03640				
162329	9	91									.14743274 06	.540	00	.0000
162332	9	91	.15991080 01	.354	01	.01070	.30280364 03	.354	01	.03990				

FREQUENCY .0

162337	0	0	.08390663 00	.354	01	.01060	.30202739 03	.354	01	.04000
162352	0	0	.35895628 03	.354	01	.01290	.29987065 03	.355	01	.03640
162357	0	0	.35836074 03	.355	01	.00810	.29927352 03	.355	01	.03910
162402	0	0	.35777687 03	.355	01	.01030	.29869027 03	.355	01	.03820
162407	0	0	.35722994 03	.355	01	.00990	.29795941 03	.355	01	.04000
162412	0	0	.35671012 03	.355	01	.00620	.29733976 03	.355	01	.04000
162417	0	0	.35621243 03	.355	01	.01030	.29676019 03	.356	01	.04190
162422	0	0	.35573571 03	.355	01	.01350	.29619968 03	.356	01	.04030
162427	0	0	.35527697 03	.355	01	.01070	.29565725 03	.357	01	.04000
162432	0	0	.35484117 03	.356	01	.00690	.29513197 03	.357	01	.04180
162437	0	0	.35442124 03	.356	01	.00530	.29462300 03	.358	01	.04270
162442	0	0	.35401843 03	.356	01	.00860	.29412956 03	.358	01	.04210
162447	0	0	.35363183 03	.356	01	.01160	.29365081 03	.359	01	.04080
162452	0	0	.35326064 03	.356	01	.01090	.29318617 03	.359	01	.03900
162457	0	0	.35290409 03	.357	01	.00790	.29273480 03	.359	01	.04470
162502	0	0	.35256146 03	.357	01	.01080	.29229638 03	.360	01	.05130
162507	0	0	.35223208 03	.357	01	.00850	.29187004 03	.361	01	.04080
162512	0	0	.35191531 03	.358	01	.00780	.29145534 03	.361	01	.04020
162517	0	0	.35161055 03	.358	01	.00860	.29105173 03	.362	01	.04190
162522	0	0	.35131722 03	.358	01	.01490	.29065875 03	.362	01	.04090
162527	0	0	.35103470 03	.358	01	.01590	.29027593 03	.362	01	.04770
162532	0	0	.35076275 03	.359	01	.01130	.28990262 03	.363	01	.04200
162537	0	0	.35050062 03	.359	01	.00770	.28953903 03	.363	01	.04070

STATION NUMBER 51 64/01/30 STATION NUMBER 1 PASS NUMBER 01/302

FREQUENCY 0590.5

TIME	TC	O	DEC	MA	CCD
191132	60	51			.12604443 D6 .105 00 -.0020
191232	60	51			.12079061 D6 .104 00 .0070
191332	60	51			.12076920 D6 .103 00 -.0020

FREQUENCY 0574.5

TIME	TC	O	DEC	MA	CCD
191732	60	51			.12055160 D6 .101 00 .0040
191832	60	51			.12056436 D6 .100 00 -.0195
191932	60	51			.12065732 D6 .099-01 .0303
192032	60	51			.12041072 D6 .099-01 -.0078
192132	60	51			.12036451 D6 .099-01 -.0127
192232	60	51			.12031868 D6 .098-01 .0030
192332	60	51			.12021322 D6 .098-01 -.0090
192432	60	51			.12022811 D6 .097-01 .0176
192532	60	51			.12018341 D6 .097-01 .0225
192632	60	51			.12013905 D6 .096-01 -.0106
192732	60	51			.12009504 D6 .096-01 .0106
192832	60	51			.12005140 D6 .095-01 -.0052
192932	60	51			.12000810 D6 .095-01 .0049
193032	60	51			.11996515 D6 .095-01 -.0090
193132	60	51			.11992254 D6 .094-01 .0010
193232	60	51			.11988028 D6 .094-01 .0020
193332	60	51			.11983835 D6 .093-01 -.0010
193432	60	51			.11979675 D6 .093-01 .0106
193532	60	51			.11975548 D6 .093-01 .0000
193632	60	51			.11971454 D6 .092-01 .0117
193732	60	51			.11967392 D6 .092-01 .0000
193832	60	51			.11963361 D6 .092-01 .0106
193932	60	51			.11959363 D6 .091-01 -.0107
194032	60	51			.11955395 D6 .091-01 -.0090
194132	60	51			.11951459 D6 .091-01 .0107
194232	60	51			.11947553 D6 .090-01 -.0106
194332	60	51			.11943678 D6 .090-01 .0090
194432	60	51			.11939832 D6 .090-01 .0000
194532	60	51			.11936017 D6 .090-01 .0106
194632	60	51			.11932231 D6 .090-01 -.0070
194732	60	51			.11928474 D6 .089-01 .0117
194832	60	51			.11924746 D6 .089-01 .0000
194932	60	51			.11921046 D6 .089-01 .0010
195032	60	51			.11917375 D6 .089-01 -.0090
195132	60	51			.11913733 D6 .089-01 -.0117
195232	60	51			.11910118 D6 .089-01 .0090
195332	60	51			.11906530 D6 .089-01 .0117
195432	60	51			.11902970 D6 .089-01 -.0090
195532	60	51			.11899437 D6 .089-01 .0106
195632	60	51			.11895931 D6 .089-01 .0030
195732	60	51			.11892452 D6 .089-01 .0107
195832	60	51			.11888999 D6 .089-01 .0070

STATION NUMBER 51 64/01/30 PASS NUMBER 01/303

FREQUENCY .0

TIME	TC	O	DEC	MA	CCD
200602	0	0	.35101319 C3 .105 01 .00100 .20609104 03 .106 01 .03110		
200702	0	0	.35101249 C3 .104 01 .00670 .20710578 03 .106 01 .03090		
200802	0	0	.35107100 C3 .104 01 .00770 .20732066 03 .105 01 .03090		
200902	0	0	.35109127 C3 .104 01 .01930 .20753591 03 .105 01 .03030		
201002	0	0	.35111015 03 .104 01 -.00090 .20775143 03 .105 01 .03060		
201102	0	0	.35112910 03 .104 01 .02200 .20796724 03 .105 01 .03080		
201202	0	0	.35114811 C3 .104 01 .00100 .20818332 03 .105 01 .03070		
201302	0	0	.35116690 C3 .104 01 .00790 .20839967 03 .105 01 .03030		
201402	0	0	.35118570 03 .104 01 -.00790 .20861630 03 .105 01 .03060		
201502	0	0	.35120444 03 .104 01 .00770 .20883319 03 .105 01 .03070		
201602	0	0	.35122304 03 .104 01 -.00010 .20905034 03 .105 01 .03090		
201702	0	0	.35124155 C3 .104 01 .02920 .20926777 03 .105 01 .03010		
201802	0	0	.35125997 C3 .104 01 -.00140 .20948545 03 .105 01 .03030		
201902	0	0	.35127812 C3 .104 01 -.00690 .20970339 03 .105 01 .03060		
202002	0	0	.35129608 C3 .104 01 .00100 .20992159 03 .105 01 .03010		
202102	0	0	.35131476 C3 .104 01 -.00790 .21014004 03 .105 01 .03070		
202202	0	0	.35133286 03 .104 01 .00770 .21035874 03 .105 01 .03060		
202302	0	0	.35135087 03 .104 01 -.00330 .21057769 03 .105 01 .03080		
202402	0	0	.35136881 03 .103 01 .00700 .21079689 03 .105 01 .03070		
202502	0	0	.35138667 C3 .103 01 .00790 .21101634 03 .104 01 .03020		
202602	0	0	.35140443 C3 .103 01 -.00100 .21123602 03 .104 01 .03050		
202702	0	0	.35142215 03 .103 01 -.00590 .21145594 03 .104 01 .03050		
202802	0	0	.35143970 C3 .103 01 .01090 .21167611 03 .104 01 .03060		
202902	0	3	.35145719 C3 .103 01 -.00090 .21189651 03 .104 01 .03090		
203002	0	0	.35147460 C3 .103 01 -.00440 .21211714 03 .104 01 .03030		
203102	0	0	.35149225 C3 .103 01 .00190 .21233801 03 .104 01 .03030		
203202	0	0	.35150952 C3 .103 01 -.00570 .21255910 03 .104 01 .03020		
203302	0	0	.35152677 03 .103 01 .00490 .21278043 03 .104 01 .03000		
203402	0	0	.35154395 03 .103 01 -.00100 .21302176 03 .104 01 .03050		

FREQUENCY 0592.0

TIME	TC	O	DEC	MA	CCD
203902	0	41	.35162077 C3 .103 01 -.00220 .21411301 03 .104 01 .03010		
204002	0	41	.35163752 03 .102 01 -.00720 .21433507 03 .104 01 .03020		
204102	0	41	.35165420 03 .102 01 -.00200 .21455743 03 .104 01 .03010		

FREQUENCY 0519.0

TIME	TC	O	DEC	MA	CCD
204302	0	51	.35169537 C3 .102 01 .00200 .21502571 03 .104 01 .03020		
204312	60	51		.11751602 D6 .010-01	.0030
204402	60	51	.35171105 03 .102 01 .00900 .21527046 03 .104 01 .03050		

FREQUENCY .0

TIME	TC	O	DEC	MA	CCD
204502	0	0	.35172627 03 .102 01 -.00000 .21551530 03 .104 01 .03060		

FREQUENCY 0469.0

TIME	TC	O	DEC	MA	CCD
204602	0	51	.35174042 03 .102 01 -.00100 .21576026 03 .104 01 .03050		

FREQUENCY .0

TIME	TC	O	DEC	MA	CCD
204702	0	0	.35175094 03 .102 01 .00220 .21600530 03 .104 01 .03010		

STATION NUMBER 51 66/01/30 STRATION NUMBER 3 PASS NUMBER 01/305

FREQUENCY 9419.0

TIME	TC	B	DOC			MB			CCI		
204002	0	51	.95177119	03	.102 01	-.00030	.29912021	03	.104 01	.02000	
204032	60	51									.11765017 06 .020-01 .0140
204032	60	51	.95170120	03	.102 01	.00360	.29815091	03	.104 01	.02000	
204102	60	51									.11743262 06 .020-01 -.0010
204102	60	51	.95100937	03	.102 01	.00110	.29657561	03	.103 01	.02000	
204132	60	51									.11740926 06 .020-01 .0070
204132	60	51	.95102541	03	.102 01	-.00510	.29582090	03	.103 01	.02000	
204202	60	51									.11730604 06 .020-01 .0090
204202	60	51	.95104150	03	.102 01	-.00120	.29702619	03	.103 01	.02000	
204232	60	51									.11736307 06 .020-01 .0103
204232	60	51	.95105720	03	.102 01	.00070	.29725166	03	.103 01	.02000	
204302	60	51									.11734017 06 .020-01 -.0199
204302	60	51	.95107119	03	.102 01	-.00130	.29767733	03	.103 01	.02020	
204332	60	51									.11731709 06 .020-01 .0090
204332	60	51	.95108091	03	.102 01	-.00530	.29770318	03	.103 01	.02030	
204402	60	51									.11729496 06 .020-01 -.0100
204402	60	51	.95109463	03	.102 01	-.01320	.29792922	03	.103 01	.02330	
204432	60	51									.11727264 06 .020-01 .0097
204432	60	51	.95109079	03	.102 01	-.00700	.29815545	03	.103 01	.02300	
204502	60	51									.11725040 06 .020-01 -.0204
204502	60	51	.95109500	03	.102 01	.01520	.29838186	03	.103 01	.02060	
204532	60	51									.11722847 06 .020-01 .0000
204532	60	51	.95109164	03	.102 01	-.00260	.29860845	03	.103 01	.02190	
204602	60	51									.11720664 06 .020-01 .0107
204602	60	51	.95108607	03	.102 01	.00300	.29883523	03	.103 01	.02310	
204632	60	51									.11718497 06 .020-01 .0137
204632	60	51	.95108236	03	.102 01	-.00180	.29906218	03	.103 01	.02210	
204702	60	51									.11716346 06 .020-01 .0029
204702	60	51	.95109772	03	.102 01	-.01760	.29928930	03	.103 01	.01890	
204732	60	51									.11714212 06 .020-01 -.0301
204732	60	51	.95251906	03	.102 01	-.00290	.29951661	03	.103 01	.02160	
204802	60	51									.11712094 06 .020-01 -.0000
204802	60	51	.95202829	03	.102 01	-.00430	.29974410	03	.103 01	.02400	
204832	60	51									.11709997 06 .020-01 .0030
204832	60	51	.95204360	03	.102 01	-.00770	.29997175	03	.103 01	.02260	
204902	60	51									.11707906 06 .020-01 .0176
204902	60	51	.95205863	03	.102 01	.00530	.30019958	03	.103 01	.02650	
204932	60	51									.11705837 06 .020-01 .0000
204932	60	51	.95207375	03	.102 01	-.00030	.30042757	03	.103 01	.02250	
205002	60	51									.11703785 06 .020-01 .0000
205002	60	51	.95208870	03	.102 01	.00050	.30065574	03	.103 01	.02230	
205032	60	51									.11701744 06 .020-01 .0000
205032	60	51	.95210329	03	.102 01	-.03200	.30088407	03	.103 01	.02390	
205102	60	51									.11699721 06 .020-01 -.0322
205102	60	51	.95211866	03	.102 01	-.00470	.30111258	03	.103 01	.02140	
205132	0	51	.95210835	03	.102 01	.00020	.30157057	03	.103 01	.02180	
205132	60	51									.11693746 06 .020-01 -.0049
205202	60	51	.95210311	03	.102 01	-.00070	.30179987	03	.103 01	.02090	
205202	60	51									.11691705 06 .020-01 -.0020
205232	60	51	.95211783	03	.102 01	.00060	.30202922	03	.103 01	.02150	
205232	60	51									.11689690 06 .020-01 -.0070
205302	60	51	.95219260	03	.102 01	-.00060	.30225894	03	.103 01	.02220	
205302	60	51									.11687700 06 .020-01 .0042
205332	60	51	.95220710	03	.102 01	.02000	.30248906	03	.103 01	.02470	
205332	60	51									.11685742 06 .020-01 -.0091
205402	60	51	.95222165	03	.102 01	-.00990	.30271964	03	.102 01	.02700	
205402	60	51									.11683801 06 .020-01 .0215
205432	60	51	.95223616	03	.102 01	-.00660	.30294062	03	.102 01	.02520	
205432	60	51									.11682203 06 .020-01 -.0111
205502	60	51	.95225062	03	.102 01	-.00120	.30317206	03	.102 01	.02120	
205502	60	51									.11680333 06 .020-01 .0010
205532	60	51	.95226562	03	.102 01	-.00700	.30340405	03	.102 01	.02310	
205532	60	51									.11678476 06 .020-01 .0039
205602	60	51	.95227930	03	.102 01	-.00430	.30363670	03	.102 01	.02290	
205602	60	51									.11676634 06 .020-01 -.0032
205632	60	51	.95229369	03	.102 01	-.00660	.30386910	03	.102 01	.02230	
205632	60	51									.11674806 06 .020-01 .0090
205702	60	51	.95230906	03	.102 01	-.00120	.30409766	03	.102 01	.02370	
205732	60	51									.11672992 06 .020-01 .0117
205732	60	51	.95232215	03	.102 01	.00000	.30432835	03	.102 01	.02500	
205802	60	51									.11671192 06 .020-01 .0060
205802	60	51	.95233631	03	.102 01	-.00390	.30455919	03	.102 01	.02410	
205832	60	51									.11669407 06 .020-01 -.0060
205832	60	51	.95235042	03	.102 01	-.00420	.30479019	03	.102 01	.02710	
205902	60	51									.11667636 06 .020-01 -.0127
205902	60	51	.95236440	03	.102 01	-.00660	.30502137	03	.102 01	.02790	
205932	60	51									.11665879 06 .020-01 -.0060
205932	60	51	.95237851	03	.102 01	-.01320	.30525261	03	.102 01	.02860	
210002	60	51									.11664136 06 .020-01 .0000
210002	60	51	.95239260	03	.102 01	-.00700	.30548403	03	.102 01	.02910	
210032	60	51									.11662406 06 .020-01 -.0146
210032	60	51	.95240640	03	.101 01	-.00000	.30571561	03	.102 01	.02790	
210102	60	51									.11660691 06 .020-01 -.0000
210102	60	51	.95242070	03	.101 01	-.01460	.30594751	03	.102 01	.02560	
210132	60	51									.11658990 06 .020-01 -.0294
210132	60	51	.95243611	03	.101 01	-.01090	.30617956	03	.102 01	.02390	
210202	60	51									.11657301 06 .020-01 .0430
210202	60	51	.95244790	03	.101 01	-.00400	.30641115	03	.102 01	.02560	
210232	60	51									.11655626 06 .020-01 -.0204
210232	60	51	.95246164	03	.101 01	-.01270	.30664327	03	.102 01	.02360	
210302	60	51									.11653965 06 .020-01 .0030
210302	60	51	.95247533	03	.101 01	-.01260	.30687553	03	.102 01	.02550	
210332	60	51									.11652317 06 .020-01 -.0010
210332	60	51	.95248890	03	.101 01	-.00660	.30710794	03	.102 01	.02290	
210402	60	51									.11650682 06 .020-01 .0127
210402	60	51	.95250250	03	.101 01	-.00620	.30734047	03	.102 01	.02330	
210432	60	51									.11649061 06 .020-01 .0000
210432	60	51	.95251615	03	.101 01	-.00790	.30757313	03	.102 01	.02360	
210502	60	51									.11647452 06 .020-01 -.0060
210502	60	51	.95252967	03	.101 01	-.00460	.30780593	03	.102 01	.02600	
210532	60	51									.11645857 06 .020-01 -.0040
210532	60	51	.95254315	03	.101 01	-.00730	.30803884	03	.102 01	.02500	
210602	60	51									.11644275 06 .020-01 -.0060
210602	60	51	.95255650	03	.101 01	-.00000	.30827192	03	.102 01	.02420	

STATION NUMBER 91 04/01/70 STATION NUMBER 3 PASS NUMBER 01/303

FREQUENCY .0

TIME	TC	G	DEC	RA	CCD	
214702	0	3	.95256997 03 .101 01 -.00090	.95092911 03 .102 01 .02790		
			FREQUENCY 8619.0			
214602	0	51	.95259661 03 .101 01 .00270	.95097187 03 .102 01 .02660	.11630094 06 .030-01	-.0127
214632	0	51				
214702	0	51	.95260989 03 .101 01 -.01170	.95092593 03 .102 01 .02790	.11630556 06 .030-01	-.0117
214732	0	51				
214802	0	51	.95262311 03 .101 01 .00590	.95093819 03 .102 01 .02770	.11630950 06 .030-01	.0203
214832	0	51				
214702	0	51	.95263629 03 .101 01 -.00360	.95096497 03 .102 01 .02730	.11631557 06 .030-01	.0127
214732	0	51				
214802	0	51	.95264943 03 .101 01 -.00670	.95095091 03 .102 01 .02540	.11632076 06 .030-01	-.0197
214832	0	51				
214902	0	51	.95266251 03 .101 01 -.00400	.95094099 03 .102 01 .02770	.11632600 06 .030-01	.0060
214932	0	51				
215002	0	51	.95267558 03 .101 01 -.00670	.95093918 03 .102 01 .02790	.11633151 06 .030-01	-.0030
215032	0	51				
215102	0	51	.95268860 03 .101 01 -.00290	.95092909 03 .102 01 .02670	.11633717 06 .030-01	.0090
215132	0	51				
215202	0	51	.95270158 03 .101 01 .02950	.95084092 03 .102 01 .02620	.11634275 06 .030-01	-.0030
215232	0	51				
215302	0	51	.95271452 03 .101 01 -.03060	.95117047 03 .102 01 .02360	.11634856 06 .030-01	.0030
215332	0	51				
215402	0	51	.95272742 03 .101 01 -.01100	.95111916 03 .102 01 .02280	.11635468 06 .030-01	-.0090
215432	0	51				
215502	0	51	.95274028 03 .101 01 -.00860	.95154792 03 .102 01 .02090	.11636092 06 .030-01	-.0171
215532	0	51				
215602	0	51	.95275310 03 .101 01 -.00360	.95170203 03 .102 01 .02110	.11636660 06 .030-01	.0205
215632	0	51				
215702	0	51	.95276590 03 .101 01 -.01350	.95201706 03 .102 01 .02290	.11637296 06 .030-01	-.0030
215732	0	51				
215802	0	51	.95277863 03 .101 01 .00660	.95226297 03 .102 01 .01890	.11637915 06 .030-01	.0303
215832	0	51				
215902	0	51	.95279133 03 .101 01 -.01790	.95246022 03 .102 01 .01950	.11638506 06 .030-01	-.0106
215932	0	51				
220002	0	51	.95280400 03 .101 01 -.02530	.95272950 03 .102 01 .02710	.11639209 06 .030-01	-.0206
220032	0	51				
220102	0	51	.95281660 03 .101 01 -.01190	.95295905 03 .102 01 .02260	.11639826 06 .030-01	.0000
220132	0	51				
220202	0	51	.95282922 03 .101 01 -.01060	.95316063 03 .102 01 .02290	.11640609 06 .030-01	-.0030
220232	0	51				
220302	0	51	.95284178 03 .101 01 -.02730	.95343032 03 .102 01 .02520	.11641207 06 .030-01	.0322
220332	0	51				
220402	0	51	.95285430 03 .101 01 .00210	.95366612 03 .102 01 .02160	.11641865 06 .030-01	-.0357
220432	0	51				
220502	0	51	.95286678 03 .101 01 -.00290	.95390255 03 .102 01 .02360	.11642735 06 .030-01	.0157
220532	0	51				
220602	0	51	.95287923 03 .101 01 .00000	.95413004 03 .102 01 .02360	.11643466 06 .030-01	.0020
220632	0	51				
220702	0	51	.95289163 03 .101 01 -.00470	.95437617 03 .102 01 .02530	.11644209 06 .030-01	-.0301
220732	0	51				
220802	0	51	.95290400 03 .101 01 -.00470	.95461003 03 .102 01 .02290	.11644962 06 .030-01	.0090
220832	0	51				
220902	0	51	.95291636 03 .101 01 -.01270	.95484673 03 .102 01 .02290	.11645927 06 .030-01	-.0210
220932	0	51				
221002	0	51	.95292869 03 .101 01 -.01130	.95508516 03 .102 01 .02090	.11646502 06 .030-01	.0203
221032	0	51				
221102	0	51	.95294101 03 .101 01 -.00790	.95531971 03 .102 01 .02040	.11647200 06 .030-01	-.0195
221132	0	51				
221202	0	51	.95295316 03 .101 01 -.00990	.95555635 03 .102 01 .01870	.11648006 06 .030-01	-.0200
221232	0	51				
221302	0	51	.95296536 03 .101 01 -.01630	.95579510 03 .102 01 .01990	.11648804 06 .030-01	.0000
221332	0	51				
221402	0	51	.95297755 03 .101 03 -.00650	.95602995 03 .102 01 .02170	.11649711 06 .030-01	.0040
221432	0	51				
221502	0	51	.95298963 03 .101 01 -.00090	.95626690 03 .102 01 .02050	.11650542 06 .030-01	-.0236
221532	0	51				
221602	0	51	.95300172 03 .101 01 -.00090	.95650396 03 .102 01 .02090	.11651382 06 .030-01	-.0070
221632	0	51				
221702	0	51	.95301378 03 .101 03 -.00570	.95674109 03 .102 03 .01970	.11652251 06 .030-01	.0106
221732	0	51				
221802	0	51	.95302587 03 .101 01 -.00790	.95697819 03 .102 01 .01860	.11653096 06 .030-01	-.0117
221832	0	51				
221902	0	51	.95303779 03 .101 01 -.01190	.95721560 03 .102 01 .01900	.11653986 06 .030-01	.0040
221932	0	51				
222002	0	51	.95304975 03 .101 03 -.00390	.95745312 03 .102 01 .02150	.11654860 06 .030-01	-.0130
222032	0	51				
222102	0	51	.95306164 03 .101 01 -.00570	.95769265 03 .102 01 .02390	.11655741 06 .030-01	.0090
222132	0	51				
222202	0	51	.95307357 03 .101 03 -.01170	.95792970 03 .102 01 .02620	.11656643 06 .030-01	-.0010
222232	0	51				
222302	0	51	.95308543 03 .101 01 -.01170	.95816609 03 .102 01 .02250	.11657556 06 .030-01	-.0103
222332	0	51				
222402	0	51	.95309726 03 .101 01 -.01100	.95840101 03 .102 01 .02360	.11658470 06 .030-01	.0301
222432	0	51				
222502	0	51	.95310906 03 .101 01 -.00360	.95864173 03 .102 01 .02060	.11659412 06 .030-01	.0060
222532	0	51				
222602	0	51	.95312082 03 .101 03 -.00390	.95887973 03 .102 01 .02060	.11660356 06 .030-01	-.0030
222632	0	51				
222702	0	51	.95313255 03 .101 01 .00070	.95911702 03 .102 01 .02250	.11661309 06 .030-01	-.0060
222732	0	51				
222802	0	51	.95314425 03 .101 03 -.00910	.95935601 03 .102 01 .02270	.11662272 06 .030-01	.0420
222832	0	51				
222902	0	51	.95315591 03 .101 01 -.00990	.95959470 03 .102 01 .01900	.11663266 06 .030-01	-.0060
222932	0	51				
223002	0	51	.95316755 03 .101 01 -.00870	.95983265 03 .102 01 .02100		
			FREQUENCY .0			
223102	0	3	.95317919 03 .101 01 -.00990	.96007179 03 .102 01 .01890		
			FREQUENCY 8619.0			
223302	0	51	.95320226 03 .101 01 -.01300	.96054826 03 .102 01 .01970		

STATION NUMBER 51 04/01/33 ITERATION NUMBER 3 PASS NUMBER 01/301

FREQUENCY 0410.0

TIME	DC	Q	DEC			RA			CES		
223337	00	51							.11977239	06 .959-01	-.0293
223407	00	51	.95321196	03 .101	01 -.00960	.32076667	03 .102	01 .02290			
223437	00	51							.11976258	06 .958-01	.0352
223507	00	51	.95322526	03 .101	01 -.01300	.32102577	03 .102	01 .02400			
223537	00	51							.11975290	06 .957-01	.0205
223607	00	51	.95323671	03 .101	01 -.02460	.32126665	03 .102	01 .02470			
223637	00	51							.11974330	06 .957-01	-.0347
223707	00	51	.95324615	03 .101	01 -.03610	.32150362	03 .102	01 .02610			
223737	00	51							.11973381	06 .957-01	.0244
223807	00	51	.95325952	03 .101	01 -.00560	.32174260	03 .102	01 .02690			
223837	00	51							.11972441	06 .957-01	-.0244
223907	00	51	.95327080	03 .101	01 -.01710	.32198181	03 .102	01 .02770			
223937	00	51							.11971510	06 .957-01	-.0156
224007	00	51	.95328771	03 .101	01 -.03860	.32221153	03 .102	01 .02850			
224037	00	51							.11970589	06 .957-01	-.0018
224107	00	51	.95329652	03 .101	01 .00270	.32244137	03 .102	01 .02710			
224137	00	51							.11969676	06 .957-01	.0301
224207	00	51	.95330478	03 .101	01 -.00560	.32269970	03 .102	01 .02960			
224237	00	51							.11968773	06 .955-01	-.0322
224307	00	51	.95331665	03 .101	01 -.01670	.32293917	03 .102	01 .03040			
224337	00	51							.11967879	06 .955-01	-.0098
224407	00	51	.95332726	03 .101	01 -.00810	.32317870	03 .102	01 .03050			
224437	00	51							.11966996	06 .955-01	-.0127
224507	00	51	.95333665	03 .101	01 -.01970	.32341833	03 .102	01 .03200			
224537	00	51							.11966119	06 .955-01	-.0099
224607	00	51	.95334659	03 .101	01 .00340	.32365803	03 .101	01 .03310			
224637	00	51							.11965252	06 .955-01	.0117
224707	00	51	.95336072	03 .101	01 -.00990	.32389786	03 .101	01 .03530			
224737	00	51							.11964396	06 .955-01	-.0117
224807	00	51	.95337182	03 .101	01 -.01710	.32413765	03 .101	01 .03530			
224837	0	51	.95338193	03 .101	01 -.01140	.32441759	03 .101	01 .03130			
224907	00	51							.11961075	06 .957-01	-.0409
224937	00	51	.95340495	03 .101	01 -.00690	.32465767	03 .101	01 .03070			
225007	00	51							.11961152	06 .957-01	.0293
225037	00	51	.95341596	03 .101	01 -.00960	.32489783	03 .101	01 .03090			
225107	00	51							.11960238	06 .957-01	-.0106
225137	00	51	.95342690	03 .101	01 -.00870	.32513806	03 .101	01 .03060			
225207	00	51							.11959333	06 .957-01	.0313
225237	00	51	.95343783	03 .101	01 -.01170	.32537836	03 .101	01 .03230			
225307	00	51							.11958437	06 .957-01	-.0301
225337	00	51	.95344874	03 .101	01 -.00680	.32561876	03 .101	01 .03080			
225407	00	51							.11957049	06 .957-01	.0070
225437	00	51	.95345962	03 .101	01 -.00580	.32605919	03 .101	01 .03130			
225507	00	51							.11956070	06 .956-01	-.0066
225537	00	51	.95347047	03 .101	01 -.00670	.32629971	03 .101	01 .03270			
225607	00	51							.11955299	06 .956-01	.0256
225637	00	51	.95348129	03 .101	01 -.00700	.32654030	03 .101	01 .03210			
225707	00	51							.11954537	06 .956-01	-.0176
225737	00	51	.95349209	03 .101	01 .00190	.32678096	03 .101	01 .03190			
225807	00	51							.11953783	06 .956-01	.0060
225837	00	51	.95350287	03 .101	01 -.00760	.32702169	03 .101	01 .03060			
230007	00	51							.11952037	06 .956-01	-.0195
230037	00	51	.95351361	03 .101	01 -.00930	.32726249	03 .101	01 .03570			
230107	00	51							.11952299	06 .956-01	-.0117
230137	00	51	.95352433	03 .101	01 -.01110	.32750337	03 .101	01 .03070			
230207	00	51							.11951570	06 .956-01	.0303
230237	00	51	.95353502	03 .101	01 -.00790	.32774430	03 .101	01 .03190			
230307	00	51							.11950849	06 .956-01	.0000
230337	00	51	.95354569	03 .101	01 .00140	.32798531	03 .101	01 .03070			
230407	00	51							.11950136	06 .962-01	-.0127
230437	00	51	.95355633	03 .101	01 .00300	.32822638	03 .101	01 .03090			
230507	00	51							.11949431	06 .962-01	.0020
230537	00	51	.95356696	03 .101	01 -.01010	.32846752	03 .101	01 .03030			
230607	00	51							.11948735	06 .962-01	-.0303
230637	00	51	.95357756	03 .101	01 -.01200	.32870873	03 .101	01 .03110			
230707	00	51							.11948046	06 .962-01	.0236
230737	00	51	.95358815	03 .100	01 -.00760	.32895000	03 .101	01 .03170			
230807	00	51							.11947365	06 .962-01	-.0060
230837	00	51	.95359864	03 .100	01 -.01710	.32919133	03 .101	01 .03030			
230907	00	51							.11946692	06 .962-01	.0117
230937	00	51	.95360916	03 .100	01 -.00670	.32943276	03 .101	01 .03200			
231007	00	51							.11946027	06 .962-01	-.0029
231037	00	51	.95361965	03 .100	01 -.00730	.32967420	03 .101	01 .03030			
231107	00	51							.11945370	06 .964-01	.0020
231137	00	51	.95363011	03 .100	01 -.01300	.32991573	03 .101	01 .03170			
231207	00	51							.11944720	06 .964-01	-.0195
231237	00	51	.95364055	03 .100	01 -.01740	.33015732	03 .101	01 .03010			
231307	00	51							.11944079	06 .964-01	.0156
231337	00	51	.95365096	03 .100	01 -.01490	.33039897	03 .101	01 .03030			
231407	00	51							.11943444	06 .964-01	.0215
231437	00	51	.95366135	03 .100	01 .00000	.33064068	03 .101	01 .03060			
231507	00	51							.11942818	06 .964-01	.0371
231537	00	51	.95367172	03 .100	01 -.00780	.33088246	03 .101	01 .03070			
231607	00	51							.11942199	06 .964-01	-.0020
231637	00	51	.95368206	03 .100	01 -.00870	.33112429	03 .101	01 .03000			
231707	00	51							.11941588	06 .964-01	.0234
231737	00	51	.95369238	03 .100	01 -.01070	.33136618	03 .101	01 .03200			
231807	00	51							.11940984	06 .967-01	-.0040
231837	00	51	.95370268	03 .100	01 -.01390	.33160816	03 .101	01 .03200			
231907	00	51							.11941387	06 .967-01	-.0010
231937	00	51	.95371296	03 .100	01 -.01300	.33185015	03 .101	01 .03200			
232007	00	51							.11940790	06 .967-01	.0156
232037	00	51	.95372319	03 .100	01 -.00570	.33209222	03 .101	01 .03060			
232107	00	51							.11940217	06 .967-01	.0156
232137	00	51	.95373342	03 .100	01 -.01270	.33233435	03 .101	01 .03200			
232207	00	51							.11939642	06 .967-01	-.0256
232237	00	51	.95374361	03 .100	01 -.01570	.33257656	03 .101	01 .03010			
232307	00	51							.11939075	06 .967-01	.0490
232337	00	51	.95375379	03 .100	01 -.01260	.33281878	03 .101	01 .03190			
232407	00	51							.11938515	06 .967-01	.0107
232437	00	51	.95376395	03 .100	01 -.00800	.33306108	03 .101	01 .03090			
232507	00	51							.11937963	06 .969-01	.0195
232537	00	51	.95377407	03 .100	01 -.01990	.33330343	03 .101	01 .03110			
232607	00	51							.11937417	06 .969-01	.0070
232637	00	51									

STATION NUMBER 51 66/01/30 ITERATION NUMBER 9 PASS NUMBER 01/303

FREQUENCY 8419.0

TIME	TC	Q	DEC		NO		CCS	
232982	60	51	.35370417 03 .100 01	-.01320	.33396583 03 .101 01	.02060		
232982	60	51					.11536879 06 .969-01	-.0070
232982	60	51	.35379625 03 .100 01	.01690	.33378831 03 .101 01	.02070		
232982	60	51					.11536368 06 .969-01	.0040
232982	60	51	.35380432 03 .100 01	-.00950	.33403083 03 .101 01	.02100		
232982	60	51					.11535823 06 .969-01	-.0070
232982	60	51	.35381539 03 .100 01	-.00590	.33427351 03 .101 01	.02000		
232982	60	51					.11535306 06 .969-01	-.0275
232982	60	51	.35382437 03 .100 01	-.00570	.33451603 03 .101 01	.02210		
232982	60	51					.11534796 06 .969-01	.0080
232982	60	51	.35383436 03 .100 01	-.01100	.33475871 03 .101 01	.01930		
232982	60	51					.11534282 06 .972-01	-.0215
232982	60	51	.35384433 03 .100 01	-.01580	.33500144 03 .101 01	.02360		
232982	60	51					.11533795 06 .972-01	-.0040
232982	60	51	.35385428 03 .100 01	-.01590	.33524422 03 .101 01	.01970		
232982	60	51					.11533305 06 .972-01	.0107
232982	60	51	.35386423 03 .100 01	-.01180	.33548726 03 .101 01	.02200		
232982	60	51					.11532827 06 .972-01	.0080
232982	60	51	.35387411 03 .100 01	-.01700	.33572994 03 .101 01	.02190		
232982	60	51					.11532366 06 .972-01	-.0080
232982	60	51	.35388398 03 .100 01	-.01700	.33597286 03 .101 01	.02290		
232982	60	51					.11531876 06 .972-01	-.0293
232982	60	51	.35389386 03 .100 01	-.01570	.33621586 03 .101 01	.02370		
232982	60	51					.11531413 06 .972-01	.0352
232982	60	51	.35390368 03 .100 01	-.00960	.33645890 03 .101 01	.02260		
232982	60	51					.11530956 06 .976-01	.0020
232982	60	51	.35391355 03 .100 01	-.00950	.33670198 03 .101 01	.01950		
232982	60	51					.11530506 06 .976-01	-.0313
232982	60	51	.35392329 03 .100 01	-.00960	.33694511 03 .101 01	.02290		
232982	60	51					.11530063 06 .976-01	.0190
232982	60	51	.35393306 03 .100 01	-.01320	.33718829 03 .101 01	.02110		
232982	60	51					.11529626 06 .976-01	-.0275
232982	60	51	.35394281 03 .100 01	-.01950	.33743152 03 .101 01	.02370		
232982	60	51					.11529195 06 .976-01	-.0510
232982	60	51	.35395254 03 .100 01	-.00600	.33767480 03 .101 01	.02260		
232982	60	51					.11528771 06 .976-01	.0060
232982	60	51	.35396225 03 .100 01	-.01060	.33791811 03 .101 01	.01960		
232982	60	51					.11528353 06 .976-01	.0170
232982	60	51	.35397193 03 .100 01	-.01260	.33816148 03 .101 01	.01950		
232982	60	51					.11527942 06 .977-01	-.0166
232982	60	51	.35398160 03 .100 01	-.00810	.33840489 03 .101 01	.01810		
232982	60	51					.11527536 06 .977-01	.0020
232982	60	51	.35399126 03 .102 01	-.00900	.33864835 03 .101 01	.01860		
232982	60	51					.11527137 06 .977-01	-.0060
232982	60	51	.35400087 03 .100 01	-.01150	.33889186 03 .101 01	.01970		
232982	60	51					.11526746 06 .977-01	.0236
232982	60	51	.35401047 03 .100 01	-.01310	.33913540 03 .101 01	.01650		
232982	60	51					.11526357 06 .977-01	-.0752
232982	60	51	.35402006 03 .100 01	-.01000	.33937899 03 .101 01	.01570		
232982	60	51					.11525977 06 .977-01	.0342
232982	60	51	.35402962 03 .100 01	-.01760	.33962262 03 .101 01	.01790		
232982	60	51					.11525602 06 .977-01	.0146
232982	60	51	.35403916 03 .100 01	-.00900	.33986630 03 .101 01	.01620		
232982	60	51					.11525231 06 .978-01	.0710
232982	60	51	.35404868 03 .100 01	.00240	.34011002 03 .101 01	.02060		
232982	60	51					.11524870 06 .978-01	-.0225
232982	60	51	.35405818 03 .100 01	-.00910	.34035378 03 .101 01	.01650		
232982	60	51					.11524514 06 .978-01	-.0710
232982	60	51	.35406766 03 .100 01	-.01270	.34059758 03 .101 01	.01870		
232982	60	51					.11524163 06 .978-01	.0215
232982	60	51	.35407712 03 .100 01	-.01420	.34084142 03 .101 01	.01600		

FREQUENCY .0

232982	0	0	.35408657 03 .100 01	-.01370	.34108531 03 .101 01	.01800		

FREQUENCY 8425.0

232982	0	51	.35409598 03 .100 01	-.01120	.34132926 03 .101 01	.02000		
232982	60	51					.11523465 06 .978-01	.0127

66/01/31

000002	60	51	.35410539 03 .100 01	-.01200	.34157325 03 .101 01	.01670		
000002	60	51					.11522010 06 .981-01	-.0017
000002	60	51	.35411477 03 .100 01	-.01090	.34181725 03 .101 01	.01670		
000002	60	51					.11522496 06 .981-01	-.0070
000002	60	51	.35412413 03 .100 01	-.01150	.34206129 03 .101 01	.01850		
000002	60	51					.11522179 06 .981-01	.0060
000002	60	51	.35413347 03 .100 01	-.00600	.34230537 03 .101 01	.01860		
000002	60	51					.11521868 06 .981-01	-.0195
000002	60	51	.35414279 03 .100 01	-.01220	.34254950 03 .101 01	.02010		
000002	60	51					.11521563 06 .981-01	.0006
000002	60	51	.35415209 03 .100 01	-.01360	.34279369 03 .101 01	.01990		
000002	60	51					.11521264 06 .981-01	-.0005
000002	60	51	.35416138 03 .100 01	-.01090	.34303795 03 .101 01	.01560		
000002	60	51					.11520969 06 .984-01	.0190
000002	60	51	.35417065 03 .100 01	-.01020	.34328228 03 .101 01	.01730		
000002	60	51					.11520681 06 .984-01	.0090
000002	60	51	.35417989 03 .100 01	-.00750	.34352665 03 .101 01	.01500		
000002	60	51					.11520397 06 .984-01	.0204
000002	60	51	.35418912 03 .100 01	-.00000	.34377105 03 .101 01	.01060		
000002	60	51					.11520119 06 .984-01	.0306
000002	60	51	.35419833 03 .100 01	-.01200	.34401550 03 .101 01	.01820		
000002	60	51					.11519847 06 .984-01	-.0040
000002	60	51	.35420750 03 .100 01	-.01150	.34425997 03 .101 01	.01970		
000002	60	51					.11519579 06 .984-01	-.0007
000002	60	51	.35421666 03 .100 01	-.00450	.34450450 03 .101 01	.02120		
000002	60	51					.11519317 06 .984-01	.0090
000002	60	51	.35422581 03 .100 01	-.01570	.34474923 03 .101 01	.02070		
000002	60	51					.11519060 06 .984-01	-.0075
000002	60	51	.35423496 03 .100 01	-.01680	.34499371 03 .101 01	.02220		
000002	60	51					.11518809 06 .984-01	-.0020
000002	60	51	.35424408 03 .100 01	-.01200	.34523822 03 .101 01	.02150		

STATION NUMBER 51 06/01/31 ITERATION NUMBER 3 PASS NUMBER 01/001

FREQUENCY 8473.5

TIME	IC	G	DEC			HA			CCS		
0:1532	03	51							.11510967	06 .000-01	.0152
0:1532	03	51	.35625117	03 .100	01	-.01110	.34546117	03 .101 01	.02290		
0:1532	03	51							.11510371	06 .000-01	-.0107
0:1732	03	51	.35626126	03 .100	01	-.00620	.34572035	03 .101 01	.02230		
0:1732	03	51							.11510105	06 .000-01	-.0097
0:1832	03	51	.35627130	03 .100	01	-.01130	.34597096	03 .101 01	.02160		
0:1832	03	51							.11517859	06 .000-01	-.0250
0:1932	03	51	.35628036	03 .100	01	-.01260	.34621561	03 .101 01	.02090		
0:1932	03	51							.11517627	06 .000-01	-.0106
0:2032	03	51	.35629036	03 .100	01	-.01350	.34646029	03 .101 01	.02210		
0:2032	03	51							.11517605	06 .000-01	-.0219
0:2132	03	51	.35629016	03 .100	01	-.01050	.34671493	03 .101 01	.01930		
0:2132	03	51							.11517109	06 .000-01	-.0070
0:2232	03	51	.35630735	03 .100	01	-.01050	.34694973	03 .101 01	.01850		
0:2232	03	51							.11516977	06 .000-01	.0048
0:2332	03	51	.35631631	03 .100	01	-.01050	.34719440	03 .101 01	.01760		
0:2332	03	51							.11516771	06 .000-01	-.0236
0:2432	03	51	.35632526	03 .100	01	-.01150	.34743933	03 .101 01	.01660		
0:2432	03	51							.11516569	06 .000-01	.0203
0:2532	03	51	.35633419	03 .100	01	-.01050	.34768412	03 .101 01	.01760		
0:2532	03	51							.11516371	06 .000-01	.0176
0:2632	03	51	.35634311	03 .100	01	-.02160	.34792848	03 .101 01	.01890		
0:2632	03	51							.11516179	06 .000-01	-.0236
0:2732	03	51	.35635202	03 .100	01	-.01150	.34817307	03 .101 01	.02190		
0:2732	03	51							.11515991	06 .000-01	-.0127
0:2832	03	51	.35636087	03 .100	01	-.01470	.34841879	03 .101 01	.01690		
0:2832	03	51							.11515809	06 .000-01	.0106
0:2932	03	51	.35636973	03 .100	01	-.01410	.34866375	03 .101 01	.01990		
0:2932	03	51							.11515630	06 .000-01	.0371
0:3032	03	51	.35637857	03 .100	01	-.01450	.34890875	03 .101 01	.02270		
0:3032	03	51							.11515456	06 .000-01	-.0225
0:3132	03	51	.35638740	03 .100	01	-.01490	.34915370	03 .101 01	.02140		
0:3132	03	51							.11515286	06 .000-01	-.0203
0:3232	03	51	.35639621	03 .100	01	-.01070	.34939873	03 .101 01	.02670		
0:3232	03	51							.11515121	06 .000-01	.0405
0:3327	03	51	.35640498	03 .100	01	-.01550	.34964379	03 .101 01	.02150		
0:3332	03	51							.11514961	06 .000-01	.0070
0:3432	03	51	.35641377	03 .100	01	-.02230	.34988906	03 .101 01	.01230		
0:3432	03	51							.11514805	06 .000-01	-.0150
0:3532	03	51	.35642252	03 .100	01	.00500	.35013397	03 .101 01	.02320		
0:3532	03	51							.11514653	06 .000-01	.0362
0:3632	03	51	.35643126	03 .100	01	-.01780	.35037911	03 .101 01	.02390		
0:3632	03	51							.11514506	06 .000-01	-.0206
0:3732	03	51	.35643998	03 .100	01	-.01060	.35062426	03 .101 01	.02270		
0:3732	03	51							.11514363	06 .000-01	.0199
0:3832	03	51	.35644865	03 .100	01	-.02120	.35086946	03 .101 01	.02140		
0:3832	03	51							.11514226	06 .000-01	-.0275
0:3932	03	51	.35645737	03 .100	01	-.01200	.35111465	03 .101 01	.02010		
0:3932	03	51							.11514090	06 .000-01	-.0150
0:4032	03	51	.35646606	03 .100	01	-.01060	.35135989	03 .101 01	.01690		
0:4032	03	51							.11513959	06 .000-01	-.0127
0:4132	03	51	.35647469	03 .100	01	-.01550	.35160516	03 .101 01	.01950		
0:4132	03	51							.11513834	06 .000-01	.0137
0:4232	03	51	.35648333	03 .100	01	-.00070	.35185042	03 .101 01	.01010		
0:4232	03	51							.11513712	06 .000-01	-.0100
0:4332	03	51	.35649195	03 .100	01	-.00060	.35209572	03 .101 01	.02090		
0:4332	03	51							.11513594	06 .000-01	.0107
0:4432	03	51	.35650056	03 .100	01	-.01120	.35234105	03 .101 01	.01730		
0:4432	03	51							.11513480	06 .000-01	-.0074
0:4532	03	51	.35650915	03 .100	01	-.00090	.35258640	03 .101 01	.01790		
0:4532	03	51							.11513370	06 .000-01	.0127
0:4632	03	51	.35651773	03 .100	01	-.00060	.35283177	03 .101 01	.01060		
0:4632	03	51							.11513264	06 .000-01	.0099
0:4732	03	51	.35652626	03 .100	01	-.00970	.35307717	03 .101 01	.01900		
0:4732	03	51							.11513163	06 .000-01	.0391
0:4832	03	51	.35653479	03 .100	01	-.00590	.35332258	03 .101 01	.02150		
0:4832	03	51							.11513065	06 .000-01	-.0150
0:4932	03	51	.35654331	03 .100	01	-.01300	.35356801	03 .101 01	.02000		

FREQUENCY .0

0:5032	0	5	.35655181	03 .100	01	.00150	.35381347	03 .101 00	.02000		

FREQUENCY 8473.5

0:5132	0	51	.35656030	03 .100	01	-.00900	.35405895	03 .101 01	.01090		
0:5132	03	51							.11512906	06 .000-01	-.0439
0:5232	03	51	.35656877	03 .100	01	-.01150	.35430446	03 .101 01	.02190		
0:5232	03	51							.11512712	06 .000-01	.0150
0:5332	03	51	.35657722	03 .100	01	-.01150	.35454996	03 .101 01	.01970		
0:5332	03	51							.11512521	06 .100 00	.0040
0:5432	03	51	.35658566	03 .100	01	-.01000	.35479550	03 .101 01	.02010		
0:5432	03	51							.11512330	06 .100 00	-.0107
0:5532	03	51	.35659409	03 .100	01	-.00080	.35504105	03 .101 01	.01090		
0:5532	03	51							.11512140	06 .100 00	.0205
0:5632	03	51	.35660250	03 .100	01	-.01120	.35528663	03 .101 01	.01670		
0:5632	03	51							.11511950	06 .100 00	-.0010
0:5732	03	51	.35661088	03 .100	01	-.00700	.35553223	03 .101 01	.01700		
0:5732	03	51							.11511759	06 .100 00	-.0000
0:5832	03	51	.35661925	03 .100	01	-.00000	.35577785	03 .101 01	.01730		
0:5832	03	51							.11511570	06 .100 00	-.0052
0:5932	03	51	.35662761	03 .100	01	-.01030	.35602346	03 .101 01	.02160		
0:5932	03	51							.11511379	06 .100 00	.0106
0:6032	03	51	.35663595	03 .100	01	-.00970	.35626911	03 .101 01	.01990		
0:6032	03	51							.11511181	06 .100 00	-.0272
0:6132	03	51	.35664428	03 .100	01	-.01160	.35651476	03 .101 01	.01810		
0:6132	03	51							.11510980	06 .100 00	-.0054
0:6232	03	51	.35665259	03 .100	01	-.00790	.35676046	03 .101 01	.01940		
0:6232	03	51							.11510777	06 .100 00	.0020
0:6332	03	51	.35666088	03 .100	01	-.00900	.35700616	03 .101 01	.01800		
0:6332	03	51							.11510572	06 .100 00	-.0010
0:6432	03	51	.35666916	03 .100	01	-.01190	.35725187	03 .101 01	.01600		
0:6432	03	51							.11510362	06 .100 00	.0030
0:6532	03	51	.35667743	03 .100	01	-.00010	.35749756	03 .101 01	.02100		

STATION NUMBER 51 04/01/71 STRATION NUMBER 5 PASS NUMBER 01/003

FREQUENCY 0423.5

TIME	TC	B	CSC	MG	ECS
010532	60	51	.95468568 C5 .100 01 -.01560 .15774555 03 .101 01 .02110		.11511966 06 .101 00 -.0236
010602	60	51	.95469192 C5 .100 01 -.01760 .15708911 03 .101 01 .02150		.11511932 06 .101 00 .0273
010632	60	51	.95470719 C5 .100 01 -.00980 .15923609 03 .101 01 .02340		.11511902 06 .101 00 -.0205
010702	60	51	.95471015 C5 .100 01 -.01130 .15946568 03 .101 01 .02360		.11511875 06 .101 00 -.0006
010732	60	51	.95471657 C5 .100 01 -.01120 .15972649 03 .101 01 .02170		.11511851 06 .101 00 .0049
010802	60	51	.95472669 C5 .100 01 -.00990 .15997231 03 .101 01 .02170		.11511831 06 .101 00 -.0059
010832	60	51	.95473665 C5 .100 01 -.01150 .15921015 03 .101 01 .01900		.11511813 06 .101 00 -.0137
010902	60	51	.95476299 C5 .100 01 .01440 .15946399 03 .101 01 .01790		.11511798 06 .101 00 .0313
010932	60	51			.11511787 06 .101 00 -.0050
011002	60	51			.11511779 06 .101 00 -.0209
011032	60	51			.11511773 06 .101 00 -.0196
011102	60	51	.95476739 C5 .100 01 -.00990 .20162756 00 .101 01 .02060		
011132	60	51	.95479155 C5 .100 01 -.01100 .19959012 00 .101 01 .02200		
011202	60	51	.95479956 C5 .100 01 -.01010 .11052028 01 .101 01 .02200		.11511781 06 .101 00 .0300
011232	60	51	.95480739 C5 .100 01 -.01100 .14312390 01 .101 01 .02390		.11511790 06 .101 00 .0020
011302	60	51	.95481559 C5 .100 01 -.01030 .16771904 01 .101 01 .02390		.11511801 06 .101 00 -.0018
011332	60	51	.95482358 C5 .100 01 -.01000 .19231674 01 .101 01 .02360		.11511816 06 .101 00 .0576
011402	60	51	.95483157 C5 .100 01 -.00600 .21691458 01 .101 01 .02370		.11511835 06 .101 00 -.0095
011432	60	51	.95483959 C5 .100 01 -.00990 .24151358 01 .101 01 .02370		.11511859 06 .101 00 .0225
011502	60	51	.95484748 C5 .100 01 -.00700 .26611352 01 .101 01 .02360		.11511885 06 .101 00 -.0026
011532	60	51	.95485541 C5 .100 01 -.00970 .29071471 01 .101 01 .02350		.11511900 06 .101 00 -.0718
011602	60	51	.95486333 C5 .100 01 -.01700 .31531506 01 .101 01 .02100		.11511928 06 .101 00 -.0060
011632	60	51	.95487123 C5 .100 01 -.01150 .33991064 01 .101 01 .02170		.11511958 06 .101 00 .0106
011702	60	51	.95487913 C5 .100 01 -.01130 .36452719 01 .101 01 .02310		.11511991 06 .101 00 -.0090
011732	60	51	.95488700 C5 .100 01 -.01120 .38912649 01 .101 01 .02100		.11512026 06 .101 00 .0050
011802	60	51	.95489487 C5 .100 01 -.01190 .41373174 01 .101 01 .02290		.11512064 06 .102 00 .0093
011832	60	51	.95490271 C5 .100 01 -.01700 .43833775 01 .101 01 .01870		.11512104 06 .102 00 -.0090
011902	60	51	.95492617 C5 .100 01 -.00670 .51216051 01 .101 01 .02070		
011932	60	51	.95493397 C5 .100 01 -.01590 .53676915 01 .101 01 .02000		.11512707 06 .102 00 -.0219
012002	60	51	.95494174 C5 .100 01 -.01770 .56137866 01 .101 01 .01780		.11512339 06 .102 00 -.0117
012032	60	51	.95494950 C5 .100 01 -.01540 .58598873 01 .101 01 .01570		.11512392 06 .102 00 .0005
012102	60	51	.95501875 C5 .100 01 -.01470 .60750662 01 .101 01 .01570		.11512971 06 .102 00 .0991
012132	60	51	.95502637 C5 .100 01 -.01500 .63211984 01 .101 01 .02360		.11513065 06 .102 00 -.0242
012202	60	51	.95503399 C5 .100 01 -.01140 .65673526 01 .101 01 .02170		.11513121 06 .102 00 -.0299
012232	60	51	.95504159 C5 .100 01 -.01290 .68135102 01 .101 01 .02090		.11513199 06 .102 00 -.0000
012302	60	51	.95504917 C5 .100 01 -.02360 .70596698 01 .101 01 .02070		.11513279 06 .102 00 -.0117
012332	60	51	.95505674 C5 .100 01 -.00990 .73058350 01 .101 01 .02040		.11513360 06 .102 00 -.0288
012402	60	51	.95506430 C5 .100 01 -.01190 .75520000 01 .101 01 .02020		.11513443 06 .102 00 .0094
012432	60	51	.95507184 C5 .100 01 -.01280 .77981688 01 .101 01 .01990		.11513528 06 .102 00 -.0322
012502	60	51	.95507937 C5 .100 01 -.01340 .10044330 02 .101 01 .01760		.11513615 06 .103 00 .0342
012532	60	51	.95508699 C5 .100 01 -.00990 .10290512 02 .101 01 .01940		.11513703 06 .103 00 -.0070
012602	60	51	.95509439 C5 .100 01 -.01150 .10536286 02 .101 01 .01910		.11513793 06 .103 00 .0719
012632	60	51	.95510188 C5 .100 01 -.01280 .10782059 02 .101 01 .02090		.11513884 06 .103 00 -.0204

FREQUENCY .0

023002	5	0	.95510936 C5 .100 01 -.01450 .11027815 02 .101 01 .02060		

FREQUENCY 0423.5

020102	0	51	.95511682 C5 .100 01 -.00960 .11273219 02 .101 01 .02090		
020132	0	51	.95513171 C5 .100 01 -.01090 .11519571 02 .101 01 .01900		
020202	60	51			.11514364 06 .103 00 -.0000
020232	60	51	.95513914 C5 .100 01 -.01770 .12013760 02 .101 01 .01950		
020302	60	51			.11514404 06 .103 00 .0070
020332	60	51	.95514655 C5 .100 01 -.01900 .12259075 02 .101 01 .02120		
020402	60	51			.11514444 06 .103 00 .0030
020432	60	51	.95515395 C5 .100 01 -.01240 .12505154 02 .101 01 .02090		
020502	60	51			.11514484 06 .103 00 .0270
020532	60	51	.95516133 C5 .100 01 -.01770 .12752202 02 .101 01 .01870		
020602	60	51			.11514775 06 .103 00 -.0140
020632	60	51	.95516871 C5 .100 01 -.01700 .12998459 02 .101 01 .01890		
020702	60	51			.11514879 06 .103 00 -.0050
020732	60	51	.95517607 C5 .100 01 -.01230 .13244833 02 .101 01 .02010		
020802	60	51			.11514989 06 .103 00 .0010
020832	60	51	.95518341 C5 .100 01 -.01150 .13490811 02 .101 01 .02190		
020902	60	51			.11515093 06 .103 00 -.0100

STATION NUMBER 51 64/61/31 STRATION NUMBER 3 PASS NUMBER 01/303

FREQUENCY 8423.5

TIME	PC	B	DOC			MA			CCS		
0/1132	69	51	.35519079	03	.100 01	-.01290	.13776901	02 .101 01	.02160		
0/1132	63	51									
0/1232	60	51	.35519007	03	.100 01	-.01040	.13983159	02 .101 01	.01930	.11515203	06 .103 00 .0066
0/1232	6.	51								.11515313	06 .103 00 -.0137
0/1332	69	51	.35520537	03	.100 01	-.01350	.14229323	02 .101 01	.01910		
0/1332	69	51								.11515626	06 .103 00 -.0127
0/1432	69	51	.35521207	03	.100 01	-.01250	.14475491	02 .101 01	.02080		
0/1432	67	51								.11515537	06 .103 00 -.0215
0/1532	65	51	.35521995	03	.100 01	-.01370	.14721656	02 .101 01	.02260		
0/1532	6.	51								.11515651	06 .103 00 .0254
0/1632	6.	51	.35522722	03	.100 01	-.00690	.14967820	02 .101 01	.02030		
0/1632	65	51								.11515765	06 .103 00 -.0050
0/1732	65	51	.35523468	03	.100 01	-.01210	.15213979	02 .101 01	.02210		
0/1732	6.	51								.11515801	06 .103 00 .0703
0/1832	67	51	.35524172	03	.100 01	-.01170	.15460137	02 .101 01	.02190		
0/1832	66	51								.11515990	06 .103 00 -.0137
0/1932	65	51	.35524895	03	.100 01	-.01040	.15706290	02 .101 01	.02360		
0/1932	6.	51								.11516116	06 .103 00 -.0068
0/2032	67	51	.35525617	03	.100 01	-.01150	.15952441	02 .101 01	.02330		
0/2032	6.	51								.11516236	06 .104 00 -.0410
0/2132	65	51	.35526337	03	.100 01	-.01260	.16198589	02 .101 01	.02310		
0/2132	65	51								.11516353	06 .104 00 -.0195
0/2232	67	51	.35527057	03	.100 01	-.00990	.16444734	02 .101 01	.02090		
0/2232	66	51								.11516476	06 .104 00 .0167
0/2332	6.	51	.35527779	03	.100 01	-.01290	.16690875	02 .101 01	.02200		
0/2332	6.	51								.11516595	06 .104 00 .0166
0/2432	65	51	.35528492	03	.100 01	-.01190	.16937008	02 .101 01	.02240		
0/2432	65	51								.11516717	06 .104 00 -.0215
0/2532	63	51	.35529207	03	.100 01	-.01190	.17183140	02 .101 01	.02220		
0/2532	67	51								.11516840	06 .104 00 .0000
0/2632	67	51	.35529922	03	.100 01	-.01010	.17429267	02 .101 01	.02200		
0/2632	6.	51								.11516963	06 .104 00 -.0036
0/2732	63	51	.35530635	03	.100 01	-.01510	.17675388	02 .101 01	.02170		
0/2732	66	51								.11517080	06 .104 00 .0000
0/2832	65	51	.35531347	03	.100 01	-.01010	.17921505	02 .101 01	.02150		
0/2832	67	51								.11517213	06 .104 00 .0000
0/2932	67	51	.35532037	03	.100 01	-.01510	.18167618	02 .101 01	.01730		
0/2932	66	51								.11517330	06 .104 00 .0060
0/3032	67	51	.35532767	03	.100 01	-.01210	.18413728	02 .101 01	.01910		
0/3032	67	51								.11517444	06 .104 00 -.0273
0/3132	66	51	.35533475	03	.100 01	-.01910	.18659832	02 .101 01	.01600		
0/3132	68	51								.11517561	06 .104 00 .0527
0/3232	67	51	.35534187	03	.100 01	-.01910	.18905919	02 .101 01	.01870		
0/3232	6.	51								.11517719	06 .104 00 -.0295
0/3332	6.	51	.35534887	03	.100 03	-.01110	.19152007	02 .101 01	.01060		
0/3332	67	51								.11517867	06 .104 00 .0196
0/3432	65	51	.35535597	03	.100 01	-.01400	.19398090	02 .101 01	.01060		
0/3432	63	51								.11517975	06 .104 00 -.0301
0/3532	66	51	.35536295	03	.100 01	-.01500	.19644167	02 .101 01	.02020		
0/3532	63	51								.11518104	06 .104 00 .0200
0/3632	6.	51	.35536997	03	.100 01	-.02190	.19890236	02 .101 01	.02400		
0/3632	66	51								.11518236	06 .104 00 .0137
0/3732	6.	51	.35537690	03	.100 01	-.01600	.20136302	02 .101 01	.02300		
0/3732	6.	51								.11518363	06 .104 00 -.0036
0/3832	67	51	.35538390	03	.100 01	-.01170	.20382355	02 .101 01	.02170		
0/3832	67	51								.11518496	06 .104 00 .0117
0/3932	6.	51	.35539096	03	.100 01	-.01060	.20628406	02 .101 01	.02160		
0/3932	67	51								.11518626	06 .104 00 -.0293
0/4032	67	51	.35539793	03	.100 01	-.01190	.20874446	02 .101 01	.02130		
0/4032	6.	51								.11518756	06 .104 00 .0273
0/4132	6.	51	.35540489	03	.100 01	-.01490	.21120480	02 .101 01	.02330		
0/4132	67	51								.11518887	06 .104 00 -.0195
0/4232	67	51	.35541186	03	.100 01	-.01510	.21366507	02 .101 01	.02120		
0/4232	6.	51								.11519018	06 .104 00 .0069
0/4332	67	51	.35541870	03	.100 01	-.01590	.21612529	02 .101 01	.02310		
0/4332	65	51								.11519151	06 .104 00 .0107
0/4432	67	51	.35542570	03	.100 01	-.01200	.21858536	02 .101 01	.02100		
0/4432	66	51								.11519283	06 .104 00 -.0439
0/4532	67	51	.35543261	03	.100 01	-.01560	.22104538	02 .101 01	.02090		
0/4532	68	51								.11519415	06 .104 00 -.0318
0/4632	6.	51	.35543951	03	.100 01	-.01590	.22350534	02 .101 01	.02080		
0/4632	6.	51								.11519546	06 .104 00 .0301
0/4732	65	51	.35544640	03	.100 01	-.01510	.22596518	02 .101 01	.02000		
0/4732	65	51								.11519680	06 .104 00 .0107
0/4832	69	51	.35545328	03	.100 01	-.01790	.22842496	02 .101 01	.02070		
0/4832	67	51								.11519813	06 .104 00 -.0020
0/4932	67	51	.35546013	03	.100 01	-.01730	.23088464	02 .101 01	.01900		
0/4932	6.	51								.11519946	06 .105 00 .0030
0/5032	67	51	.35546699	03	.100 01	-.01760	.23334426	02 .101 01	.01860		
0/5032	68	51								.11520080	06 .105 00 -.0293
0/5132	67	51	.35547383	03	.100 01	-.01610	.23580373	02 .101 01	.01650		
0/5132	68	51								.11520213	06 .105 00 .0301
0/5232	68	51	.35548066	03	.100 01	-.01090	.23826313	02 .101 01	.01850		
0/5232	68	51								.11520346	06 .105 00 .0060
0/5332	68	51	.35548747	03	.100 01	-.02590	.24072244	02 .101 01	.02060		
0/5332	68	51								.11520479	06 .105 00 -.0420
0/5432	67	51	.35549428	03	.100 01	-.01620	.24318166	02 .101 01	.02060		
0/5432	68	51								.11520612	06 .105 00 .0000
0/5532	67	51	.35550107	03	.100 01	-.02190	.24564077	02 .101 01	.02000		
0/5532	67	51								.11520745	06 .105 00 -.0225
0/5632	63	51	.35550785	03	.100 01	-.00990	.24809978	02 .101 01	.01860		
0/5632	68	51								.11520879	06 .105 00 .0137
0/5732	68	51	.35551462	03	.100 01	-.01020	.25055867	02 .101 01	.02250		
0/5732	68	51								.11521011	06 .105 00 .0170
0/5832	63	51	.35552138	03	.100 01	-.01200	.25301746	02 .101 01	.02250		
0/5832	67	51								.11521144	06 .105 00 .0060
0/5932	68	51	.35552813	03	.100 01	-.00990	.25547615	02 .101 01	.02250		
0/5932	68	51								.11521277	06 .105 00 .0703
0/6032	68	51	.35553486	03	.100 01	-.01010	.25793476	02 .101 01	.02260		

[illegible] .0

0/6100	0	0	.35554150	03	.100 01	-.01400	.26039325	02 .101 01	.00000	

FREQUENCY 8423.5

0/6200	0	51	.35554830	03	.100 01	-.01530	.26285169	02 .101 01	.00070	

STATION NUMBER 61 64/51/71 STATION NUMBER 9 PASS NUMBER 01/301

FREQUENCY 0423.5

TIME	YR	D	DEC															
031732	60	51																
031732	60	51	.35566490	03	.100	01	-.01100	.26552601	02	.101	01	.02000	.11921074	00	.105	00	.0090	
031732	60	51																
031402	60	51	.35556160	03	.100	01	-.01040	.26776707	02	.101	01	.01000	.11921006	00	.105	00	.0010	
031402	60	51																
031402	60	51	.35556030	03	.100	01	-.01290	.27022990	02	.101	01	.01700	.11921937	00	.105	00	-.0010	
031402	60	51																
031402	60	51	.35557503	03	.100	01	-.01350	.27265980	02	.101	01	.01720	.11922000	00	.105	00	-.0070	
031402	60	51																
031702	60	51	.35558160	03	.100	01	-.01000	.27514169	02	.101	01	.01970	.11922200	00	.105	00	-.0127	
031702	60	51																
031002	60	51	.35558032	03	.100	01	-.01250	.27759935	02	.101	01	.02360	.11922330	00	.105	00	-.0242	
031002	60	51																
031002	60	51	.35556456	03	.100	01	-.00770	.28005667	02	.101	01	.02150	.11922460	00	.105	00	-.0195	
030932	60	51																
031332	60	51	.35560157	03	.100	01	-.01150	.28251630	02	.101	01	.02170	.11922590	00	.105	00	.0400	
031332	60	51																
031107	60	51	.35560010	03	.100	01	-.01390	.28497159	02	.101	01	.01990	.11922719	00	.105	00	.0650	
031107	60	51																
031703	60	51	.35561470	03	.100	01	-.02000	.28742876	02	.101	01	.02210	.11922840	00	.105	00	.0952	
031702	60	51																
031302	60	51	.35562197	03	.100	01	-.01490	.28988579	02	.101	01	.02230	.11922970	00	.106	00	.0010	
031302	60	51																
031002	60	51	.35562796	03	.100	01	-.01130	.29234269	02	.101	01	.02250	.11923104	00	.106	00	-.0117	
031002	60	51																
031502	60	51	.35563450	03	.100	01	-.01370	.29479048	02	.101	01	.02290	.11923232	00	.106	00	-.0170	
031502	60	51																
031602	60	51	.35564106	03	.101	01	-.01410	.29723612	02	.101	01	.02150	.11923359	00	.106	00	.0301	
031602	60	51																
031702	60	51	.35564759	03	.101	01	-.01450	.29971264	02	.101	01	.02330	.11923485	00	.106	00	-.0144	
031702	60	51																
031002	60	51	.35565412	03	.101	01	-.02000	.30216099	02	.101	01	.02350	.11923610	00	.106	00	.0203	
031002	60	51																
031002	60	51											.11923735	00	.106	00	.0127	
031002	60	51											.11923860	00	.106	00	-.0079	
032702	60	51	.35566715	03	.101	01	-.01160	.30700131	02	.101	01	.02410						
032702	60	51											.11923983	00	.106	00	-.0010	
032102	60	51	.35567366	03	.101	01	-.01000	.30953729	02	.101	01	.02460						
032102	60	51											.11924106	00	.106	00	.0295	
032702	60	51	.35568012	03	.101	01	-.01490	.31199300	02	.101	01	.02060						
032702	60	51											.11924230	00	.106	00	.0913	
032902	60	51	.35568660	03	.101	01	-.02000	.31444077	02	.101	01	.01710						
032902	60	51											.11924350	00	.106	00	.0942	
032902	60	51	.35569309	03	.101	01	-.01190	.31690478	02	.101	01	.01990						
032902	60	51											.11924472	00	.106	00	-.0060	
032902	60	51	.35569951	03	.101	01	-.01730	.31935966	02	.101	01	.01700						
032902	60	51											.11924590	00	.106	00	-.0904	
032902	60	51	.35570595	03	.101	01	-.00900	.32181409	02	.101	01	.01020						

FREQUENCY .0

032702	0	0	.35571237	03	.101	01	-.01700	.32426998	02	.101	01	.01000						

FREQUENCY 0423.5

032002	0	51	.35571879	03	.101	01	-.01010	.32672042	02	.101	01	.01900						
032002	60	51											.11929093	00	.106	00	-.0170	
032002	60	51	.35572520	03	.101	01	-.01030	.32916060	02	.101	01	.02160						
032032	60	51											.11929061	00	.106	00	.0170	
033302	60	51	.35573160	03	.101	01	-.01050	.33163632	02	.101	01	.02190						
033302	60	51											.11929177	00	.106	00	-.0301	
033102	60	51	.35573790	03	.101	01	-.01200	.33408079	02	.101	01	.02230						
033102	60	51											.11929297	00	.106	00	.0400	
033102	60	51	.35574436	03	.101	01	-.01500	.33654311	02	.101	01	.02000						
033202	60	51											.11929409	00	.106	00	-.0303	
033002	60	51	.35575071	03	.101	01	-.01320	.33899720	02	.101	01	.01930						
033302	60	51											.11929510	00	.106	00	.0195	
033602	60	51	.35575707	03	.101	01	-.01900	.34145130	02	.101	01	.02190						
033602	60	51											.11929629	00	.107	00	.0030	
033602	60	51	.35576341	03	.101	01	-.01060	.34390516	02	.101	01	.02230						
033602	60	51											.11929740	00	.107	00	-.0020	
033602	60	51	.35576973	03	.101	01	-.01570	.34635083	02	.101	01	.02290						
033602	60	51											.11929850	00	.107	00	.0127	
033702	60	51	.35577605	03	.101	01	-.00900	.34881237	02	.101	01	.02140						
033702	60	51											.11929960	00	.107	00	.0070	
033802	60	51	.35578234	03	.101	01	-.01050	.35126569	02	.101	01	.02270						
033802	60	51											.11930069	00	.107	00	-.0050	
033902	60	51	.35578865	03	.101	01	-.01020	.35371000	02	.101	01	.02260						
033902	60	51											.11930172	00	.107	00	-.0090	
034002	60	51	.35579494	03	.101	01	-.01230	.35617193	02	.101	01	.01920						
034002	60	51											.11930277	00	.107	00	-.0020	
034102	60	51	.35580121	03	.101	01	-.01060	.35862436	02	.101	01	.02190						
034102	60	51											.11930381	00	.107	00	.0040	
034202	60	51	.35580748	03	.101	01	-.01090	.36107967	02	.101	01	.02250						
034202	60	51											.11930483	00	.107	00	-.0061	
034302	60	51	.35581375	03	.101	01	-.01060	.36353002	02	.101	01	.01970						
034302	60	51											.11930589	00	.107	00	-.0020	
034402	60	51	.35581997	03	.101	01	-.01060	.36600236	02	.101	01	.01700						
034402	60	51											.11930685	00	.107	00	.0202	
034502	60	51	.35582620	03	.101	01	-.02070	.36843455	02	.101	01	.01050						
034502	60	51											.11930784	00	.107	00	-.0117	
034602	60	51	.35583242	03	.101	01	-.01070	.37086655	02	.101	01	.01970						
034602	60	51											.11930882	00	.107	00	.0273	
034702	60	51	.35583863	03	.101	01	-.01400	.37333630	02	.101	01	.02000						
034702	60	51											.11930979	00	.107	00	-.0047	
034802	60	51	.35584483	03	.101	01	-.02000	.37579004	02	.101	01	.01870						
034802	60	51											.11931074	00	.107	00	-.0097	
034902	60	51	.35585102	03	.101	01	-.01000	.37824194	02	.101	01	.01950						
034902	60	51											.11931168	00	.107	00	.0225	
035002	60	51	.35585719	03	.101	01	-.01300	.38069385	02	.101	01	.01870						
035002	60	51											.11931260	00	.107	00	-.0010	
035102	60	51	.35586336	03	.101	01	-.01200	.38314596	02	.101	01	.01900						
035102	60	51											.11931351	00	.107	00	.0070	
035202	60	51	.35586952	03	.101	01	-.01000	.38559490	02	.101	01	.01000						
035202	60	51											.11931441	00	.107	00	.0070	
035302	60	51	.35587567	03	.101	01	-.01070	.38805467	02	.101	01	.00670						
035302	60	51											.11931529	00	.107	00	-.0036	
035402	60	51	.35588180	03	.101	01	-.01070	.39044625	02	.101	01	.01700						

STATION NUMBER 51 04/01/71 ITERATION NUMBER 5 PASS NUMBER 01/103

FREQUENCY 6423.5

TIME	YC	G	DEC			RA			CCD		
031632	60	51							.11527910	06 .107	00 -.0236
031637	60	51	.35468792	C3 .101	C1	-.02460	.39206666	02 .101	01 .01060		
031642	60	51							.11527901	06 .107	00 .0547
031647	60	51	.35509065	C3 .101	01	-.02050	.39519685	02 .101	01 .01730		
031652	60	51							.11527705	06 .100	00 .0100
031657	60	51	.35550014	C3 .101	01	-.01650	.39784691	02 .101	C1 .01020		
031702	60	51							.11527867	06 .100	00 -.0201
031707	60	51	.35590625	C3 .101	C1	-.01240	.40029671	02 .101	01 .02120		
031712	60	51							.11527940	06 .100	00 .0527
031717	60	51	.35631231	03 .101	C1	-.01020	.40274638	02 .101	C1 .01010		
031722	60	51							.11528027	06 .100	00 -.0049
031727	60	51	.35671838	C3 .101	C1	-.01020	.40519584	02 .101	01 .01900		
031732	60	51							.11528105	06 .100	00 -.0196
031737	60	51	.35712444	C3 .101	C1	-.01200	.40764511	02 .101	C1 .02010		
031742	60	51							.11528101	06 .100	00 .0410
031747	60	51	.35753049	03 .101	01	-.01590	.41009420	02 .101	01 .02310		

FREQUENCY .0

031752	0	0	.35793653	C3 .101	C1	-.02170	.41254308	02 .101	01 .02610		
031757	0	0	.35834255	03 .101	C1	-.01390	.41499177	02 .101	01 .02310		
031802	0	0	.35874857	C3 .101	C1	-.01360	.41744025	02 .101	01 .02220		
031807	0	0	.35915456	C3 .101	C1	-.01660	.42273251	02 .101	C1 .02760		
031812	0	0	.35957053	C3 .101	C1	-.02030	.42867901	02 .101	01 .02180		
031817	0	0	.35998646	C3 .101	C1	-.01610	.43312709	02 .101	01 .01900		
031822	0	0	.35999239	C3 .101	01	-.01980	.43957620	02 .101	C1 .02220		

FREQUENCY 6423.5

041307	0	51	.35999833	C3 .101	C1	-.01550	.43702112	02 .101	01 .02560		
041312	60	51							.11529961	06 .100	00 -.0137
041317	60	51	.35600226	C3 .101	C1	-.01370	.43946702	02 .101	C1 .02260		
041322	63	51							.11529015	06 .100	00 .0050
041327	63	51	.35600817	C3 .101	01	-.01350	.44191451	02 .101	01 .01990		
041332	63	51							.11529066	06 .100	00 -.0137
041337	60	51	.35601407	C3 .101	C1	-.01670	.44436060	02 .101	01 .02120		
041342	63	51							.11529116	06 .100	00 -.0009
041347	60	51	.35601996	C3 .101	01	-.01660	.44681660	02 .101	C1 .01060		
041352	60	51							.11529164	06 .100	00 .0273
041357	60	51	.35602586	C3 .101	01	-.01800	.44927253	02 .101	01 .01900		
041402	63	51							.11529210	06 .100	00 .0352
041407	60	51	.35603176	C3 .101	01	-.01970	.45169820	02 .101	C1 .02120		
041412	60	51							.11529254	06 .100	00 -.0029
041417	60	51	.35603767	C3 .101	C1	-.01930	.45414366	02 .101	01 .01060		
041422	60	51							.11529299	06 .100	00 .0107
041427	60	51	.35604362	C3 .101	C1	-.02500	.45658891	02 .101	01 .01700		
041432	60	51							.11529335	06 .100	00 .0117
041437	60	51	.35604926	C3 .101	C1	-.02060	.45903392	02 .101	C1 .01560		

FREQUENCY .0

041442	0	0	.35605520	C3 .101	C1	-.02220	.46147875	02 .101	C1 .01000		
041447	0	51	.35606091	C3 .101	C1	-.02190	.46392339	02 .101	01 .01920		
041452	60	51							.11529449	06 .100	00 -.0332
041457	60	51	.35606671	C3 .101	C1	-.02100	.46636773	02 .101	01 .01700		
041462	60	51							.11529475	06 .100	00 .0352
041467	63	51	.35607251	C3 .101	C1	-.01500	.46881191	02 .101	01 .01720		
041472	60	51							.11529505	06 .100	00 .0100
041477	60	51	.35607830	C3 .101	01	-.02250	.47125585	02 .101	01 .01600		
041482	60	51							.11529532	06 .100	00 -.0410
041487	60	51	.35608400	C3 .101	01	-.02610	.47369961	02 .101	C1 .01630		
041492	0	51	.35609960	C3 .101	C1	-.02510	.47614311	02 .101	01 .01750		
041497	63	51							.11529602	06 .100	00 .0450
041502	63	51	.35610196	03 .101	01	-.01670	.47858640	02 .101	C1 .01710		
041507	60	51							.11529621	06 .100	00 -.0332
041512	64	51	.35610768	03 .101	01	-.02270	.48102946	02 .102	C1 .01070		
041517	60	51							.11529638	06 .100	00 -.0106
041522	63	51	.35611200	03 .101	01	-.02170	.48347230	02 .102	01 .01060		
041527	60	51							.11529653	06 .100	00 .0500
041532	60	51	.35611652	C3 .101	01	-.02120	.48591490	02 .102	01 .01000		
041537	60	51							.11529684	06 .100	00 -.0230
041542	60	51	.35612122	C3 .101	C1	-.02760	.48835728	02 .102	01 .01770		
041547	60	51							.11529676	06 .100	00 -.0000
041552	60	51	.35612991	C3 .101	C1	-.02610	.49079942	02 .102	C1 .01950		
041557	60	51							.11529606	06 .100	00 .0003
041602	60	51	.35613560	C3 .101	01	-.02500	.49324132	02 .102	01 .01720		
041607	60	51							.11529609	06 .100	00 -.0490
041612	60	51	.35614129	03 .101	01	-.02500	.49568296	02 .102	01 .01700		
041617	60	51							.11529695	06 .100	00 -.0490
041622	60	51	.35614696	03 .101	01	-.01060	.49812435	02 .102	C1 .01200		
041627	60	51							.11529696	06 .110	00 .0430
041632	60	51	.35615259	03 .101	01	-.02190	.50056551	02 .102	01 .01660		
041637	63	51							.11529691	06 .110	00 .0000
041642	60	51	.35615825	C3 .101	C1	-.02150	.50300642	02 .102	01 .01660		
041647	63	51							.11529680	06 .110	00 -.0752
041652	60	51	.35616386	C3 .101	C1	-.02470	.50544709	02 .102	01 .01620		
041657	0	51	.35617529	C3 .101	C1	-.02360	.50788748	02 .102	01 .01610		
041702	60	51							.11529666	06 .110	00 .0060
041707	60	51	.35618059	03 .101	01	-.02290	.51032763	02 .102	01 .01000		
041712	60	51							.11529651	06 .110	00 -.0270
041717	60	51	.35618628	C3 .101	01	-.02610	.51276753	02 .102	01 .01300		
041722	0	51	.35619195	03 .101	01	-.02600	.51520714	02 .102	01 .01900		
041727	60	51							.11529907	06 .110	00 .0307
041732	60	51	.35620299	03 .102	01	-.02010	.51764647	02 .102	01 .01700		
041737	60	51							.11529924	06 .110	00 -.0230
041742	63	51	.35620854	03 .102	01	-.01960	.52008548	02 .102	01 .01600		
041747	60	51							.11529940	06 .110	00 .0107
041752	60	51	.35621408	03 .102	01	-.02270	.52252426	02 .102	01 .01610		
041757	60	51							.11529921	06 .110	00 .0391
041802	60	51	.35621960	03 .102	01	-.02400	.52496269	02 .102	01 .01620		

FREQUENCY .0

041807	0	0	.35622513	C3 .102	01	-.01950	.52740060	02 .102	01 .00630		

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FREQUENCY .0

TIME	PC	G	DEC			RA			CCI		
065607	0	0	.35627063	C1	.102 01	-.01650	.55715723	02 .102 01	.01650		

FREQUENCY 8423.5

065502	0	51	.35627612	C1	.102 01	-.02500	.55995672	02 .102 01	.01650		
065537	63	51								.11529304 06 .110 00	-.0000
065602	60	51	.35624161	C1	.102 01	-.02100	.56281159	02 .102 01	.01680		
065637	60	51								.11529343 06 .110 00	-.0301
065707	60	51	.35624708	C1	.102 01	-.03630	.56566950	02 .102 01	.02100		
065732	60	51								.11529300 06 .110 00	-.0029
065807	60	51	.35625255	C1	.102 01	-.01360	.56850570	02 .102 01	.01920		
065832	60	51								.11529256 06 .110 00	-.0117
065907	60	51	.35625802	C1	.102 01	-.02500	.57135230	02 .102 01	.01750		
065932	60	51								.11529206 06 .110 00	.0391
065957	60	51	.35626345	C1	.102 01	-.02100	.55177956	02 .102 01	.01580		

FREQUENCY .0

051107	0	0	.35626889	C1	.102 01	-.02790	.55421650	02 .102 01	.01620		

FREQUENCY 8423.5

051202	0	51	.35627431	C1	.102 01	-.02010	.55665599	02 .102 01	.01650		
051232	63	51								.11529045 06 .111 00	-.0011
051302	60	51	.35627972	C1	.102 01	-.02150	.55910590	02 .102 01	.01690		
051332	60	51								.11529005 06 .111 00	-.1266
051402	60	51	.35628512	C1	.102 01	-.02600	.56157115	02 .102 01	.01730		
051432	63	51								.11528974 06 .111 00	.0499
051502	60	51	.35629052	C1	.102 01	-.03160	.56405679	02 .102 01	.01570		
051532	0	51	.35630177	C1	.102 01	-.02300	.56882547	02 .102 01	.01800		
051732	63	51								.11528722 06 .111 00	-.0050
051802	60	51	.35630663	C1	.102 01	-.02890	.57125974	02 .102 01	.01710		
051832	63	51								.11528649 06 .111 00	.0410
051902	63	51	.35631198	C1	.102 01	-.02600	.57369574	02 .102 01	.01760		
051932	63	51								.11528574 06 .111 00	.0001
051962	63	51	.35631732	C1	.102 01	-.02910	.57612367	02 .102 01	.01620		

FREQUENCY .0

051132	0	0	.35632264	C1	.102 01	-.02010	.57856096	02 .102 01	.01670		
051232	0	0	.35632796	C1	.102 01	-.02720	.58099618	02 .102 01	.01950		
051302	0	0	.35633327	C1	.102 01	-.02220	.58342916	02 .102 01	.01600		

FREQUENCY 8423.5

051402	0	51	.35633856	C1	.102 01	-.02120	.58585985	02 .102 01	.01660		
051432	63	51								.11528194 06 .111 00	.0273
051502	60	51	.35634385	C1	.102 01	-.02620	.58829220	02 .102 01	.01330		
051532	60	51								.11528061 06 .111 00	-.0313
051602	63	51	.35634913	C1	.102 01	-.02720	.59071667	02 .102 01	.01200		
051632	60	51								.11527966 06 .111 00	.0040
051702	60	51	.35635439	C1	.102 01	-.02020	.59313636	02 .102 01	.01080		
051732	60	51								.11527860 06 .112 00	-.0127
051802	60	51	.35635964	C1	.102 01	-.01720	.59554651	02 .102 01	.01350		
051832	63	51								.11527767 06 .112 00	.0106
051902	63	51	.35636489	C1	.102 01	-.02620	.59801930	02 .102 01	.01230		
051932	63	51								.11527663 06 .112 00	-.0117
052002	60	51	.35637012	C1	.102 01	-.02310	.60045040	02 .102 01	.01510		
052032	60	51								.11527556 06 .112 00	.0070
052102	63	51	.35637534	C1	.102 01	-.02400	.60288132	02 .102 01	.01200		
052132	63	51								.11527446 06 .112 00	-.0204
052202	63	51	.35638055	C1	.102 01	-.02500	.60532109	02 .102 01	.01000		
052232	63	51								.11527335 06 .112 00	.0004
052302	60	51	.35638575	C1	.102 01	-.03010	.60776270	02 .102 01	.01170		
052332	63	51								.11527217 06 .112 00	-.0192
052402	63	51	.35639095	C1	.102 01	-.02400	.61017219	02 .102 01	.01670		
052432	60	51								.11527098 06 .112 00	.0045
052502	63	51	.35639611	C1	.102 01	-.02570	.61261196	02 .102 01	.01300		
052532	60	51								.11526977 06 .112 00	-.0195
052602	60	51	.35640129	C1	.102 01	-.02600	.61503150	02 .102 01	.01260		
052632	60	51								.11526852 06 .112 00	.0117
052702	63	51	.35640644	C1	.102 01	-.02790	.61746056	02 .102 01	.01300		
052732	60	51								.11526726 06 .112 00	-.0295
052802	60	51	.35641158	C1	.102 01	-.03230	.61989950	02 .103 01	.01070		
052832	60	51								.11526596 06 .112 00	-.0215
052902	63	51	.35641671	C1	.102 01	-.02270	.62231010	02 .103 01	.00970		
052932	63	51								.11526463 06 .112 00	.0000
053002	63	51	.35642183	C1	.102 01	-.02620	.62474667	02 .103 01	.01000		
053032	60	51								.11526323 06 .112 00	.0093
053102	60	51	.35642694	C1	.102 01	-.02200	.62718658	02 .103 01	.01190		
053132	63	51								.11526183 06 .112 00	-.0400
053202	63	51	.35643204	C1	.102 01	-.02460	.62962220	02 .103 01	.01310		
053232	60	51								.11526040 06 .112 00	-.0195
053302	63	51	.35643713	C1	.103 01	-.02660	.63202978	02 .103 01	.00990		
053332	63	51								.11525894 06 .112 00	.0400
053402	60	51	.35644220	C1	.103 01	-.02510	.63446690	02 .103 01	.01190		
053432	60	51								.11525745 06 .113 00	-.0510
053502	60	51	.35644727	C1	.103 01	-.03030	.63688300	02 .103 01	.01070		
053532	63	51								.11525595 06 .113 00	-.0445
053602	63	51	.35645232	C1	.103 01	-.02270	.63931750	02 .103 01	.01200		
053632	63	51								.11525437 06 .113 00	-.0256
053702	60	51	.35645736	C1	.103 01	-.02590	.64173000	02 .103 01	.01130		
053732	63	51								.11525279 06 .113 00	.0596
053802	60	51	.35646239	C1	.103 01	-.03020	.64416203	02 .103 01	.01200		
053832	60	51								.11525117 06 .113 00	-.0410
053902	63	51	.35646741	C1	.103 01	-.02900	.64658956	02 .103 01	.01200		
053932	60	51								.11524952 06 .113 00	.0070
054002	60	51	.35647241	C1	.103 01	-.02900	.64901400	02 .103 01	.01360		
054032	60	51								.11524785 06 .113 00	.0020
054102	60	51	.35647741	C1	.103 01	-.02630	.65143012	02 .103 01	.01400		
054132	63	51								.11524615 06 .113 00	-.0095
054202	60	51	.35648239	C1	.103 01	-.02900	.65386395	02 .103 01	.01620		
054232	60	51								.11524439 06 .113 00	.0234
054302	60	51	.35648736	C1	.103 01	-.02900	.65628044	02 .103 01	.01170		

STATION NUMBER 51 04/01/91 ITERATION NUMBER 3 PASS NUMBER 01/300

FREQUENCY .0

TIME	TC	B	DEC		MA		CES
094062	9	5	.39690734 C3 .103 01	-.03920	.69871290 02 .108 01	.01120	
			FREQUENCY 8421.5				
094062	9	51	.39690719 C3 .103 01	-.03950	.66796210 02 .106 01	.01030	.11523710 06 .119 00 -.3636
094062	03	51					
094062	04	51	.39690717 C3 .103 01	-.03970	.65510362 02 .106 01	.00990	.11523520 06 .119 00 .0952
094062	04	51					
094062	05	51	.39690722 C3 .103 01	-.03970	.66966697 02 .106 01	.01100	.11523326 06 .116 00 -.0117
094062	05	51					
094062	06	51	.39691692 C3 .106 01	-.02990	.67382900 02 .106 01	.00920	
094062	06	51	.39691159 C3 .106 01	-.03170	.67806495 02 .106 01	.01490	
094062	06	51					.11522519 06 .110 00 -.0200
094062	06	51	.39691637 C3 .106 01	-.02690	.68051620 02 .106 01	.01730	
094062	06	51					.11522309 06 .116 00 -.0236
094062	06	51	.39690170 C3 .106 01	-.02690	.68293526 02 .106 01	.01610	
094062	06	51					.11522096 06 .116 00 .0030
094062	06	51	.39690622 C3 .106 01	-.02690	.68515702 02 .106 01	.01270	
094062	06	51					.11521879 06 .116 00 -.0010
094062	06	51	.39690702 C3 .106 01	-.02690	.68777026 02 .106 01	.01190	
094062	06	51					.11521659 06 .116 00 -.0000
094062	06	51	.39690561 C3 .106 01	-.02550	.69019010 02 .106 01	.01300	
094062	06	51					.11521436 06 .116 00 -.0090
094062	06	51	.39690708 C3 .106 01	-.02690	.69261780 02 .106 01	.01540	
094062	06	51	.39690903 C3 .106 01	-.02720	.69503999 02 .106 01	.01300	
094062	06	51					.11520706 06 .115 00 -.0771
094062	06	51	.39690661 C3 .106 01	-.02730	.69987652 02 .105 01	.01590	
			FREQUENCY .0				
094062	0	5	.39690935 C3 .106 01	-.02500	.70220273 02 .105 01	.01600	
			FREQUENCY 8421.5				
094062	06	51	.39690805 C3 .105 01	-.02390	.70471092 02 .105 01	.01620	
094062	06	51					.11520626 06 .115 00 -.0962
094062	06	51	.39690876 C3 .105 01	-.02850	.70717796 02 .105 01	.01440	
094062	06	51					.11519770 06 .115 00 -.0715
094062	06	51	.39690901 C3 .105 01	-.02800	.70966520 02 .105 01	.01200	
094062	06	51					.11519520 06 .115 00 -.0106
094062	06	51	.39690907 C3 .105 01	-.02700	.71196169 02 .105 01	.01590	
094062	06	51					.11519275 06 .115 00 .0106
094062	06	51	.39690771 C3 .105 01	-.03130	.71437796 02 .105 01	.00920	
094062	06	51					.11519010 06 .115 00 .0901
094062	06	51	.39690733 C3 .105 01	-.02900	.71690505 02 .105 01	.00900	
094062	06	51					.11518757 06 .116 00 -.0947
094062	06	51	.39691196 C3 .105 01	-.02700	.71942594 02 .105 01	.01200	
094062	06	51					.11518495 06 .116 00 -.0322
094062	06	51	.39691634 C3 .105 01	-.02610	.72182443 02 .105 01	.01300	
094062	06	51					.11518226 06 .116 00 -.0244
094062	06	51	.39692111 C3 .105 01	-.02090	.72409906 02 .105 01	.00990	
094062	06	51					.11517995 06 .116 00 .0952

STATION NUMBER 51 04/01/91 PASS NUMBER 01/300

FREQUENCY 8421.5

TIME	TC	B	DEC		MA		CES
094062	03	51	.39693576 C3 .103 01	-.03070	.72606000 02 .106 01	-.00990	
094062	03	51					.11517600 06 .116 00 -.0209
094062	03	51	.39690612 C3 .106 01	-.03000	.72807160 02 .106 01	-.00890	
094062	03	51					.11517401 06 .116 00 .0970
094062	03	51	.39690600 C3 .106 01	-.03070	.73148191 02 .106 01	-.00560	
094062	03	51					.11517121 06 .117 00 .0939
094062	03	51	.39690693 C3 .106 01	-.03070	.73389178 02 .106 01	-.00930	
094062	03	51					.11516836 06 .117 00 -.0106
094062	03	51	.39690316 C3 .106 01	-.03070	.73630099 02 .106 01	-.00790	
094062	03	51					.11516560 06 .117 00 .0961
094062	03	51	.39690706 C3 .106 01	-.03070	.73878975 02 .107 01	-.00800	
094062	03	51					.11516256 06 .117 00 -.0127
094062	03	51	.39690176 C3 .107 01	-.03060	.74111056 02 .107 01	-.00990	
094062	03	51					.11515961 06 .118 00 .0236
094062	03	51	.39690001 C3 .107 01	-.03090	.74352502 02 .107 01	-.00930	
094062	03	51					.11515662 06 .118 00 -.1945
094062	03	51	.39690725 C3 .107 01	-.03230	.74595524 02 .107 01	-.00510	
094062	03	51					.11515360 06 .118 00 .0929
094062	03	51	.39690904 C3 .107 01	-.03320	.74833976 02 .107 01	-.00590	
			FREQUENCY 8399.1				
094062		12	.39690866 C3 .107 01	-.03010	.75074500 02 .107 01	-.00690	
094062	0	12	.39690701 C3 .107 01	-.02990	.75315160 02 .107 01	-.00910	
094062	0	12	.39690697 C3 .107 01	-.03170	.75556047 02 .108 01	-.00900	
094062	0	12	.39690117 C3 .108 01	-.03190	.75796068 02 .108 01	-.00610	
094062	0	12	.39690919 C3 .108 01	-.03270	.76036071 02 .108 01	-.00960	
094062	0	12	.39690976 C3 .108 01	-.03090	.76276792 02 .109 01	-.00890	
094062	0	12	.39691111 C3 .109 01	-.03200	.76517069 02 .109 01	-.00190	
094062	0	12	.39691142 C3 .109 01	-.03030	.76757206 02 .109 01	-.00390	
094062	0	12	.39691131 C3 .109 01	-.02990	.76997373 02 .109 01	-.00370	
			FREQUENCY .0				
094062	0	0	.39691919 C3 .110 01	-.02910	.77237610 02 .110 01	.00010	
094062	0	0	.39691910 C3 .110 01	-.03060	.77477841 02 .110 01	.00020	
094062	0	2	.39691896 C3 .111 01	-.02910	.77717105 02 .111 01	.00230	
094062	0	2	.39691876 C3 .111 01	-.02990	.78196996 02 .111 01	.00050	
094062	0	0	.39691819 C3 .111 01	-.02700	.78436848 02 .111 01	.00270	
094062	0	5	.39691835 C3 .111 01	-.02760	.78676259 02 .112 01	.00500	
094062	0	0	.39691767 C3 .112 01	-.02700	.78915705 02 .112 01	.00990	
094062	0	0	.39691677 C3 .112 01	-.03110	.79155701 02 .112 01	.00000	
094062	0	0	.39691691 C3 .112 01	-.02690	.79395375 02 .113 01	.00000	
094062	0	0	.39691613 C3 .113 01	-.03060	.79633651 02 .113 01	.00190	
094062	0	0	.39691619 C3 .113 01	-.02790	.79873510 02 .114 01	.00000	
094062	0	0	.39691611 C3 .114 01	-.02790	.80112095 02 .114 01	.00000	
094062	0	0	.39691590 C3 .115 01	-.02790	.80351060 02 .115 01	.00000	

DATA STATISTICS STATION 5 ITERATION 3

PASS	DATA TYPE	OBSERVATION TIME		CYC	NUMBER OF POINTS	STD DEV	ORG	FIRST MOMENT	SECOND MOMENT
01/301	CES	1730-162149	1730-162529		81	.170-01	.700-01	.115-01	.110-00
1/300	CES	1731-191138	1731-191538		64	.102-01	.100-01	.110-02	.150-01
1/300	CES	1731-204118	1731-211130		449	.126-01	.120-01	-.110-02	.170-02
1/300	CES	1731-012130	1731-042032		9	.050-01	.030-01	-.110-02	.150-02

CASE 1 SPACE TRAJECTORIES 1

EPHEMERIS TAPE IN BITS AND VELOCITIES, 0-0 15

LAM	.39860175 06	J	.16299500-02	H	-.57499999-05	D	.70749999-05	RE	.63781600 04	RDM	.63783039 04
G	.66709998-10	A	.86787487 29	B	.86800000 29	C	.86813000 29	OME	.61780761-02	AU	.14959000 08
GMM	.49026666 04	GMS	.13271944 12	LMM	.32678952 06	LMS	.6/877799 05	LMC	.37918700 08	GMJ	.12671162 09
LGM	.39860320 06	MGM	.49077779 04	JM	.29215000-02	MM	.00000000 00	EM	.00000000 00	AM	.38439000 04
AMM	.35677000 01	WM	.39197946 02	MMS	.37410006 03	SMI	.00000000 00	SMZ	.00000000 00	SC	.10120000 00

INJECTION CONDITIONS MODEL 2356675745722022000000 J.D.= 2430425.17025231 JAN. 30,1964 10 16 41.000

GEOCENTRIC X0 .61037175 04 Y0 .22928608 04 Z0-.78690995 03 DX0-.37731652 01 DY0 .09534889 01 DZ0-.50910193 01
CARTESIAN DMC .00000000 00 DCC .00000000 00 DD .00000000 00 DMM .11109487 02 DMD .12027076 03
DATE OF RUN 071,1960 DECODED EARTH IS THE CENTRAL BODY FOR INTEGRATION CONELL EQUATIONS OF MOTION

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. 2356675745722022000000 J.D.= 2430425.17025231 JAN. 30,1964 10 16 41.000

GEOCENTRIC EQUATORIAL COORDINATES

X	.61037175 04	Y	.22928607 04	Z	-.78690992 03	DX	-.37731652 01	DY	.09534879 01	DZ	-.50910193 01
R	.65674868 04	DRC	-.00816657 01	RA	.20568884 02	V	.10608332 02	PTH	.11973714 01	AZ	.11771372 03
H	.65674867 04	LAT	-.00816657 01	LGA	.76741214 01	HI	.10550846 02	PTI	.12669711 01	AZE	.11891900 03
RS	.94350000 08	VS	-.10305150 09	ZS	-.65035368 08	DRS	.23361195 02	DVS	.17587676 02	DZS	.76275624 01
RM	-.31756866 06	VM	.15508977 06	ZM	.09561978 05	DRM	-.53804657 00	DVM	-.84240504 00	DZM	-.29578704 00
RT	-.31756866 06	VT	.15508977 06	ZT	.09561978 05	DRT	-.53804657 00	DVT	-.84240504 00	DZT	-.29578704 00
RS	.15740017 09	VS	.30720058 02	RM	.37836362 06	VM	.10647257 01	RT	.37836360 06	VT	.10627257 01
WEN	-.63781796 03	ALT	.10958641 03	LCS	.29519052 03	RAS	.31225811 03	RAM	.15528210 03	LOM	.16217260 03
DWT	.35000000 02	DT	.37500000 01	DM	.22927161 00	SMA	-.86594701 06	DES	-.17793729 02	DEM	.14620646 02
DAC	.00000000 00	CCL	.11181656 01	MCL	.10673238 03	TCL	.10673238 03				

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2356675745722076151050 J.D.= 2430425.17796021 JAN. 30,1964 16 16 15.963

SMA	.37606072 06	ECC	.90296380 00	B	.69954097 05	SLR	.13016562 05	APO	.74555685 06	RCA	.65645675 04
VM	.96675862-01	CS	-.10509372 01	C1	.72025169 05	TIP	.25236922 02	TS	-.70107561-02	PER	.30251320 05
TA	.74160235 01	RTA	.00000000 00	LA	.22673922 00	MA	.39585952-02	CSJ	-.19411093 01	TPI	.00000000 00

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	.61037175 04	Y	.22928607 04	Z	-.78690992 03	DX	-.37731652 01	DY	.09534879 01	DZ	-.50910193 01
INC	.28695588 02	LAN	.18776205 03	APP	.19213031 03	RX	-.36367452 00	RY	.83911023 00	RZ	-.66176513 00
GX	-.64260174-01	GY	.67220872 00	GZ	.07087720 00	PX	.94388100 00	PY	.31470498 00	PZ	-.10026601 00
GX	-.37397798 00	GY	.67310829 00	GZ	-.66040963 00	RX	-.91102714-01	RY	-.31707919-01	RZ	-.99498257 00
RX	.37397798 00	RY	-.67310831 00	RZ	.66040963 00	TX	.31629823 00	TY	-.94869981 00	TZ	.00000000 00
LAP	-.57511991 01	RAP	.18439204 02								
DTG	.61794198 05	DRG	-.52704515 05	B	.69954097 05	THG	.35206671 03				

CASE 1 SPACE TRAJECTORIES 2

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.96352784 08	Y	.10365379 09	Z	.45032981 08	TX	-.27136368 02	DY	-.86341086 01	DZ	-.12719207 02
R	.16736550 09	LAT	.17769720 02	LGN	.13275963 03	V	.31186550 02	PTH	.13729177 02	AZ	.12120011 03
HI	-.36358008 08	VI	.17305190 09	ZI	.45033768 08	DRI	-.27136199 02	DVI	-.17587676 02	DZI	-.76275624 01
RT	-.96675484 08	VT	.15508977 06	ZT	.09561978 05	DRT	-.53804657 00	DVT	-.10930781 02	DZT	-.79213002 01
LTT	.17336725 02	LON	.13275811 03	LTT	.13709748 02	LCT	.13231644 03	RST	.16771620 09	VST	.31203360 02
.PS	.11260197 03	LSP	.27455912-10	SLP	.67316675 02	EPM	.66457276 02	EMP	.69543969 00	MEP	.13490004 03
MPS	.15408945 03	MLP	.57674939-01	SMP	.72954658 02	SEM	.45767943 03	EPS	.22744829 02	ESP	.56300341-01
RPM	.18302772 06	SPM	.36470523 02								
SAC	.62322079-10										
WCL	.26018394 02	GCI	.25701303 03	SIP	.13672967 03	CPT	.06752102 02	SIN	.84502198 02	DI	.13012732 00
MIP	.65676608 04	VIP	.10469312 02	CPE	.10662200 03	EPS	.10270792 03	DZ	.12556710 00	D3	.19582624-02

2 DAYS 0 HRS. 54 MIN. 5.784 SEC. 2356677408652075320612 J.D.= 2430427.54015186 FEB. 2,1964 01 10 46.784

GEOCENTRIC EQUATORIAL COORDINATES

X	-.36066799 08	Y	-.54726358 03	Z	.15057311 04	DX	-.10359662 01	DY	-.20050796 00	DZ	.16679109 00
R	.36066817 08	DRC	.84316591 00	RA	.10069276 03	V	.10037596 01	PTH	.85434337 02	AZ	.46189519 02
H	.36066817 08	LAT	.84316591 00	LGA	.19667960 02	HI	.26678857 02	PTI	.23129855 01	AZE	.27036000 03
RS	.99301630 08	VS	-.10419955 09	ZS	-.63632760 08	DRS	.22946667 02	DVS	.18952806 02	DZS	.60021600 01
RM	-.38066590 06	VM	.13169363 05	ZM	.27959658 05	DRM	-.35251193-02	DVM	-.62913806 00	DZM	-.50308260 00
RT	-.38066590 06	VT	.13169363 05	ZT	.27959658 05	DRT	-.35251193-02	DVT	-.62913806 00	DZT	-.50308260 00
RS	.16761673 09	VS	.30213961 02	RM	.39078645 06	VM	.10653237 01	RT	.39078645 06	VT	.10653237 01
WEN	.87130078 03	ALT	.19426197 03	LCS	.19571404 03	RAS	.31608426 03	RAM	.10487460 03	LOM	.59906400 02
DWT	.35000000 02	DT	.46000000 03	DM	.10686613 01	SMA	.39041720 06	DES	-.17139166 02	DEM	.39290804 01
DAC	.00000000 00	CCL	.20169598 03	MCL	.29219407 03	TCL	.29210407 03				

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2356675766722079150447612 J.D.= 2430425.22866002 JAN. 30,1964 17 29 14.967

SMA	.39303930 06	ECC	.99617326 00	B	.65201992 05	SLR	.10818362 05	APO	.78242301 06	RCA	.54668372 04
VM	.83928157-01	CS	-.10118630 01	C1	.65667399 05	TIP	.2 .40716 06	TS	.12093766 01	PER	.61210686 05
TA	.16076636 03	RTA	.00000000 00	LA	.85675394 02	MA	.29537666 02	CSJ	-.13891067 01	TPI	.00001606 02

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	-.36066799 08	Y	-.54726358 03	Z	.15057311 04	DX	-.10359662 01	DY	-.20050796 00	DZ	.16679109 00
INC	.65017285 02	LAN	.19771100 03	APP	.10155325 03	RX	.11065171 00	RY	.71100911 00	RZ	.60211024 00
GX	-.93138167-01	GY	.66066772 00	GZ	.72155117 00	PX	.94194602 00	PY	.27475974 00	PZ	-.13062861 00
GX	-.49637450 00	GY	.67366030 00	GZ	-.67038131 00	RX	-.11299640 00	RY	-.66062751-01	RZ	-.99657264 00
RX	.29372632 00	RY	-.67366030 00	RZ	.67038131 00	TX	.27793071 00	TY	-.66074566 00	TZ	.00000000 00
RAP	-.57664150 01	RAP	.16176416 02								
DTG	.47562219 05	DRG	-.44716594 05	B	.65201992 05	THG	.31670620 03				

CASE 1 SPACE TRAJECTORIES 3

MERCURY EQUATORIAL COORDINATES

X	-.99622797 00	Y	.81210047 00	Z	.93619266 00	PX	-.27150153 02	PY	-.10761192 02	PZ	-.70613930 01
R	.16478732 00	LAT	.27312010 02	LON	.13660395 00	W	.31133027 02	PTH	.15027729 01	RZ	.15503286 01
RE	-.99066163 00	VX	.23251955 00	VY	.93637367 00	DRX	-.27566667 02	DRY	-.10657096 02	DRZ	-.06621969 01
RT	-.99941 00	VR	.31 00	VT	.93636 00	DRT	-.27566667 02	DRR	.19301967 02	DRT	-.80607276 01
LTX	.17134146 00	LTY	.13660926 00	LTZ	.17133665 00	LTT	.17160729 00	AST	.16766726 00	VST	.30896277 02
EPS	.15557621 02	EPP	.11867279 02	SLP	.12652350 00	EPR	.12649179 01	EPP	.66973065 02	RRP	.69550569 01
RPS	.16741157 01	RPP	.27653512-10	SRP	.12569763 02	SRW	.12099606 01	ERS	.57925666 02	ESP	.11107620 00
RPR	.10009908 01	SPR	.56315597 02								
SRC	.67177-10										
XCE	.78166 01 02	XCT	.81170828 02	SIP	.18952328 02	CPT	.09975665 02	SIN	.07915376 02	DI	.13147823 01
DTP	.36660127 00	DTP	.31.01726 01	CPE	.07566683 02	CPS	.11.268026 01	CZ	.12063609 01	DS	.27617CAC 00

Z DAYS 8 HRS. 56 MIN. 36.736 SEC. 2456677.9[illegible] JULIAN DATE 2439627.5[illegible] FEB. 7,1966 21 17 46.704
CHANGE IN PHASE ANGLE OF THIS PRINT EARTH - SUN CENTRAL ECLIPTIC INTERCEPTION COMPUTED EQUATIONS OF MOTION

Z DAYS 10 HRS. 37 MIN. 35.736 SEC. 2456677.9[illegible] JULIAN DATE 2439627.0[illegible] FEB. 7,1966 00 54 46.704

VENUS EQUATORIAL COORDINATES

X	-.99 11767 00	Y	-.54221769 01	Z	.12757980 00	PX	-.26 5738 00	PY	.67916655 00	PZ	.15176705 01
R	.19667 00	LTX	.19[illegible]67 01	RE	.10661715 00	W	.27[illegible]9 01	PTH	.23119911 02	RZ	.32627316 01
R	.19667 00	LAT	.19[illegible]67 01	LON	.29966771 00	VZ	.23563771 02	PTH	.15271766 01	DTZ	.27.21296 01
RT	.19677 00	VX	.[illegible]9966767 00	VY	-.[illegible] 00	PXS	.27631467 02	PYS	.10566 05 02	DPS	.06527111 01
RR	-.19777 00	VR	.[illegible]	ZP	.19733[illegible] 00	LPR	.6[illegible]01	LPP	-.91[illegible]	LPR	-.99716393 00
RT	.19779 00	VT	.[illegible]	ZT	.19[illegible] 00	EBT	.[illegible]	EPT	.91[illegible]	ZZT	-.90716393 00
VS	.19672110 00	VS	.[illegible]	RR	.[illegible]	VW	.[illegible] 01	PT	.35235569 00	VT	.10[illegible] 01
LTD	.19[illegible] 01	ALT	.[illegible]	LTS	.6[illegible] 02	RAS	.[illegible] 01	AAR	.18863315 01	LOM	.20567[illegible] 03
INT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	SMA	.[illegible] 03	DPS	-.17[illegible]	DPP	.19327[illegible] 01
EAC	[illegible]	CCA	.[illegible]	RLS	.19[illegible]	TCA	.19[illegible]				

MERCURY EQUATORIAL COORDINATES

X	-.1[illegible] 00	Y	.09[illegible] 00	Z	.93227 00	PX	-.21[illegible] 02	PY	-.17[illegible] 02	PZ	-.69[illegible] 01
R	.19[illegible] 00	LAT	.31[illegible]	LON	.19[illegible]	W	.29[illegible] 02	PTH	.29257[illegible]	RZ	.31[illegible] 01
RT	-.19[illegible] 00	VX	.[illegible]	ZP	.93[illegible]	PXT	-.27[illegible] 02	PYT	-.19[illegible]	DTZ	.06[illegible] 01
RT	-.19[illegible] 00	VT	.[illegible]	ZT	.93[illegible]	EBT	.[illegible]	EPT	.19[illegible]	DZT	-.06[illegible] 01
LTX	.19265529 00	LTY	.1[illegible]	LTZ	.37[illegible]	LTT	.19[illegible]	AST	.16[illegible]	VST	.30[illegible]
EPS	.15[illegible] 02	EPP	.11[illegible]	SLP	.11[illegible]	EPR	.11[illegible] 02	EPP	.16[illegible]	RRP	.15[illegible] 00
RPS	.61[illegible] 02	RPP	.27[illegible]	SRP	.11[illegible]	SRW	.12[illegible] 03	ERS	.54[illegible]	ESP	.12[illegible] 00
RPR	.23[illegible] 00	SPR	.55[illegible]								
SRC	.67[illegible]										
XCE	.76[illegible] 02	XCT	.95[illegible]	SIP	.17[illegible] 02	CPT	.17[illegible] 03	SIN	.96[illegible] 02	DI	.20[illegible] 02
DTP	.39[illegible] 00	DTP	.16[illegible]	CPE	.06[illegible] 02	CPS	.17[illegible] 03	CZ	.29[illegible] 02	DS	.16[illegible] 02

CASE 1 SPACE TRAJECTORIES 4

SELENOCENTRIC ECLIPTIC COORDINATES

X	-.26[illegible] 00	Y	-.96[illegible] 01	Z	-.69[illegible] 00	PX	-.47[illegible] 01	PY	.15991236 [illegible]	PZ	.15[illegible] 01
R	.29[illegible] 00	LTX	-.15[illegible] 01	RE	.10[illegible] 00	W	.29[illegible] 01	PTH	.51713030 [illegible]	RZ	.31[illegible] 01
R	.29[illegible] 00	LAT	-.[illegible] 01	LON	.19[illegible] 00	PP	.25[illegible] 01	PTP	.51576266 [illegible]	RPP	.29[illegible] 03
LTS	-.[illegible]	LTY	.[illegible]	LTZ	-.67[illegible] 01	EBE	.[illegible]				
RLT	.76[illegible] 00	LAR	.[illegible]	RLP	.17[illegible] 00	PX	.2[illegible]-01	CP	.62[illegible]-01	ESP	.6[illegible] 02
RRL	.3[illegible] 00	SOR	.[illegible]	RRG	.29[illegible] 00	SIR	-.29[illegible] 02				
SRC	.67[illegible]										

SELENOCENTRIC ECLIPTIC

EPOCH OF REFERENCE PASSED 2456677.9[illegible] JULIAN DATE 2439627.0[illegible] FEB. 7,1966 00 54 01.306

SMA	-.19[illegible] 00	ECC	.87710915 00	E	.67767[illegible] 00	SLR	.69839326 00	RPU	.[illegible] 00	RCA	.25199916 00
RM	.17255128 01	IN	.15[illegible] 01	EI	.58[illegible] 00	TFP	.15[illegible] 02	TP	.64622320 02	ETP	.66190[illegible] 02
TR	.19[illegible] 02	RTA	.11[illegible] 03	LA	.6[illegible]	PA	.32[illegible] 01	CSJ	-.16[illegible] 01	TRI	.66[illegible] 02
ZAC	.15[illegible] 03	ZAP	.16[illegible] 03	ZAC	.8[illegible] 02	DPP	.6[illegible] 02	IR	.37[illegible] 00	SP	.61[illegible] 01
SPS	[illegible]	[illegible]	[illegible]	RP2	[illegible]						

ALL VECTORS REFERENCED TO EMBIT PLANE OF TARGET

X	-.26[illegible] 00	Y	.16[illegible] 03	Z	-.69[illegible] 03	PX	-.9[illegible]-01	PY	.21[illegible] 01	PZ	.79[illegible] 00
INC	.15[illegible] 03	LAN	.1[illegible] 03	APP	.1[illegible] 03	PY	.[illegible]	PY	.83[illegible] 00	PZ	.27[illegible] 00
RE	.27[illegible] 03	RP	.5[illegible] 00	RZ	-.[illegible] 00	PX	.[illegible] 03	PY	.[illegible]-01	PZ	-.27[illegible] 00
RT	-.67[illegible]	VX	.[illegible]	VZ	.[illegible]	RT	.[illegible]	RV	.[illegible]	RZ	-.99[illegible] 00
RR	-.7[illegible]	VY	.[illegible]	PZ	-.[illegible]	TR	.[illegible]	TV	.58[illegible]	TZ	.00[illegible] 00
SRE	-.[illegible] 03	SRI	.[illegible]	SZE	.[illegible]	PAE	.[illegible] 01	RAE	.12[illegible] 03		
SRD	.6[illegible] 03	SRL	.[illegible]	SZC	.[illegible]	DAR	.[illegible] 02	RAD	.96[illegible] 02		
ETE	.17[illegible] 03	ETL	.[illegible]	ETC	.2[illegible] 03						
ETD	.6[illegible] 04	ETC	.1[illegible] 04	R	.67[illegible] 04	TMA	.1[illegible] 03				

ALL VECTORS REFERENCED TO TOTAL LUNAR EQU. PLANE

X	-.26[illegible] 04	Y	-.9[illegible] 04	Z	-.19[illegible] 03	PX	-.5[illegible] 00	PY	.21[illegible] 01	PZ	.79[illegible] 00
INC	.15[illegible] 03	LAN	.1[illegible] 03	APP	.1[illegible] 03	PY	.2[illegible] 00	PY	.90[illegible] 00	PZ	.36[illegible] 00
RE	.76[illegible]-01	RP	.9[illegible] 00	RZ	-.97[illegible] 00	PX	-.9[illegible] 01	PY	.23[illegible] 02	PZ	-.10[illegible] 00
RT	-.6[illegible]	VX	.[illegible]	VZ	.3[illegible] 00	RT	.1[illegible] 00	RV	.12[illegible] 00	PZ	-.99[illegible] 00
RR	-.6[illegible] 03	VY	.[illegible]	PZ	-.[illegible] 00	TR	.1[illegible] 00	TV	.76[illegible] 00	TZ	.00[illegible] 00
SRE	-.7[illegible] 03	SRI	.[illegible]	SZE	.1[illegible] 03	DAE	.1[illegible] 03	RAE	.16[illegible] 03		
SRD	.1[illegible] 00	SRL	.[illegible]	SZC	.3[illegible] 03	DAR	.2[illegible] 02	RAD	.69[illegible] 02		
ETE	.1[illegible] 03	ETL	.[illegible]	ETC	.2[illegible] 03						
ETD	.6[illegible] 04	ETC	.1[illegible] 04	R	.67[illegible] 04	TMA	.1[illegible] 03				

U MATRIX FOR MAPPING FORWARD ITERATION NUMBER

	X	Y	Z	DX	DY	DZ	DS	DT	S
X	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Y	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Z	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DZ	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	DP	DI(1)	DI(2)	DI(3)	DI(4)	DI(5)	DI(6)	DI(7)	DI(8)	DI(9)
X	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Y	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Z	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DZ	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

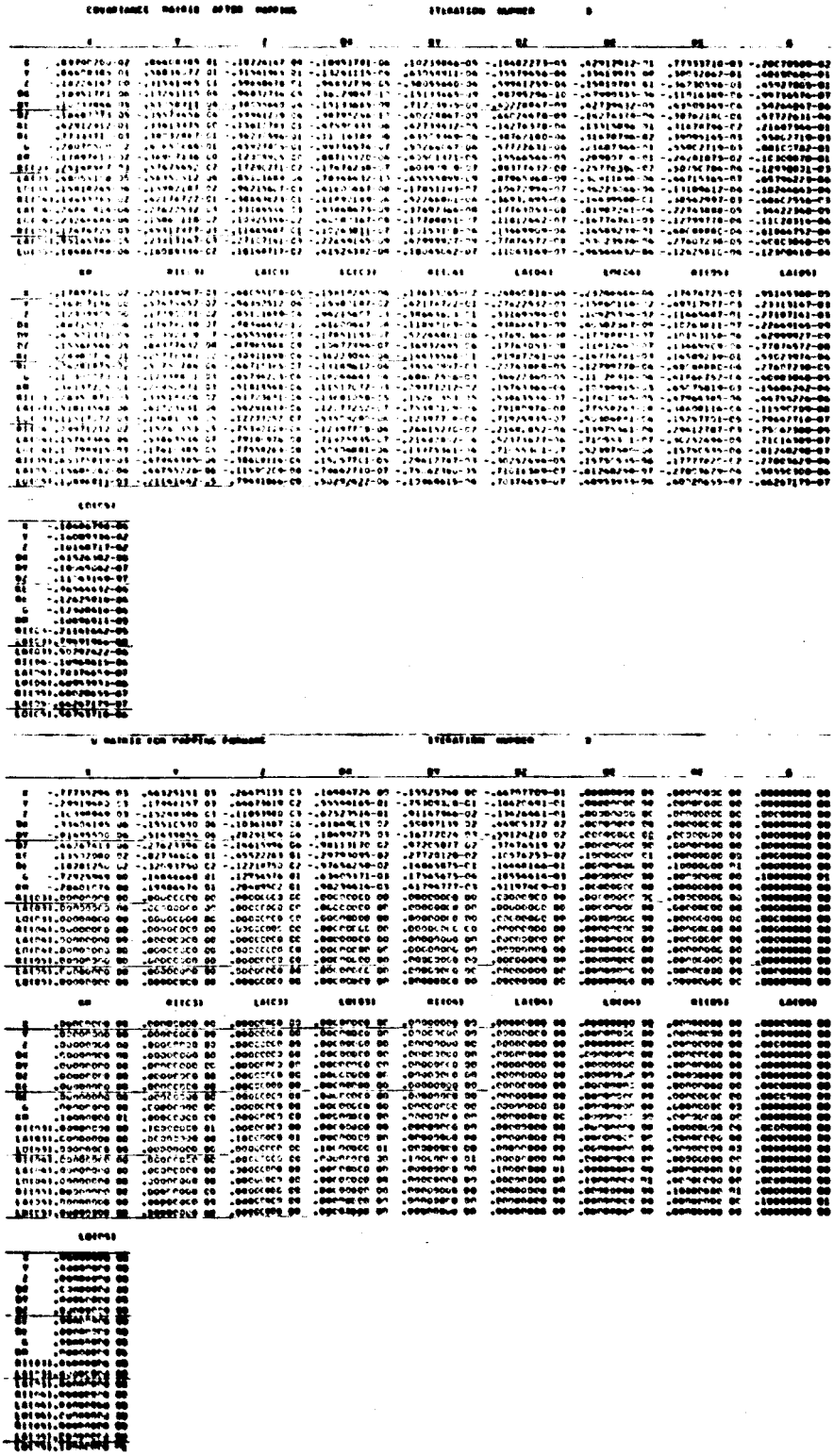
	DI(10)
X	[illegible]
Y	[illegible]
Z	[illegible]
DX	[illegible]
DY	[illegible]
DZ	[illegible]
DS	[illegible]
DT	[illegible]
S	[illegible]

CONDITIONS AFTER FORWARD MAPPING 04/01/30 101041.000 TO 04/01/30 005704.000

X= [illegible]	Y= [illegible]	Z= [illegible]	DX= [illegible]	DY= [illegible]	DZ= [illegible]

STANDARD DEVIATIONS

X= [illegible]	Y= [illegible]	Z= [illegible]	DX= [illegible]	DY= [illegible]	DZ= [illegible]



COVARIANCE MATRIX AT IMPACT — [illegible] 3

	X	Y	Z	DX	DY	DZ	DE	DG	A
X	.20325786 00	-.99988376 00	.23555152 02	-.11670955-01	.51646060-03	-.51176947-03	.13237127 00	-.71639219-02	-.13001916-04
Y	-.99988376 00	.30151913 02	.22748057 02	.11050300-01	.10537782-02	.87777645-02	-.15700545 01	.30564903-01	.26669328 00
Z	.23555152 00	.22748057 02	.31675740 02	.12866461-01	.70579390-02	.31104650-02	-.32956850 01	-.31009793-01	.27770950 00
DX	-.11670955-01	.11050300-01	.12866461-01	.97229031-05	.25570213-05	.25653289-05	-.11778920-02	-.10771030-05	.12527031-03
DY	.51646060-03	.10537782-02	.70579390-02	.25570213-05	.21244079-05	.81901818-06	-.91637738-03	-.20731938-04	.00531200-04
DZ	-.51176947-03	.87777645-02	.31104650-02	.25653289-05	.81801818-06	.36253165-05	.65007513-04	.27050776-04	.66606750-04
DE	.13237127 00	-.15700545 01	-.32956850 01	-.11778920-02	-.91637738-03	.65007513-04	.13215096 01	.31670796-02	.21687300-01
DG	-.71639219-02	.30564903-01	-.31009793-01	-.10771030-05	-.20731938-04	.27050776-04	.31670796-02	.39009165-03	.99002710-03
A	-.13001916-01	.26669328 00	.27770950 00	.12527031-03	.00531200-04	.66606750-04	.21687300-01	.99002710-03	.00100702-01
RM	.93163461-01	-.73096846 00	-.27031760 00	-.21239225-03	.60244623-04	-.76530169-03	.20980704-01	-.24281079-02	-.10500070-01
R11(3)	.14499183-02	.17267032-01	.13803724-01	.70.75658-05	.14881360-05	.52354700-05	.23770380-02	.50750784-04	-.12710001-03
L6(3)	.71818659-05	-.19772636-04	.12668997-03	.24826749-07	.56110017-07	-.30459608-07	-.10911658-04	-.46715365-07	.65706223-06
L0(3)	.24658739-01	-.25966882-02	-.22594894-03	-.55100273-06	.55[illegible]-06	-.17143063-05	-.36223046-04	-.13109612-04	-.10244063-06
R11(4)	-.89299666-02	.59626588-01	-.16689989-01	.86213767-05	-.27611555-06	.32271274-04	-.16639588-01	.38542997-03	-.00607956-03
L6(4)	.62895680-06	-.51806670-03	-.22545172-04	-.10468802-06	.11533959-06	-.25706016-06	.81907261-04	-.22763000-05	.30422300-03
L0(4)	.27545163-03	-.23613770-02	.17130726-03	-.39680313-06	.63597969-06	-.11772568-05	-.16776761-03	-.12709770-04	-.11020316-04
R11(5)	.22957492-02	-.33976742-01	.33513320-01	.15517687-04	.53621133-05	.18273361-05	.14509239-01	-.40090080-04	-.61806752-04
L6(5)	-.31331570-04	-.96.7[illegible]12-03	-.16660841-02	-.62875682-06	-.61801991-06	-.49705785-07	.53073976-04	.27607230-05	-.40000040-05
L0(5)	.24679956-03	-.25577660-02	-.95285957-04	-.51014009-06	.55387468-06	-.12598896-05	-.96544432-04	-.12625010-04	-.12300410-04

	RM	R11(3)	L6(3)	L0(3)	R11(4)	L6(4)	L0(4)	R11(5)	L6(5)
X	.93163461-01	.14499183-02	.71818659-05	.24658739-01	-.89299666-02	.62895680-06	.27545163-03	.22957492-02	-.31331570-04
Y	-.73096846 00	.17267032-01	-.19772636-04	-.25966882-02	.59626588-01	-.51806670-03	-.23613770-02	.33976742-01	-.96279612-03
Z	-.27031760 00	.13803724-01	.12668997-03	-.22594894-03	-.16689989-01	-.22545172-04	.17130726-03	.33510320-01	-.10660841-02
DX	-.21239225-03	.70.75658-05	.24826749-07	-.55100273-06	.86213767-05	-.10468802-06	-.39680313-06	.15517687-04	-.62875682-06
DY	.60244623-04	.14881360-05	.56110017-07	.56[illegible]-06	-.27611555-06	.11533959-06	.63597969-06	.53621133-05	-.61801991-06
DZ	-.76530169-03	.52354700-05	-.30459608-07	-.17143063-05	.32271274-04	-.25706016-06	-.11772568-05	.18273361-05	-.49705785-07
DE	.20980704-01	.23770380-02	-.10911658-04	-.36223046-04	-.16639588-01	.81907261-04	-.16776761-03	.14509239-01	.53073976-04
DG	-.24281079-02	.50750784-04	-.46715365-07	-.13109612-04	.38542997-03	-.22763000-05	-.12709770-04	-.40090080-04	.27607230-05
A	-.10500070-01	-.12710001-03	.65706223-06	-.10244063-06	-.60607956-03	.30422300-03	-.11020316-04	-.61806752-04	-.40000040-05
RM	.93163461-01	-.14499183-02	.71818659-05	.24658739-01	-.89299666-02	.62895680-06	.27545163-03	.22957492-02	-.31331570-04
R11(3)	-.29957071-03	.33519926-02	.61723631-04	-.13681058-05	.19763359-05	.53865316-07	-.17617365-05	-.67904385-04	.66759220-06
L6(3)	.51819568-06	.61723631-04	.94291614-06	.12273752-07	-.75391120-06	.79189976-08	.77550263-08	-.38600116-06	-.11560709-08
L0(3)	.11511772-03	-.13681058-05	.12273752-07	.55579280-06	-.12397738-06	.71925935-07	.50904681-06	.15257701-05	-.79642710-07
R11(4)	-.29957071-02	.65.[illegible]-05	-.75391120-06	-.12397738-06	.26615278-07	-.21487852-06	-.13975361-06	.29612787-03	-.95062300-05
L6(4)	.15769366-06	.53865316-07	.79189976-08	.71925935-07	-.21487852-06	.52377677-08	.71553[illegible]1-07	-.90752494-05	.71016309-07
L0(4)	.19708915-03	-.17617365-05	.77550263-08	.50904681-06	-.13975361-06	.71553[illegible]1-07	.52397560-06	.15750535-06	-.61240790-07
R11(5)	.67904385-03	-.67904385-04	-.38600116-06	.15257701-05	.29612787-03	-.90752494-05	.15750535-06	.17777020-02	-.27003620-04
L6(5)	-.16660841-04	.66759220-06	-.11560709-08	-.79642710-07	-.95062300-05	.71016309-07	-.61240790-07	-.27003620-04	.50950300-05
L0(5)	.10990411-03	-.11[illegible]1-03	.79991[illegible]-08	.50[illegible]-08	.19[illegible]-06	.70374029-07	.40990933-08	.60[illegible]-07	-.60[illegible]-07

	L0(5)
X	.24679956-03
Y	-.25577660-02
Z	-.95285957-04
DX	-.51014009-06
DY	.55387468-06
DZ	-.12598896-05
DE	-.96544432-04
DG	-.12625010-04
A	-.12300410-04
R11(3)	.21361062-05
L6(3)	.74971665-08
L0(3)	.50792437-06
R11(4)	-.10960615-06
L6(4)	.70374029-07
L0(4)	.40990933-08
R11(5)	.60[illegible]-07
L6(5)	-.60[illegible]-07
L0(5)	.50[illegible]-06

IMPACT PARAMETERS 06/02/62 005456

Q MATRIX (TARGET ORBITAL PLANE)

	B.DG	B.TG	TL	CD	S.TS	S.DS
B.DG	.31423663 02	.17205112 02	.17320136-02	.77500065-02	.20519009-02	.97726399-03
B.TG	.17205111 02	.18780473 02	-.10166626-02	.50279110-02	.24062262-03	.01309500-03
TL	.17320136-02	-.19165461-03	.52671764-06	.49536487-06	.45636640-06	.34315603-07
CD	.77500065-02	.99279112-02	.49536495-06	.20961003-05	.79879470-06	.99163063-06
S.TS	.20519007-02	.24042192-03	.45636450-06	.79879493-06	.66656204-06	.74360130-07
S.DS	.97726376-03	.01309522-03	.34317635-07	.99163031-06	.74360101-07	.95090870-07

NORMALIZED Q MATRIX

	B.DG	B.TG	TL	CD	S.TS	S.DS
B.DG	.10000000 01	.70023061 00	.54083171 00	.01952087 00	.65571130 00	.73736700 00
B.TG	.70023546 00	.10000000 01	-.77571737-01	.06436276 00	.73044055-01	.09500095 00
TL	.54083177 00	-.77571870-01	.99999999 00	.66827046 00	.00022033 00	.25396337 00
CD	.01952090 00	.06436284 00	.66827033 00	.99999999 00	.60251563 00	.97370797 00
S.TS	.65571133 00	.73044040-01	.00022037 00	.60251564 00	.10000000 01	.60300927 00
S.DS	.73736190 00	.09500906 00	.25396361 00	.97370760 00	.60300950 00	.10000000 01

DP/DQ MATRIX

	B.DG	B.TG	TL	CD	S.TS	S.DS
X	.45022115 03	-.57755496 03	-.66630700 03	.12732701-01	.20067770-01	.12720651-01
Y	.23744491 03	-.20755882 03	-.25117639 03	.40176019-02	.13061600-01	.46306110-02
Z	-.56299222 02	.32516472 02	.11060092 03	-.19595677-02	.71159710-02	-.24020194-02
DX	-.15079953 06	.20110477 06	.27490008 06	-.54068119 01	-.13005041 02	-.32402197 01
DY	.61255363 06	-.50350768 06	-.70310270 06	.15376267 02	.20157700 02	.19462049 02
DZ	-.29169626 06	.33906590 06	.39601183 06	-.74099160 01	-.19567300 02	-.34050471 01

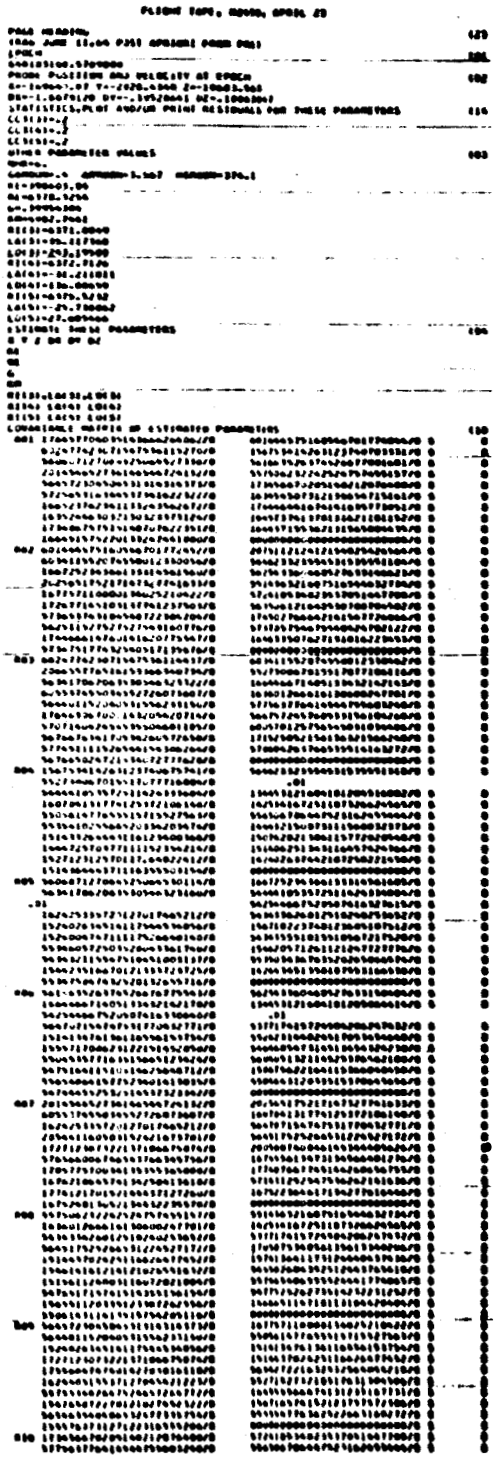
B	.47947230 04
B.DG	.10755001 04
B.TG	-.43677406 04
B.DT	.15012987 04
B.TT	-.45052707 04
TL	.04199069 02
SMAA	.69902819 01
SMIA	.20027073 04
THETA	.12401270 03
DEL T	.20577320 01
DEL B	.70054067 01
DEL S	.25217002 01
TP	.66020903 02

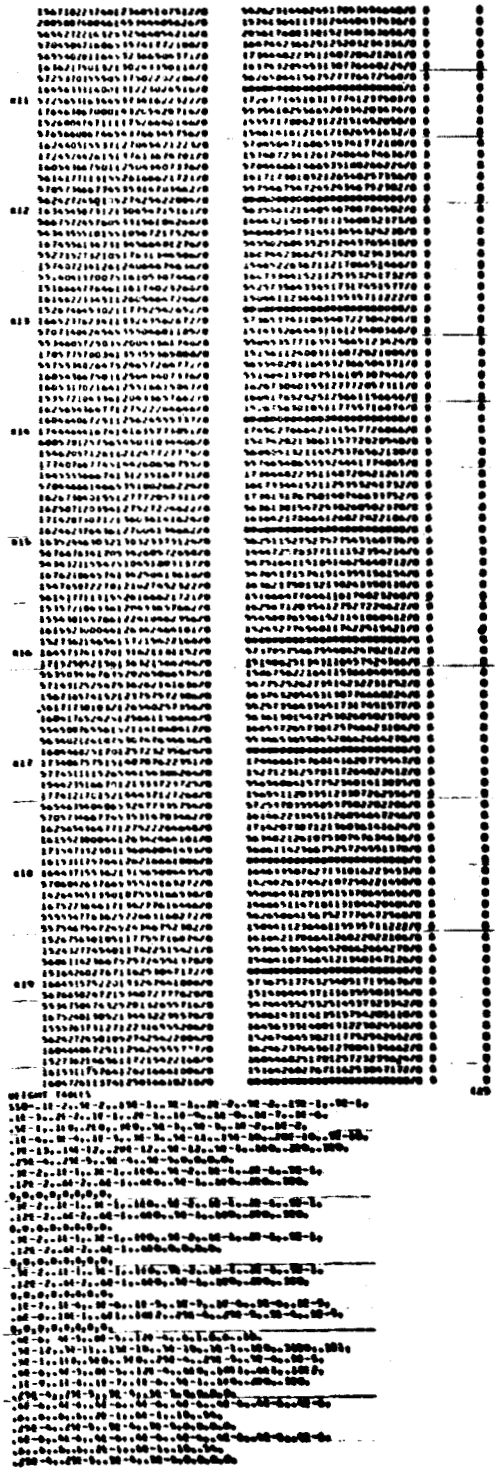
Q MATRIX (TARGET EQUATORIAL PLANE)

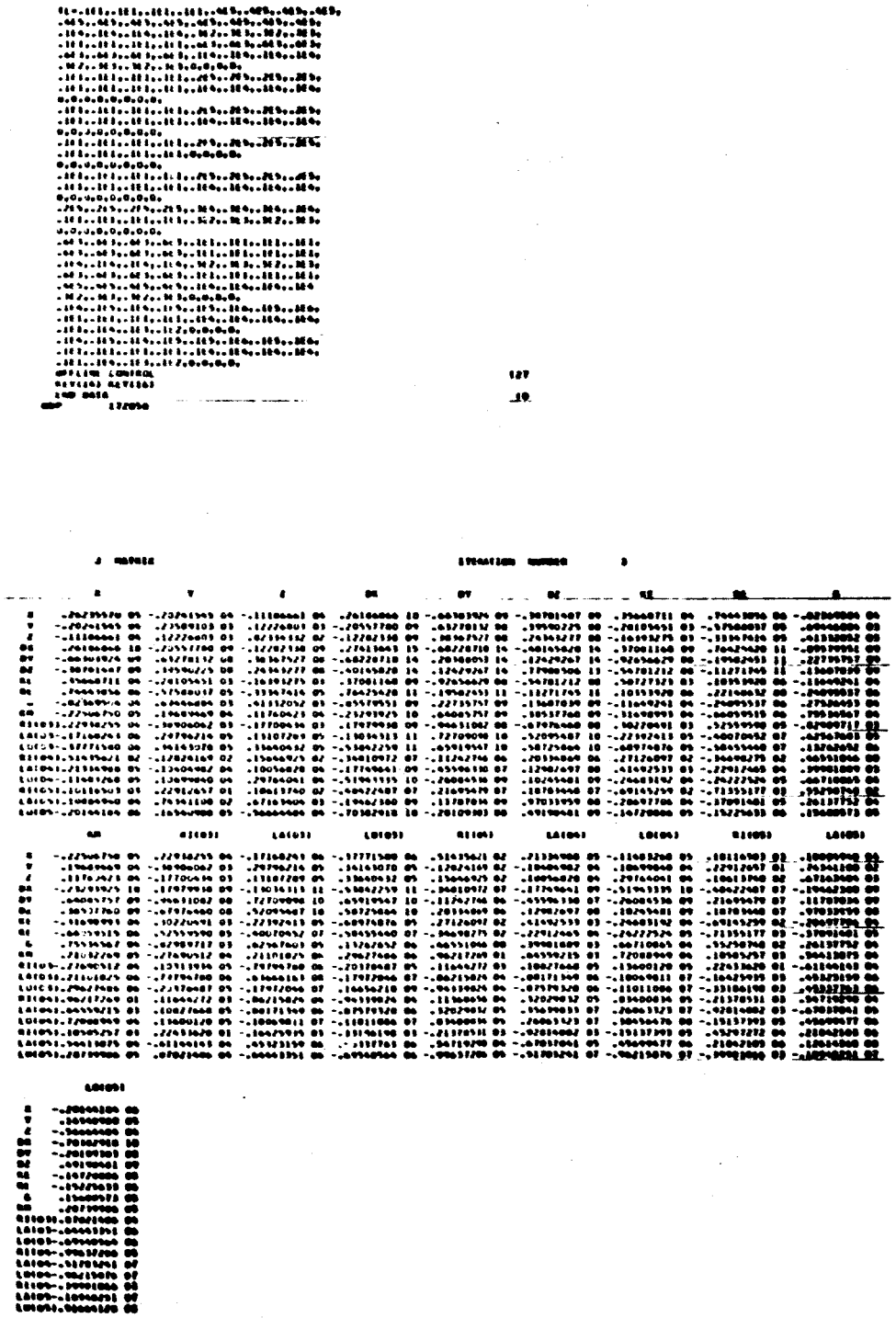
	B.DT	B.TT	TL
B.DT	.34550496 02	.15021908 03	.17091600-02
B.TT	.15021979 02	.15047708 02	-.30410395-03
TL	.17091690-02	-.30410620-03	.52671764-06

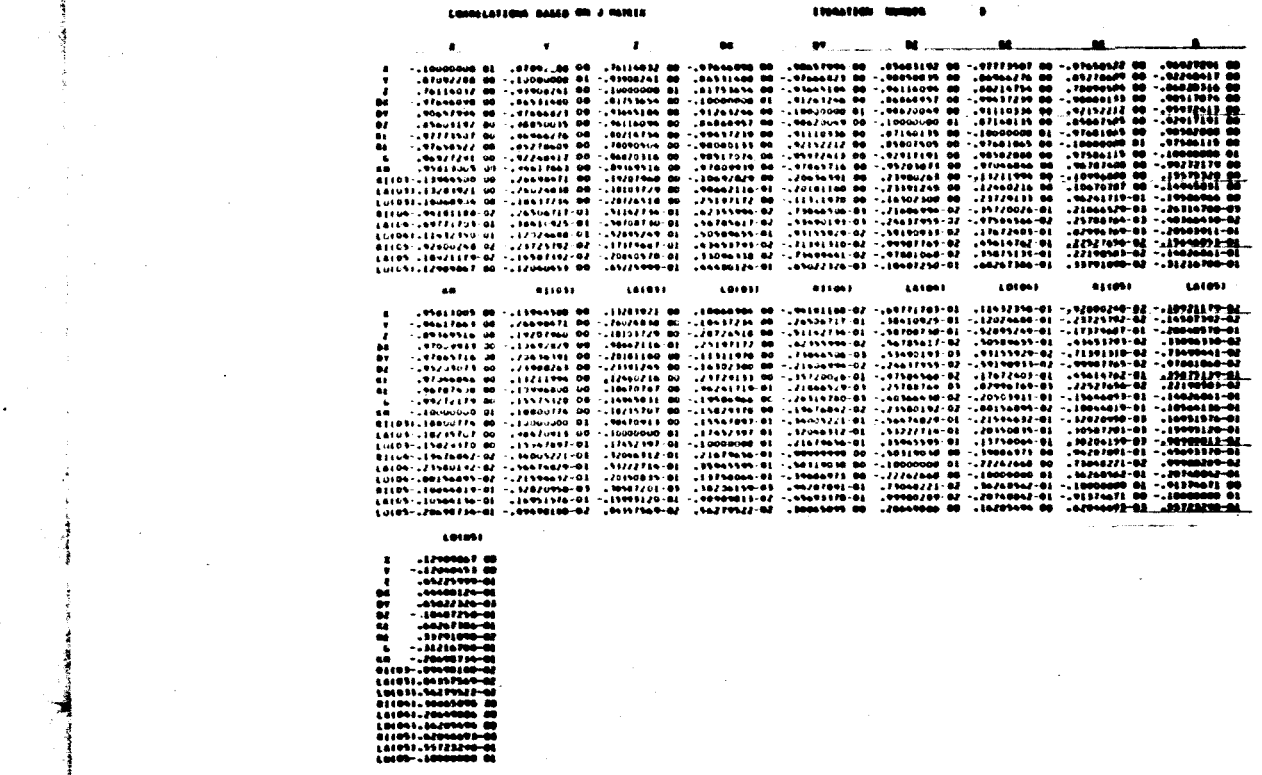
APPENDIX H

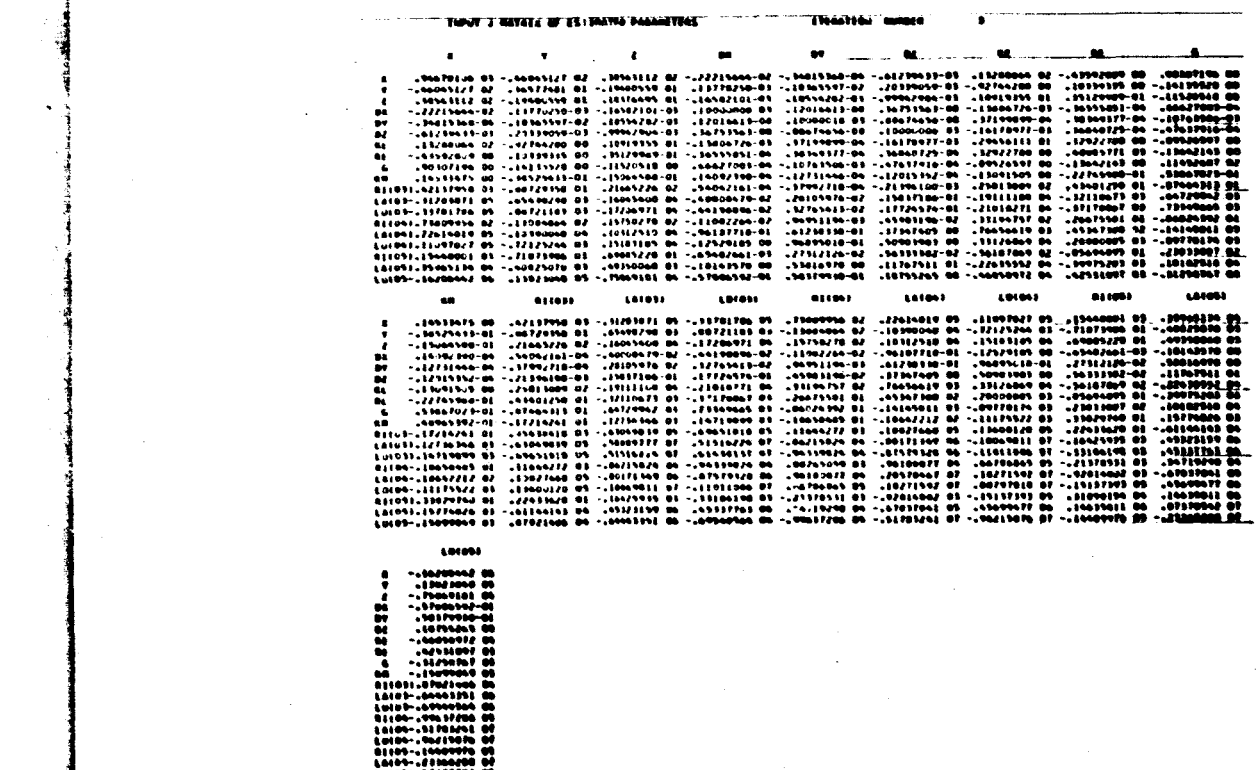
Ranger VI Postmidcourse ODP Printout











[illegible]

ITERATION NUMBER [illegible]		EPOCH [illegible]				
W	DO	STATE	OLD O	NEW O	CONTROL O	DO (NEW)
X	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Y	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Z	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DZ	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RZ	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
STA 3						
R1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
STA 4						
R1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
STA 5						
R1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

COVARIANCE MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	RX	RY	RZ
X	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Y	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Z	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DZ	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RZ	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
R1(03)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L4(03)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L0(03)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
R1(04)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L4(04)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L0(04)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
R1(05)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L4(05)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L0(05)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	RM	R1(03)	L4(03)	L0(03)	R1(04)	L4(04)	L0(04)	R1(05)	L4(05)
X	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Y	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Z	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DZ	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RZ	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
R1(03)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L4(03)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L0(03)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
R1(04)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L4(04)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L0(04)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
R1(05)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L4(05)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L0(05)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	L0(05)
X	[illegible]
Y	[illegible]
Z	[illegible]
DX	[illegible]
DY	[illegible]
DZ	[illegible]
RX	[illegible]
RY	[illegible]
RZ	[illegible]
RM	[illegible]
R1(03)	[illegible]
L4(03)	[illegible]
L0(03)	[illegible]
R1(04)	[illegible]
L4(04)	[illegible]
L0(04)	[illegible]
R1(05)	[illegible]
L4(05)	[illegible]
L0(05)	[illegible]

CORRELATION MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	DU	DV	G
X	.99999999 00	.41091704 00	-.79790961 00	-.30100061 00	.51749936 00	-.30441888 00	.99100000 00	.00072588 00	-.00062586-01
Y	.41091704 00	.10000000 01	.19667267 00	-.04142098 00	.05666753 00	-.81767706 00	.11101661 00	.70815970 00	.99993342-01
Z	-.79790961 00	.19667267 00	.10000000 01	.00000015 00	-.70844656 00	.67980169 00	-.55605670 00	-.77178136 00	.10015221-01
DX	-.30100061 00	.04142098 00	.00000015 00	.10000000 01	-.00037624 00	.00005722 00	-.60671085 00	-.19611790 00	.60606100-02
DY	.51749936 00	.05666753 00	-.70844656 00	.00037624 00	.99999999 00	-.03618176 00	.70696926-01	.19696400 00	.85170111-01
DZ	-.44441888 00	-.81767706 00	.67980169 00	.00005722 00	-.03618176 00	.10000000 01	.61731605-01	-.19762159 00	-.17117510 00
DU	.99100000 00	.11101661 00	-.55605670 00	-.60671085 00	.70696926-01	.61731605-01	.10000000 01	.15100.00 00	.65910569-01
DV	.00072588 00	.70815970 00	-.77178136 00	-.19611790 00	.19696400 00	-.19762159 00	.15100.00 00	.10000000 00	.97000007-01
G	-.99626766-01	.99993342-01	.10015221-01	.60606100-02	.85170111-01	-.17117510 00	.65910569-01	.97000007-01	.10000000 01
GR	-.12678164 00	-.76906169 00	.27621161 00	.61060199 00	-.56019664 00	.65799001 00	.17162729 00	-.01173996 00	-.10103153 00
DI105	-.62127962-01	.65662761-01	.89091296 02	-.26735676-01	.35760605-01	-.55166116-01	-.17668967-01	.65673.00-01	-.37019606-02
DI101	-.66671151-01	-.91670.17 01	.66674962-01	.27180905 01	.31663661-02	-.60062975-02	-.56522686-01	-.26722.06-02	.20002000-02
DI103	-.75660066 00	-.41576.19 00	.55967180 00	.67875167 00	-.77691667 00	.89251656 00	-.56761565-01	-.67799978 00	-.66610661-01
DI101	.60.65065 00	.16161961 00	-.91676649 00	-.13662269 00	.65.72265 00	-.66972668 00	-.22466657 00	.10010.95 00	-.61157767-01
DI106	-.15702669 00	-.11903775 00	.18679116 00	.16191970 00	-.27.99627 00	.19679622 00	.90671787-01	-.27116511 00	.15609062-01
DI104	-.17666567 00	-.11921077 00	.66.16511 00	.91031110 00	-.76.1954.1 00	.65075621 00	-.18703200 00	-.00063365 00	-.51600009-01
DI103	-.11670667-01	-.55.2657.-02	.83107715 01	-.66.62818-01	-.66.22955-01	.87769816-01	.91181327 00	-.19999.00-01	-.67009677-02
DI101	-.16750066 00	.14.17657 00	-.17.7.570 00	-.17.76000 00	.16.09572 00	-.16009161 00	.70661757-01	-.26.2.995 00	-.15170624-01
DI105	-.11170651 00	-.96.6.002 00	.00000142 00	.00000150 00	-.75115611 00	.06776.00 00	-.12916.06 00	-.00001150 00	-.00062963-01

	GR	DI103	DI101	DI105	DI106	DI104	DI103	DI101
X	-.12678164 00	-.62127962-01	-.66671151-01	-.75660066 00	.60651065 00	-.15702669 00	-.17666567 00	.16750066 00
Y	-.76906169 00	.65662761-01	-.91670.17-01	-.41576.19 00	.16161961 00	-.11903775 00	-.11921077 00	.14.17657 00
Z	.27621161 00	.89091296-02	.66674962-01	.55967180 00	-.91676649 00	.18679116 00	.66.16511 00	-.17.7.570 00
DX	.61060199 00	-.26735676-01	.27180905 01	.67875167 00	.13662269 00	.16191970 00	.91031110 00	-.17.76000 00
DY	-.56019664 00	.35760605-01	.31663661-02	-.77691667 00	.65.72265 00	-.27.99627 00	-.76.1954.1 00	.16.09572 00
DZ	.65799001 00	-.55166116-01	-.60062975-02	.89251656 00	-.66972668 00	.19679622 00	.65075621 00	-.16009161 00
DU	.17162729 00	-.17668967-01	.56522686-01	-.56761565-01	-.22466657 00	.90671787-01	-.18703200 00	.70661757-01
DV	-.01173996 00	.65673.00-01	-.26722.06-02	-.67799978 00	.10010.95 00	-.27116511 00	-.00063365 00	-.26.2.995 00
G	-.10103153 00	-.37019606-02	.20002000-02	-.66610661-01	-.61157767-01	.15609062-01	-.51600009-01	-.15170624-01
GR	.10000000 01	.15170624-01	.51600009-01	.15609062-01	-.61157767-01	-.66610661-01	-.67799978 00	-.00001150 00
DI103	-.15170624-01	.10000000 01	.10010.95 00	-.27116511 00	.10010.95 00	.10000000 01	.10010.95 00	-.27116511 00
DI101	.51600009-01	.10010.95 00	.10000000 00	.10010.95 00	.10000000 00	.10010.95 00	.10000000 00	.10010.95 00
DI105	.15609062-01	-.27116511 00	.10010.95 00	.10000000 00	.10010.95 00	-.27116511 00	.10010.95 00	.10000000 00
DI106	-.61157767-01	.10010.95 00	.10000000 00	.10010.95 00	.10000000 00	.10010.95 00	.10000000 00	.10010.95 00
DI104	-.66610661-01	-.27116511 00	.10010.95 00	.10000000 00	.10010.95 00	-.27116511 00	.10010.95 00	.10000000 00
DI103	-.67799978 00	.10010.95 00	.10000000 00	.10010.95 00	.10000000 00	.10010.95 00	.10000000 00	.10010.95 00
DI101	-.00001150 00	.10000000 00	.10010.95 00	.10000000 00	.10010.95 00	.10000000 00	.10010.95 00	.10000000 00

	DI105
X	-.01170651 00
Y	-.96.6.002 00
Z	.00001142 00
DX	.00000150 00
DY	-.75115611 00
DZ	.06776.00 00
DU	-.12916.06 00
DV	-.00001150 00
G	-.00062963-01
GR	.77.6.963 00
DI103	-.62007.10-01
DI101	.16776211-01
DI105	.10000000 01
DI106	-.31776.01 00
DI104	.10010.95 00
DI103	-.20095.30-02
DI101	-.12700005 00
DI105	.10000000 01

STATION NUMBER 12 04/06/74 ITERATION NUMBER 3 PASS NUMBER 01/303

FREQUENCY 8400.2

TIME	DC	G	GCS		
0000:12	00	12	.11070005 00	.120 00	.0037
0013:12	00	12	.11070020 00	.120 00	-.0004
0015:12	00	12	.11070029 00	.120 00	.0000
0015:12	00	12	.11070041 00	.120 00	-.0000
0016:12	00	12	.11070055 00	.120 00	-.0000
0017:12	00	12	.11070071 00	.120 00	.0000
0018:12	00	12	.11070095 00	.120 00	-.0000
0019:12	00	12	.11070117 00	.120 00	-.0000
0020:12	00	12	.11070141 00	.120 00	.0000
0021:12	00	12	.11070175 00	.121 00	.0000
0022:12	00	12	.11070205 00	.121 00	-.0000
0023:12	00	12	.11070240 00	.121 00	-.0000
0024:12	00	12	.11070278 00	.121 00	.0000
0025:12	00	12	.11070318 00	.121 00	.0000
0026:12	00	12	.11070362 00	.121 00	-.0000
0027:12	00	12	.11070406 00	.121 00	-.0000
0028:12	00	12	.11070457 00	.121 00	.0000
0029:12	00	12	.11070509 00	.121 00	-.0000
0030:12	00	12	.11070563 00	.121 00	.0000
0031:12	00	12	.11070620 00	.121 00	.0000
0032:12	00	12	.11071000 00	.121 00	-.0000
0033:12	00	12	.11071063 00	.121 00	-.0000
0034:12	00	12	.11071008 00	.121 00	.0000
0035:12	00	12	.11071776 00	.121 00	.0000
0036:12	00	12	.11071846 00	.121 00	-.0000
0037:12	00	12	.11072219 00	.121 00	.0000
0038:12	00	12	.11072694 00	.121 00	.0000
0039:12	00	12	.11073172 00	.121 00	.0000
0040:12	00	12	.11073663 00	.121 00	-.0000
0041:12	00	12	.11074156 00	.121 00	.0000
0042:12	00	12	.11074662 00	.121 00	.0000
0043:12	00	12	.11075170 00	.121 00	-.0000
0044:12	00	12	.11075680 00	.121 00	.0000
0045:12	00	12	.11076091 00	.121 00	.0000
0046:12	00	12	.11076598 00	.121 00	-.0000
0047:12	00	12	.11077098 00	.121 00	.0000
0048:12	00	12	.11077596 00	.121 00	.0000
0049:12	00	12	.11078089 00	.122 00	-.0000
0050:12	00	12	.11078580 00	.122 00	.0000
0051:12	00	12	.11079069 00	.122 00	-.0000
0052:12	00	12	.11079550 00	.122 00	.0000

STATION NUMBER 12 04/01/26 STRATUM NUMBER 3 PASS NUMBER 04/304

FREQUENCY 8300.0

TIME	PC	G	CCD		
1002	00	12	.11044673	06 .052-01	-.0144
1003	00	12	.11047156	06 .052-01	.0030
1004	00	12	.11047491	06 .052-01	.0020
1005	00	12	.11048479	06 .052-01	-.0029
1006	00	12	.11048968	06 .052-01	.0019
1007	00	12	.11049549	06 .052-01	.0000
1008	00	12	.11050052	06 .052-01	-.0050
1009	00	12	.11050497	06 .052-01	-.0070
1010	00	12	.11051156	06 .052-01	.0049
1011	00	12	.11051693	06 .052-01	-.0010
1012	00	12	.11052264	06 .052-01	-.0000
1013	00	12	.11052797	06 .052-01	.0137
1014	00	12	.11053351	06 .052-01	-.0137
1015	00	12	.11053908	06 .052-01	.0019
1016	00	12	.11054466	06 .052-01	.0244
1017	00	12	.11054978	06 .052-01	-.0244
1018	00	12	.11055587	06 .052-01	.0000
1019	00	12	.11056151	06 .052-01	.0000
1020	00	12	.11056716	06 .052-01	-.0000
1021	00	12	.11057282	06 .052-01	.0070
1022	00	12	.11057851	06 .052-01	-.0000
1023	00	12	.11058471	06 .052-01	.0215
1024	00	12	.11058991	06 .052-01	-.0127
1025	00	12	.11059566	06 .052-01	.0000
1026	00	12	.11060141	06 .052-01	-.0107
1027	00	12	.11060717	06 .052-01	.0070
1028	00	12	.11061295	06 .052-01	-.0000
1029	00	12	.11061875	06 .052-01	.0166
1030	00	12	.11062456	06 .052-01	-.0107
1031	00	12	.11063039	06 .052-01	.0137
1032	00	12	.11063623	06 .052-01	.0000
1033	00	12	.11064208	06 .052-01	-.0127
1034	00	12	.11064795	06 .052-01	.0070
1035	00	12	.11065383	06 .052-01	.0019
1036	00	12	.11065972	06 .052-01	-.0000
1037	00	12	.11066563	06 .052-01	.0166
1038	00	12	.11067156	06 .052-01	-.0000
1039	00	12	.11067749	06 .052-01	.0070
1040	00	12	.11068344	06 .052-01	-.0000
1041	00	12	.11068940	06 .052-01	-.0029
1042	00	12	.11069538	06 .052-01	.0000
1043	00	12	.11070136	06 .052-01	-.0117
1044	00	12	.11070736	06 .052-01	-.0000
1045	00	12	.11071337	06 .052-01	-.0029
1046	00	12	.11071939	06 .052-01	.0000
1047	00	12	.11072542	06 .052-01	-.0019
1048	00	12	.11073146	06 .052-01	.0000
1049	00	12	.11073752	06 .052-01	.0127
1050	00	12	.11074359	06 .052-01	-.0029
1051	00	12	.11074968	06 .052-01	-.0127
1052	00	12	.11075578	06 .052-01	.0029
1053	00	12	.11076189	06 .052-01	.0019
1054	00	12	.11076795	06 .052-01	-.0010
1055	00	12	.11077406	06 .052-01	.0010
1056	00	12	.11078019	06 .052-01	-.0070
1057	00	12	.11078632	06 .052-01	.0000
1058	00	12	.11079247	06 .052-01	-.0000
1059	00	12	.11079862	06 .052-01	.0293
1100	00	12	.11080478	06 .052-01	-.0029
1101	00	12	.11081095	06 .052-01	-.0166
1102	00	12	.11081713	06 .052-01	-.0000
1103	00	12	.11082331	06 .052-01	.0215
1104	00	12	.11082950	06 .052-01	-.0215
1105	00	12	.11083570	06 .052-01	.0117
1106	00	12	.11084191	06 .052-01	-.0117
1107	00	12	.11084812	06 .052-01	.0000
1108	00	12	.11085435	06 .052-01	.0019
1109	00	12	.11086057	06 .052-01	-.0070
1110	00	12	.11086681	06 .052-01	.0000
1111	00	12	.11087305	06 .052-01	.0029
1112	00	12	.11087929	06 .052-01	-.0117
1113	00	12	.11088555	06 .052-01	.0019
1114	00	12	.11089180	06 .052-01	-.0019
1115	00	12	.11089807	06 .052-01	.0000
1116	00	12	.11090433	06 .052-01	-.0029
1117	00	12	.11091061	06 .052-01	.0000
1118	00	12	.11091688	06 .052-01	-.0029
1119	00	12	.11092317	06 .052-01	-.0010
1120	00	12	.11092945	06 .052-01	-.0019
1121	00	12	.11093576	06 .052-01	.0000
1122	00	12	.11094206	06 .052-01	-.0019
1123	00	12	.11094837	06 .052-01	-.0029
1124	00	12	.11095469	06 .052-01	-.0029
1125	00	12	.11096099	06 .052-01	.0000
1126	00	12	.11096729	06 .052-01	.0019
1127	00	12	.11097365	06 .052-01	-.0019
1128	00	12	.11097987	06 .052-01	-.0029
1129	00	12	.11098618	06 .052-01	.0166
1130	00	12	.11099250	06 .052-01	.0010
1131	00	12	.11099882	06 .052-01	-.0010
1132	00	12	.11100516	06 .052-01	-.0029
1133	00	12	.11101150	06 .052-01	.0000
1134	00	12	.11101778	06 .052-01	.0029
1135	00	12	.11102410	06 .052-01	-.0029
1136	00	12	.11103043	06 .052-01	.0029
1137	00	12	.11103675	06 .052-01	.0117
1138	00	12	.11104308	06 .052-01	-.0117
1139	00	12	.11104940	06 .052-01	.0007
1140	00	12	.11105573	06 .052-01	.0029
1141	00	12	.11106205	06 .052-01	-.0029
1142	00	12	.11106838	06 .052-01	.0029
1143	00	12	.11107470	06 .052-01	-.0029
1144	00	12	.11108102	06 .052-01	.0000
1145	00	12	.11108735	06 .052-01	.0010

STATION NUMBER 12 [illegible] ITERATION NUMBER 3 PASS NUMBER 01/216

FREQUENCY 2300.0

TIME	DC	B			
1140:32	00	12	.1110[illegible]	00	.002-01	-.0029
1140:32	00	12	.1110[illegible]	00	.002-01	-.0069
1140:32	00	12	.1111[illegible]	00	.002-01	.0201
1140:32	00	12	.1111[illegible]	00	.002-01	-.0205
1140:32	00	12	.1111[illegible]	00	.002-01	.0060
1141:32	00	12	.1111[illegible]	00	.002-01	.0070
1142:32	00	12	.1111[illegible]	00	.002-01	.0000
1143:32	00	12	.1111[illegible]	00	.002-01	.0107
1144:32	00	12	.1111[illegible]	00	.002-01	-.0070
1145:32	00	12	.1111[illegible]	00	.002-01	-.0069
1146:32	00	12	.1111[illegible]	00	.002-01	.0100
1147:32	00	12	.1111[illegible]	00	.002-01	-.0000
1148:32	00	12	.1111[illegible]	00	.002-01	.0039
1149:32	00	12	.1111[illegible]	00	.002-01	.0039
1150:32	00	12	.1111[illegible]	00	.002-01	.0000
1151:32	00	12	.1111[illegible]	00	.002-01	-.0156
1152:32	00	12	.1111[illegible]	00	.002-01	-.0029
1153:32	00	12	.1112[illegible]	00	.002-01	.0000
1154:32	00	12	.1112[illegible]	00	.002-01	.0000
1155:32	00	12	.1112[illegible]	00	.002-01	.0029
1156:32	00	12	.1112[illegible]	00	.002-01	.0039
1157:32	00	12	.1112[illegible]	00	.002-01	-.0059
1158:32	00	12	.1112[illegible]	00	.002-01	.0070
1159:32	00	12	.1112[illegible]	00	.002-01	-.0059
1200:32	00	12	.1112[illegible]	00	.002-01	.0029
1201:32	00	12	.1112[illegible]	00	.002-01	.0029
1202:32	00	12	.1112[illegible]	00	.002-01	.0000
1203:32	00	12	.1112[illegible]	00	.002-01	-.0157
1204:32	00	12	.1112[illegible]	00	.002-01	.0000
1205:32	00	12	.1112[illegible]	00	.002-01	.0029
1206:32	00	12	.1112[illegible]	00	.002-01	.0275
1207:32	00	12	.1112[illegible]	00	.002-01	-.0186
1208:32	00	12	.1112[illegible]	00	.002-01	.0186
1209:32	00	12	.1113[illegible]	00	.002-01	-.0060
1210:32	00	12	.1113[illegible]	00	.002-01	.0117
1211:32	00	12	.1113[illegible]	00	.002-01	-.0127
1212:32	00	12	.1113[illegible]	00	.002-01	.0070
1213:32	00	12	.1113[illegible]	00	.002-01	.0029
1214:32	00	12	.1113[illegible]	00	.002-01	.0029
1215:32	00	12	.1113[illegible]	00	.002-01	.0029
1216:32	00	12	.1113[illegible]	00	.002-01	-.0060
1217:32	00	12	.1113[illegible]	00	.002-01	.0000
1218:32	00	12	.1113[illegible]	00	.002-01	.0029
1219:32	00	12	.1113[illegible]	00	.002-01	-.0029
1220:32	00	12	.1113[illegible]	00	.002-01	.0029
1221:32	00	12	.1113[illegible]	00	.002-01	.0029
1222:32	00	12	.1113[illegible]	00	.002-01	-.0029
1223:32	00	12	.1113[illegible]	00	.002-01	.0029
1224:32	00	12	.1113[illegible]	00	.002-01	.0029
1225:32	00	12	.1113[illegible]	00	.002-01	.0029
1226:32	00	12	.1113[illegible]	00	.002-01	-.0029
1227:32	00	12	.1113[illegible]	00	.002-01	.0029
1228:32	00	12	.1113[illegible]	00	.002-01	.0029
1229:32	00	12	.1113[illegible]	00	.002-01	.0029
1230:32	00	12	.1113[illegible]	00	.002-01	.0029
1231:32	00	12	.1113[illegible]	00	.002-01	-.0029
1232:32	00	12	.1113[illegible]	00	.002-01	-.0029
1233:32	00	12	.1113[illegible]	00	.002-01	.0117
1234:32	00	12	.1113[illegible]	00	.002-01	.0029
1235:32	00	12	.1113[illegible]	00	.002-01	.0029
1236:32	00	12	.1113[illegible]	00	.002-01	-.0117
1237:32	00	12	.1113[illegible]	00	.002-01	.0100
1238:32	00	12	.1113[illegible]	00	.002-01	.0029
1239:32	00	12	.1113[illegible]	00	.002-01	.0029
1240:32	00	12	.1113[illegible]	00	.002-01	.0029
1241:32	00	12	.1113[illegible]	00	.002-01	.0010
1242:32	00	12	.1113[illegible]	00	.002-01	-.0029
1243:32	00	12	.1113[illegible]	00	.002-01	.0100
1244:32	00	12	.1113[illegible]	00	.002-01	-.0117
1245:32	00	12	.1113[illegible]	00	.002-01	.0010
1246:32	00	12	.1113[illegible]	00	.002-01	.0100
1247:32	00	12	.1113[illegible]	00	.002-01	.0029
1248:32	00	12	.1113[illegible]	00	.002-01	-.0029
1249:32	00	12	.1113[illegible]	00	.002-01	.0010
1250:32	00	12	.1113[illegible]	00	.002-01	.0029
1251:32	00	12	.1113[illegible]	00	.002-01	.0029
1252:32	00	12	.1113[illegible]	00	.002-01	.0000
1253:32	00	12	.1113[illegible]	00	.002-01	-.0029
1254:32	00	12	.1113[illegible]	00	.002-01	.0275
1255:32	00	12	.1113[illegible]	00	.002-01	-.0029
1256:32	00	12	.1113[illegible]	00	.002-01	.0029
1257:32	00	12	.1113[illegible]	00	.002-01	-.0029
1258:32	00	12	.1113[illegible]	00	.002-01	.0029
1259:32	00	12	.1113[illegible]	00	.002-01	.0000
1300:32	00	12	.1113[illegible]	00	.002-01	-.0029
1301:32	00	12	.1113[illegible]	00	.002-01	.0100
1302:32	00	12	.1113[illegible]	00	.002-01	-.0127
1303:32	00	12	.1113[illegible]	00	.002-01	.0000
1304:32	00	12	.1113[illegible]	00	.002-01	-.0029
1305:32	00	12	.1113[illegible]	00	.002-01	.0029
1306:32	00	12	.1113[illegible]	00	.002-01	.0029
1307:32	00	12	.1113[illegible]	00	.002-01	.0000
1308:32	00	12	.1113[illegible]	00	.002-01	.0117
1309:32	00	12	.1113[illegible]	00	.002-01	-.0127
1310:32	00	12	.1113[illegible]	00	.002-01	.0127
1311:32	00	12	.1113[illegible]	00	.002-01	-.0000
1312:32	00	12	.1113[illegible]	00	.002-01	.0100
1313:32	00	12	.1113[illegible]	00	.002-01	-.0029
1314:32	00	12	.1113[illegible]	00	.002-01	.0186
1315:32	00	12	.1113[illegible]	00	.002-01	-.0000
1316:32	00	12	.1113[illegible]	00	.002-01	.0100
1317:32	00	12	.1113[illegible]	00	.002-01	.0070
1318:32	00	12	.1113[illegible]	00	.002-01	-.0007
1319:32	00	12	.1113[illegible]	00	.002-01	.0029
1320:32	00	12	.1113[illegible]	00	.002-01	.0000
1321:32	00	12	.1113[illegible]	00	.002-01	.0000
1322:32	00	12	.1113[illegible]	00	.002-01	-.0029
1323:32	00	12	.1113[illegible]	00	.002-01	-.0060
1324:32	00	12	.1113[illegible]	00	.002-01	.0117
1325:32	00	12	.1113[illegible]	00	.002-01	.0010
1326:32	00	12	.1113[illegible]	00	.002-01	.0117
1327:32	00	12	.1113[illegible]	00	.002-01	-.0060
1328:32	00	12	.1113[illegible]	00	.002-01	.0100

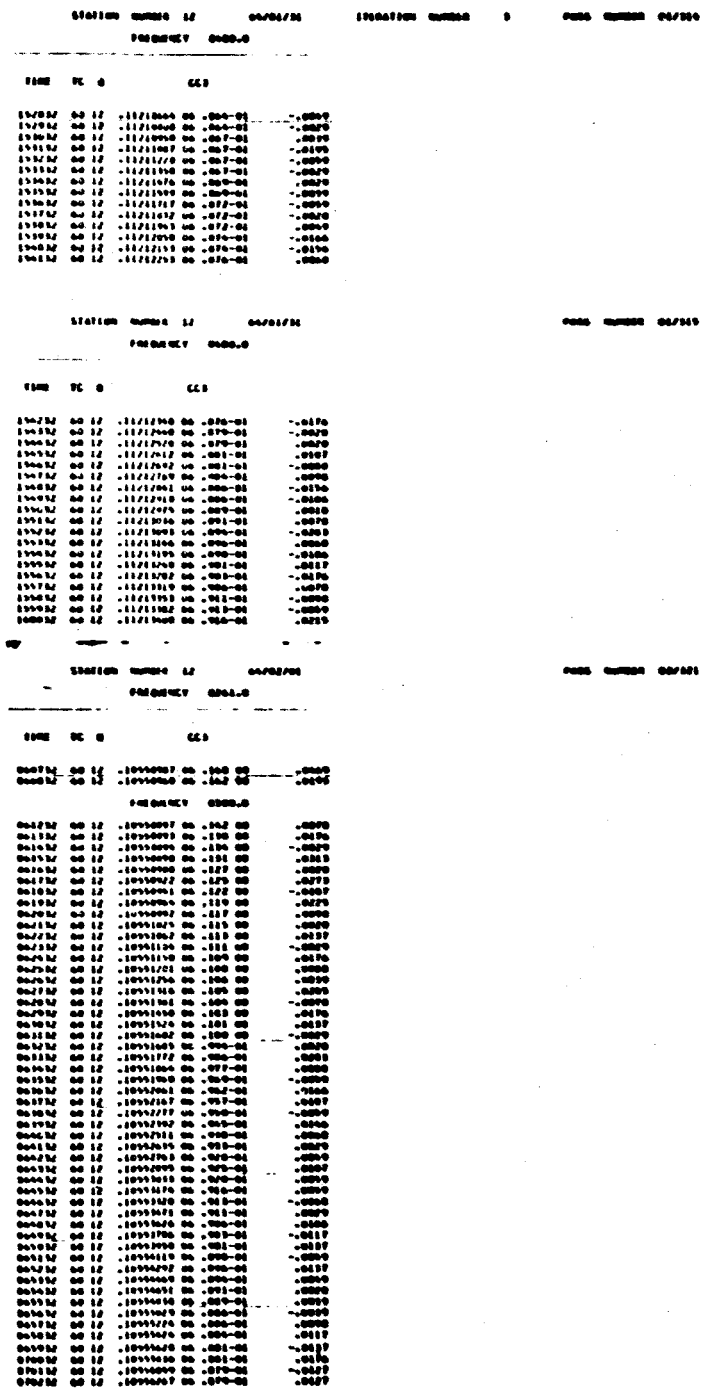
FREQUENCY 2300.0

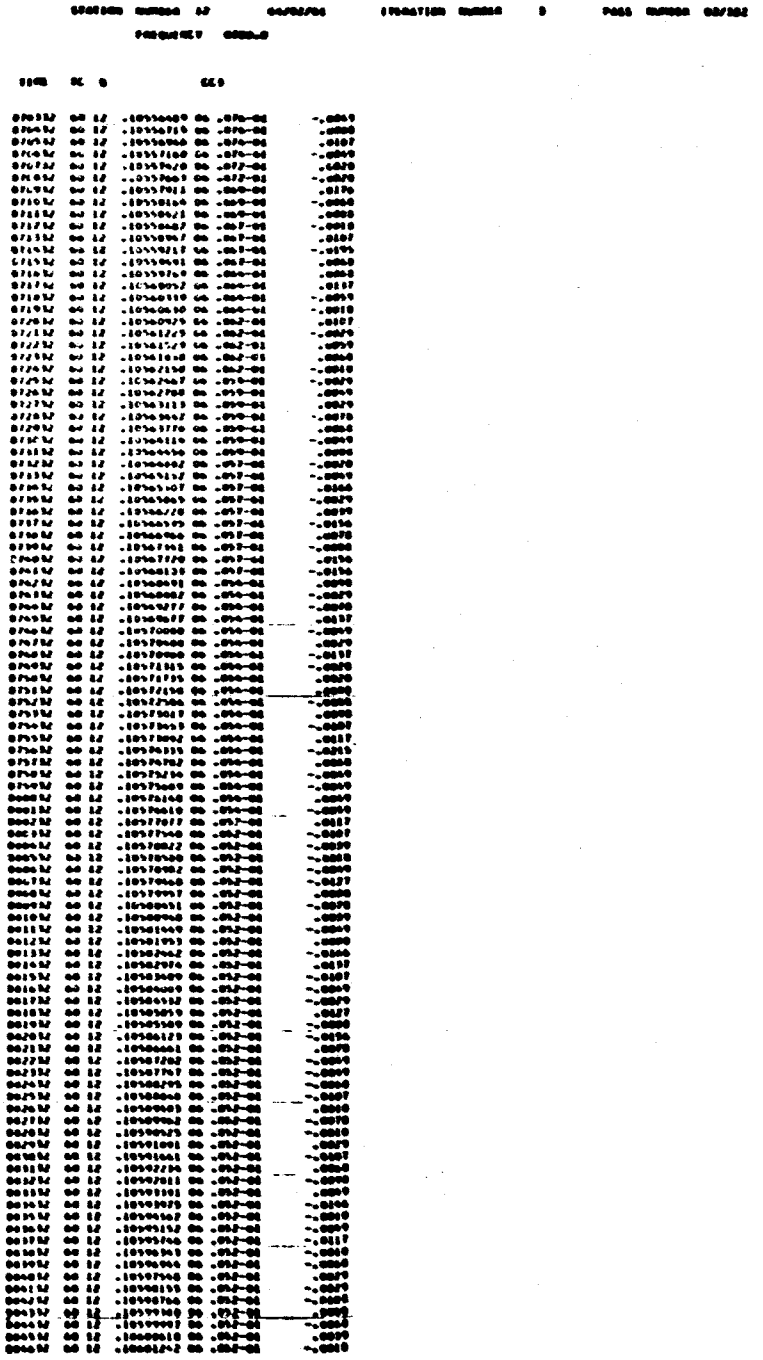
1330:32	00	12	.1113[illegible]	00	.002-01	.0007

STATION NUMBER 12 [illegible] ITERATION NUMBER 3 PASS NUMBER [illegible]

FREQUENCY 8400.0

TIME	TC	O	CCS		
13463Z	60	12	.11177240	06	.052-01	-.0020
13553Z	60	12	.11177713	06	.052-01	.0067
13643Z	60	12	.11178182	06	.052-01	.0000
13733Z	60	12	.11178650	06	.052-01	.0010
13823Z	60	12	.11179115	06	.052-01	.0010
13913Z	60	12	.11179577	06	.052-01	.0107
13963Z	60	12	.11180037	06	.052-01	-.0060
14153Z	60	12	.11180495	06	.052-01	.0020
14253Z	60	12	.11180950	06	.052-01	.0205
14353Z	60	12	.11181402	06	.052-01	-.0029
14543Z	60	12	.11181852	06	.052-01	.0000
14553Z	60	12	.11182299	06	.052-01	.0107
14643Z	60	12	.11182743	06	.052-01	-.0020
14733Z	60	12	.11183185	06	.052-01	.0117
14823Z	60	12	.11183625	06	.052-01	.0106
14913Z	60	12	.11184061	06	.052-01	-.0156
14003Z	60	12	.11184495	06	.052-01	.0107
14613Z	60	12	.11184927	06	.052-01	-.0020
14623Z	60	12	.11185355	06	.052-01	.0107
14713Z	60	12	.11185781	06	.052-01	.0020
14803Z	60	12	.11186205	06	.052-01	.0106
14853Z	60	12	.11186625	06	.052-01	-.0020
14943Z	60	12	.11187043	06	.052-01	.0029
14033Z	60	12	.11187458	06	.052-01	.0039
14103Z	60	12	.11187870	06	.052-01	-.0020
14093Z	63	12	.11188279	06	.052-01	.0049
14193Z	60	12	.11188686	06	.052-01	.0059
14113Z	60	12	.11189090	06	.052-01	.0010
14123Z	60	12	.11189491	06	.052-01	.0078
14133Z	60	12	.11189889	06	.052-01	.0107
14143Z	63	12	.11190284	06	.052-01	.0098
14153Z	60	12	.11190676	06	.052-01	-.0137
14163Z	60	12	.11191066	06	.052-01	.0088
14173Z	60	12	.11191452	06	.052-01	.0098
14183Z	60	12	.11191836	06	.052-01	.0078
14193Z	60	12	.11192216	06	.052-01	.0010
14203Z	60	12	.11192594	06	.052-01	.0078
14213Z	60	12	.11192969	06	.052-01	-.0068
14223Z	60	12	.11193341	06	.052-01	.0098
14233Z	60	12	.11193709	06	.052-01	.0059
14243Z	60	12	.11194075	06	.052-01	-.0010
14253Z	60	12	.11194438	06	.052-01	.0039
14263Z	60	12	.11194797	06	.052-01	-.0098
14273Z	60	12	.11195154	06	.052-01	.0088
14283Z	60	12	.11195508	06	.052-01	.0059
14293Z	60	12	.11195858	06	.052-01	.0010
14303Z	60	12	.11196206	06	.052-01	.0098
14313Z	60	12	.11196550	06	.052-01	.0088
14323Z	60	12	.11196891	06	.052-01	.0059
14333Z	60	12	.11197229	06	.052-01	-.0000
14343Z	60	12	.11197566	06	.052-01	.0078
14353Z	60	12	.11197896	06	.052-01	.0068
14363Z	60	12	.11198225	06	.052-01	.0039
14373Z	60	12	.11198550	06	.052-01	-.0176
14383Z	60	12	.11198872	06	.052-01	.0098
14393Z	60	12	.11199191	06	.052-01	.0029
14403Z	60	12	.11199507	06	.052-01	.0117
14413Z	60	12	.11199820	06	.052-01	-.0146
14423Z	60	12	.11200129	06	.052-01	.0000
14433Z	60	12	.11200435	06	.052-01	-.0029
14443Z	60	12	.11200738	06	.054-01	.0029
14453Z	60	12	.11201037	06	.054-01	.0068
14463Z	60	12	.11201334	06	.054-01	-.0059
14473Z	60	12	.11201627	06	.054-01	-.0029
14483Z	60	12	.11201916	06	.054-01	.0000
14493Z	60	12	.11202203	06	.054-01	.0039
14503Z	60	12	.11202486	06	.054-01	-.0098
14513Z	60	12	.11202766	06	.054-01	.0098
14523Z	60	12	.11203042	06	.054-01	-.0059
14533Z	60	12	.11203315	06	.054-01	-.0166
14543Z	60	12	.11203584	06	.054-01	.0049
14553Z	60	12	.11203851	06	.054-01	.0098
14563Z	60	12	.11204113	06	.054-01	-.0070
14573Z	60	12	.11204373	06	.054-01	-.0127
14583Z	60	12	.11204629	06	.054-01	-.0049
14593Z	60	12	.11204881	06	.054-01	.0039
15003Z	60	12	.11205130	06	.054-01	.0137
15013Z	60	12	.11205376	06	.054-01	-.0088
15023Z	60	12	.11205618	06	.054-01	-.0146
15033Z	60	12	.11205857	06	.057-01	-.0010
15043Z	60	12	.11206092	06	.057-01	-.0029
15053Z	60	12	.11206324	06	.057-01	-.0029
15063Z	60	12	.11206552	06	.057-01	.0068
15073Z	60	12	.11206776	06	.057-01	-.0137
15083Z	60	12	.11206997	06	.057-01	.0068
15093Z	60	12	.11207215	06	.057-01	-.0176
15103Z	60	12	.11207429	06	.057-01	.0000
15113Z	60	12	.11207639	06	.057-01	-.0127
15123Z	60	12	.11207846	06	.057-01	.0010
15133Z	60	12	.11208050	06	.059-01	.0029
15143Z	60	12	.11208249	06	.059-01	.0049
15153Z	60	12	.11208446	06	.059-01	-.0070
15163Z	60	12	.11208638	06	.059-01	-.0156
15173Z	60	12	.11208827	06	.059-01	.0117
15183Z	60	12	.11209012	06	.059-01	-.0070
15193Z	60	12	.11209194	06	.059-01	-.0070
15203Z	60	12	.11209372	06	.059-01	-.0049
15213Z	60	12	.11209546	06	.062-01	.0029
15223Z	60	12	.11209717	06	.062-01	-.0049
15233Z	60	12	.11209884	06	.062-01	-.0070
15243Z	60	12	.11210047	06	.062-01	.0070
15253Z	60	12	.11210207	06	.062-01	-.0049
15263Z	60	12	.11210363	06	.064-01	-.0137
15273Z	60	12	.11210515	06	.064-01	-.0029





STATION NUMBER 12 04/02/01 ELEVATION NUMBER 9 PASS NUMBER 02/322

FREQUENCY 8380.0

TIME	TC	Q	CLS			
0047132	00	12	.10001868	00	.052-01	-.0050
0048132	00	12	.10002769	00	.052-01	-.0050
0049132	00	12	.10001133	00	.052-01	.0050
0050132	00	12	.10003770	00	.052-01	-.0144
0051132	00	12	.10004619	00	.052-01	.0070
0052132	00	12	.10005533	00	.052-01	-.0127
0053132	00	12	.10006439	00	.052-01	.0068
0054132	00	12	.10006369	00	.052-01	-.0050
0055132	00	12	.10007701	00	.052-01	-.0040
0056132	00	12	.10007637	00	.052-01	-.0068
0057132	00	12	.10008316	00	.052-01	.0037
0058132	00	12	.10008978	00	.052-01	.0070
0059132	00	12	.10009663	00	.052-01	-.0132
0100132	00	12	.10010311	00	.052-01	.0070
0101132	00	12	.10010982	00	.052-01	.0078
0102132	00	12	.10011637	00	.052-01	-.0018
0103132	00	12	.10012334	00	.052-01	-.0050
0104132	00	12	.10013014	00	.052-01	-.0068
0105132	00	12	.10013697	00	.052-01	-.0070
0106132	00	12	.10014383	00	.052-01	-.0070
0107132	00	12	.10015073	00	.052-01	.0068
0108132	00	12	.10015766	00	.052-01	-.0127
0109132	00	12	.10016459	00	.052-01	.0050
0110132	00	12	.10017157	00	.052-01	-.0068
0111132	00	12	.10017858	00	.052-01	-.0146
0112132	00	12	.10018552	00	.052-01	.0000
0113132	00	12	.10019250	00	.052-01	.0070
0114132	00	12	.10019977	00	.052-01	-.0256
0115132	00	12	.10020669	00	.052-01	.0050
0116132	00	12	.10021334	00	.052-01	.0068
0117132	00	12	.10022127	00	.052-01	-.0195
0118132	00	12	.10022842	00	.052-01	.0090
0119132	00	12	.10023565	00	.052-01	-.0215
0120132	00	12	.10024291	00	.052-01	.0070
0121132	00	12	.10025020	00	.052-01	-.0010
0122132	00	12	.10025751	00	.052-01	-.0127
0123132	00	12	.10026485	00	.052-01	.0137
0124132	00	12	.10027222	00	.052-01	-.0070
0125132	00	12	.10027961	00	.052-01	-.0127
0126132	00	12	.10028723	00	.052-01	.0070
0127132	00	12	.10029468	00	.052-01	-.0137
0128132	00	12	.10030195	00	.052-01	.0070
0129132	00	12	.10030906	00	.052-01	-.0137
0130132	00	12	.10031637	00	.052-01	-.0010
0131132	00	12	.10032354	00	.052-01	-.0050
0132132	00	12	.10033129	00	.052-01	.0127
0133132	00	12	.10033900	00	.052-01	-.0195
0134132	00	12	.10034711	00	.052-01	-.0050
0135132	00	12	.10035495	00	.052-01	-.0050
0136132	00	12	.10036261	00	.052-01	.0050
0137132	00	12	.10037032	00	.052-01	-.0070
0138132	00	12	.10037806	00	.052-01	.0050
0139132	00	12	.10038579	00	.052-01	-.0050
0140132	00	12	.10039356	00	.052-01	-.0070
0141132	00	12	.10040135	00	.052-01	.0068
0142132	00	12	.10040916	00	.052-01	-.0144
0143132	00	12	.10041730	00	.052-01	.0050
0144132	00	12	.10042508	00	.052-01	-.0137
0145132	00	12	.10043275	00	.052-01	.0070
0146132	00	12	.10044065	00	.052-01	-.0050
0147132	00	12	.10044850	00	.052-01	-.0176
0148132	00	12	.10045634	00	.052-01	.0137
0149132	00	12	.10046421	00	.052-01	-.0070
0150132	00	12	.10047251	00	.052-01	-.0050
0151132	00	12	.10048052	00	.052-01	-.0068
0152132	00	12	.10048836	00	.052-01	.0050
0153132	00	12	.10049622	00	.052-01	-.0050
0154132	00	12	.10050470	00	.052-01	-.0050
0155132	00	12	.10051280	00	.052-01	-.0050
0156132	00	12	.10052091	00	.052-01	.0070
0157132	00	12	.10052907	00	.052-01	-.0068
0158132	00	12	.10053726	00	.052-01	-.0050
0159132	00	12	.10054562	00	.052-01	-.0068
1000132	00	12	.10055363	00	.052-01	-.0037
1001132	00	12	.10056185	00	.052-01	-.0070
1002132	00	12	.10057009	00	.052-01	.0050
1003132	00	12	.10057836	00	.052-01	-.0068
1004132	00	12	.10058664	00	.052-01	.0070
1005132	00	12	.10059494	00	.052-01	-.0037
1006132	00	12	.10060326	00	.052-01	.0070
1007132	00	12	.10061160	00	.052-01	-.0070
1008132	00	12	.10061996	00	.052-01	-.0127
1009132	00	12	.10062834	00	.052-01	-.0050
1010132	00	12	.10063673	00	.052-01	.0050
1011132	00	12	.10064516	00	.052-01	-.0137
1012132	00	12	.10065357	00	.052-01	-.0070
1013132	00	12	.10066202	00	.052-01	.0137
1014132	00	12	.10067049	00	.052-01	-.0050
1015132	00	12	.10067897	00	.052-01	-.0068
1016132	00	12	.10068747	00	.052-01	-.0010
1017132	00	12	.10069598	00	.052-01	.0050
1018132	00	12	.10070451	00	.052-01	-.0146
1019132	00	12	.10071306	00	.052-01	.0050
1020132	00	12	.10072163	00	.052-01	.0050
1021132	00	12	.10073021	00	.052-01	-.0070
1022132	00	12	.10073880	00	.052-01	-.0050
1023132	00	12	.10074741	00	.052-01	-.0010
1024132	00	12	.10075604	00	.052-01	-.0050
1025132	00	12	.10076468	00	.052-01	-.0070
1026132	00	12	.10077334	00	.052-01	-.0070
1027132	00	12	.10078201	00	.052-01	-.0127
1028132	00	12	.10079070	00	.052-01	.0166
1029132	00	12	.10079940	00	.052-01	-.0176
1030132	00	12	.10080811	00	.052-01	.0070

STATION NUMBER 12 04/02/01 ITERATION NUMBER 3 PASS NUMBER 02/202

FREQUENCY 8400.0

TIME	SC	O	CCD		
0047:32	63	12	.1000[illegible]	06	.052-01	-.0050
0048:32	63	12	.1000[illegible]	06	.052-01	-.0090
0049:32	63	12	.1000[illegible]	06	.052-01	.0040
0050:32	63	12	.1000[illegible]	06	.052-01	-.0144
0051:32	63	12	.1000[illegible]	06	.052-01	.0020
0052:32	63	12	.1000[illegible]	06	.052-01	-.0127
0053:32	63	12	.1000[illegible]	06	.052-01	.0050
0054:32	63	12	.1000[illegible]	06	.052-01	-.0050
0055:32	63	12	.1000[illegible]	06	.052-01	-.0040
0056:32	63	12	.1000[illegible]	06	.052-01	-.0060
0057:32	63	12	.1000[illegible]	06	.052-01	.0010
0058:32	63	12	.1000[illegible]	06	.052-01	.0020
0059:32	63	12	.1000[illegible]	06	.052-01	-.0132
0100:32	63	12	.1001[illegible]	06	.052-01	.0020
0101:32	63	12	.1001[illegible]	06	.052-01	.0070
0102:32	63	12	.1001[illegible]	06	.052-01	-.0010
0103:32	63	12	.1001[illegible]	06	.052-01	-.0050
0104:32	63	12	.1001[illegible]	06	.052-01	-.0060
0105:32	63	12	.1001[illegible]	06	.052-01	-.0070
0106:32	63	12	.1001[illegible]	06	.052-01	-.0020
0107:32	63	12	.1001[illegible]	06	.052-01	.0060
0108:32	63	12	.1001[illegible]	06	.052-01	-.0127
0109:32	63	12	.1001[illegible]	06	.052-01	.0040
0110:32	63	12	.1001[illegible]	06	.052-01	-.0060
0111:32	63	12	.1001[illegible]	06	.052-01	-.0140
0112:32	63	12	.1001[illegible]	06	.052-01	.0060
0113:32	63	12	.1001[illegible]	06	.052-01	-.0020
0114:32	63	12	.1001[illegible]	06	.052-01	-.0040
0115:32	63	12	.1001[illegible]	06	.052-01	.0040
0116:32	63	12	.1001[illegible]	06	.052-01	.0060
0117:32	63	12	.1001[illegible]	06	.052-01	-.0195
0118:32	63	12	.1001[illegible]	06	.052-01	.0090
0119:32	63	12	.1001[illegible]	06	.052-01	-.0215
0120:32	63	12	.1001[illegible]	06	.052-01	.0020
0121:32	63	12	.1001[illegible]	06	.052-01	-.0010
0122:32	63	12	.1001[illegible]	06	.052-01	-.0127
0123:32	63	12	.1001[illegible]	06	.052-01	.0117
0124:32	63	12	.1001[illegible]	06	.052-01	-.0020
0125:32	63	12	.1001[illegible]	06	.052-01	-.0127
0126:32	63	12	.1001[illegible]	06	.052-01	.0020
0127:32	63	12	.1001[illegible]	06	.052-01	-.0407
0128:32	63	12	.1001[illegible]	06	.052-01	.0020
0129:32	63	12	.1001[illegible]	06	.052-01	-.0117
0130:32	63	12	.1001[illegible]	06	.052-01	-.0010
0131:32	63	12	.1001[illegible]	06	.052-01	-.0040
0132:32	63	12	.1001[illegible]	06	.052-01	.0127
0133:32	63	12	.1001[illegible]	06	.052-01	-.0195
0134:32	63	12	.1001[illegible]	06	.052-01	-.0000
0135:32	63	12	.1001[illegible]	06	.052-01	-.0060
0136:32	63	12	.1001[illegible]	06	.052-01	.0040
0137:32	63	12	.1001[illegible]	06	.052-01	-.0070
0138:32	63	12	.1001[illegible]	06	.052-01	.0050
0139:32	63	12	.1001[illegible]	06	.052-01	-.0050
0140:32	63	12	.1001[illegible]	06	.052-01	-.0020
0141:32	63	12	.1001[illegible]	06	.052-01	-.0040
0142:32	63	12	.1001[illegible]	06	.052-01	.0040
0143:32	63	12	.1001[illegible]	06	.052-01	-.0137
0144:32	63	12	.1001[illegible]	06	.052-01	.0020
0145:32	63	12	.1001[illegible]	06	.052-01	-.0060
0146:32	63	12	.1001[illegible]	06	.052-01	-.0170
0147:32	63	12	.1001[illegible]	06	.052-01	-.0130
0148:32	63	12	.1001[illegible]	06	.052-01	-.0130
0149:32	63	12	.1001[illegible]	06	.052-01	-.0000
0150:32	63	12	.1001[illegible]	06	.052-01	-.0050
0151:32	63	12	.1001[illegible]	06	.052-01	-.0060
0152:32	63	12	.1001[illegible]	06	.052-01	.0040
0153:32	63	12	.1001[illegible]	06	.052-01	-.0050
0154:32	63	12	.1001[illegible]	06	.052-01	-.0050
0155:32	63	12	.1001[illegible]	06	.052-01	-.0050
0156:32	63	12	.1001[illegible]	06	.052-01	.0020
0157:32	63	12	.1001[illegible]	06	.052-01	-.0060
0158:32	63	12	.1001[illegible]	06	.052-01	-.0050
0159:32	63	12	.1001[illegible]	06	.052-01	-.0060
0200:32	63	12	.1001[illegible]	06	.052-01	-.0007
0201:32	63	12	.1001[illegible]	06	.052-01	-.0070
0202:32	63	12	.1001[illegible]	06	.052-01	-.0050
0203:32	63	12	.1001[illegible]	06	.052-01	-.0060
0204:32	63	12	.1001[illegible]	06	.052-01	.0040
0205:32	63	12	.1001[illegible]	06	.052-01	-.0007
0206:32	63	12	.1001[illegible]	06	.052-01	.0020
0207:32	63	12	.1001[illegible]	06	.052-01	-.0050
0208:32	63	12	.1001[illegible]	06	.052-01	-.0027
0209:32	63	12	.1001[illegible]	06	.052-01	-.0050
0210:32	63	12	.1001[illegible]	06	.052-01	.0000
0211:32	63	12	.1001[illegible]	06	.052-01	-.0117
0212:32	63	12	.1001[illegible]	06	.052-01	-.0070
0213:32	63	12	.1001[illegible]	06	.052-01	.0117
0214:32	63	12	.1001[illegible]	06	.052-01	-.0050
0215:32	63	12	.1001[illegible]	06	.052-01	-.0040
0216:32	63	12	.1001[illegible]	06	.052-01	-.0010
0217:32	63	12	.1001[illegible]	06	.052-01	.0000
0218:32	63	12	.1001[illegible]	06	.052-01	-.0144
0219:32	63	12	.1001[illegible]	06	.052-01	.0070
0220:32	63	12	.1001[illegible]	06	.052-01	.0050
0221:32	63	12	.1001[illegible]	06	.052-01	-.0050
0222:32	63	12	.1001[illegible]	06	.052-01	-.0030
0223:32	63	12	.1001[illegible]	06	.052-01	.0010
0224:32	63	12	.1001[illegible]	06	.052-01	-.0000
0225:32	63	12	.1001[illegible]	06	.052-01	-.0020
0226:32	63	12	.1001[illegible]	06	.052-01	-.0070
0227:32	63	12	.1001[illegible]	06	.052-01	-.0127
0228:32	63	12	.1001[illegible]	06	.052-01	.0060
0229:32	63	12	.1001[illegible]	06	.052-01	-.0170
0230:32	63	12	.1001[illegible]	06	.052-01	.0020

STATION NUMBER 12 04/02/04 IRRADIATION NUMBER 9 PASS NUMBER 03/302

FREQUENCY 8300.0

TIME	DC	G	CCD
1031W	00	12	.10681045 06 .012-01 -.0060
1032W	00	12	.10682990 06 .012-01 -.0104
1033W	00	12	.10683934 06 .012-01 .0070
1034W	00	12	.10684911 06 .012-01 -.0107
1035W	00	12	.10685189 06 .012-01 .0060
1036W	00	12	.10686069 06 .012-01 -.0060
1037W	00	12	.10686969 06 .012-01 -.0137
1038W	00	12	.10687832 06 .012-01 .0000
1039W	00	12	.10688715 06 .012-01 .0000
1040W	00	12	.10689599 06 .012-01 -.0107
1041W	00	12	.10690095 06 .012-01 -.0010
1042W	00	12	.10691072 06 .012-01 -.0070
1043W	00	12	.10692260 06 .012-01 .0010
1044W	00	12	.10693149 06 .012-01 -.0060
1045W	00	12	.10694039 06 .012-01 -.0060
1046W	00	12	.10694938 06 .012-01 -.0069
1047W	00	12	.10695823 06 .012-01 .0010
1048W	00	12	.10696716 06 .012-01 -.0127
1049W	00	12	.10697611 06 .012-01 -.0060
1050W	00	12	.10698506 06 .012-01 .0069
1051W	00	12	.10699402 06 .012-01 -.0060
1052W	00	12	.10700130 06 .012-01 -.0166
1053W	00	12	.10701198 06 .012-01 .0106
1054W	00	12	.10702097 06 .012-01 -.0070
1055W	00	12	.10702997 06 .012-01 -.0090
1056W	00	12	.10703899 06 .012-01 .0146
1057W	00	12	.10704830 06 .012-01 -.0215
1058W	00	12	.10705703 06 .012-01 .0070
1059W	00	12	.10706607 06 .012-01 .0000
1100W	00	12	.10707511 06 .012-01 -.0090
1101W	00	12	.10708416 06 .012-01 .0090
1102W	00	12	.10709322 06 .012-01 -.0070
1103W	00	12	.10710228 06 .012-01 -.0070
1104W	00	12	.10711136 06 .012-01 -.0070
1105W	00	12	.10712044 06 .012-01 -.0090
1106W	00	12	.10712952 06 .012-01 .0090
1107W	00	12	.10713862 06 .012-01 -.0010
1108W	00	12	.10714771 06 .012-01 .0000
1109W	00	12	.10715682 06 .012-01 -.0090
1110W	00	12	.10716593 06 .012-01 .0000
1111W	00	12	.10717505 06 .012-01 .0000
1112W	00	12	.10718417 06 .012-01 -.0090
1113W	00	12	.10719330 06 .012-01 .0010
1114W	00	12	.10720243 06 .012-01 .0010
1115W	00	12	.10721157 06 .012-01 -.0070
1116W	00	12	.10722071 06 .012-01 .0090
1117W	00	12	.10722986 06 .012-01 -.0060
1118W	00	12	.10723901 06 .012-01 -.0060
1119W	00	12	.10724816 06 .012-01 .0090
1120W	00	12	.10725732 06 .012-01 -.0070
1121W	00	12	.10726648 06 .012-01 .0070
1122W	00	12	.10727565 06 .012-01 .0090
1123W	00	12	.10728481 06 .012-01 -.0137
1124W	00	12	.10729398 06 .012-01 .0146
1125W	00	12	.10730316 06 .012-01 -.0060
1126W	00	12	.10731233 06 .012-01 -.0060
1127W	00	12	.10732151 06 .012-01 .0090
1128W	00	12	.10733069 06 .012-01 -.0137
1129W	00	12	.10733988 06 .012-01 .0060
1130W	00	12	.10734906 06 .012-01 .0090
1131W	00	12	.10735825 06 .012-01 -.0137
1132W	00	12	.10736743 06 .012-01 .0010
1133W	00	12	.10737662 06 .012-01 -.0090
1134W	00	12	.10738581 06 .012-01 .0070
1135W	00	12	.10739500 06 .012-01 -.0146
1136W	00	12	.10740419 06 .012-01 .0127
1137W	00	12	.10741338 06 .012-01 -.0090
1138W	00	12	.10742256 06 .012-01 .0010
1139W	00	12	.10743175 06 .012-01 -.0090
1140W	00	12	.10744094 06 .012-01 .0090
1141W	00	12	.10745013 06 .012-01 .0010
1142W	00	12	.10745932 06 .012-01 -.0070
1143W	00	12	.10746850 06 .012-01 -.0090
1144W	00	12	.10747769 06 .012-01 -.0060
1145W	00	12	.10748687 06 .012-01 .0090
1146W	00	12	.10749605 06 .012-01 -.0090
1147W	00	12	.10750523 06 .012-01 -.0010
1148W	00	12	.10751441 06 .012-01 .0090
1149W	00	12	.10752359 06 .012-01 .0137
1150W	00	12	.10753276 06 .012-01 -.0060
1151W	00	12	.10754193 06 .012-01 .0090
1152W	00	12	.10755109 06 .012-01 .0090
1153W	00	12	.10756026 06 .012-01 .0060
1154W	00	12	.10756942 06 .012-01 -.0106
1155W	00	12	.10757857 06 .012-01 .0060
1156W	00	12	.10758773 06 .012-01 .0090
1157W	00	12	.10759688 06 .012-01 -.0090
1158W	00	12	.10760602 06 .012-01 -.0070
1159W	00	12	.10761516 06 .012-01 -.0060
1200W	00	12	.10762429 06 .012-01 -.0107
1201W	00	12	.10763342 06 .012-01 .0070
1202W	00	12	.10764255 06 .012-01 .0000
1203W	00	12	.10765167 06 .012-01 .0127
1204W	00	12	.10766078 06 .012-01 -.0176
1205W	00	12	.10766989 06 .012-01 .0060
1206W	00	12	.10767899 06 .012-01 .0090
1207W	00	12	.10768809 06 .012-01 .0070
1208W	00	12	.10769718 06 .012-01 .0010
1209W	00	12	.10770626 06 .012-01 .0070
1210W	00	12	.10771534 06 .012-01 -.0090
1211W	00	12	.10772441 06 .012-01 .0090
1212W	00	12	.10773347 06 .012-01 -.0060
1213W	00	12	.10774253 06 .012-01 .0090
1214W	00	12	.10775158 06 .012-01 .0090

STATION NUMBER 12 04/02/01 IRRADIATION NUMBER 3 PASS NUMBER 03/000

FREQUENCY 0000.0

TIME	YC	Q		CLS		
1215M	00	12	.1077[illegible]	00	.0E2-01	-.0010
1216M	00	12	.1078[illegible]	00	.0E2-01	.0010
1217M	00	12	.1077[illegible]	00	.0E2-01	-.0000
1218M	00	12	.1077[illegible]	00	.0E2-01	.0117
1219M	00	12	.1077[illegible]	00	.0E2-01	-.0117
1220M	00	12	.1078[illegible]	00	.0E2-01	.0070
1221M	00	12	.1078[illegible]	00	.0E2-01	.0070
1222M	00	12	.1078[illegible]	00	.0E2-01	.0059
1223M	00	12	.1078[illegible]	00	.0E2-01	.0059
1224M	00	12	.1078[illegible]	00	.0E2-01	-.0000
1225M	00	12	.1078[illegible]	00	.0E2-01	.0000
1226M	00	12	.1078[illegible]	00	.0E2-01	.0010
1227M	00	12	.1078[illegible]	00	.0E2-01	-.0117
1228M	00	12	.1078[illegible]	00	.0E2-01	.0106
1229M	00	12	.1078[illegible]	00	.0E2-01	-.0070
1230M	00	12	.1078[illegible]	00	.0E2-01	-.0059
1231M	00	12	.1078[illegible]	00	.0E2-01	-.0000
1232M	00	12	.1079[illegible]	00	.0E2-01	.0106
1233M	00	12	.1079[illegible]	00	.0E2-01	-.0010
1234M	00	12	.1079[illegible]	00	.0E2-01	-.0070
1235M	00	12	.1079[illegible]	00	.0E2-01	.0000
1236M	00	12	.1079[illegible]	00	.0E2-01	-.0059
1237M	00	12	.1079[illegible]	00	.0E2-01	-.0059
1238M	00	12	.1079[illegible]	00	.0E2-01	-.0070
1239M	00	12	.1079[illegible]	00	.0E2-01	.0176
1240M	00	12	.1079[illegible]	00	.0E2-01	.0059
1241M	00	12	.1079[illegible]	00	.0E2-01	-.0059
1242M	00	12	.1080[illegible]	00	.0E2-01	.0059
1243M	00	12	.1080[illegible]	00	.0E2-01	.0000
1244M	00	12	.1080[illegible]	00	.0E2-01	.0000
1245M	00	12	.1080[illegible]	00	.0E2-01	-.0106
1246M	00	12	.1080[illegible]	00	.0E2-01	.0176
1247M	00	12	.1080[illegible]	00	.0E2-01	.0059
1248M	00	12	.1080[illegible]	00	.0E2-01	.0010
1249M	00	12	.1080[illegible]	00	.0E2-01	-.0059
1250M	00	12	.1080[illegible]	00	.0E2-01	-.0000
1251M	00	12	.1080[illegible]	00	.0E2-01	.0059
1252M	00	12	.1080[illegible]	00	.0E2-01	.0117
1253M	00	12	.1080[illegible]	00	.0E2-01	-.0106
1254M	00	12	.1081[illegible]	00	.0E2-01	.0000
1255M	00	12	.1081[illegible]	00	.0E2-01	-.0059
1256M	00	12	.1081[illegible]	00	.0E2-01	.0059
1257M	00	12	.1081[illegible]	00	.0E2-01	.0000
1258M	00	12	.1081[illegible]	00	.0E2-01	-.0059
1259M	00	12	.1081[illegible]	00	.0E2-01	.0000
1300M	00	12	.1081[illegible]	00	.0E2-01	.0059
1301M	00	12	.1081[illegible]	00	.0E2-01	.0000
1302M	00	12	.1081[illegible]	00	.0E2-01	-.0059
1303M	00	12	.1081[illegible]	00	.0E2-01	.0059
1304M	00	12	.1081[illegible]	00	.0E2-01	-.0000
1305M	00	12	.1081[illegible]	00	.0E2-01	.0059
1306M	00	12	.1082[illegible]	00	.0E2-01	.0117
1307M	00	12	.1082[illegible]	00	.0E2-01	-.0107
1308M	00	12	.1082[illegible]	00	.0E2-01	.0106
1309M	00	12	.1082[illegible]	00	.0E2-01	-.0000
1310M	00	12	.1082[illegible]	00	.0E2-01	.0000
1311M	00	12	.1082[illegible]	00	.0E2-01	.0000
1312M	00	12	.1082[illegible]	00	.0E2-01	.0000
1313M	00	12	.1082[illegible]	00	.0E2-01	-.0070
1314M	00	12	.1082[illegible]	00	.0E2-01	.0070
1315M	00	12	.1083[illegible]	00	.0E2-01	.0059
1316M	00	12	.1083[illegible]	00	.0E2-01	-.0117
1317M	00	12	.1083[illegible]	00	.0E2-01	.0000
1318M	00	12	.1083[illegible]	00	.0E2-01	-.0059
1319M	00	12	.1083[illegible]	00	.0E2-01	.0000
1320M	00	12	.1083[illegible]	00	.0E2-01	.0000
1321M	00	12	.1083[illegible]	00	.0E2-01	.0000
1322M	00	12	.1083[illegible]	00	.0E2-01	-.0107
1323M	00	12	.1083[illegible]	00	.0E2-01	.0000
1324M	00	12	.1083[illegible]	00	.0E2-01	.0000
1325M	00	12	.1084[illegible]	00	.0E2-01	.0070
1326M	00	12	.1084[illegible]	00	.0E2-01	.0000
1327M	00	12	.1084[illegible]	00	.0E2-01	.0137
1328M	00	12	.1084[illegible]	00	.0E2-01	.0000
1329M	00	12	.1084[illegible]	00	.0E2-01	-.0000
1330M	00	12	.1084[illegible]	00	.0E2-01	.0000
1331M	00	12	.1084[illegible]	00	.0E2-01	.0000
1332M	00	12	.1084[illegible]	00	.0E2-01	.0000
1333M	00	12	.1084[illegible]	00	.0E2-01	-.0010
1334M	00	12	.1084[illegible]	00	.0E2-01	.0000
1335M	00	12	.1084[illegible]	00	.0E2-01	-.0010
1336M	00	12	.1084[illegible]	00	.0E2-01	.0000
1337M	00	12	.1084[illegible]	00	.0E2-01	.0000
1338M	00	12	.1084[illegible]	00	.0E2-01	-.0000
1339M	00	12	.1084[illegible]	00	.0E2-01	.0000
1340M	00	12	.1084[illegible]	00	.0E2-01	.0137
1341M	00	12	.1084[illegible]	00	.0E2-01	-.0137
1342M	00	12	.1084[illegible]	00	.0E2-01	-.0010
1343M	00	12	.1084[illegible]	00	.0E2-01	-.0000
1344M	00	12	.1084[illegible]	00	.0E2-01	.0000
1345M	00	12	.1084[illegible]	00	.0E2-01	.0000
1346M	00	12	.1084[illegible]	00	.0E2-01	.0000
1347M	00	12	.1084[illegible]	00	.0E2-01	.0000
1348M	00	12	.1084[illegible]	00	.0E2-01	-.0137
1349M	00	12	.1084[illegible]	00	.0E2-01	.0000
1350M	00	12	.1084[illegible]	00	.0E2-01	.0000
1351M	00	12	.1084[illegible]	00	.0E2-01	.0176
1352M	00	12	.1084[illegible]	00	.0E2-01	.0000
1353M	00	12	.1084[illegible]	00	.0E2-01	-.0010
1354M	00	12	.1084[illegible]	00	.0E2-01	.0000
1355M	00	12	.1084[illegible]	00	.0E2-01	-.0010
1356M	00	12	.1084[illegible]	00	.0E2-01	-.0107
1357M	00	12	.1084[illegible]	00	.0E2-01	.0070
1358M	00	12	.1084[illegible]	00	.0E2-01	.0070

STATION NUMBER 12 04/03/01 INTEGRATION NUMBER 3 PAGE NUMBER 04/302

FREQUENCY 8400.0

TIME	YC	D	CCS			
1999	00	12	.10061970	00	.052-01	-.0000
1000	00	12	.10062602	00	.052-01	-.0000
1001	00	12	.10063000	00	.052-01	-.0117
1002	00	12	.10064111	00	.052-01	.0000
1003	00	12	.10064015	00	.052-01	-.0000
1004	00	12	.10065110	00	.052-01	.0000
1005	00	12	.10066217	00	.052-01	.0117
1006	00	12	.10066915	00	.052-01	-.0000
1007	00	12	.10067607	00	.052-01	-.0000
1008	00	12	.10068290	00	.052-01	.0000
1009	00	12	.10068985	00	.052-01	.0117
1010	00	12	.10069670	00	.052-01	-.0000
1011	00	12	.10070352	00	.052-01	.0107
1012	00	12	.10071031	00	.052-01	.0000
1013	00	12	.10071727	00	.052-01	.0000
1014	00	12	.10072400	00	.052-01	-.0000
1015	00	12	.10073090	00	.052-01	-.0000
1016	00	12	.10073717	00	.052-01	.0000
1017	00	12	.10074402	00	.052-01	.0000
1018	00	12	.10075065	00	.052-01	.0000
1019	00	12	.10075700	00	.052-01	.0117
1020	00	12	.10076355	00	.052-01	-.0000
1021	00	12	.10077007	00	.052-01	.0107
1022	00	12	.10077656	00	.052-01	.0000
1023	00	12	.10078302	00	.052-01	.0000
1024	00	12	.10078944	00	.052-01	-.0000
1025	00	12	.10079565	00	.052-01	.0176
1026	00	12	.10080219	00	.052-01	.0000
1027	00	12	.10080857	00	.052-01	.0000
1028	00	12	.10081485	00	.052-01	-.0000
1029	00	12	.10082109	00	.052-01	.0000
1030	00	12	.10082733	00	.052-01	.0000
1031	00	12	.10083355	00	.052-01	.0000
1032	00	12	.10083970	00	.052-01	.0000
1033	00	12	.10084583	00	.052-01	-.0000
1034	00	12	.10085194	00	.052-01	.0000
1035	00	12	.10085801	00	.052-01	.0000
1036	00	12	.10086405	00	.052-01	.0000
1037	00	12	.10087005	00	.052-01	.0107
1038	00	12	.10087605	00	.052-01	.0000
1039	00	12	.10088197	00	.052-01	-.0000
1040	00	12	.10088787	00	.052-01	-.0000
1041	00	12	.10089374	00	.052-01	.0000
1042	00	12	.10089958	00	.052-01	.0000
1043	00	12	.10090539	00	.052-01	.0127
1044	00	12	.10091118	00	.052-01	-.0000
1045	00	12	.10091689	00	.052-01	.0000
1046	00	12	.10092259	00	.052-01	.0000
1047	00	12	.10092826	00	.052-01	-.0000
1048	00	12	.10093389	00	.052-01	.0000
1049	00	12	.10093950	00	.052-01	.0000
1050	00	12	.10094506	00	.052-01	-.0000
1051	00	12	.10095059	00	.052-01	-.0000
1052	00	12	.10095608	00	.052-01	-.0000
1053	00	12	.10096154	00	.052-01	-.0000
1054	00	12	.10096696	00	.052-01	.0000
1055	00	12	.10097235	00	.052-01	.0000
1056	00	12	.10097770	00	.052-01	-.0000
1057	00	12	.10098301	00	.052-01	.0000
1058	00	12	.10098830	00	.052-01	.0000
1059	00	12	.10099354	00	.052-01	-.0000
1100	00	12	.10099875	00	.052-01	.0000
1101	00	12	.10100392	00	.052-01	.0000
1102	00	12	.10100906	00	.052-01	-.0000
1103	00	12	.10101416	00	.052-01	.0000
1104	00	12	.10101922	00	.052-01	.0117
1105	00	12	.10102425	00	.052-01	.0000
1106	00	12	.10102923	00	.052-01	-.0000
1107	00	12	.10103419	00	.054-01	-.0000
1108	00	12	.10103910	00	.054-01	.0000
1109	00	12	.10104403	00	.054-01	.0000
1110	00	12	.10104893	00	.054-01	.0000
1111	00	12	.10105380	00	.054-01	-.0000
1112	00	12	.10105860	00	.054-01	.0000
1113	00	12	.10106338	00	.054-01	-.0000
1114	00	12	.10106812	00	.054-01	.0000
1115	00	12	.10107287	00	.054-01	-.0000
1116	00	12	.10107759	00	.054-01	.0000
1117	00	12	.10108227	00	.054-01	-.0000
1118	00	12	.10108691	00	.054-01	-.0000
1119	00	12	.10109151	00	.054-01	.0000
1120	00	12	.10109617	00	.054-01	.0000
1121	00	12	.10110079	00	.054-01	-.0000
1122	00	12	.10110533	00	.054-01	.0000
1123	00	12	.10110984	00	.054-01	.0000
1124	00	12	.10111434	00	.054-01	.0000
1125	00	12	.10111881	00	.054-01	.0000
1126	00	12	.10112325	00	.057-01	-.0127
1127	00	12	.10112766	00	.057-01	-.0117
1128	00	12	.10113204	00	.057-01	-.0000
1129	00	12	.10113641	00	.057-01	-.0000
1130	00	12	.10114074	00	.057-01	-.0176
1131	00	12	.10114502	00	.057-01	.0000
1132	00	12	.10114921	00	.057-01	-.0000
1133	00	12	.10115337	00	.057-01	-.0117
1134	00	12	.10115750	00	.057-01	-.0000
1135	00	12	.10116157	00	.057-01	.0000
1136	00	12	.10116560	00	.057-01	-.0000
1137	00	12	.10116960	00	.057-01	-.0000
1138	00	12	.10116356	00	.057-01	.0000
1139	00	12	.10117750	00	.057-01	-.0107
1140	00	12	.10118125	00	.057-01	-.0000
1141	00	12	.10118500	00	.057-01	-.0000
1142	00	12	.10118869	00	.057-01	-.0000

STATION NUMBER 12 04/02/70 STATION NUMBER 5 PASS NUMBER 02/320

FREQUENCY 0000.0

TIME	TC	G	GEO
[illegible]	00	12	[illegible]
[illegible]	00	12	[illegible]
[illegible]	00	12	[illegible]

[illegible]

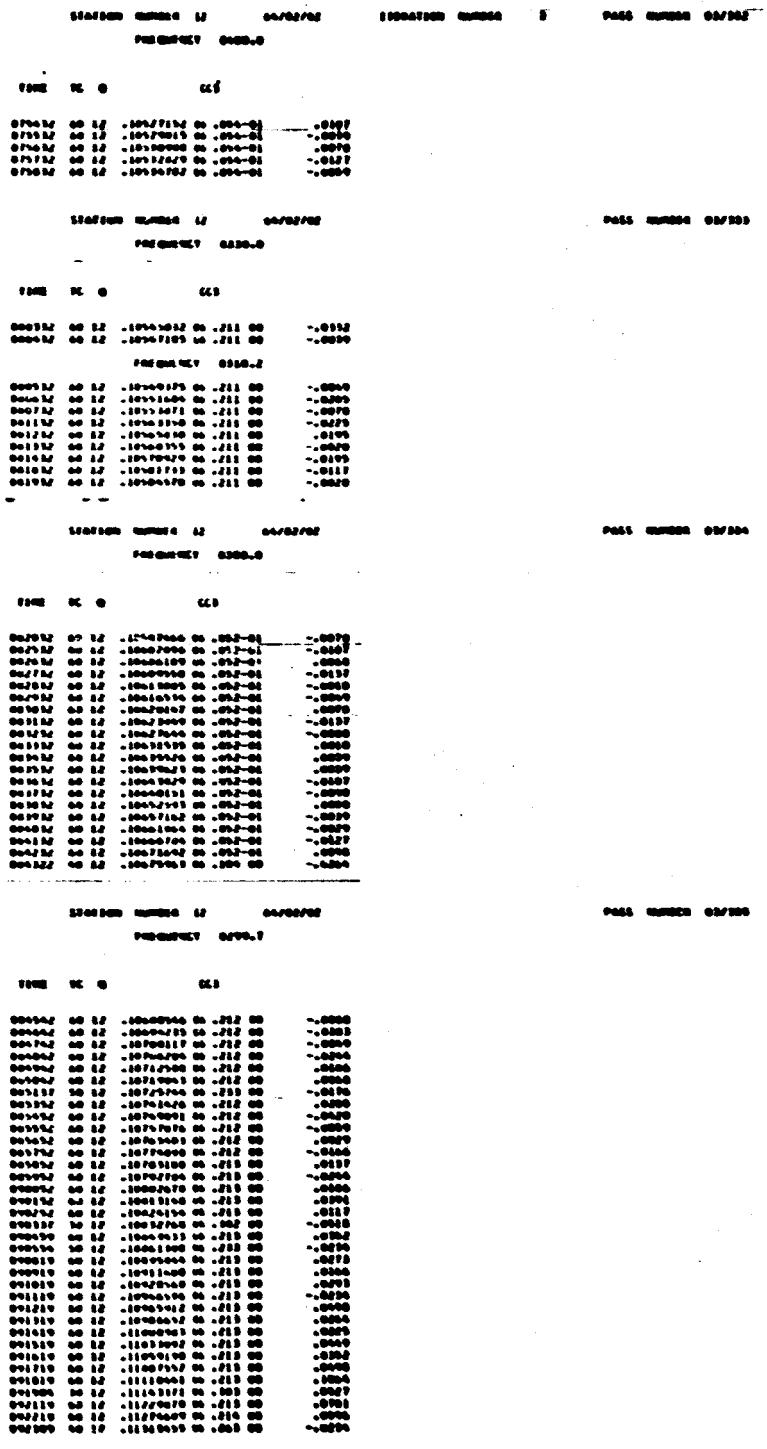
FREQUENCY [illegible]

TIME	TC	B	CCS	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

FREQUENCY [illegible]

TIME	TC	B	CCS	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]



STATION NUMBER 12 [illegible] ITERATION NUMBER 3 PASS NUMBER 03/[illegible]

FREQUENCY [illegible]

TIME	TC	Q	CC3	
092334	5	12	.11337566 06 .750 00	-.0012
092339	5	12	.11342000 06 .750 00	-.2164
092344	5	12	.11346506 06 .750 00	.1307
092349	5	12	.11351042 06 .750 00	-.2207
092354	5	12	.11355616 06 .750 00	-.1563
092359	5	12	.11360227 06 .750 00	-.2736
092404	5	12	.11364877 06 .750 00	-.1738
092409	5	12	.11369566 06 .750 00	.3309
092414	5	12	.11374293 06 .750 00	-.3309
092419	5	12	.11379060 06 .750 00	.1973
092421	2	12	.11382419 06 .121 01	-.1099
092429	5	12	.11388712 06 .750 00	.0011

DATA STATISTICS STATION 3 ITERATION 3

PASS	DATA TYPE	BEGINNING TIME	END TIME	NUMBER OF POINTS	STD DEV	RMS	FIRST MOMENT	SECOND MOMENT
01/313	CC3	[illegible]	[illegible]	41	[illegible]	[illegible]	[illegible]	[illegible]
01/314	CC3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
01/315	CC3	[illegible]	[illegible]	19	[illegible]	[illegible]	[illegible]	[illegible]
02/321	CC3	[illegible]	[illegible]	51	[illegible]	[illegible]	[illegible]	[illegible]
02/322	CC3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
02/323	CC3	[illegible]	[illegible]	71	[illegible]	[illegible]	[illegible]	[illegible]
03/331	CC3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
03/332	CC3	[illegible]	[illegible]	57	[illegible]	[illegible]	[illegible]	[illegible]
03/333	CC3	[illegible]	[illegible]	11	[illegible]	[illegible]	[illegible]	[illegible]
03/334	CC3	[illegible]	[illegible]	20	[illegible]	[illegible]	[illegible]	[illegible]
03/335	CC3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
03/336	CC3	[illegible]	[illegible]	12	[illegible]	.221 00	[illegible]	[illegible]

STATION NUMBER 44 [illegible] PASS NUMBER 04/[illegible]

FREQUENCY [illegible]

TIME	TC	Q	CC3	
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

STATION NUMBER 41 04/01/31 STRATION NUMBER 1 PASS NUMBER 04/311

FREQUENCY 8270.0

TIME	YC	D	CC3			
170030	04	41	.10005400	04	.130	00	.0044
170130	04	41	.10006162	04	.130	00	-.0371
170230	04	41	.10006881	04	.130	00	.0144
170330	04	41	.10007622	04	.130	00	-.0029
170430	04	41	.10008365	04	.130	00	.0029
170530	04	41	.10009109	04	.130	00	-.0430
170630	04	41	.10009856	04	.130	00	-.0004
170730	04	41	.10090604	04	.130	00	.0430
170830	04	41	.10091354	04	.130	00	-.0244
170930	04	41	.10092106	04	.130	00	.0004
171030	04	41	.10092860	04	.130	00	-.0293
171130	04	41	.10093615	04	.130	00	.0312
171230	04	41	.10094372	04	.130	00	-.0309
171330	04	41	.10095131	04	.130	00	-.0410
171430	04	41	.10095891	04	.130	00	-.0127
171530	04	41	.10096653	04	.130	00	.0372
171630	04	41	.10097417	04	.130	00	.0117
171730	04	41	.10098182	04	.130	00	-.0070
171830	04	41	.10098949	04	.130	00	.0275
171930	04	41	.10099718	04	.130	00	-.0450
172030	04	41	.10090489	04	.130	00	.0040
172130	04	41	.10090257	04	.130	00	.0049
172230	04	41	.10091028	04	.130	00	-.0070
172330	04	41	.10091803	04	.130	00	.0273
172430	04	41	.10092579	04	.130	00	.0215
172530	04	41	.10093358	04	.130	00	-.0315
172630	04	41	.10094138	04	.130	00	.0029
172730	04	41	.10094924	04	.130	00	.0040
172830	04	41	.10095709	04	.130	00	.0293
172930	04	41	.10096496	04	.130	00	-.0040
173030	04	41	.10097286	04	.130	00	.0049
173130	04	41	.10098078	04	.130	00	-.0040
173230	04	41	.10098872	04	.130	00	-.0293
173330	04	41	.10099670	04	.130	00	.0234
173430	04	41	.10100469	04	.130	00	-.0049
173530	04	41	.10101270	04	.130	00	-.0293
173630	04	41	.10102073	04	.130	00	-.0315
173730	04	41	.10102879	04	.130	00	.0029
173830	04	41	.10103686	04	.130	00	.0040
173930	04	41	.10104496	04	.130	00	.0293
174030	04	41	.10105308	04	.130	00	-.0040
174130	04	41	.10106122	04	.130	00	-.0040
174230	04	41	.10106938	04	.130	00	.0049
174330	04	41	.10107756	04	.130	00	.0234
174430	04	41	.10108576	04	.130	00	-.0049
174530	04	41	.10109398	04	.130	00	-.0293
174630	04	41	.10110222	04	.130	00	-.0273
174730	04	41	.10111048	04	.130	00	-.0371
174830	04	41	.10111876	04	.130	00	.0029
174930	04	41	.10112706	04	.130	00	-.0175
175030	04	41	.10113536	04	.130	00	.0049
175130	04	41	.10114370	04	.130	00	.0040
175230	04	41	.10115207	04	.130	00	-.0351
175330	04	41	.10116045	04	.130	00	-.0352
175430	04	41	.10116886	04	.130	00	.0029
175530	04	41	.10117726	04	.130	00	-.0195
175630	04	41	.10118568	04	.130	00	-.0234
175730	04	41	.10119413	04	.130	00	-.0010
175830	04	41	.10120260	04	.130	00	-.0010
175930	04	41	.10121108	04	.130	00	.0371
180030	04	41	.10121959	04	.130	00	-.0040
180130	04	41	.10122807	04	.130	00	.0156
180230	04	41	.10123671	04	.130	00	.0117
180330	04	41	.10124526	04	.130	00	-.0372
180430	04	41	.10125382	04	.130	00	-.0040
180530	04	41	.10126240	04	.130	00	.0040
180630	04	41	.10127100	04	.130	00	.0234
180730	04	41	.10127963	04	.130	00	-.0351
180830	04	41	.10128827	04	.130	00	.0029
180930	04	41	.10129693	04	.130	00	-.0352
181030	04	41	.10130561	04	.130	00	.0040
181130	04	41	.10131431	04	.130	00	-.0040
181230	04	41	.10132303	04	.130	00	.0156
181330	04	41	.10133177	04	.130	00	.0117
181430	04	41	.10134052	04	.130	00	-.0372
181530	04	41	.10134932	04	.130	00	-.0040
181630	04	41	.10135809	04	.130	00	.0040
181730	04	41	.10136688	04	.130	00	.0234
181830	04	41	.10137573	04	.130	00	-.0351
181930	04	41	.10138461	04	.130	00	.0029
182030	04	41	.10139349	04	.130	00	.0040
182130	04	41	.10140240	04	.130	00	-.0293
182230	04	41	.10141134	04	.141	00	.0234
182330	04	41	.10142030	04	.141	00	-.0040
182430	04	41	.10142928	04	.141	00	.0352
182530	04	41	.10143827	04	.141	00	-.0312
182630	04	41	.10144730	04	.141	00	-.0176
182730	04	41	.10145633	04	.141	00	-.0029
182830	04	41	.10146537	04	.141	00	.0117
182930	04	41	.10147444	04	.141	00	.0234
183030	04	41	.10148353	04	.141	00	.0040
183130	04	41	.10149264	04	.141	00	-.0215
183230	04	41	.10150178	04	.141	00	-.0293
183330	04	41	.10151093	04	.141	00	-.0410
183430	04	41	.10152010	04	.141	00	-.0040
183530	04	41	.10152929	04	.141	00	-.0040
183630	04	41	.10153850	04	.142	00	.0293
183730	04	41	.10154773	04	.142	00	.0352
183830	04	41	.10155699	04	.142	00	-.0040
183930	04	41	.10156627	04	.142	00	-.0273
184030	04	41	.10157557	04	.142	00	-.0127
184130	04	41	.10158488	04	.142	00	-.0430
184230	04	41	.10159422	04	.142	00	.0137
184330	04	41	.10160357	04	.142	00	-.0040
184430	04	41	.10161294	04	.142	00	.0275
184530	04	41	.10162233	04	.142	00	-.0215
184630	04	41	.10163174	04	.142	00	.0352
184730	04	41	.10164116	04	.142	00	-.0430
184830	04	41	.10165060	04	.142	00	.0215
184930	04	41	.10166007	04	.142	00	-.0004
185030	04	41	.10166955	04	.142	00	.0040
185130	04	41	.10167906	04	.142	00	-.0293
185230	04	41	.10168858	04	.142	00	-.0040

STATION NUMBER 41 [illegible] INTEGRATION NUMBER 3 PASS NUMBER 01/311

FREQUENCY 8270.0

TIME	DC	D	CCD		
191631	00	41	.10906806 00	.143 00	.0127
191731	00	41	.10907191 00	.143 00	.0176
191831	00	41	.10907499 00	.143 00	-.0209
191931	00	41	.10908805 00	.143 00	.0010
192031	00	41	.10908610 00	.143 00	-.0106
192131	00	41	.10909016 00	.143 00	-.0127
192231	00	41	.10909210 00	.143 00	.0352
192331	00	41	.10909021 00	.143 00	-.0732
192431	00	41	.10909022 00	.143 00	.0645
192531	00	41	.10909023 00	.143 00	.0215
192631	00	41	.10909022 00	.143 00	.0204
192731	00	41	.10909221 00	.143 00	.0000
192831	00	41	.10909010 00	.143 00	-.0352
192931	00	41	.10909015 00	.143 00	.0176
193031	00	41	.10907610 00	.143 00	-.0106
193131	00	41	.10906636 00	.143 00	.0059
193231	00	41	.10906127 00	.143 00	-.0004
193331	00	41	.10905908 00	.143 00	.0275
193431	00	41	.10905780 00	.143 00	-.0010
193531	00	41	.10905570 00	.143 00	-.0137
193631	00	41	.10905350 00	.143 00	.0059
193731	00	41	.10905145 00	.143 00	.0000
193831	00	41	.10905031 00	.143 00	-.0266
193931	00	41	.10904715 00	.143 00	.0059
194031	00	41	.10904498 00	.143 00	-.0004
194131	00	41	.10904280 00	.143 00	.0000
194231	00	41	.10903061 00	.144 00	.0010
194331	00	41	.10902860 00	.144 00	-.0490
194431	00	41	.10902610 00	.144 00	.0275
194531	00	41	.10901714 00	.144 00	-.0265
194631	00	41	.10901665 00	.144 00	-.0000
194731	00	41	.10901356 00	.144 00	.0275
194831	00	41	.10900671 00	.144 00	-.0265
194931	00	41	.10900767 00	.144 00	.0275
195031	00	41	.10901552 00	.144 00	.0010
195131	00	41	.10901516 00	.144 00	.0000
195231	00	41	.10901375 00	.144 00	.0127
195331	00	41	.10901815 00	.144 00	-.0265
195431	00	41	.10901941 00	.144 00	-.0000
195531	00	41	.10901949 00	.144 00	-.0275
195631	00	41	.10902083 00	.144 00	.0352
200031	00	41	.10902096 00	.144 00	-.0266
200131	00	41	.10902627 00	.144 00	.0106
200231	00	41	.10902756 00	.144 00	-.0129
200331	00	41	.10903125 00	.144 00	.0479
200431	00	41	.10903469 00	.144 00	.0000
200531	00	41	.10904593 00	.144 00	.0595
200631	00	41	.10905395 00	.144 00	.0010
200731	00	41	.10906475 00	.145 00	.0000
200831	00	41	.10907613 00	.145 00	.0000
200931	00	41	.10907758 00	.145 00	-.0266
201031	00	41	.10908204 00	.145 00	.0479
201131	00	41	.10908017 00	.145 00	-.0266
201231	00	41	.10909767 00	.145 00	.0007
201331	00	41	.10910676 00	.145 00	.0266
201431	00	41	.10911742 00	.145 00	-.0266
201531	00	41	.10911427 00	.145 00	.0000
201631	00	41	.10912669 00	.145 00	-.0000
201731	00	41	.10913378 00	.145 00	.0266
201831	00	41	.10914068 00	.145 00	.0000
201931	00	41	.10914625 00	.145 00	-.0595
202031	00	41	.10915519 00	.145 00	.0275
202131	00	41	.10916731 00	.145 00	-.0266
202231	00	41	.10916941 00	.145 00	.0266
202331	00	41	.10917649 00	.145 00	.0010
202431	00	41	.10918954 00	.145 00	-.0000
202531	00	41	.10919057 00	.145 00	.0070
202631	00	41	.10919750 00	.145 00	-.0037
202731	00	41	.10920457 00	.145 00	.0060
202831	00	41	.10921154 00	.145 00	-.0066
202931	00	41	.10921069 00	.145 00	.0117
203031	00	41	.10922361 00	.145 00	-.0266
203131	00	41	.10923258 00	.146 00	.0049
203231	00	41	.10923918 00	.146 00	.0059
203331	00	41	.10924663 00	.146 00	.0059
203431	00	41	.10925364 00	.146 00	.0098
203531	00	41	.10925966 00	.146 00	-.0079
203631	00	41	.10926646 00	.146 00	.0301
203731	00	41	.10927319 00	.146 00	.0275
203831	00	41	.10927992 00	.146 00	.0000
203931	00	41	.10928663 00	.146 00	.0095
204031	00	41	.10929331 00	.146 00	.0079
204131	00	41	.10929997 00	.146 00	-.0176
204231	00	41	.10930660 00	.146 00	.0079
204331	00	41	.10931294 00	.146 00	-.0071
204431	00	41	.10931886 00	.146 00	-.0022
204531	00	41	.10932937 00	.146 00	.0000
204631	00	41	.10933500 00	.146 00	-.0075
204731	00	41	.10933229 00	.146 00	.0094
204831	00	41	.10934072 00	.146 00	-.0176
204931	00	41	.10934311 00	.146 00	-.0049
205031	00	41	.10935168 00	.146 00	-.0176
205131	00	41	.10935782 00	.146 00	-.0000
205231	00	41	.10936616 00	.146 00	.0129
205331	00	41	.10937041 00	.146 00	.0095
205431	00	41	.10937660 00	.146 00	.0275
205531	00	41	.10938292 00	.146 00	-.0275
205631	00	41	.10938917 00	.146 00	-.0060
205731	00	41	.10939530 00	.146 00	-.0029
205831	00	41	.10940165 00	.146 00	.0066
205931	00	41	.10940797 00	.146 00	-.0095
210031	00	41	.10941360 00	.146 00	.0095
210131	00	41	.10941972 00	.146 00	.0094

STATION NUMBER 44 04/20/74 TRANSMITTER NUMBER 3 PASS NUMBER 00/001

FREQUENCY 8000.0

TIME	TC	Q		SEC		
1740:31	00	41	.1061[illegible]07	00	.106	00	.0090
1740:31	00	41	.1061[illegible]61	00	.106	00	-.0000
1750:31	00	41	.1061[illegible]34	00	.106	00	.0000
1751:31	00	41	.1061[illegible]12	00	.106	00	-.0342
1752:31	00	41	.1061[illegible]09	00	.106	00	.0203
1753:31	00	41	.1061[illegible]47	00	.106	00	-.0070
1754:31	00	41	.1061[illegible]46	00	.106	00	-.0004
1755:31	00	41	.1061[illegible]27	00	.106	00	-.0030
1756:31	00	41	.1066[illegible]09	00	.106	00	-.0137
1757:31	00	41	.1064[illegible]91	00	.106	00	-.0313
1758:31	00	41	.1064[illegible]75	00	.106	00	-.0010
1759:31	00	41	.1064[illegible]68	00	.106	00	.0010
1800:31	00	41	.1064[illegible]46	00	.106	00	.0005
1801:31	00	41	.1064[illegible]17	00	.106	00	-.0732
1802:31	00	41	.1064[illegible]70	00	.106	00	-.0362
1803:31	00	41	.1064[illegible]09	00	.106	00	.0137
1804:31	00	41	.1064[illegible]98	00	.106	00	-.0040
1805:31	00	41	.1064[illegible]48	00	.106	00	-.0106
1806:31	00	41	.1065[illegible]93	00	.107	00	.0342
1807:31	00	41	.1065[illegible]19	00	.107	00	.0035
1808:31	00	41	.1065[illegible]31	00	.107	00	-.0000
1811:31	00	41	.1065[illegible]48	00	.107	00	-.0752
1812:31	00	41	.1065[illegible]96	00	.107	00	-.0127
1813:31	00	41	.1065[illegible]41	00	.107	00	-.1200
1816:31	00	41	.1066[illegible]35	00	.107	00	.0771
1817:31	00	41	.1066[illegible]35	00	.107	00	.0000
1818:31	00	41	.1066[illegible]35	00	.107	00	-.0332
1819:31	00	41	.1066[illegible]35	00	.107	00	.0499
1820:31	00	41	.1066[illegible]37	00	.107	00	.0156
1821:31	00	41	.1066[illegible]38	00	.107	00	.0004
1822:31	00	41	.1066[illegible]41	00	.107	00	-.0732
1823:31	00	41	.1066[illegible]63	00	.107	00	.0366
1824:31	00	41	.1066[illegible]96	00	.107	00	.0004
1825:31	00	41	.1066[illegible]98	00	.107	00	-.1162
1826:31	00	41	.1067[illegible]96	00	.107	00	.0204
1827:31	00	41	.1067[illegible]59	00	.107	00	-.0009
1828:31	00	41	.1067[illegible]63	00	.107	00	.0079
1832:31	00	41	.1067[illegible]86	00	.107	00	.0362
1833:31	00	41	.1067[illegible]07	00	.107	00	-.0122
1834:31	00	41	.1068[illegible]16	00	.107	00	-.0371
1837:31	00	41	.1068[illegible]71	00	.107	00	-.0107
1838:31	00	41	.1068[illegible]78	00	.107	00	.0079
1839:31	00	41	.1068[illegible]56	00	.107	00	-.0005
1840:31	00	41	.1068[illegible]05	00	.107	00	-.0010
1841:31	00	41	.1068[illegible]62	00	.107	00	-.0371
1842:31	00	41	.1068[illegible]68	00	.108	00	.0342
1843:31	00	41	.1068[illegible]68	00	.108	00	.0205
1844:31	00	41	.1068[illegible]76	00	.108	00	-.0005
1845:31	00	41	.1068[illegible]85	00	.108	00	.0150
1846:31	00	41	.1069[illegible]92	00	.108	00	.0117
1849:31	00	41	.1069[illegible]24	00	.108	00	-.0723
1851:31	00	41	.1069[illegible]52	00	.108	00	.0176
1852:31	00	41	.1069[illegible]39	00	.108	00	.0254
1853:31	00	41	.1069[illegible]46	00	.108	00	-.0020
1854:31	00	41	.1070[illegible]67	00	.108	00	-.0020
1857:31	00	41	.1070[illegible]26	00	.108	00	-.0068
1858:31	00	41	.1070[illegible]00	00	.108	00	.0164
1859:31	00	41	.1070[illegible]06	00	.108	00	.0301
1900:31	00	41	.1070[illegible]02	00	.108	00	.0313
1901:31	00	41	.1070[illegible]97	00	.108	00	-.0215
1902:31	00	41	.1070[illegible]87	00	.108	00	.0137
1903:31	00	41	.1070[illegible]67	00	.108	00	-.0010
1904:31	00	41	.1070[illegible]11	00	.108	00	-.0068
1905:31	00	41	.1070[illegible]16	00	.108	00	.0301
1906:31	00	41	.1071[illegible]18	00	.108	00	.0090
1909:31	00	41	.1071[illegible]29	00	.108	00	.0703
1910:31	00	41	.1071[illegible]26	00	.108	00	-.1426
1911:31	00	41	.1071[illegible]26	00	.108	00	.0086
1912:31	00	41	.1071[illegible]27	00	.108	00	-.0010
1913:31	00	41	.1071[illegible]26	00	.108	00	-.0127
1914:31	00	41	.1071[illegible]25	00	.108	00	.0313
1915:31	00	41	.1071[illegible]21	00	.108	00	.0000
1916:31	00	41	.1072[illegible]21	00	.108	00	-.0117
1917:31	00	41	.1072[illegible]18	00	.108	00	-.0303
1918:31	00	41	.1072[illegible]15	00	.108	00	.0070
1919:31	00	41	.1072[illegible]10	00	.108	00	.0195
1920:31	00	41	.1072[illegible]00	00	.108	00	-.0009
1921:31	00	41	.1072[illegible]98	00	.108	00	-.0096
1922:31	00	41	.1072[illegible]91	00	.108	00	-.0196
1923:31	00	41	.1072[illegible]86	00	.108	00	-.0391
1924:31	00	41	.1072[illegible]79	00	.108	00	-.0009
1925:31	00	41	.1072[illegible]66	00	.108	00	-.0009
1926:31	00	41	.1073[illegible]56	00	.108	00	-.0004
1927:31	00	41	.1073[illegible]44	00	.108	00	.0303
1928:31	00	41	.1073[illegible]33	00	.108	00	.0000
1929:31	00	41	.1073[illegible]19	00	.108	00	-.0137
1930:31	00	41	.1073[illegible]06	00	.109	00	-.0294
1931:31	00	41	.1073[illegible]91	00	.109	00	.0752
1932:31	00	41	.1073[illegible]75	00	.109	00	-.0045
1933:31	00	41	.1073[illegible]21	00	.109	00	-.0068
1934:31	00	41	.1074[illegible]00	00	.109	00	-.0045
1937:31	00	41	.1074[illegible]39	00	.109	00	.0004
1938:31	00	41	.1074[illegible]97	00	.109	00	.0362
1939:31	00	41	.1074[illegible]33	00	.109	00	-.0009
1940:31	00	41	.1074[illegible]08	00	.109	00	-.0322
1941:31	00	41	.1074[illegible]02	00	.109	00	.0771
1942:31	00	41	.1074[illegible]93	00	.109	00	-.0000
1943:31	00	41	.1074[illegible]78	00	.109	00	.0010
1944:31	00	41	.1074[illegible]97	00	.109	00	.0313
1945:31	00	41	.1074[illegible]34	00	.109	00	-.0004
1946:31	00	41	.1075[illegible]39	00	.109	00	-.0003
1947:31	00	41	.1075[illegible]19	00	.109	00	-.0170
1951:31	00	41	.1075[illegible]72	00	.109	00	-.0020
1952:31	00	41	.1075[illegible]91	00	.109	00	-.0303

STATION NUMBER 46 04/03/66 STATION NUMBER 3 PASS NUMBER 02/361

FREQUENCY 2000.0

TIME	TC	Q	GCD
195331	00	01	.1075[illegible] 00 .100 00 .0000
195431	00	01	.1075[illegible] 00 .100 00 .0000
195531	00	00	.1075[illegible] 00 .100 00 .0000
195631	00	01	.1075[illegible] 00 .100 00 .0000
195731	00	01	.1076[illegible] 00 .100 00 -.0079
195831	00	01	.1076[illegible] 00 .100 00 -.0106
195931	00	01	.1076[illegible] 00 .100 00 -.0070
200031	00	01	.1076[illegible] 00 .100 00 -.0085
200131	00	01	.1076[illegible] 00 .100 00 -.0075
200231	00	01	.1076[illegible] 00 .100 00 -.0067
200331	00	01	.1076[illegible] 00 .100 00 -.0076
200431	00	01	.1076[illegible] 00 .100 00 -.0066
200531	00	01	.1076[illegible] 00 .100 00 -.0076
200631	00	01	.1076[illegible] 00 .100 00 -.0075
200731	00	01	.1077[illegible] 00 .100 00 -.0094
200831	00	01	.1077[illegible] 00 .100 00 -.0090
200931	00	01	.1077[illegible] 00 .100 00 -.0089
201031	00	01	.1077[illegible] 00 .100 00 -.0072
201131	00	01	.1077[illegible] 00 .100 00 -.0080
201231	00	01	.1077[illegible] 00 .100 00 -.0087
201331	00	01	.1077[illegible] 00 .100 00 -.0095
201431	00	01	.1077[illegible] 00 .100 00 -.0086
201531	00	01	.1077[illegible] 00 .100 00 -.0090
201631	00	01	.1078[illegible] 00 .100 00 -.0092
201731	00	01	.1078[illegible] 00 .100 00 -.0090
201831	00	01	.1078[illegible] 00 .100 00 -.0088
201931	00	01	.1078[illegible] 00 .100 00 -.0086
202031	00	01	.1078[illegible] 00 .100 00 -.0082
202131	00	01	.1078[illegible] 00 .100 00 -.0117
202231	00	01	.1078[illegible] 00 .100 00 -.0090
202331	00	01	.1078[illegible] 00 .100 00 -.0080
202431	00	01	.1078[illegible] 00 .100 00 -.0086
202531	00	01	.1079[illegible] 00 .100 00 -.0085
202631	00	01	.1079[illegible] 00 .100 00 -.0082
202731	00	01	.1079[illegible] 00 .100 00 -.0090
202831	00	01	.1079[illegible] 00 .100 00 -.0083
202931	00	01	.1079[illegible] 00 .100 00 -.0082
203031	00	01	.1079[illegible] 00 .100 00 -.0082
203131	00	01	.1079[illegible] 00 .100 00 -.0080
203231	00	01	.1079[illegible] 00 .100 00 -.0080
203331	00	01	.1079[illegible] 00 .100 00 -.0084

DATA STATISTICS STATION 4 STATION 3

PASS	DATA TYPE	GREENWICH TIME		END TIME	NUMBER OF POINTS	STD DEV	RMS	FIRST MEAN	SECOND MEAN
02/361	GCD	2/31-[illegible]		2/31-2[illegible]	299	.5[illegible]-01	.5[illegible]-01	.0[illegible]-01	.0[illegible]-02
02/361	GCD	2/01-1[illegible]		2/01-2[illegible]	144	.5[illegible]-01	.5[illegible]-01	.0[illegible]-02	.0[illegible]-02

STATION NUMBER 46 04/03/66 STATION NUMBER 3 PASS NUMBER 02/361

FREQUENCY 2000.0

TIME	TC	Q	GCD
200031	00	01	.1076[illegible] 00 .100 00 -.0094
210231	00	01	.1076[illegible] 00 .100 00 -.0090
210331	00	00	.1076[illegible] 00 .100 00 -.0090
210431	00	01	.1076[illegible] 00 .100 00 -.0093
210531	00	01	.1076[illegible] 00 .100 00 -.0086
210631	00	01	.1076[illegible] 00 .100 00 -.0090
210731	00	01	.1076[illegible] 00 .100 00 -.0090
210831	00	01	.1076[illegible] 00 .100 00 -.0090
210931	00	01	.1076[illegible] 00 .100 00 -.0088
211031	00	01	.1076[illegible] 00 .100 00 -.0088
211131	00	01	.1076[illegible] 00 .100 00 -.0088
211231	00	01	.1076[illegible] 00 .100 00 -.0088
211331	00	01	.1076[illegible] 00 .100 00 -.0088
211431	00	01	.1076[illegible] 00 .100 00 -.0088
211531	00	01	.1076[illegible] 00 .100 00 -.0088
211631	00	01	.1076[illegible] 00 .100 00 -.0088
211731	00	01	.1076[illegible] 00 .100 00 -.0088
211831	00	01	.1076[illegible] 00 .100 00 -.0088
211931	00	01	.1076[illegible] 00 .100 00 -.0088
212031	00	01	.1076[illegible] 00 .100 00 -.0088
212131	00	01	.1076[illegible] 00 .100 00 -.0088
212231	00	01	.1076[illegible] 00 .100 00 -.0088
212331	00	01	.1076[illegible] 00 .100 00 -.0088
212431	00	01	.1076[illegible] 00 .100 00 -.0088
212531	00	01	.1076[illegible] 00 .100 00 -.0088
212631	00	01	.1076[illegible] 00 .100 00 -.0088
212731	00	01	.1076[illegible] 00 .100 00 -.0088
212831	00	01	.1076[illegible] 00 .100 00 -.0088
212931	00	01	.1076[illegible] 00 .100 00 -.0088
213031	00	01	.1076[illegible] 00 .100 00 -.0088
213131	00	01	.1076[illegible] 00 .100 00 -.0088
213231	00	01	.1076[illegible] 00 .100 00 -.0088
213331	00	01	.1076[illegible] 00 .100 00 -.0088
213431	00	01	.1076[illegible] 00 .100 00 -.0088
213531	00	01	.1076[illegible] 00 .100 00 -.0088
213631	00	01	.1076[illegible] 00 .100 00 -.0088
213731	00	01	.1076[illegible] 00 .100 00 -.0088
213831	00	01	.1076[illegible] 00 .100 00 -.0088
213931	00	01	.1076[illegible] 00 .100 00 -.0088
214031	00	01	.1076[illegible] 00 .100 00 -.0088
214131	00	01	.1076[illegible] 00 .100 00 -.0088
214231	00	01	.1076[illegible] 00 .100 00 -.0088
214331	00	01	.1076[illegible] 00 .100 00 -.0088
214431	00	01	.1076[illegible] 00 .100 00 -.0088
214531	00	01	.1076[illegible] 00 .100 00 -.0088
214631	00	01	.1076[illegible] 00 .100 00 -.0088
214731	00	01	.1076[illegible] 00 .100 00 -.0088
214831	00	01	.1076[illegible] 00 .100 00 -.0088
214931	00	01	.1076[illegible] 00 .100 00 -.0088
215031	00	01	.1076[illegible] 00 .100 00 -.0088
215131	00	01	.1076[illegible] 00 .100 00 -.0088
215231	00	01	.1076[illegible] 00 .100 00 -.0088
215331	00	01	.1076[illegible] 00 .100 00 -.0088
215431	00	01	.1076[illegible] 00 .100 00 -.0088
215531	00	01	.1076[illegible] 00 .100 00 -.0088
215631	00	01	.1076[illegible] 00 .100 00 -.0088
215731	00	01	.1076[illegible] 00 .100 00 -.0088
215831	00	01	.1076[illegible] 00 .100 00 -.0088
215931	00	01	.1076[illegible] 00 .100 00 -.0088
220031	00	01	.1076[illegible] 00 .100 00 -.0088
220131	00	01	.1076[illegible] 00 .100 00 -.0088
220231	00	01	.1076[illegible] 00 .100 00 -.0088
220331	00	01	.1076[illegible] 00 .100 00 -.0088
220431	00	01	.1076[illegible] 00 .100 00 -.0088
220531	00	01	.1076[illegible] 00 .100 00 -.0088
220631	00	01	.1076[illegible] 00 .100 00 -.0088
220731	00	01	.1076[illegible] 00 .100 00 -.0088
220831	00	01	.1076[illegible] 00 .100 00 -.0088

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

STATION NUMBER 51 [illegible] ITERATION NUMBER [illegible] PASS NUMBER [illegible]

FREQUENCY [illegible]

TIME	DC	D	CC3				
005832	60	51	.10701151	00	.156	00	-.0107
005932	60	51	.10702077	00	.156	00	-.0[illegible]
010032	60	51	.10791006	00	.156	00	.0[illegible]
010132	60	51	.10791913	00	.156	00	-.0117
010232	60	51	.10794063	00	.156	00	-.0107
010332	60	51	.10795796	00	.156	00	-.00[illegible]
010432	60	51	.10796726	00	.156	00	.00[illegible]
010532	60	51	.10797668	00	.156	00	.00[illegible]
010632	60	51	.10798544	00	.156	00	-.0203
010732	60	51	.10799518	00	.156	00	-.0196
010832	60	51	.10800467	00	.156	00	-.0070
010932	60	51	.10801605	00	.156	00	.0081
011032	60	51	.10802965	00	.156	00	-.0[illegible]
011132	60	51	.10803785	00	.156	00	-.0010
011232	60	51	.10804227	00	.156	00	-.0132
011332	60	51	.10805169	00	.155	00	.00[illegible]
011432	60	51	.10806112	00	.155	00	-.00[illegible]
011532	60	51	.10807057	00	.155	00	-.0176
012132	60	51	.10812762	00	.155	00	-.0[illegible]
012432	60	51	.10815547	00	.155	00	-.0176
012532	60	51	.10816550	00	.155	00	.0030
012632	60	51	.10817501	00	.155	00	.0132
012732	60	51	.10818450	00	.155	00	-.00[illegible]
013032	60	51	.10821325	00	.155	00	.0195
013132	60	51	.10822282	00	.155	00	.00[illegible]
013232	60	51	.10823219	00	.155	00	-.00[illegible]
013532	60	51	.10826197	00	.155	00	-.0[illegible]
013632	60	51	.10825156	00	.155	00	.0078
013732	60	51	.10826115	00	.155	00	.00[illegible]
013832	60	51	.10827074	00	.155	00	-.0137
013932	60	51	.10828035	00	.155	00	.0161
014032	60	51	.10830910	00	.155	00	.0[illegible]
014132	60	51	.10831879	00	.155	00	-.00[illegible]
014232	60	51	.10832001	00	.155	00	.0100
014832	60	51	.10838620	00	.156	00	.0102
014932	60	51	.10839584	00	.156	00	-.00[illegible]
015232	60	51	.10842476	00	.156	00	-.0215
015332	60	51	.10843440	00	.156	00	-.0225
015432	60	51	.10844405	00	.156	00	.0000
015532	60	51	.10845369	00	.156	00	-.0203
015632	60	51	.10846334	00	.156	00	.00[illegible]
015732	60	51	.10847298	00	.156	00	.0122
015832	60	51	.10848263	00	.156	00	.0095
015932	60	51	.10849227	00	.156	00	-.0230
020032	60	51	.10850192	00	.156	00	.0122
020132	60	51	.10851156	00	.156	00	-.0030
020232	60	51	.10852120	00	.156	00	-.00[illegible]
020332	60	51	.10853084	00	.156	00	.0250
020432	60	51	.10854048	00	.156	00	-.0157
020732	60	51	.10856930	00	.156	00	.0062
020832	60	51	.10857901	00	.156	00	-.0069
020932	60	51	.10858864	00	.156	00	.0293
021032	60	51	.10859826	00	.156	00	.0001
021332	60	51	.10862711	00	.157	00	-.00[illegible]
021432	60	51	.10863672	00	.157	00	-.0195
021532	60	51	.10864632	00	.157	00	.00[illegible]
021632	60	51	.10865592	00	.157	00	-.0230
021732	60	51	.10866552	00	.157	00	-.0010
021832	60	51	.10867511	00	.157	00	-.00[illegible]
021932	60	51	.10868469	00	.157	00	.0220
022032	60	51	.10869427	00	.157	00	.00[illegible]
022132	60	51	.10870385	00	.157	00	-.0137
022232	60	51	.10871341	00	.157	00	.0010
022332	60	51	.10872298	03	.157	00	-.0117
022432	60	51	.10873253	00	.157	00	.00[illegible]
022532	60	51	.10874208	00	.157	00	.0010
022632	60	51	.10875162	00	.157	00	.00[illegible]
022732	60	51	.10876116	00	.157	00	-.0107
022832	60	51	.10877069	00	.157	00	.0030
022932	60	51	.10878021	00	.157	00	-.0030
023032	60	51	.10878972	00	.157	00	-.0225
023132	60	51	.10879923	00	.157	00	.0[illegible]
023232	60	51	.10880872	00	.157	00	.0130
023332	60	51	.10881821	00	.157	00	.0090
023432	60	51	.10882769	00	.157	00	-.00[illegible]
023532	60	51	.10883716	00	.157	00	.00[illegible]
023632	60	51	.10884662	00	.157	00	-.00[illegible]
023732	60	51	.10885608	00	.157	00	.0[illegible]
023832	60	51	.10886552	00	.157	00	-.00[illegible]
023932	60	51	.10887495	00	.157	00	-.0195
024032	60	51	.10888437	00	.158	00	.0070
024132	60	51	.10889379	00	.158	00	-.0067
024232	60	51	.10890319	00	.158	00	.0[illegible]
024332	60	[illegible]	.10891258	00	.158	00	-.0311
024432	60	51	.10892196	00	.158	00	.00[illegible]
024532	60	51	.10893133	00	.158	00	.00[illegible]
024632	60	51	.10894069	00	.158	00	-.0076
024732	60	51	.10895004	00	.158	00	.00[illegible]
024832	60	51	.10895937	00	.158	00	-.0[illegible]
024932	60	51	.10896869	00	.158	00	.00[illegible]
025032	60	51	.10897800	00	.158	00	.0127
025132	60	51	.10898730	00	.158	00	-.00[illegible]
025232	60	51	.10899659	00	.158	00	-.0371
025332	60	51	.10900586	00	.158	00	.00[illegible]
025432	60	51	.10901512	00	.158	00	-.0[illegible]
025532	60	51	.10902436	00	.158	00	.00[illegible]

FREQUENCY [illegible]

030032	60	51	.10907039	00	.158	00	.0007
030132	60	51	.10907953	00	.158	00	-.0219
030232	60	51	.10908870	00	.158	00	-.00[illegible]
030332	60	51	.10909781	00	.158	00	-.0237
030632	60	51	.10912511	00	.158	00	-.0027

STATION [illegible] 51 [illegible] [illegible] [illegible] 5 [illegible] [illegible] [illegible]

[illegible] [illegible]

TIME	TC	Q		CC3		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

STATION NUMBER 51 04/02/01 INTEGRATION NUMBER 3 PASS NUMBER 01/341

FREQUENCY 8446.4

TIME	PC	Q				
0512:32	00	51	.11007949	00	.104	00	.0166
0513:32	00	51	.11007963	00	.104	00	-.0046
0514:32	00	51	.11008000	00	.104	00	.0047
0515:32	00	51	.11009028	00	.104	00	-.0000
0516:32	00	51	.11009069	00	.104	00	.0010
0517:32	00	51	.11010007	00	.104	00	-.0204
0518:32	00	51	.11010078	00	.104	00	.0215
0519:32	00	51	.11011151	00	.104	00	.0000
0520:32	00	51	.11011622	00	.104	00	-.0182
0521:32	00	51	.11012188	00	.104	00	-.0166
0522:32	00	51	.11012701	00	.104	00	.0059
0523:32	00	51	.11013218	00	.104	00	.0070
0524:32	00	51	.11013716	00	.104	00	-.0203
0525:32	00	51	.11014215	00	.104	00	-.0315
0526:32	00	51	.11014712	00	.104	00	-.0176
0527:32	00	51	.11015204	00	.104	00	-.0000
0528:32	00	51	.11015693	00	.104	00	.0191
0529:32	00	51	.11016177	00	.104	00	-.0030
0530:32	00	51	.11016657	00	.104	00	.0204
0531:32	00	51	.11017131	00	.104	00	-.0242
0532:32	00	51	.11017597	00	.105	00	-.0090
0533:32	00	51	.11018056	00	.105	00	.0010
0534:32	00	51	.11018512	00	.105	00	-.0020
0535:32	00	51	.11018963	00	.105	00	.0020
0536:32	00	51	.11019410	00	.105	00	-.0000
0537:32	00	51	.11019851	00	.105	00	-.0117
0538:32	00	51	.11020290	00	.105	00	.0029
0539:32	00	51	.11020721	00	.105	00	.0000
0540:32	00	51	.11021145	00	.105	00	.0254
0541:32	00	51	.11021565	00	.105	00	-.0000
0542:32	00	51	.11022096	00	.105	00	-.0154
0543:32	00	51	.11022521	00	.105	00	-.0146
0544:32	00	51	.11022943	00	.105	00	-.0146
0545:32	00	51	.11023360	00	.105	00	.0027
0546:32	00	51	.11023773	00	.105	00	.0000
0547:32	00	51	.11024182	00	.105	00	-.0171
0548:32	00	51	.11024586	00	.105	00	-.0001
0549:32	00	51	.11024984	00	.105	00	.0000
0550:32	00	51	.11025381	00	.105	00	-.0010
0551:32	00	51	.11025772	00	.105	00	.0004
0552:32	00	51	.11026158	00	.105	00	-.0000

STATION NUMBER 51 04/02/01 PASS NUMBER 02/341

FREQUENCY 8446.2

TIME	PC	Q				
2355:32	00	51	.10910122	00	.196	00	-.0019
2356:32	00	51	.10910967	00	.196	00	.0003
2357:32	00	51	.10920814	00	.196	00	-.0027
2358:32	00	51	.10920965	00	.196	00	-.0006
2359:32	00	51	.10921919	00	.196	00	-.0071

04/02/02

0002:32	00	51	.10924796	00	.197	00	.0026
0003:32	00	51	.10925761	00	.197	00	-.0000
0004:32	00	51	.10926720	00	.197	00	.0000
0005:32	00	51	.10927679	00	.197	00	.0000
0006:32	00	51	.10928633	00	.197	00	-.0017
0007:32	00	51	.10929600	00	.197	00	.0027
0008:32	00	51	.10930577	00	.197	00	-.0004
0009:32	00	51	.10931560	00	.197	00	-.0017
0010:32	00	51	.10932549	00	.197	00	-.0000
0011:32	00	51	.10933541	00	.197	00	-.0017
0012:32	00	51	.10934536	00	.197	00	-.0000
0013:32	00	51	.10935533	00	.197	00	.0071
0014:32	00	51	.10936531	00	.197	00	.0000
0015:32	00	51	.10937531	00	.197	00	-.0002
0016:32	00	51	.10938530	00	.197	00	-.0002
0017:32	00	51	.10939527	00	.197	00	.0004
0018:32	00	51	.10940520	00	.197	00	-.0001
0019:32	00	51	.10941507	00	.197	00	.0004
0020:32	00	51	.10942477	00	.197	00	-.0001
0021:32	00	51	.10943440	00	.197	00	-.0003
0022:32	00	51	.10944394	00	.197	00	.0000
0023:32	00	51	.10945341	00	.197	00	-.0014
0024:32	00	51	.10946281	00	.197	00	-.0003
0025:32	00	51	.10947213	00	.197	00	.0000
0026:32	00	51	.10948137	00	.197	00	-.0004
0027:32	00	51	.10949054	00	.197	00	-.0000
0028:32	00	51	.10949963	00	.197	00	-.0004
0029:32	00	51	.10950865	00	.197	00	-.0003
0030:32	00	51	.10951759	00	.197	00	.0000
0031:32	00	51	.10952644	00	.197	00	-.0000
0032:32	00	51	.10953522	00	.197	00	.0010
0033:32	00	51	.10954391	00	.197	00	-.0000
0034:32	00	51	.10955253	00	.197	00	-.0000
0035:32	00	51	.10956107	00	.197	00	.0000
0036:32	00	51	.10956953	00	.197	00	.0010
0037:32	00	51	.10957791	00	.197	00	.0000
0038:32	00	51	.10958621	00	.197	00	.0000
0039:32	00	51	.10959443	00	.197	00	-.0010
0040:32	00	51	.10960257	00	.197	00	.0000
0041:32	00	51	.10961063	00	.197	00	.0000
0042:32	00	51	.10961861	00	.198	00	.0000
0043:32	00	51	.10962650	00	.198	00	-.0000
0044:32	00	51	.10963431	00	.198	00	.0000
0045:32	00	51	.10964203	00	.198	00	.0000
0046:32	00	51	.10964967	00	.198	00	-.0000
0047:32	00	51	.10965722	00	.198	00	.0000
0048:32	00	51	.10966469	00	.198	00	.0000
0049:32	00	51	.10967207	00	.198	00	.0000
0050:32	00	51	.10967935	00	.198	00	.0000
0051:32	00	51	.10968656	00	.198	00	-.0000
0052:32	00	51	.10969368	00	.198	00	.0000
0053:32	00	51	.10970071	00	.198	00	.0000
0054:32	00	51	.10970765	00	.198	00	-.0000
0055:32	00	51	.10971451	00	.198	00	-.0000
0056:32	00	51	.10972128	00	.198	00	-.0000
0057:32	00	51	.10972797	00	.198	00	.0000
0058:32	00	51	.10973457	00	.198	00	.0000
0059:32	00	51	.10974109	00	.198	00	.0000
0100:32	00	51	.10974752	00	.198	00	.0000
0101:32	00	51	.10975386	00	.198	00	.0000

STATION NUMBER 51 [illegible] ITERATION NUMBER [illegible] PASS NUMBER [illegible]

FREQUENCY [illegible]

TIME	TC	O	CCS			
[illegible]	[illegible]	51	[illegible]	[illegible]	[illegible]	[illegible]

STATION NUMBER 14 [illegible] STATION NUMBER 1 PASS NUMBER [illegible]

FREQUENCY [illegible]

TIME	DC	Q	CLS		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

FREQUENCY [illegible]

TIME	DC	Q	CLS		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

STATION NUMBER 51 [illegible] ESTIMATION NUMBER 3 PASS NUMBER 01/011

FREQUENCY 8000.0

TIME	SC	O	CCD
[illegible]	60	51	[illegible]
[illegible]	60	51	[illegible]
[illegible]	60	51	[illegible]
[illegible]	60	51	[illegible]
[illegible]	60	51	[illegible]
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[illegible]	60	51	[illegible]

DATA STATISTICS STATION 5 ESTIMATION 3

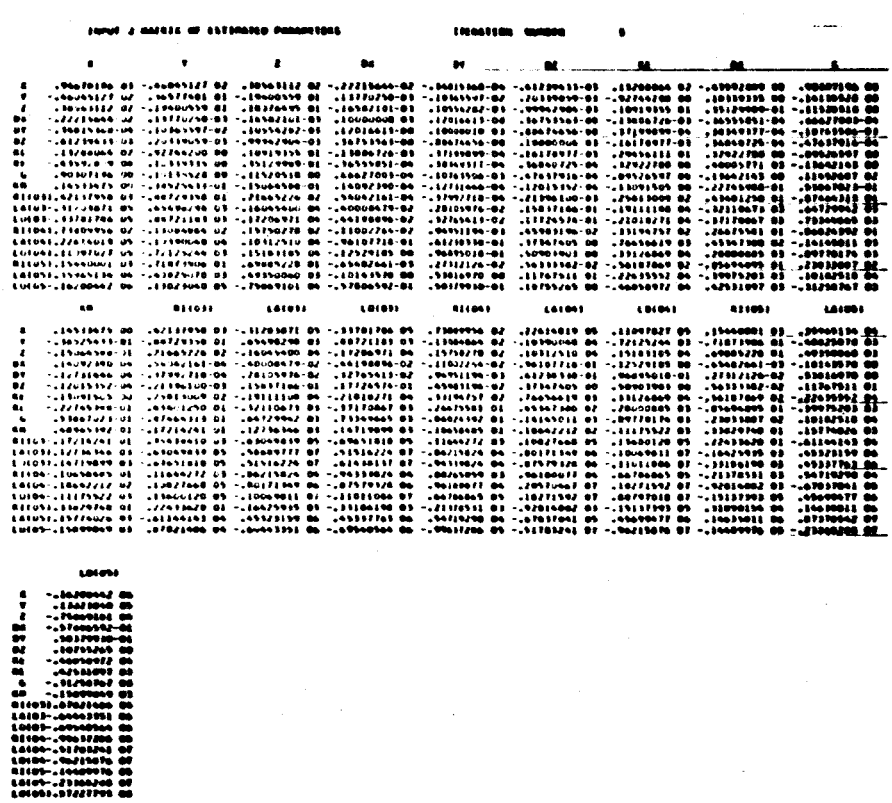
PASS	DATA TYPE	BEGINNING TIME	END TIME	NUMBER OF POINTS	STD DEV	BIAS	FIRST MOMENT	SECOND MOMENT
01/011	CCD	1731-210632	2701-055532	307	.276-01	.277-01	-.100-02	.767-03
02/011	CCD	2701-215532	2702-055532	264	.473-01	.473-01	-.[illegible]-02	.[illegible]-02

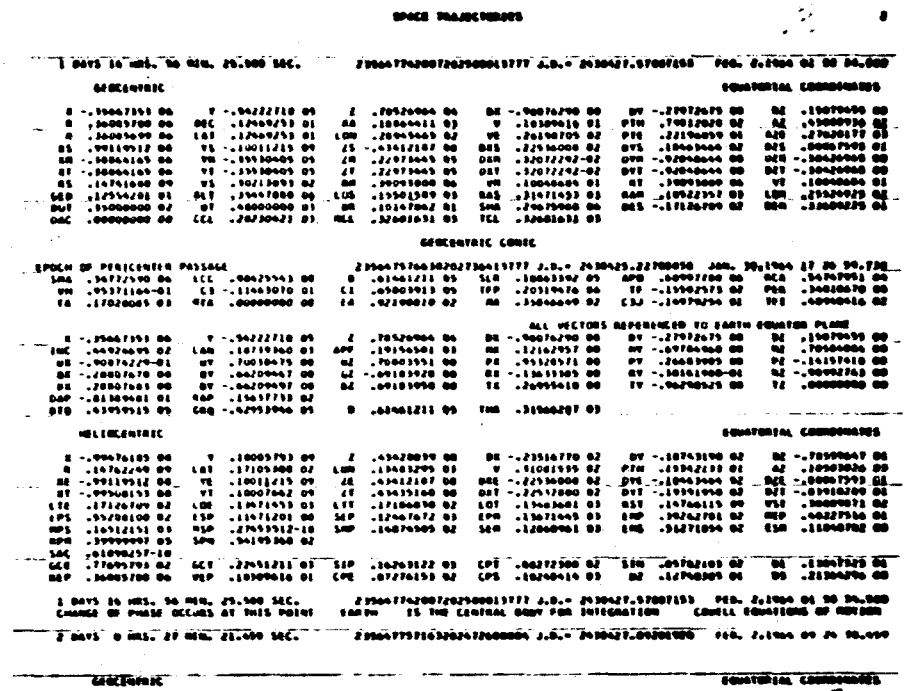
INPUT COVARIANCE MATRIX OF ESTIMATED PARAMETERS ESTIMATION NUMBER 3

	X	Y	Z	DX	DY	DZ	DS	DR	S
X	.[illegible]	.[illegible]	.[illegible]	-.[illegible]	.[illegible]	-.[illegible]	.[illegible]	.[illegible]	-.[illegible]
Y	.[illegible]	.[illegible]	.[illegible]	-.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]
Z	-.[illegible]	-.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	-.[illegible]	-.[illegible]	.[illegible]
DX	-.[illegible]	-.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	-.[illegible]	.[illegible]	.[illegible]
DY	.[illegible]	.[illegible]	-.[illegible]	-.[illegible]	.[illegible]	-.[illegible]	.[illegible]	.[illegible]	.[illegible]
DZ	-.[illegible]	-.[illegible]	.[illegible]	.[illegible]	-.[illegible]	.[illegible]	.[illegible]	-.[illegible]	-.[illegible]
DS	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]
DR	-.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]
S	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]
RI(03)	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]
LA(03)	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]
LO(03)	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]
RI(04)	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]
LA(04)	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]
LO(04)	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]

	DR	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	-.[illegible]	-.[illegible]	-.[illegible]	-.[illegible]	.[illegible]	-.[illegible]	-.[illegible]	-.[illegible]	-.[illegible]
Y	-.[illegible]	.[illegible]	-.[illegible]	-.[illegible]	.[illegible]	-.[illegible]	-.[illegible]	.[illegible]	.[illegible]
Z	.[illegible]	.[illegible]	.[illegible]	.[illegible]	-.[illegible]	.[illegible]	.[illegible]	-.[illegible]	-.[illegible]
DX	.[illegible]	-.[illegible]	.[illegible]	-.[illegible]	.[illegible]	-.[illegible]	.[illegible]	-.[illegible]	.[illegible]
DY	-.[illegible]	.[illegible]	.[illegible]	-.[illegible]	.[illegible]	-.[illegible]	.[illegible]	.[illegible]	.[illegible]
DZ	.[illegible]	-.[illegible]	.[illegible]	.[illegible]	-.[illegible]	.[illegible]	.[illegible]	-.[illegible]	-.[illegible]
DS	.[illegible]	-.[illegible]	-.[illegible]	-.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]
DR	-.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]
S	-.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]
RI(03)	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]
LA(03)	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]
LO(03)	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]
RI(04)	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]
LA(04)	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]
LO(04)	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]	.[illegible]

	LO(05)
X	-.[illegible]
Y	-.[illegible]
Z	.[illegible]
DX	.[illegible]
DY	-.[illegible]
DZ	.[illegible]
DS	-.[illegible]
DR	-.[illegible]
S	-.[illegible]
RI(03)	-.[illegible]
LA(03)	.[illegible]
LO(03)	.[illegible]
RI(04)	-.[illegible]
LA(04)	.[illegible]
LO(04)	.[illegible]
RI(05)	-.[illegible]
LA(05)	.[illegible]
LO(05)	.[illegible]





CASE 1

SPACE TRANSFORMS

ALL VECTORS REFERENCED TO TRUE LUNAR EQU. PLANE

U MATRIX FOR MAPPING FORWARD

ITERATION NUMBER 1

COVARIANCE MATRIX AT IMPACT — TRANSFORM MATRIX B

	X	Y	Z	DX	DY	DZ	DX	DY	DZ
X	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Y	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Z	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DZ	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DZ	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B1101	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L1101	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L1101	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B1101	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L1101	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L1101	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L1101	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L1101	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	DX	B1101	L1101	L1101	B1101	L1101	L1101	B1101	L1101
X	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Y	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Z	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DZ	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DZ	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B1101	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L1101	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L1101	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B1101	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L1101	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L1101	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	L1101
X	[illegible]
Y	[illegible]
Z	[illegible]
DX	[illegible]
DY	[illegible]
DZ	[illegible]
DX	[illegible]
DY	[illegible]
DZ	[illegible]
B1101	[illegible]
L1101	[illegible]
L1101	[illegible]
B1101	[illegible]
L1101	[illegible]
L1101	[illegible]

IMPACT PARAMETERS 04/02/02 [illegible]

B MATRIX (TGT. - ORBITAL PLANE)

	B.R.	B.T	TL	CD	B.T	B.R
B.R	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B.T	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B.T	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B.R	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

NORMALIZED B MATRIX

	B.R	B.T	TL	CD	B.T	B.R
B.R	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B.T	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B.T	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B.R	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

INVERSE MATRIX

	B.R	B.T	TL	CD	B.T	B.R
X	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Y	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Z	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DZ	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

B	[illegible]
B.DD	[illegible]
B.TD	[illegible]
B.DT	[illegible]
B.TT	[illegible]
DL	[illegible]
SMAA	[illegible]
SMIA	[illegible]
ENCSA	[illegible]
DEL T	[illegible]
DEL D	[illegible]
DEL S	[illegible]
DP	[illegible]

B MATRIX (TARGET EQUATORIAL PLANE)

	B.DT	B.TT	DL
B.DT	[illegible]	[illegible]	[illegible]
B.TT	[illegible]	[illegible]	[illegible]
DL	[illegible]	[illegible]	[illegible]

APPENDIX I

ODP Format Description

Block No. references are to Appendixes G and H. All units are in kilometers and seconds unless otherwise specified.

Block No. 1	Control card input.
Block No. 2	The normal equation coefficients combined with the a priori matrix.
Block No. 3	Correlation matrix on normal equations.
Block No. 4	Inverse of the a priori covariance matrix of estimated parameters.
Block No. 5	See the next page of this Appendix for an explanation of the format.
Block No. 6	Covariance matrix of estimated parameters or inverse of Block No. 4.
Block No. 7	Correlation matrix of estimated parameters.
Block No. 8	Residual page for a particular station (see next page for format explanation).

The block following the residuals has statistics on the previous residuals (self explanatory). The sheets following the statistics will have more residuals and statistics from other tracking stations.

The next block is a short printout of the trajectory based on the converged estimated parameters and is run out to lunar encounter (impact or closest approach). (See Appendix F for explanation.)

Following the trajectory printout is the U matrix which maps the covariance matrix at epoch to maneuver epoch or encounter. Immediately below the U matrix is the covariance matrix on the estimated parameters at impact or closest approach epoch. This is formed by mapping the covariance matrix at injection to impact in double precision.

The sheet following the covariance matrix contains three blocks. The first block is a covariance matrix N formed by mapping the upper 6×6 matrix of the covariance of impact into a new coordinate system (explained in Appendix C of this Report) (σ^2_{TL} is in hr^2). The second block is simply the correlation matrix of the first block covariance matrix. The third block is a mapping matrix which maps injection components into the B·T, B·R, etc., system.

B = The vector measured from the center of the Moon perpendicular to the incoming asymptote (in kilometers).

B·RO = The B vector dotted on the R axis in km (T axis in the Moon's orbital plane).

B·TO = The B vector dotted on the R axis in km (T axis in the Moon's orbital plane).

B·RT = The B vector dotted on the R axis in km (T axis in the equatorial plane of the Moon).

B·TT = The B vector dotted on the T axis in km (T axis in the equatorial plane of the Moon).

TL = Linearized time of flight in hours.

SMAA = The largest eigenvalue of the upper 2×2 of the N matrix (commonly called the semimajor axis of a 40% dispersion ellipse in the B plane).

SMIA = The semiminor axis of the dispersion ellipse or the other eigenvalue of the upper 2×2.

THETA = The orientation angle of the semimajor axis of the dispersion ellipse measured counterclockwise from the T axis.

DEL T = Uncertainty in the time of flight in sec.

DEL B = $(N_{11} + N_{22})^{1/2}$, where N's are from the first block of this sheet.

DEL S = V_∞ (*DEL T*) the position uncertainty in the direction of the incoming asymptote, where V_∞ = hyperbolic excess velocity in km/sec.

TF = Time of flight in hours from initial epoch to encounter.

Below this is the upper 3×3 of the N matrix rotated with the T axis in the target equatorial plane rather than in the target orbital plane.

BLOCK 5

JOB TITLE

Iteration number	Epoch		year/month/day	XX XXX XX	Clock XXXXXX	SOS* XXXXX QSOS** XXXXX
	GMT			hr min sec	(PC time now) hr min sec	Floating pointing numbers
Q	DQ	STDEVDQ	OLD Q	NEW Q	NOMINAL Q	DQ (NOM)
X, Y, Z = Position space fixed Cartesian component in km DX, DY, DZ = Velocity space-fixed Cartesian in km/sec RI = Radius in km KE = $GM_{\oplus}$ in km^3/sec^2 LA = Latitude in deg RE = Radius of Earth to scale ephemeris in km LO = Longitude in deg KM = $GM_{☾}$ in km^3/sec^2	Difference in estimated parameters from previous iteration and this iteration	Standard deviations on estimated parameters	Value of estimated parameters from previous iteration (Initial estimate on 1st iteration)	Value of estimated parameters on this iteration	Initial estimate of parameters	Total difference in new Q and nominal Q

*Weighted sum of the squares of the residuals.

**Weighted sum of the squares of the residuals plus the product $\delta x^T \Gamma^{-1} \delta x$ where δx is the difference in the a priori Q and the value of Q on the particular iteration and Γ is an a priori covariance on Q.

BLOCK 8—Residual Format

GMT	*TC*	Q	*FRQ*	*CC3* (HA or Dec)		
XX XX XX	X	X	XXXX.X	.XXXXXXXX XX	.XXX XX	.XXXX*
hr min sec	Doppler count time in sec	Transmitting station	Last digits in transmitter frequency 2966 XXXX.X in cps	Two-way doppler (CC3) value in cps, or hour angle in deg or declination in deg (floating point number)	Associated weight in floating point	Residual (observed minus calculated) in cps

*Data have been deleted from the fit.

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