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Technical Report 32-767

The Ranger IX Flight Path and Its Determination From Tracking Data

C. J. Vegos
F. Borncamp
A. S. Liu
E. G. Piaggi
D. W. Trask
R. A. Wallace

PROPERTY OF NORTHROP INSTITUTE OF TECHNOLOGY

JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY
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Preface

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Abstract

This report describes the current best estimate of the *Ranger IX* spacecraft flight path and the method used to analyze the tracking data. Deep Space Instrumentation Facility tracking of the spacecraft was virtually continuous from injection to lunar impact. TV photos of the lunar surface were received at the Goldstone Tracking Station during the last 18 min before impacting the moon. The lunar surface that was photographed was the area of the crater Alphonsus. Postflight analysis of the tracking data resulted in valuable determination of the masses of the earth and the moon, tracking station locations, lunar ephemeris scale factor, and lunar radius of the *Ranger IX* is known to within 0.5 km on the surface of the moon.

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The *Ranger IX* Flight Path and Its Determination From Tracking Data

I. Introduction

This report describes the current best estimate of the *Ranger IX* spacecraft flight path and the way in which the flight path 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 determination of the masses of the earth and the moon, tracking station locations, lunar ephemeris scale factor, and radius of the moon at the *Ranger IX* impact point. The impact location of *Ranger IX* was determined to within 3 km, using the standard deviation as a measure of uncertainty.

The primary objective of the *Ranger* Block III (*Rangers VI–IX*) flights was to obtain TV pictures of the lunar surface. These pictures will be of benefit to both the scientific program and the U.S. manned lunar flight program. The *Ranger IX* spacecraft, which was launched from Cape Kennedy on March 21, 1965 and which, 64 h 31 min later, impacted the moon on target, accomplished its primary objective. The flight, as did *Rangers VI, VII,* and *VIII,* dramatically demonstrated the capabilities of earth-based radio guidance, and postflight analysis provided significant information in the determination of the physical constants previously mentioned.

During the launch phase, the *Atlas* and *Agena* stages performed within tolerance and injected the spacecraft into an impact trajectory approximately 17 deg north of the original aiming point. The crater Alphonsus was selected as the area of impact, since it had favorable lunar surface lighting conditions and the terrain was of special interest. Thirty-nine hours after launch, a near-perfect midcourse maneuver was executed. The resultant impact point was 6 km from the chosen target. This difference was well within the expected error due to the uncertainties in the orbit at the time of the maneuver and the tolerance 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 the 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), *Mariner IV* (Mars), and previous *Ranger* missions. The determination of the lunar radius at the *Ranger IX* impact point is also presented. The final TV pictures serve as an independent check on the lunar impact point as estimated from the orbit determination process.

Section III discusses the operational considerations associated with the midcourse 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 the expected tolerances.

Section IV summarizes the key spacecraft events for the mission, and describes the *Ranger IX* orbit in terms of its trajectory parameters near the earth, in translunar flight, and near the moon.

Section V describes the Air Force Eastern Test Range (AFETR) tracking of the *Agena* launch vehicle. The AFETR orbit analysis is divided into three parts: (1) the parking orbit, (2) the postinjection but pre-retrorocket phase, during which the spacecraft was still attached to the *Agena*, and (3) the post-retrorocket orbit of the *Agena*.

Section VI summarizes the key events in the DSIF tracking of the *Ranger IX* mission and gives a general description of the Deep Space Stations (DSS) of the DSIF and DSIF tracking modes. The determination of the lunar radius at the *Ranger IX* 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.

II. Analysis of DSIF Transponder Tracking Data

A. Introduction

The purpose of this section is to present the technique used in analyzing the *Ranger IX* data. The best estimate of the *Ranger IX* spacecraft flight path is presented along with the physical constant solutions derived from the DSIF tracking data. A comparison is made among the physical constant solutions obtained from the individual missions, *Rangers III* through *IX*, as well as *Mariner II* (Venus) and *Mariner IV* (Mars). In general, the degree of agreement among solutions is good.

The DSIF data are divided into two distinct blocks: (1) data obtained prior to the midcourse maneuver correction, and (2) data obtained from midcourse maneuver correction to lunar impact. The data are combined using pre-midcourse maneuver correction data as *a priori* to the post-midcourse maneuver data and vice versa. All results are consistent within themselves and each other.

The initial real-time estimate of the *Ranger IX* spacecraft orbital elements and initial DSIF acquisition information were provided by AFETR. These elements were obtained from tracking the *Agena* vehicle C-band transponder during the period from injection into lunar transfer orbit to *Agena*–spacecraft separation by the AFETR tracking stations. The AFETR tracking data were not used for the flight path determination results presented in this section. A complete discussion of the AFETR data is presented in Section V.

B. Summary of Data Used in Orbit Determination

During the *Ranger IX* flight, the DSIF tracking stations provided continuous tracking data starting about 10 min after transfer orbit injection until lunar impact. Figures 1 and 2 summarize the tracking station view periods and their data coverage for the entire mission. Figures 3, 4, and 5 are tracking station stereographic projections that show the trace of the spacecraft trajectory for the view periods shown in Figs. 1 and 2. A more complete sequence of tracking events and ground station tracking modes is described in Section IV.

Table 1 summarizes the tracking data used for both inflight and postflight analyses. The table is a performance summary of the data recording and data handling systems. The total number of points received from each station is shown in column 3. Columns 5, 6, and 7 are the number of data points rejected by the JPL Tracking Data Editing Program (TDEP), described in Ref. 1. The TDEP edits all incoming tracking data, and prepares a data tape for input to the Orbit Determination Program (ODP), described in Ref. 2. The points in column 5 are the result of applying a doppler differencing test to detect gross errors. Whenever a data point is rejected by the differencing test, the following data point will automatically fail the differencing test and be rejected. Also, a point rejected because of the data condition code, or a counter restart, will cause an adjacent data point to be lost (column 6).

During the flight operations, no attempt is made to reconstruct data points which are rejected for bad format or data condition code. A data point is given a bad data condition code when automatic detectors at the tracking station sense that the data would be unusable. These detectors have manual overrides that are used whenever an equipment malfunction is suspected, and during peiods when the transmitter is being retuned prior to sending commands to the spacecraft or transferring transmitting assignments to another station (column 7).

The blunder points shown in column 8 of Table 1 result from applying the rejection limits presented in column 9.

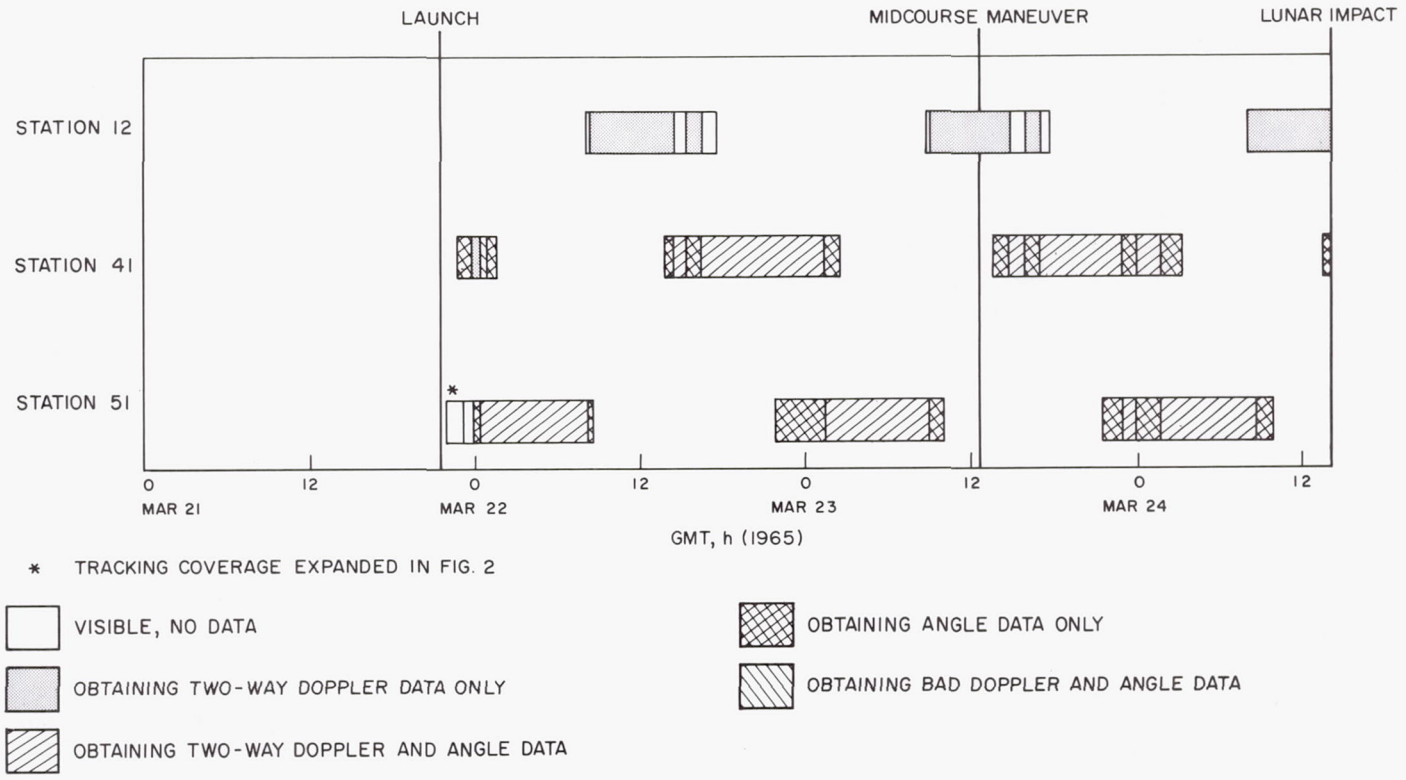


Fig. 1. *Ranger IX* tracking station view periods and data coverage

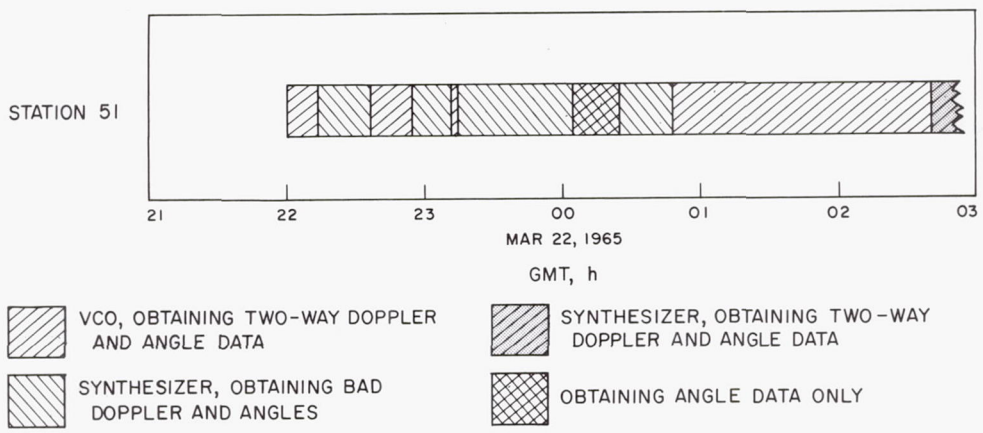


Fig. 2. Tracking coverage for Station 51 from launch to launch plus 5½ h

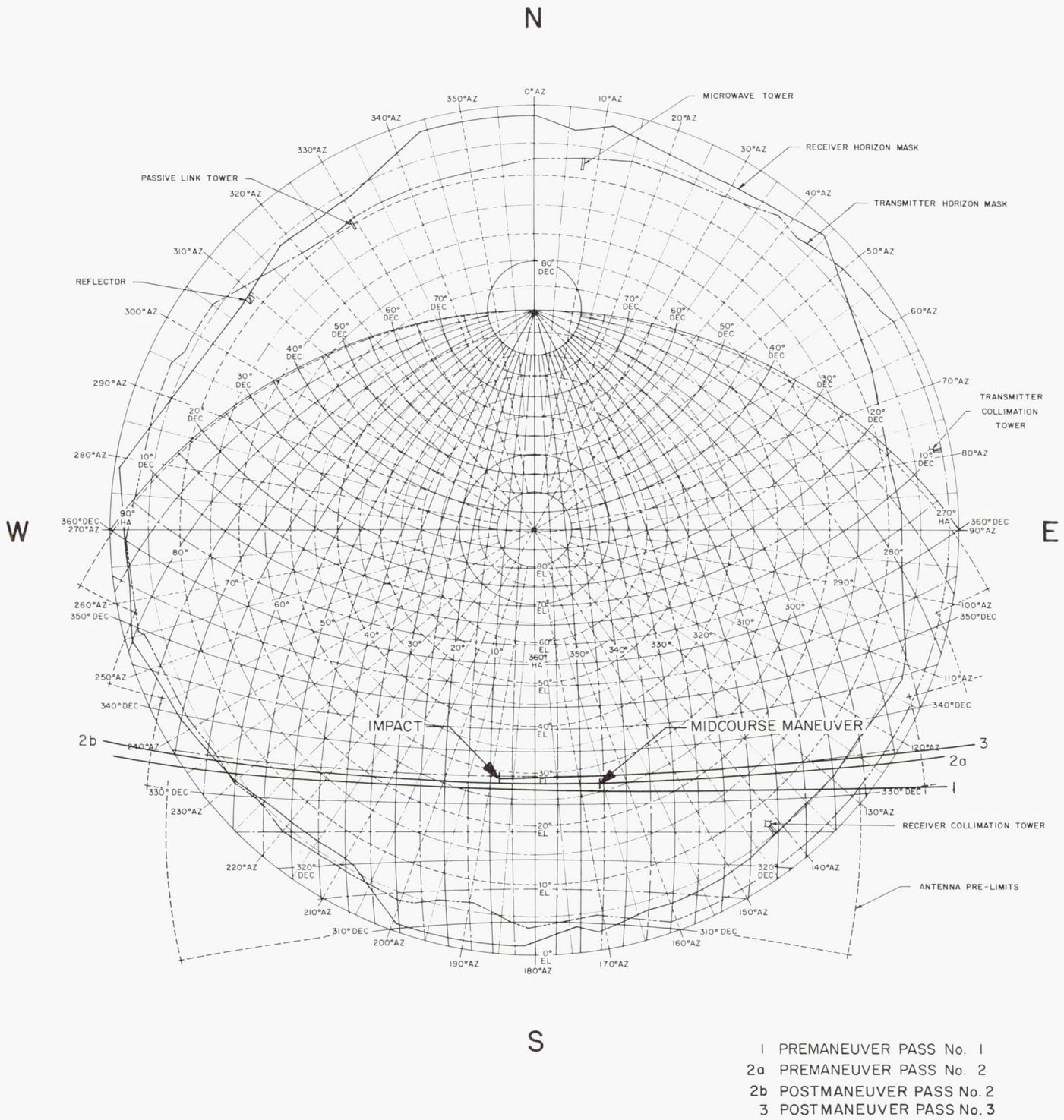


Fig. 3. Station 12 trajectory trace

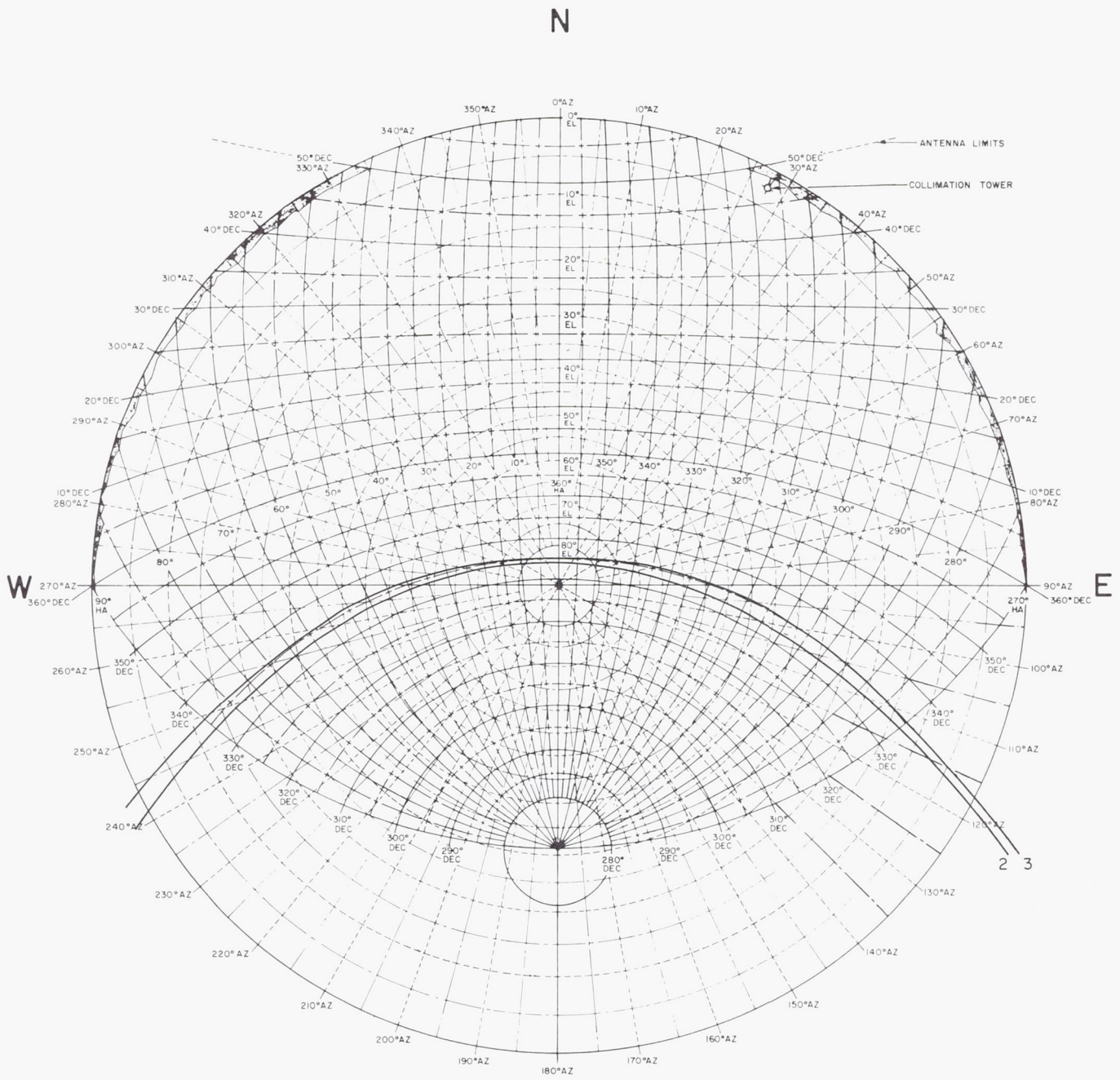


Fig. 4. Station 41 trajectory trace

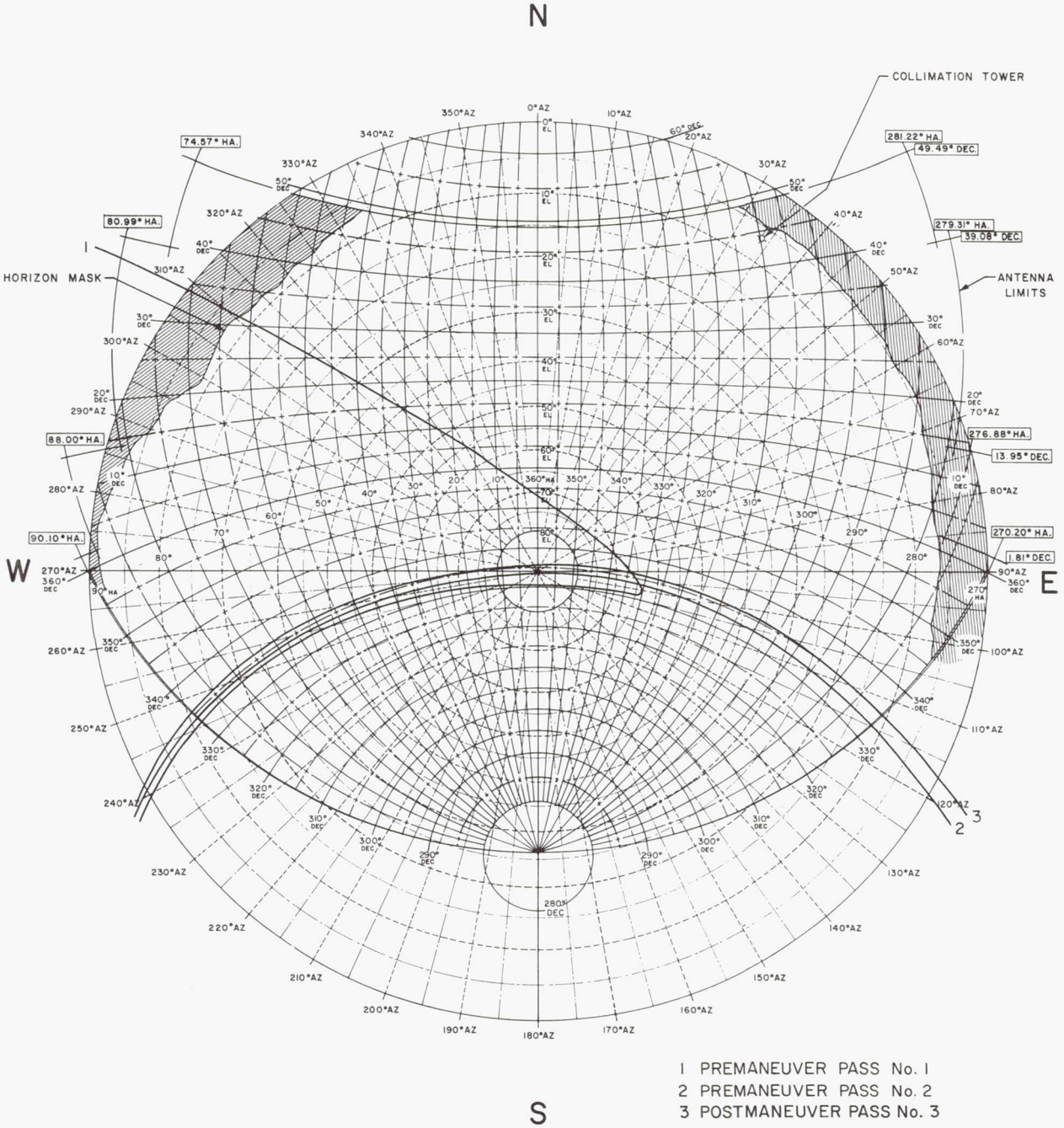


Fig. 5. Station 51 trajectory trace

Table 1. Summary of data used to determine orbit

(1) Station (Pass No.)	(2) Data type	(3) Points received[a]	(4) Number of points used in real time/ (% of received)	(5) Bad format/ (% of received)	(6) Points lost due to bad adjacent point/(% of received)	(7) Bad data condition code/(% of received)	(8) Blunder points/(% of received)	(9) Rejection limits on blunder points	(10) Points used in postflight analysis obtained from tapes[b]
Premidcourse maneuver									
12 (1)	2-way doppler	409	373/(91.2)	5/(1.2)	6/(1.5)	16/(3.9)	2/(0.5)	0.2 Hz	375
12 (2)	2-way doppler	341[c]	165/(48.4)	0/(0.0)	4/(1.2)	10/(2.9)	6/(1.8)	0.2 Hz	165
41 (1)	2-way doppler HA, dec	99 0	30/(30.3) 0/(0.0)	4/(4.0) 0/(0.0)	8/(8.1) 0/(0.0)	36/(36.4) 0/(0.0)	6/(6.1) 0/(0.0)	0.2 Hz	0
41 (2)	2-way doppler HA, dec	594 691	469/(79.0) 526/(76.2)	48/(8.1) 51/(7.4)	38/(6.4) 40/(5.8)	22/(3.7) 24/(3.5)	4/(0.7) 2/(0.3)	0.2 Hz 0.3 deg 0.1 deg	468
51 (1)	2-way doppler HA, dec	2863 2923	484[d]/(80.1) 1897/(64.9)	58/(2.0) 62/(2.1)	73/(2.5) 66/(2.3)	46/(1.6) 56/(1.9)	38/(1.3) 6/(0.2)	0.4 Hz 0.3 deg 0.1 deg	542
51 (2)	2-way doppler HA, dec	433 711[e]	346/(80.0) 0/(0.0)	20/(4.6) 36/(5.1)	17/(3.9) 27/(3.8)	6/(1.4) 36/(5.1)	3/(0.7) 1/(0.1)	0.2 Hz	337
Postmidcourse maneuver									
12 (2)	2-way doppler	301[f]	156/(51.8)	2/(0.7)	2/(0.7)	18/(6.0)	10/(3.3)	0.2 Hz	186
12 (3)	2-way doppler	585[g]	165/(28.2)	1/(0.2)	7/(1.2)	21/(3.6)	0/(0.0)	0.2 Hz	270
41 (3)	2-way doppler	557	465/(83.5)	10/(1.8)	15/(2.7)	64/(11.5)	3/(0.5)	0.2 Hz	481
51 (3)	2-way doppler	498	425/(85.3)	11/(2.2)	22/(4.4)	31/(6.2)	2/(0.4)	0.2 Hz	426

[a]Unless otherwise specified, these numbers pertain to a 60-s data sample spacing.

[b]Data points are obtained from station data tapes to avoid transmission error.

[c]Includes 164 points of 10-s data taken during spacecraft reorientation prior to midcourse motor ignition. These data were not excluded in postflight orbit computations.

[d]Data were compressed to 60-s. Of the 2863 data points received, 2702 data points were 10-s samples.

[e]Angle data points are not usually used for orbit computations during the station's second pass.

[f]Includes 85 points of 10-s data taken during spacecraft reorientation after midcourse maneuver.

[g]Includes 336 points of 10-s data taken prior to spacecraft impact of lunar surface.

These limits are based on experience gained in previous missions, and on the philosophy that it is better to immediately reject questionable points, which could cause difficulties in converging to an orbit, than to attempt to salvage every point. Further explanation of the flight path analysis operations and policies is presented in Ref. 3.

The data shown in column 10 of Table 1 were obtained from the data tapes punched at the stations and mailed to JPL at the conclusion of each tracking pass. The data tapes were converted to cards and used as input to the postflight analysis. No data were used in the postflight analysis for the first pass of DSS 41 (Woomera, Australia) as shown by the zero value in column 10. The reason for this change was that, during the first pass, DSS 41 did not obtain two-way lock on the spacecraft (the spacecraft was not above the minimum elevation angle of 5 deg). During the flight, it was determined that the data obtained from DSS 41 would aid in the determination of the orbit, since, during the first 9 h of flight, the only other tracking data available was obtained from DSS 51 (Johannesburg, South Africa). During the postflight analysis, it was determined that the low-elevation data from

DSS 41 was questionable and should be omitted from the orbit computations.

Column 3 of Table 1 indicates the number of points received. It should be noted that, during most of the first pass of DSS 51, the sample rate is one sample every 10 s. The nominal sample rate is one sample every 60 s, except during high acceleration and powered flight. DSS 51 maintained a 10-s sample rate for the first 5 h of flight due to synthesizer difficulties, which were corrected. Section VI explains this difficulty and Fig. 2 indicates the tracking coverage during this period.

C. Data Weighting and Error Source

The weighting scheme[1] used in the Orbit Determination Program considers all known error sources to determine the "effective variance." The expression used to compute the effective variance σ^2 for weighting an individual data point is

$$\sigma^2 \triangleq \sum_{i=1}^{6} s_2 \, g_i^2 \max\left\{1, \frac{T_{\text{correlation}}}{T_{\text{sample}}}\right\}$$

where

i = basic error source

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

$g_i^2 \triangleq$ sensitivity coefficient

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

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

The error sources for two-way doppler are:

(1) Error due to trajectory computations caused by round-off error in Cowell integration method (Ref. 3).

(2) Doppler counter rounding error caused by the start and stop gate pulse not occurring at times such that an integral number of cycles has passed.

(3) Transmitter drift arising from an unstable oscillator. The reference frequency is controlled by a temperature stabilized, voltage controlled oscillator (VCO) or a frequency synthesizer (SYNTHESIZER) driven by a rubidium frequency standard. The drift rate is 1 part in 10^8/15 min for the VCO, and 3 parts in 10^{11}/h for the rubidium standard.

(4) Dropped or added cycles 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 corrections due to differences between the atmospheric model used in the calculations and the actual atmosphere at a given time.

(6) Spacecraft antenna motion caused by spacecraft tumbling or stabilization motion.

The error sources associated with hour angle (HA) and declination (dec) are:

(1) Angle jitter in electrical axis or variation about the aiming point caused by the antenna drive servomechanisms.

(2) Angle correction errors caused by differences between the empirical correction model, which is based on the antenna optical axis, and the RF pointing axis.

(3) Readout error caused by the encoder system inaccuracies in compensation cams. Resolution is plus or minus one count, which corresponds to 0.002 deg.

(4) Refraction correction errors due to the difference between the atmospheric model used in the ODP and the actual atmosphere at any given time.

The manner in which the error sources enter into the weighting scheme may be seen in the expression for computing the effective variance σ^2 for weighting a given data point. Table 2 shows the functional form of the sensitivity coefficients associated with hour angle, declination, and two-way doppler.

The contribution to the total weight due to spacecraft tumbling was considered to be zero, since the only tumbling occurred between injection at 21:49:48 GMT and sun acquisition at 22:47:30 GMT. During this period, 17 min of usable data from DSS 51 was used in determining the orbit. Data taken while the spacecraft was in the cruise mode maintaining sun-earth lock indicated that the effect on doppler due to tumbling was less than 0.1 Hz. From this data, it can be concluded that the spacecraft orientation was such that the tracking station observed very little spacecraft antenna motion.

[1]T. W. Hamilton, "*Mariner R* ODP-TDEP: *a priori* Weighting Coefficients," Apr. 12, 1962 (internal communication).

Table 2. Sensitivity coefficient g_i for HA, dec, and two-way doppler

Error source	Sensitivity coefficient		
	Hour angle	Declination	Two-way doppler
1	1/cos (dec)	1	1
2	1	1	$1/T_c$
3	1	1	ρ/c
4	Δr(HA)	Δr(dec)	$1/(3T_c)^{1/2}$
5	—	—	$\Delta r\dot{\rho}$
6	—	—	1

$$\Delta r(\mathrm{HA}) = \frac{\cos\phi \sin^2(\mathrm{HA})}{\cos^2\gamma \sin\sigma} (\Delta r\,\gamma)$$

$$\Delta r(\mathrm{dec}) = \frac{\cos\gamma \sin\phi - \sin\gamma \cos\phi \cos\sigma}{\cos(\mathrm{dec})} (\Delta r\,\gamma)$$

ϕ = geocentric latitude of tracking station

γ = elevation angle

σ = azimuth angle

$\Delta r\gamma$ = refraction correction for elevation angle

= $57.2957795\, n\, b_1 b_2/340.0$, for $\gamma < 0.3$ rad

= $57.2957795\, n \times 10^{-6} \cot\gamma$, for $\gamma \geq 0.3$ rad

n = index of refraction, nominally 340.0

$b_1 = 1.0 - (1.216 \times 10^5 b_3\,\gamma) - (51.0 - 300.0\,\gamma)(b_3)^{1/2}$

$b_2 = [7.0 \times 10^{-4}/(0.0589 + \gamma)] - 1.26 \times 10^{-3}$

$b_3 = 1/10^3 (r - RE)$

RE = earth radius

$\Delta r\dot{\rho} = 0.0018958\, [(\sin A + 0.06483)^{-1.4} - (\sin B + 0.06483)^{-1.4}]\, n/340.0$

$A = \gamma + T_c\,\dot{\gamma}/2$

$B = \gamma - T_c\,\dot{\gamma}/2$

T_c = doppler count interval, s

ρ = range from station to spacecraft

In Table 3, it may be seen that the effect on the total weight for the doppler counter error sources (round and added or dropped cycles) may be minimized by using a long-counting time. The DSIF stations take continuous count doppler with a dual-counter system; that is, one counter continuously counts cycles that have passed from some known start time. When the continuous counter receives a pulse to supply a doppler sample, it transfers its contents to another counter without interrupting its counting action. The contents of the second counter are then translated from binary-coded decimal to decimal and punched onto a paper tape. Doppler refraction correction (error source 5) is not a predominant error source, except possibly for the early part of a mission when the elevation angle is changing rapidly. During the first hour of the *Ranger IX* mission, only 17 min of early usable doppler data were available from DSS 51. The transmitter reference frequency drift (error source 3) is a major contributor to the total doppler weight for stations using VCO; but the drift is negligible when using the SYNTHESIZER. For example, near lunar encounter where the contribution from this error source is a maximum, the error attributed to the frequency drift for the SYNTHESIZER is $\sigma^2 = 0.03756 \times 10^{-4}$, and for the VCO it is $\sigma^2 = 375.6 \times 10^{-4}$. During the *Ranger IX* mission, all data except for the first two hours were obtained using the SYNTHESIZER.

For the angular data types (HA and dec), the predominant error sources were angle correction errors and encoder errors. During the *Ranger IX* mission, calibration errors up to a 0.1 deg and encoder errors of approximately 0.03 deg peak-to-peak were noted. Plots of these errors may be seen in Figs. 6 and 7 in which the residuals represent the error remaining after the angle corrections had been applied. Due to these large errors, angular data were not used in the orbit calculations, except during the early phase of the mission. The angular data were very helpful in obtaining the first orbital estimates, since there was a scarcity of usable data during the first two hours after injection. The contribution due to refraction correction errors was relatively small and was not used for local elevation angles greater than 5 deg. The effect of angle jitter errors on the total HA weight was determined by the declination angles observed during the mission. For *Ranger IX*, declination angles ranged between 337 and 1 deg. In Table 2, it may be seen that this error source contributed very heavily to the total HA weight for declination angles near 90 and 270 deg.

The sample spacing to be used at the tracking stations is determined by the tradeoff between doppler counter rounding errors and truncation errors occuring in the doppler frequency computations. The expression used in the ODP for these computations is

$$f(t_{ob}) = \int_{T-\frac{1}{2}\tau}^{T+\frac{1}{2}\tau} \ddot{F}(t)dt$$

where

$f(t_{ob})$ = integrated doppler frequency, which should be observed by a station at time t_{ob}

$T = t_{ob} - \frac{1}{2}\tau$

τ = sample spacing

$\ddot{F}(t)$ = instantaneous frequency of doppler shift, which should have been observed at time t

Table 3. Contribution from individual error sources to total weight for *Ranger IX* mission

Error source	Early doppler (range = 55,000 km)				Late doppler (range ≅ 383,000 km)			
	g_i^2	s_i^2	Correlation width, s	σ_i^2, Hz^2	g_i^2	s_i^2	Correlation width, s	σ_i^2, Hz^2
(1) Computing error	1	1.1×10^{-5}	36,000	65.6×10^{-4}	1	1.1×10^{-5}	36,000	65.6×10^{-4}
(2) Counter rounding error	2.78×10^{-4}	0.16	1	0.47×10^{-4}	2.78×10^{-4}	0.16	1	0.47×10^{-4}
(3) Transmitter reference frequency error	0.0189	0.41×10^{-2}	600	7.76×10^{-4} (for VCO)	0.917	0.41×10^{-2} (VCO) 0.41×10^{-6} (SYNTHESIZER)	600	376.1×10^{-4} (VCO) 0.03761×10^{-4} (SYNTHESIZER)
(4) Dropped or added cycles	5.56×10^{-3}	0.96	1	5.43×10^{-4}	5.56×10^{-3}	0.96	1	5.34×10^{-4}
(5) Refraction correction error	1.11×10^{-6}	0.04	1,000	0.007×10^{-4}	3.92×10^{-6}	0.04	1,000	0.026×10^{-4}
(6) Spacecraft motion		Zero for *Ranger IX*				Zero for *Ranger IX*		
Total			$\sum_{i=1}^{6} \sigma_i^2 = 79.24 \times 10^{-4}$ $\sigma = 0.089$				$\sum_{i=1}^{6} \sigma_i^2 = 446.6 \times 10^{-4}$ (VCO) $= 71.5 \times 10^{-4}$ (SYNTHESIZER) $\sigma = 0.211$ (VCO) $= 0.085$ (SYNTHESIZER)	

Error source	Early angles (range = 55,000 km)				Late doppler (range ≅ 383,000 km)			
	g_i^2	s_i^2	Correlation width, s	σ_i^2, deg^2	g_i^2	s_i^2	Correlation width, s	σ_i^2, deg^2
(1) Angle jitter	Dec = 1 HA = 1.026	9.0×10^{-6}	1	Dec = 0.09×10^{-4} HA = 0.0924×10^{-4}	Dec = 1 HA = 1.008	9.0×10^{-6}	1	Dec = 0.09×10^{-4} HA = 0.0907×10^{-4}
(2) Angle correction error	1	1.0×10^{-4}	20,000	333.33×10^{-4}	1	1.0×10^{-4}	20,000	333.33×10^{-4}
(3) Angle encoder error	1	1.44×10^{-6}	1	0.0144×10^{-4}	1	1.44×10^{-6}	1	0.0144×10^{-4}
(4) Refraction correction error	Dec = 1.26×10^{-4} HA = 2.48×10^{-4}	4.0×10^{-2}	1,000	Dec = 0.84×10^{-4} HA = 1.65×10^{-4}	Dec = 4.12×10^{-4} HA = 2.44×10^{-4}	4.0×10^{-2}	1,000	Dec = 2.75×10^{-4} HA = 1.63×10^{-4}
Total				$\sum_{i=1}^{6} \sigma_i^2 = 334.27 \times 10^{-4}$ (Dec) $= 335.06 \times 10^{-4}$ (HA) $\sigma = 0.183$ (Dec) $= 0.183$ (HA)				$\sum_{i=1}^{6} \sigma_i^2 = 336.18 \times 10^{-4}$ (Dec) $= 335.06 \times 10^{-4}$ (HA) $\sigma = 0.183$ (Dec) $= 0.183$ (HA)

Note: sample rate = count time = 60 s

$$\sigma = \left[\sum_{i=1}^{6} \sigma_i^2\right]^{1/2} = \left[\sum_{i=1}^{6} g_i^2 s_i^2 \max\left\{1, \frac{T_{correlation}}{T_{sample}}\right\}\right]^{1/2}$$

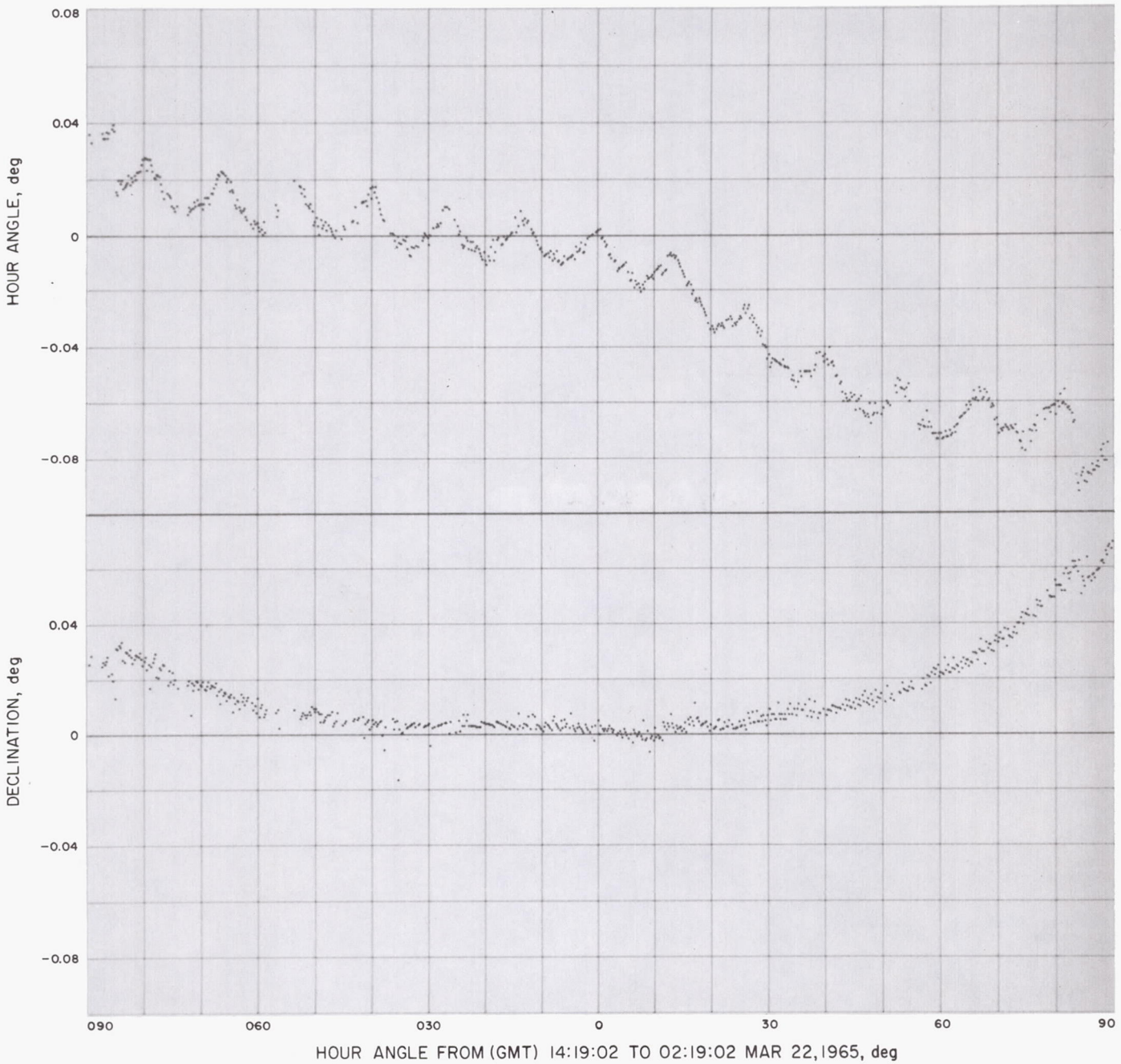


Fig. 6. Station 41 angular residuals

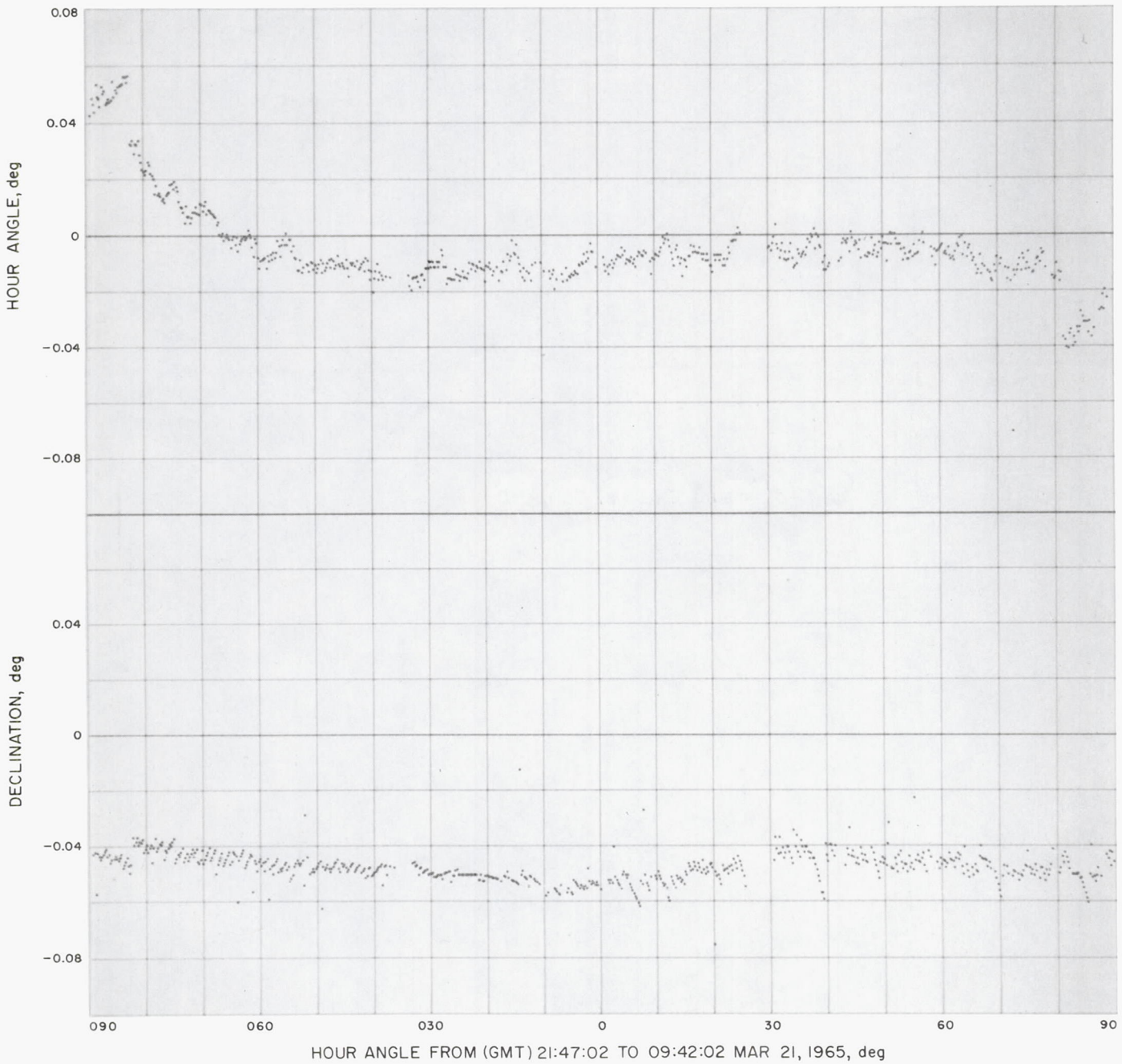


Fig. 7. Station 51 angular residuals

This integral is evaluated by expanding a Taylor series about T and integrating term-by-term leading to

$$f(t_{ob}) = \tau F(T) + \frac{\tau^3}{24}\ddot{F}(t) + O(F^{iv})$$

Thus, the truncation error is a function τ and the fourth derivative of the frequency (which is, in turn, dependent on the fifth derivative of range).

For this mission, sample spacing had to be reduced during three phases of the flight: (1) near earth, (2) during maneuver motor thrusting, and (3) near lunar encounter. For these phases, sample spacing of 10s was used. At all other times, a sample spacing of 60 s was used.

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

D. Premaneuver Orbit Based on Premaneuver Tracking Data

Table 4 summarizes the data used in the postflight analysis of the premaneuver data, and presents the statistics pertaining to these data. It should be noted that only two-way doppler data were used in the postflight orbit analysis. Angular data were not used because of biases due to the inadequacy of the angular correction model.

However, the angular data are extremely helpful in real-time orbit determination, especially when there are data from only one station. Due to the geometry of the orbit, the angular data contributes very little to the improvement of the knowledge of the orbit after approximately 13 h of tracking. The angular data biases may be seen in Figs. 6 and 7, and the correction model errors will be explained in Section VI.

From Table 4 it may be seen that the noise level for all stations was between 0.0007 and 0.001 m/s (1 Hz = 0.156 m/s) when using a 60-s sample rate. The early data from Stations 51 and 41 had a higher noise level (0.005 and 0.003 m/s, respectively), since the higher sample rate causes greater quantization error, due to the one sample per 10 s obtained during the high spacecraft acceleration (see Section II-C, next to last paragraph).

Residual plots (observed data value minus value calculated from the orbit determination program) for the premaneuver data may be seen in Figs. 8–13. It should be noted that these residual plots do not pertain to this particular calculation, but, as will be pointed out in the section on combined results, they deviate by an insignificant amount from the residuals of this orbit calculation.

Columns 1–3 of Table 5 show the parameters that were estimated and the *a priori* information used. For this orbital calculation, large uncertainties were placed on the *a priori* of all parameters so that the final solution would be determined from the tracking data with very little influence from *a priori*. For the station location uncertainties, the X_1, X_2, and X_3 coordinate system (centered at the tracking station) was used (see Fig. 19). In this system, X_1 and X_2 were parallel to the equatorial plane with X_2 in the longitude direction and X_1 normal to the earth's spin axis. The coordinate X_3 was in the direction of the earth's spin axis. One-σ *a priori* values of 500, 500 and 100 m were used for X_1, X_2, and X_3, respectively, and then rotated into the station spherical coordinate system (radius, latitude, and longitude, respectively) for input into the ODP.

Column 4 of Table 5 contains the statistics associated with this orbital calculation at injection epoch, maneuver epoch, and lunar impact. The most significant result here is the solution for $GM_\oplus$ and the probe position and velocity. Position at injection is known to within 0.4 km and velocity to within 0.5 m/s. At maneuver epoch, the velocity uncertainty has decreased. This decrease in the velocity uncertainty is related to the velocity of the spacecraft at the two epochs. At maneuver epoch, the spacecraft is moving slowly (1.5 km/s), while at injection epoch its velocity is fast (11 km/s). The velocities uncertainties when associated with the magnitude of the velocity of the spacecraft at each epoch are very nearly the same. The correlation matrices, both in space-fixed Cartesian and earth-fixed spherical coordinates, are shown in Table 6 (at injection epoch) and Table 7 (at maneuver epoch).

It is interesting to note that the uncertainties of the parameters estimated, using the premaneuver data, are well below the *a priori* uncertainties and, for the most part, are below those of *Rangers VI, VII,* and *VIII*. This is due to the midcourse maneuver correction being performed on the second pass over Goldstone (DSS 12) for *Ranger IX* (launch + 38 h) as compared to the first pass over Goldstone (launch + 16 h) for *Rangers VI, VII,* and *VIII*.

Table 4. Statistics on premaneuver data

Station	Number of doppler points	No *a priori* from postmaneuver			With postmaneuver as *a priori*		With postmaneuver as *a priori* plus *REM* constraint	
		Standard deviation, Hz[a]	Mean, Hz	Remarks[b]	Standard deviation, Hz	Mean, Hz	Standard deviation, Hz	Mean, Hz
12	107	0.0082	0.0006	Data taken below 17-deg elevation using rubidium frequency standard	0.0084	0.0037	0.0084	−0.0021
	215	0.0077	0.0006	Data taken above 17-deg elevation using rubidium frequency standard	0.0075	0.0018	0.0075	−0.0042
	53	0.0070	−0.0014	Data taken below 17-deg elevation using rubidium frequency standard	0.0070	0.0005	0.0070	−0.0061
	88	0.0078	−0.0008	Data taken below 17-deg elevation using rubidium frequency standard	0.0081	−0.0017	0.0081	−0.0100
	77	0.0071	0.0040	Data taken above 17-deg elevation using rubidium frequency standard	0.0074	−0.0013	0.0072	−0.0096
41	19[c]	0.0236	0.0028	Data taken below 17-deg elevation using rubidium frequency standard	0.0237	−0.0042	0.0237	−0.0013
	10	0.0047	0.0065	Data taken below 17-deg elevation using rubidium frequency standard	0.0046	0.0132	0.0046	0.0073
	458	0.0077	0.0011	Data taken above 17-deg elevation using rubidium frequency standard	0.0079	0.0034	0.0080	−0.0037
51	7[c]	0.0675	0.0845	Data taken below 17-deg elevation using VCO	0.0677	0.0525	0.0684	0.0566
	114[c]	0.0572	−0.0025	Data taken above 17-deg elevation using VCO	0.0580	−0.0109	0.0572	−0.0120
	410	0.0078	0.0008	Data taken above 17-deg elevation using rubidium frequency standard	0.0082	−0.0012	0.0059	−0.0034
	11	0.0104	0.0007	Data taken below 17-deg elevation using rubidium frequency standard	0.0104	0.0035	0.0103	−0.0013
	337	0.0076	0.0001	Data taken above 17-deg elevation using rubidium frequency standard	0.0078	0.0008	0.0080	−0.0070

[a] In the *Ranger IX* station configuration for L-band frequency, 1 counted doppler cycle $\cong$ 0.156 m.
[b] Remarks concerning rubidium frequency standard and VCO refer to the method used to provide ground station transmitter reference frequency.
[c] Sample rate is 1 sample per 10-s count; all other statistics refer to 60-s sample rate data.

Table 5. Estimated parameter statistics

(1) Parameters estimated	(2) Units	(3) 1-σ *a priori*		(4) Standard deviation on parameters using premaneuver data			(5) Standard deviation on parameters using premaneuver data with *a priori* from postmaneuver data			(6) Standard deviation with *REM* constraint applied to premaneuver orbit (using postmaneuver data as *a priori*) at injection epoch	(7) Standard deviation on parameters using postmaneuver data		(8) Standard deviation on parameters using postmaneuver data with *a priori* from premaneuver data		(9) Standard deviation with *REM* constraint applied to postmaneuver orbit (using premaneuver data as *a priori*) at impact epoch
		Actually used	Presently accepted[a]	Injection epoch	Maneuver epoch	Impact epoch	Injection epoch	Maneuver epoch	Impact epoch		Maneuver epoch	Impact epoch	Maneuver epoch	Impact epoch	
X[b]	km	1×10^4	5	0.315	12.58	16.05	0.113	2.91	3.38	0.081	6.33	2.79	2.91	0.74	0.41
Y	km	1×10^4	5	0.177	3.70	10.31	0.117	2.55	2.13	0.079	6.56	3.70	2.55	2.43	0.46
Z	km	1×10^4	5	0.213	8.01	8.26	0.148	5.64	3.07	0.089	27.36	20.27	5.64	5.58	1.11
DX	m/s	1×10^7	10	0.202	0.056	2.784	0.145	0.014	0.767	0.139	0.074	0.347	0.027	0.208	0.200
DY	m/s	1×10^7	10	0.523	0.019	9.077	0.163	0.013	2.240	0.146	0.048	3.796	0.019	1.195	0.169
DZ	m/s	1×10^7	10	0.458	0.043	6.015	0.343	0.030	1.224	0.331	0.100	8.441	0.042	2.606	0.503
$GM_\oplus$	km^3/s^2	10	4	0.806			0.592			0.584	9.72		0.592		0.584
$GM_\mathbb{C}$	km^3/s^2	5	0.3	1.68			0.300			0.274	0.54		0.300		0.274
REM	m	50	20	49.97			32.82			3.552	49.13		32.84		3.553
GB	—	0.3	0.2	0.300			0.300			0.300	0.300		0.300		0.300
Station 12															
Radius	m	For all stations:		91			75			61	180		75		61
Latitude	deg[c]	$X_1 = 500$ m		0.00085			0.00079			0.00073	0.00130		0.00079		0.00074
Longitude	deg	$X_2 = 500$ m		0.00273			0.00049			0.00049	0.00156		0.00049		0.00049
Station 41		$X_3 = 100$ m													
Radius	m			80			68			53	170		68		53
Latitude	deg			0.00086			0.00082			0.00077	0.00118		0.00082		0.00077
Longitude	deg			0.00273			0.00052			0.00051	0.00080		0.00052		0.00051
Station 51															
Radius	m			81			65			45	186		65		45
Latitude	deg			0.00086			0.00082			0.00078	0.00113		0.00082		0.00079
Longitude	deg			0.00273			0.00049			0.00047	0.00070		0.00049		0.00049

[a] Indicated approximate known uncertainty before estimate, which in most cases is a magnitude smaller than *a priori* actually used.

[b] Space-fixed geocentric equatorial coordinates.

[c] 0.001 deg $\approx$ 110 m.

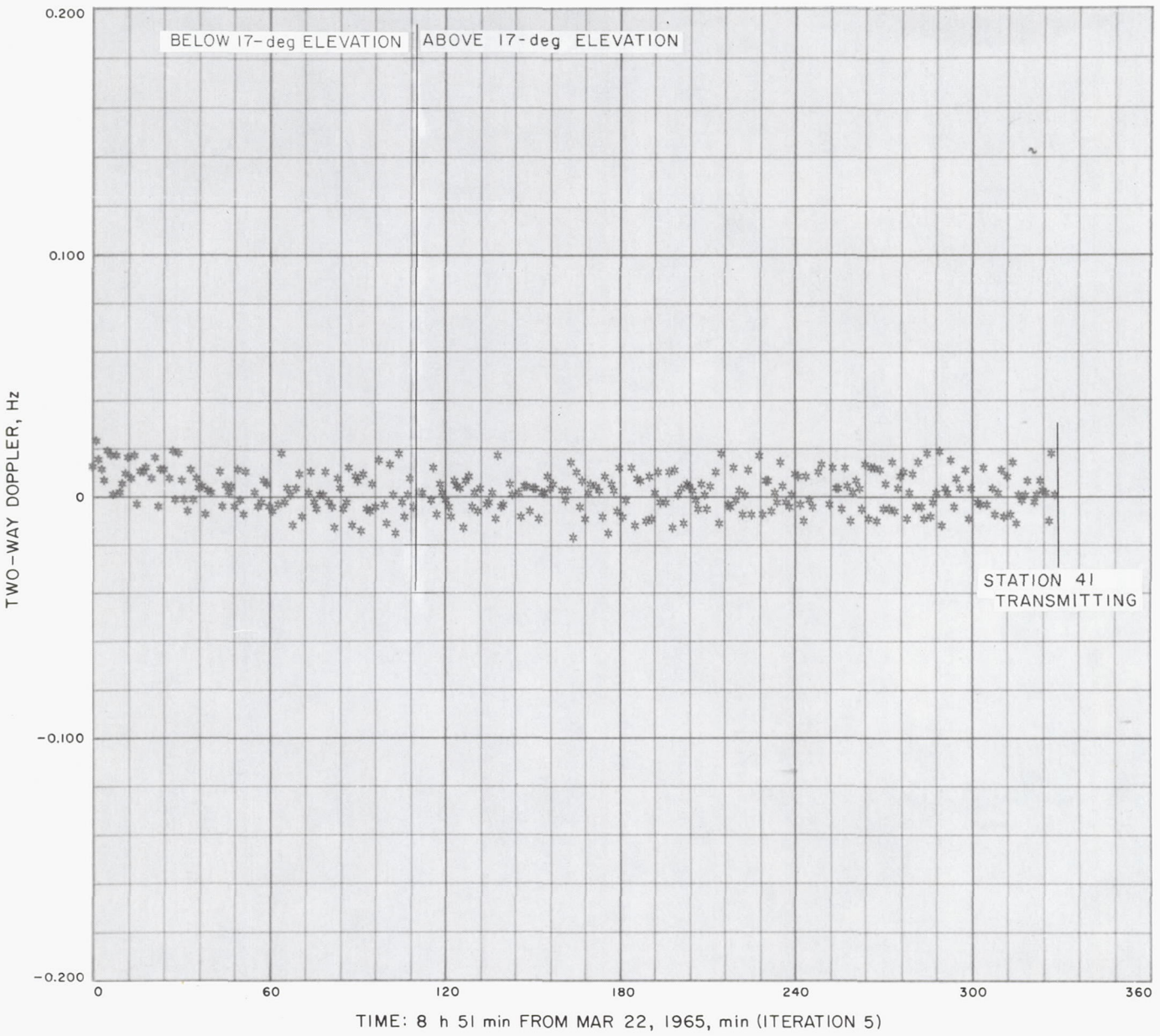


Fig. 8. Station 12 premaneuver pass No. 1 two-way doppler residuals

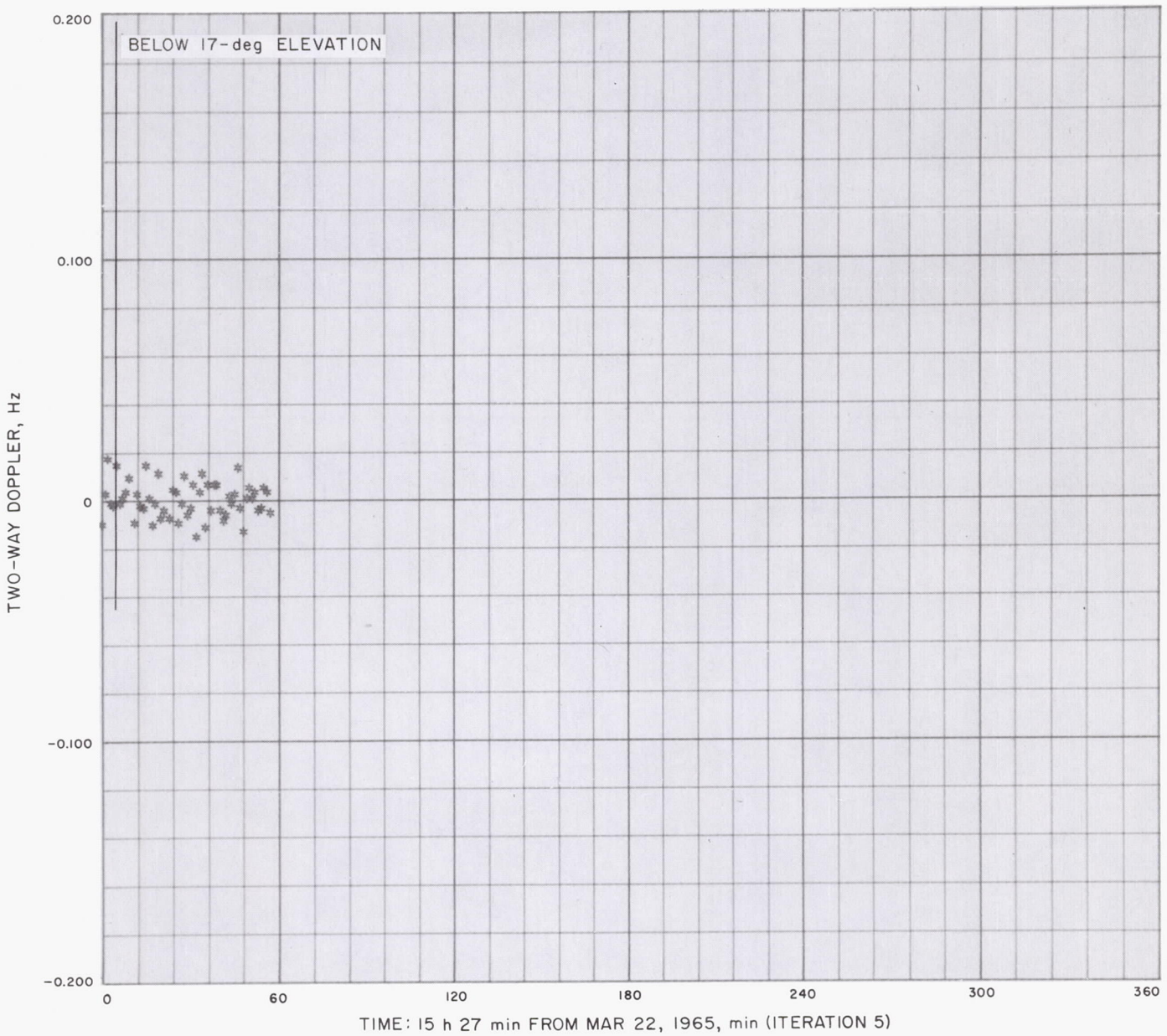

BELOW 17-deg ELEVATION
0.200
0.100
0
-0.100
-0.200
TWO-WAY DOPPLER, Hz
0
60
120
180
240
300
360
TIME: 15 h 27 min FROM MAR 22, 1965, min (ITERATION 5)

Fig. 8 (contd)

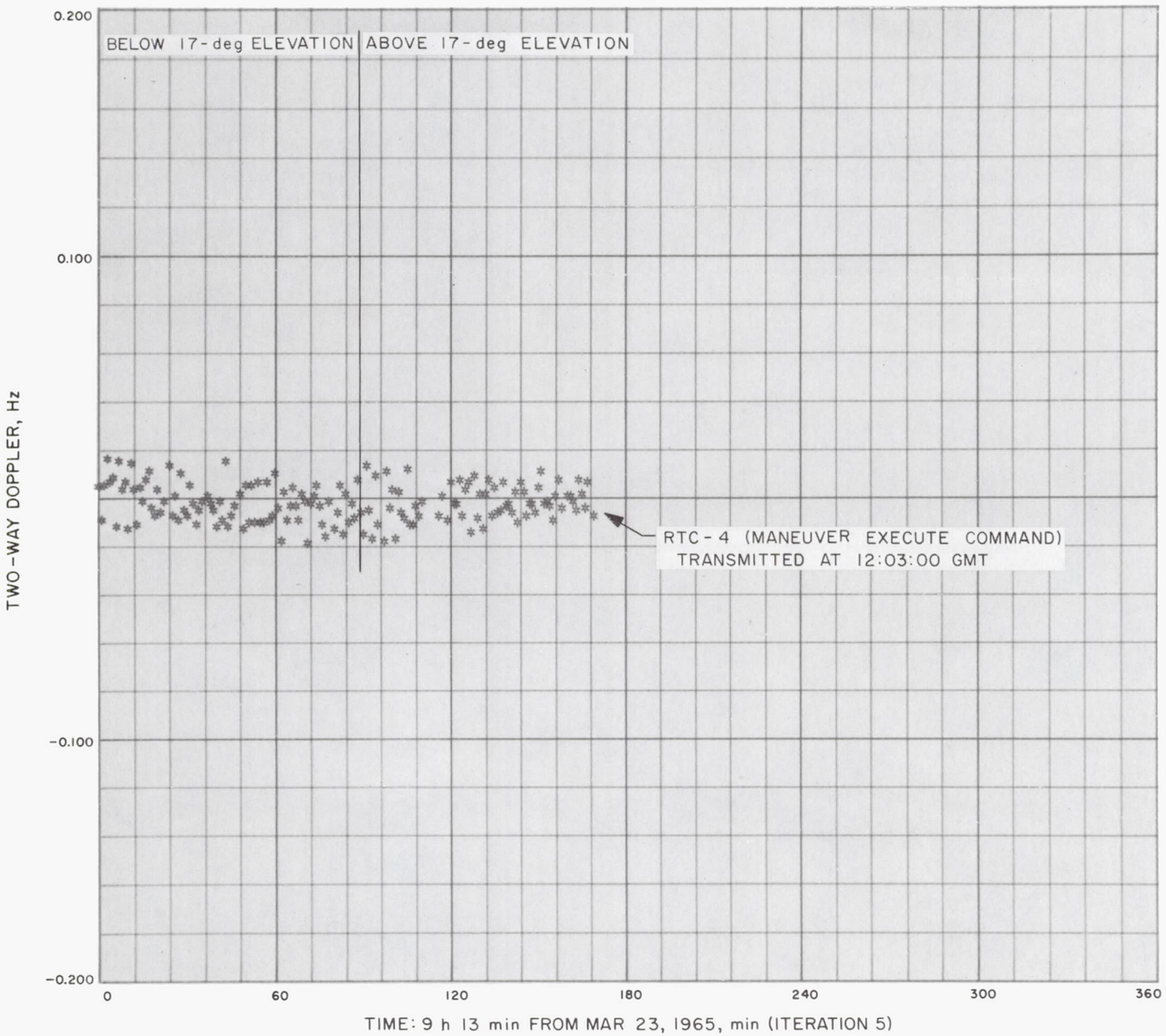


Fig. 9. Station 12 premaneuver pass No. 2 two-way doppler residuals

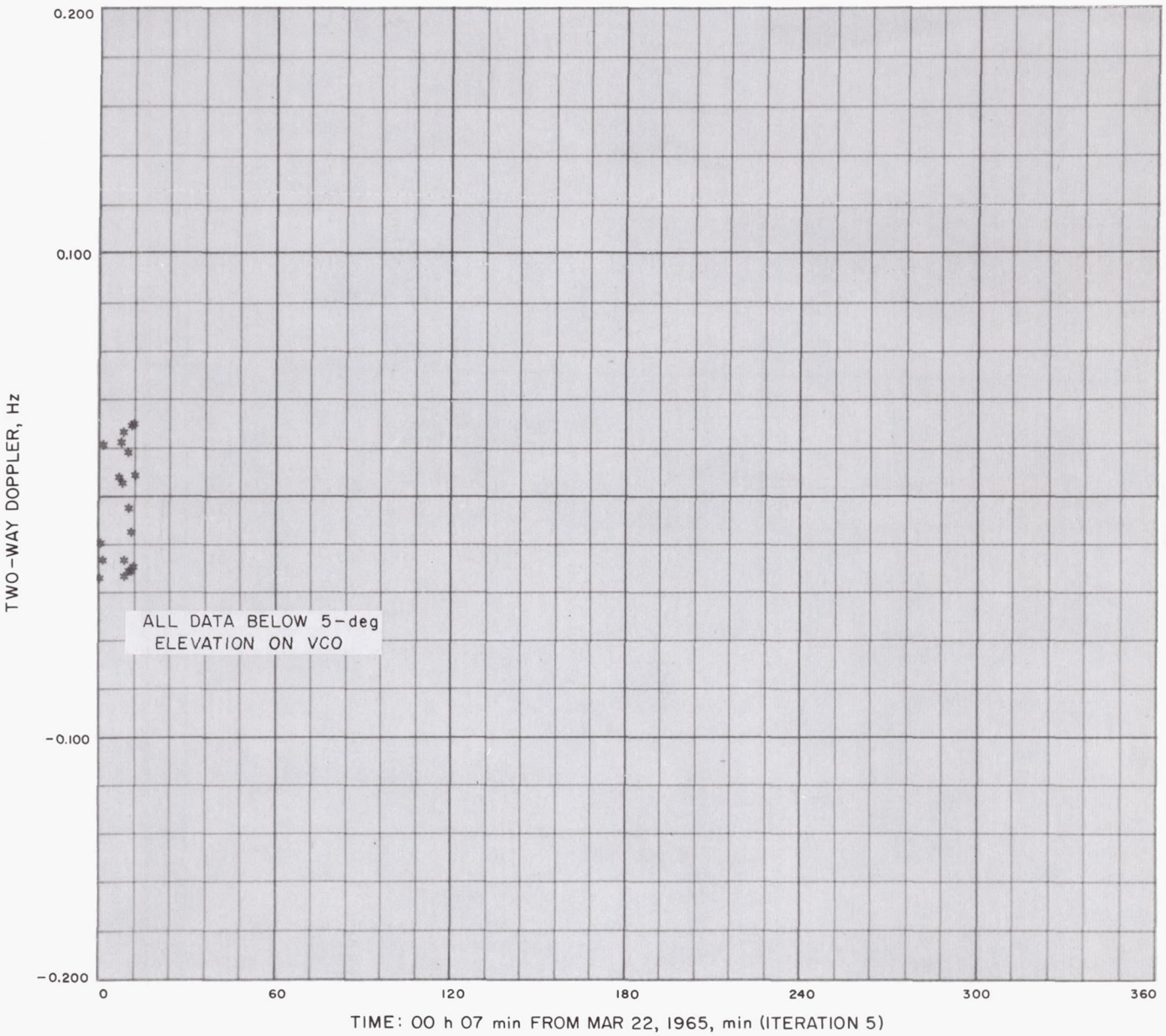


Fig. 10. Station 41 premaneuver pass No. 1 two-way doppler residuals

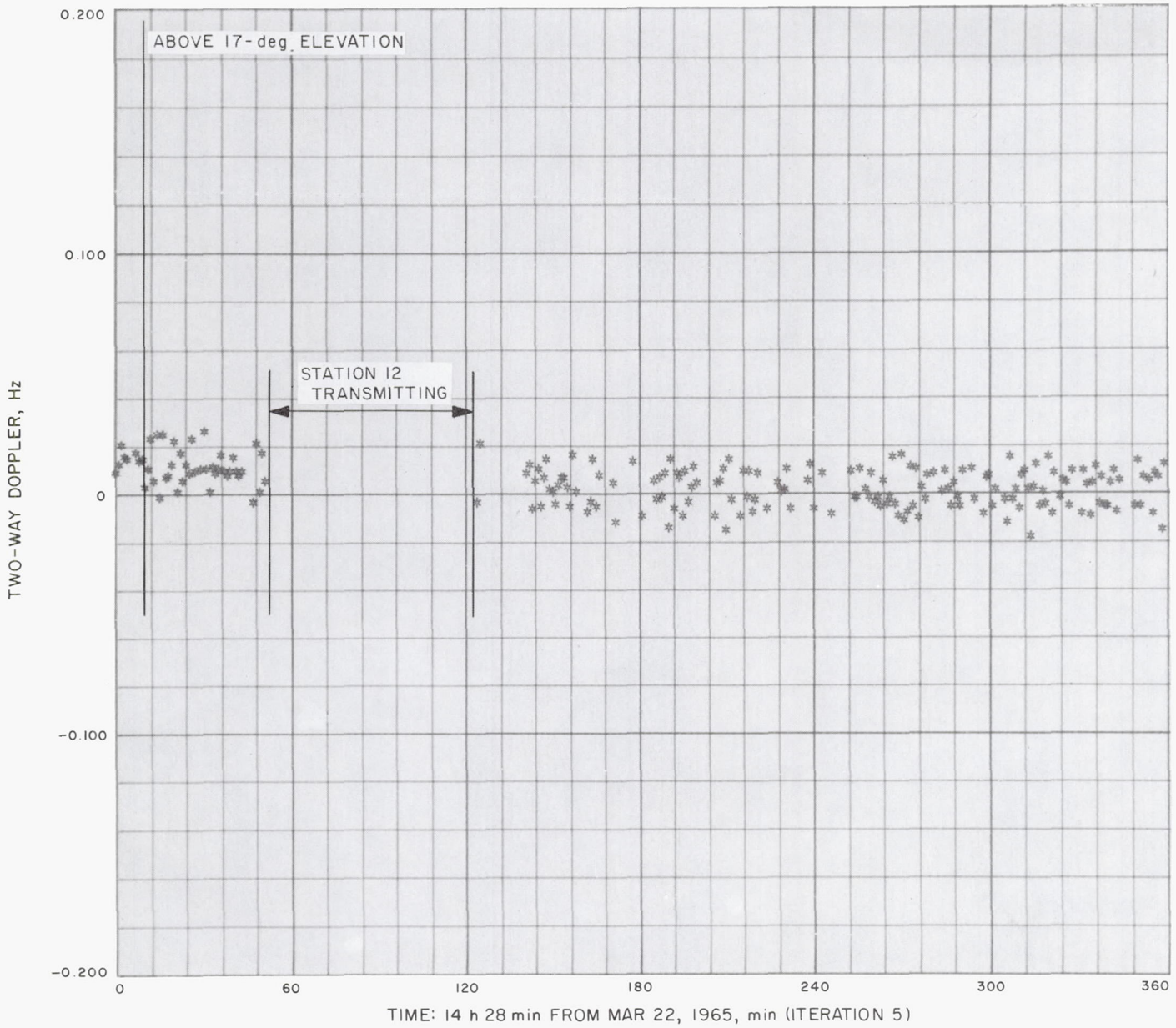


Fig. 11. Station 41 premaneuver pass No. 2 two-way doppler residuals

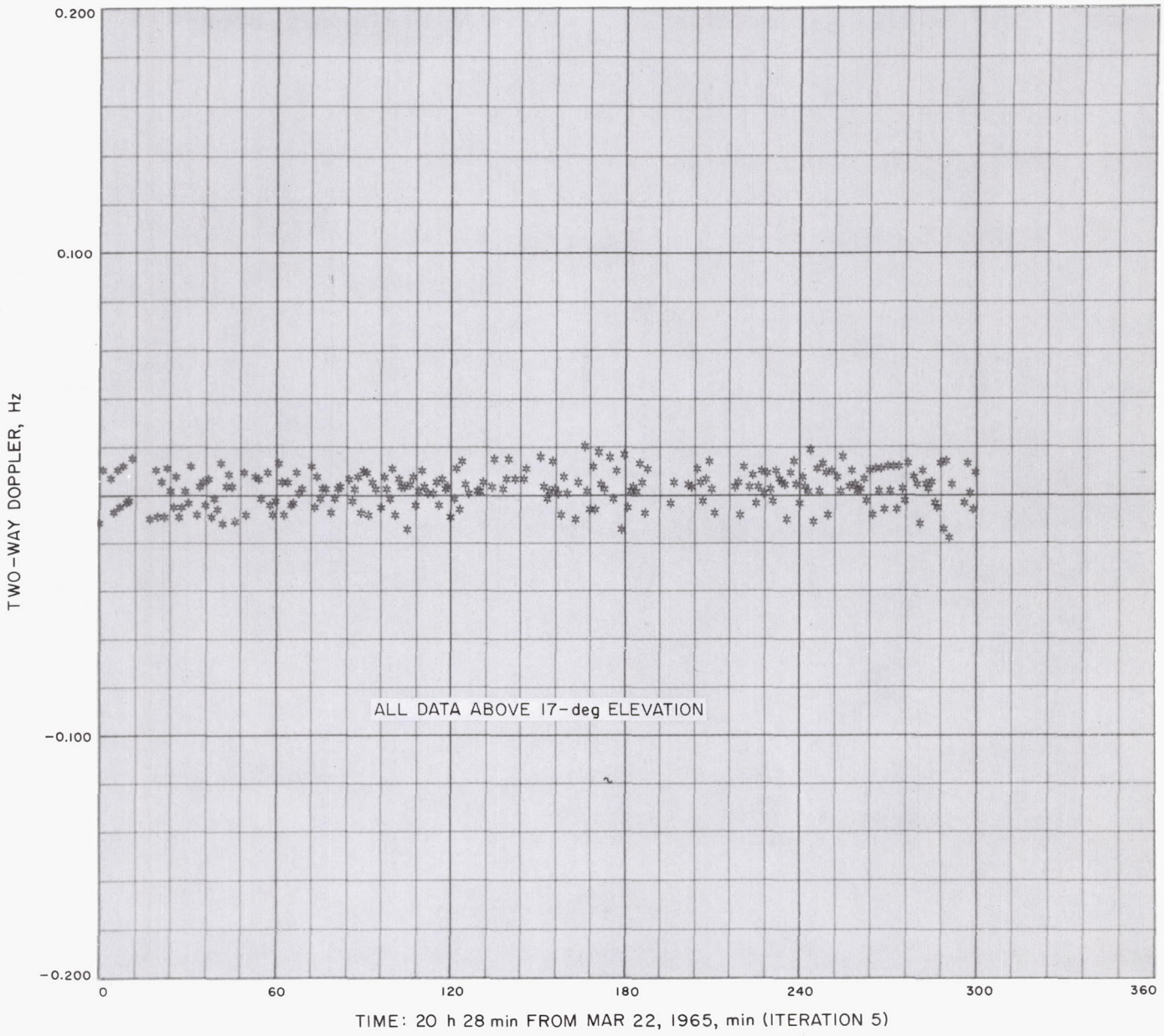

0.200
0.100
−0.100
−0.200
TWO-WAY DOPPLER, Hz
ALL DATA ABOVE 17-deg ELEVATION
0
60
120
180
240
300
360
TIME: 20 h 28 min FROM MAR 22, 1965, min (ITERATION 5)

Fig. 11 (contd)

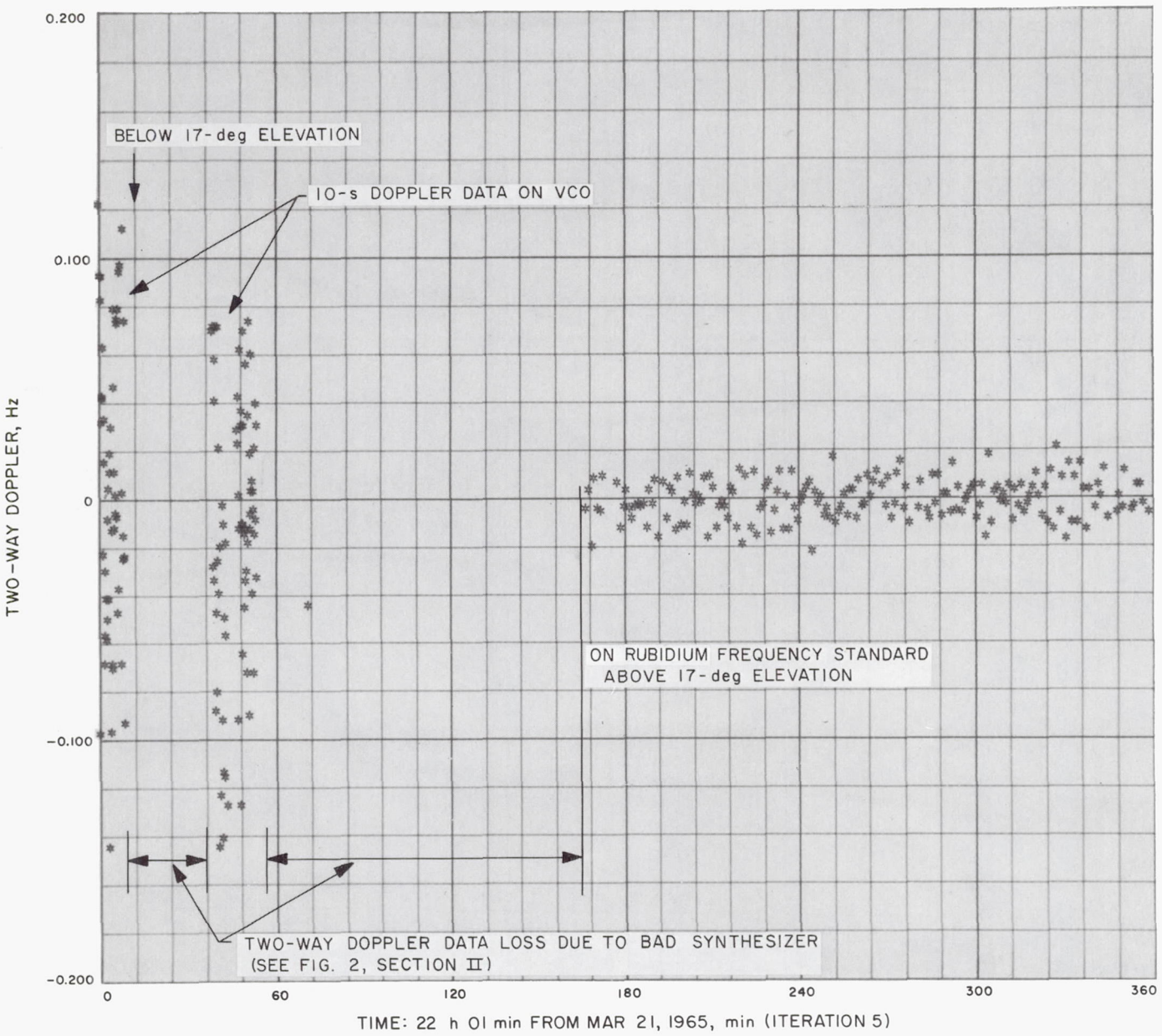


Fig. 12. Station 51 premaneuver pass No. 1 two-way doppler residuals

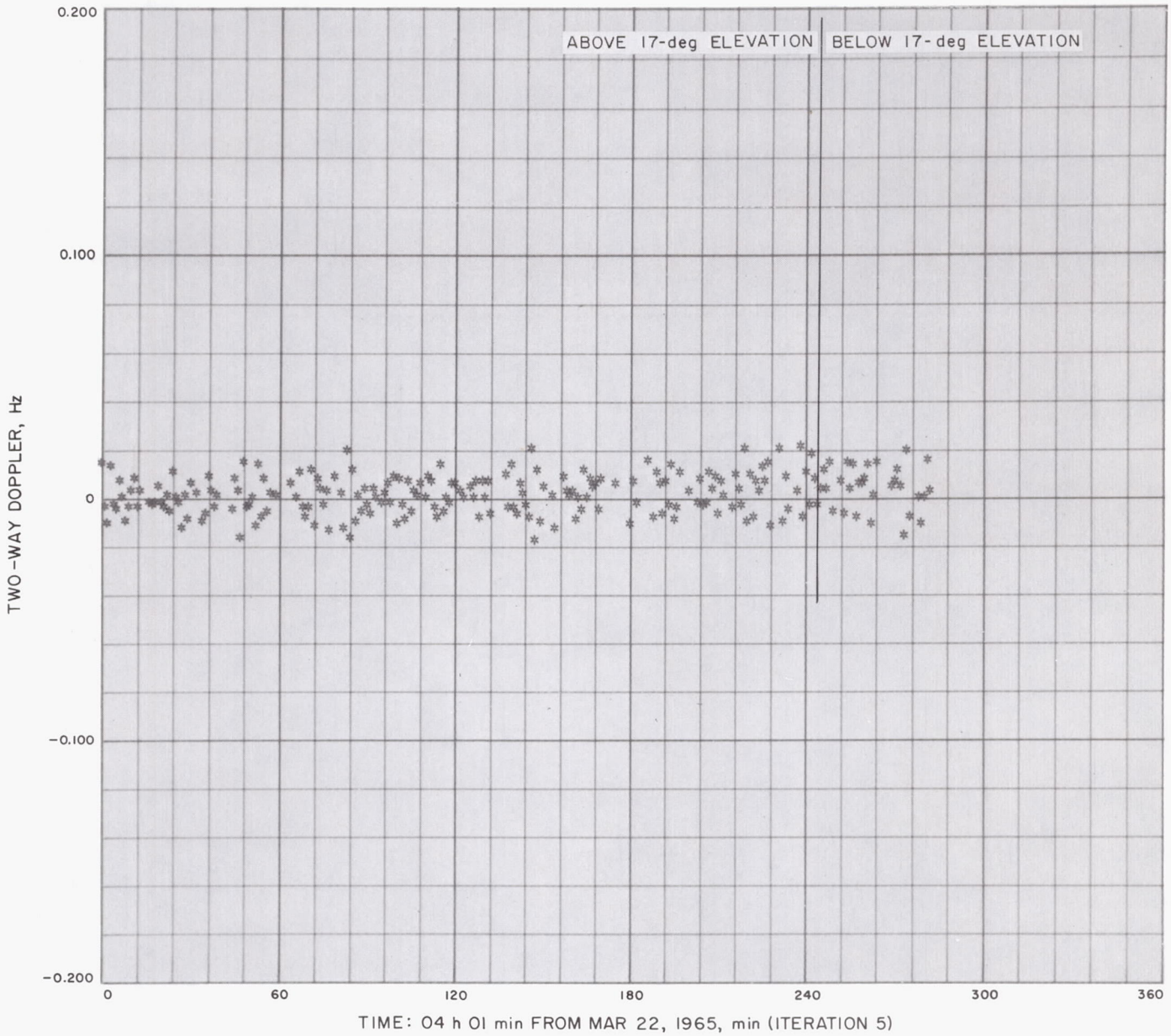

ABOVE 17-deg ELEVATION
BELOW 17-deg ELEVATION
0.200
0.100
0
−0.100
−0.200
TWO-WAY DOPPLER, Hz
0
60
120
180
240
300
360
TIME: 04 h 01 min FROM MAR 22, 1965, min (ITERATION 5)

Fig. 12 (contd)

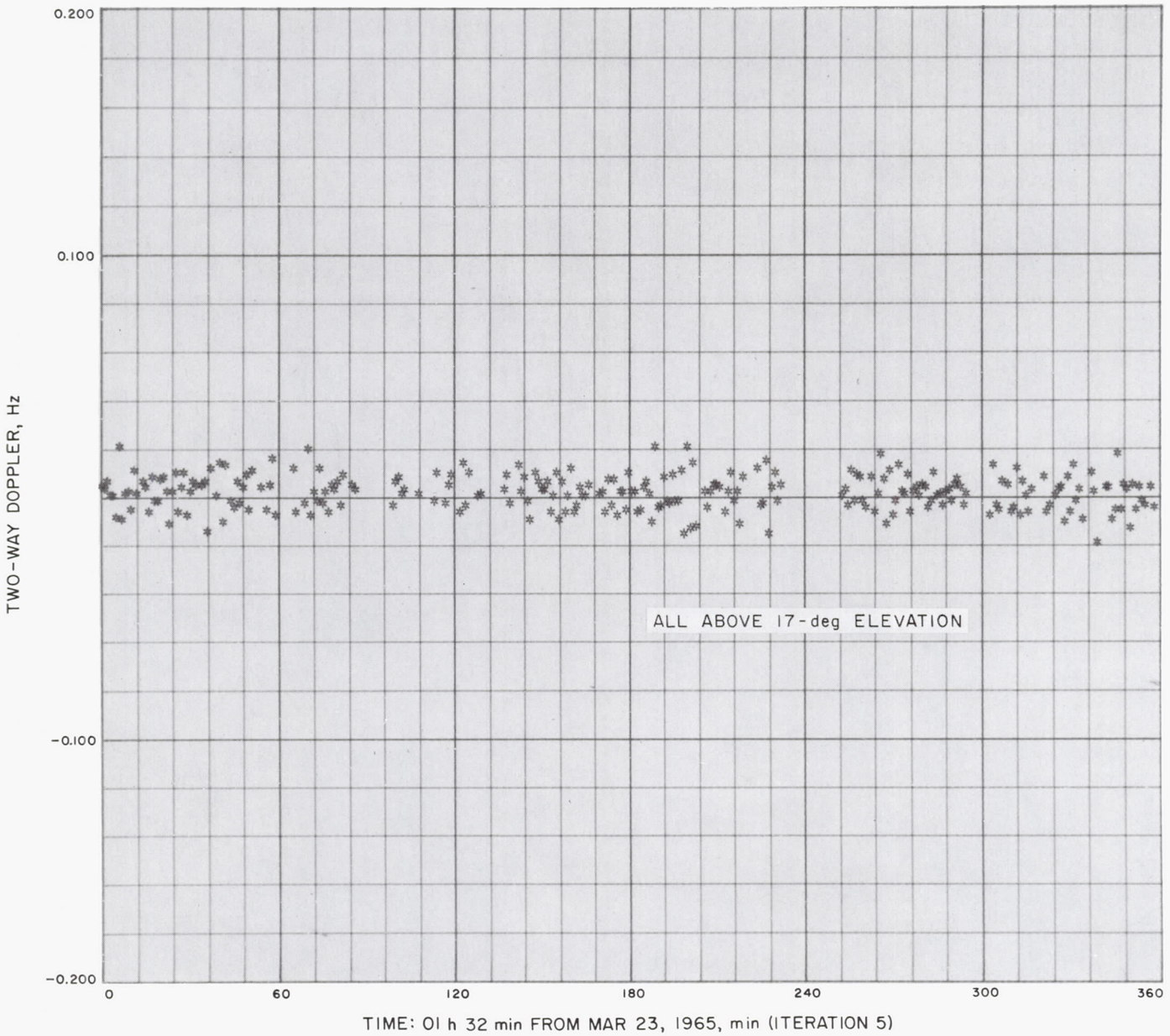


Fig. 13. Station 51 premaneuver pass No. 2 two-way doppler residuals

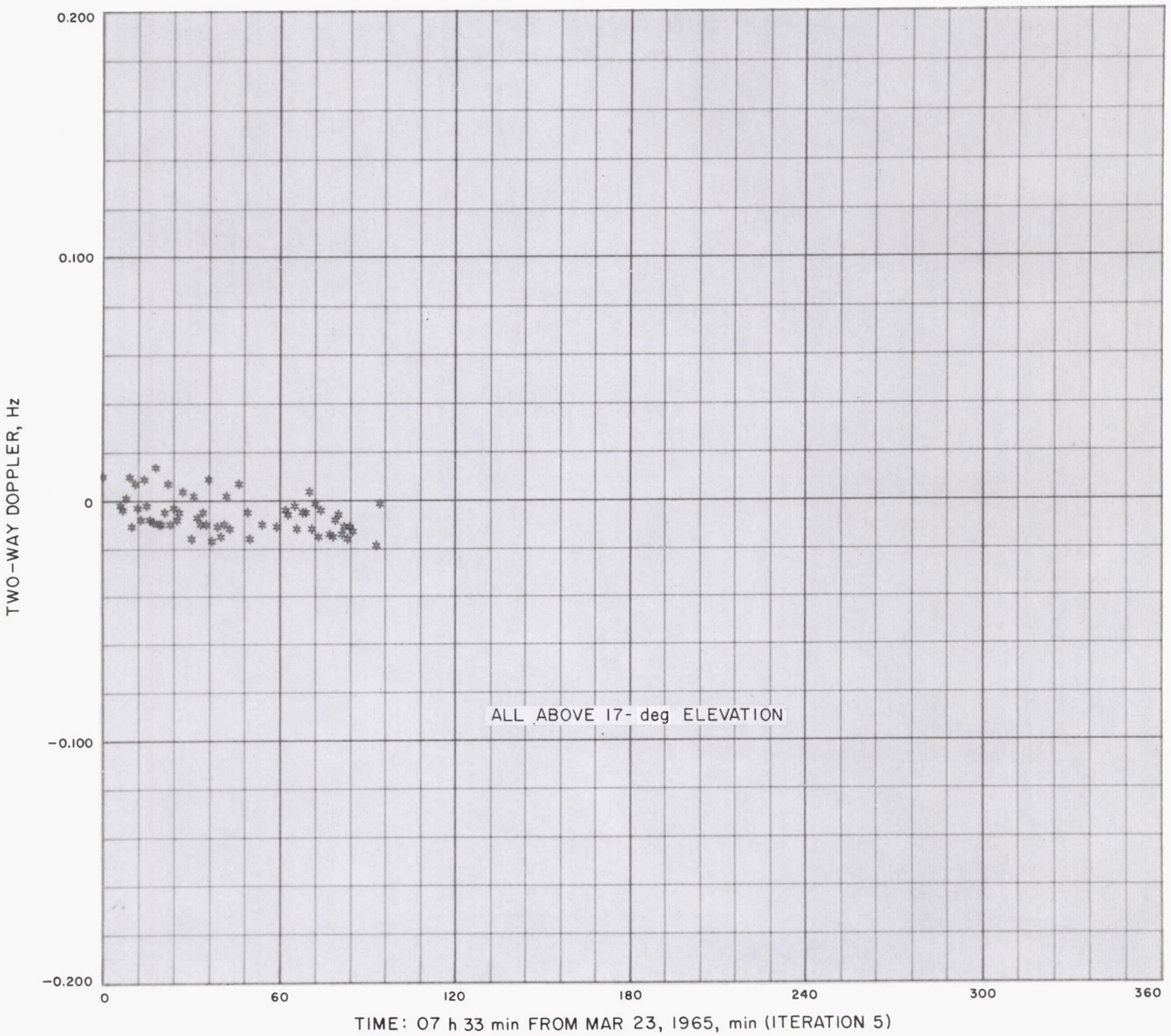

0.200
0.100
0
−0.100
−0.200
TWO-WAY DOPPLER, Hz
ALL ABOVE 17- deg ELEVATION
0
60
120
180
240
300
360
TIME: 07 h 33 min FROM MAR 23, 1965, min (ITERATION 5)

Fig. 13 (contd)

Table 6. Correlation matrix on premaneuver data at injection epoch (March 21, 1965 at 21:49:48 GMT)

Standard deviation	Units	Correlation coefficients																		
		X	*Y*	*Z*	*DX*	*DY*	*DZ*	$GM_{\oplus}$	*REM*	*G*	$GM_{\mathbb{C}}$	*RI*(3)	*LA*(3)	*LO*(3)	*RI*(4)	*LA*(4)	*LO*(4)	*RI*(5)	*LA*(5)	*LO*(5)
X 0.315	km	1.000	0.466	−0.149	−0.271	0.867	0.120	−0.154	0.006	−0.007	−0.520	−0.229	0.151	−0.899	−0.246	−0.146	−0.897	−0.375	0.007	−0.896
Y 0.177	km		1.000	−0.884	0.689	0.630	−0.736	0.302	0.004	−0.023	−0.544	−0.559	0.379	−0.368	−0.562	−0.299	−0.422	−0.586	−0.221	−0.405
Z 0.214	km			1.000	−0.757	−0.283	0.771	−0.319	−0.002	0.029	0.410	0.649	−0.440	−0.012	0.649	0.352	0.046	0.560	0.489	0.025
DX 0.202	m/s				1.000	0.114	−0.969	0.434	0.0	−0.020	−0.223	−0.291	0.204	0.188	−0.270	−0.122	0.127	−0.147	−0.228	0.147
DY 0.523	m/s					1.000	−0.296	0.060	0.006	−0.009	−0.564	−0.138	0.094	−0.943	−0.137	−0.069	−0.961	−0.131	−0.074	−0.956
DZ 0.458	m/s						1.000	−0.463	0.0	0.021	0.289	0.276	−0.193	−0.001	0.253	0.114	0.060	0.062	0.352	0.041
$GM_{\oplus}$ 0.806	km^3/s^2							1.000	0.0	0.035	0.421	−0.047	0.026	0.060	−0.075	−0.042	0.044	0.116	−0.323	0.020
REM 0.050	km								1.000	0.0	0.091	−0.003	0.002	−0.006	−0.002	−0.001	−0.006	−0.002	0.0	−0.006
G 0.300	—									1.000	−0.002	0.016	−0.011	0.0	0.017	0.009	0.0	0.019	0.008	0.0
$GM_{\mathbb{C}}$ 1.678	km^3/s^2										1.000	0.326	−0.238	0.483	0.276	0.145	0.514	0.340	0.099	0.477
RI(3) 0.091	km											1.000	0.159	−0.014	0.564	0.318	0.008	0.617	0.259	−0.005
LA(3) 0.00085	deg												1.000	0.016	−0.378	−0.213	−0.006	−0.414	−0.173	0.004
LO(3) 0.00274	deg													1.000	−0.016	−0.010	0.995	−0.003	−0.010	0.996
RI(4) 0.081	km														1.000	−0.221	0.009	0.643	0.263	0.0
LA(4) 0.00086	deg															1.000	0.005	0.364	0.159	−0.002
LO(4) 0.00273	deg																1.000	0.018	0.013	0.997
RI(5) 0.082	km																	1.000	−0.160	0.0
LA(5) 0.00086	deg																		1.000	0.007
LO(5) 0.00273	deg																			1.000

		R	ϕ	λ	*V*	γ	σ
R 0.0790	km	1.000	−0.783	−0.054	−0.984	0.306	0.864
ϕ 0.00218	deg		1.000	0.234	0.803	0.001	−0.734
λ 0.00305	deg			1.000	0.107	0.374	0.053
V 0.0658	m/s				1.000	−0.199	−0.812
γ 0.000646	deg					1.000	0.643
σ 0.00292	deg						1.000

Table 7. Correlation matrix on premaneuver data at maneuver epoch (March 23, 1965 at 12:30:38 GMT)

Standard deviation	Units	Correlation coefficients																	
		X	*Y*	*Z*	*DX*	*DY*	*DZ*	$GM_{\oplus}$	*REM*	*G*	$GM_{\mathbb{C}}$	*RI*(3)	*LA*(3)	*LO*(3)	*RI*(4)	*LA*(4)	*LO*(4)	*RI*(5)	*LA*(5)	*LO*(5)
X 12.58	km	1.000	−0.152	−0.105	0.999	0.488	−0.120	0.013	−0.006	−0.002	0.516	0.066	−0.044	0.985	0.068	0.035	0.991	0.063	0.045	0.991
Y 3.70	km		1.000	−0.966	−0.150	0.764	−0.934	−0.161	−0.001	0.026	0.259	0.718	−0.483	−0.263	0.736	0.415	−0.224	0.792	0.366	−0.241
Z 8.00	km			1.000	−0.107	−0.896	0.975	0.152	0.003	−0.025	−0.392	−0.740	0.498	0.017	−0.757	−0.425	−0.026	−0.812	−0.367	−0.009
DX 0.056	m/s				1.000	0.495	−0.127	−0.014	−0.004	−0.020	0.499	0.065	−0.043	0.981	0.069	0.035	0.988	0.052	0.061	0.989
DY 0.019	m/s					1.000	−0.920	−0.242	−0.004	0.030	0.526	0.644	−0.433	0.370	0.660	0.364	0.417	0.688	0.370	0.401
DZ 0.043	m/s						1.000	0.244	0.002	−0.026	−0.412	−0.711	0.480	0.015	−0.719	−0.397	−0.037	−0.724	−0.397	−0.018
$GM_{\oplus}$ 0.806	km^3/s^2							1.000	0.0	0.035	0.422	−0.047	0.026	0.060	−0.075	−0.042	0.044	0.116	−0.323	0.020
REM 0.050	km								1.000	0.0	0.091	−0.003	0.002	−0.006	−0.002	−0.001	−0.006	0.002	−0.001	−0.006
G 0.300	—									1.000	−0.002	0.016	−0.011	0.0	0.017	0.009	0.001	0.019	0.008	0.0
$GM_{\mathbb{C}}$ 1.678	km^3/s^2										1.000	0.326	−0.238	0.483	0.276	0.145	0.514	0.340	0.099	0.477
RI(3) 0.091	km											1.000	0.159	−0.014	0.564	0.318	0.008	0.617	0.260	−0.005
LA(3) 0.00085	deg												1.000	0.016	−0.378	−0.213	−0.006	−0.414	−0.174	0.004
LO(3) 0.0027	deg													1.000	−0.016	−0.010	0.995	−0.003	−0.010	0.997
RI(4) 0.081	km														1.000	−0.221	0.009	0.643	0.263	0.0
LA(4) 0.00086	deg															1.000	0.005	0.363	0.159	−0.002
LO(4) 0.0027	deg																1.000	0.018	0.013	0.997
RI(5) 0.082	km																	1.000	−0.160	0.001
LA(5) 0.00084	deg																		1.000	0.007
LO(5) 0.0027	deg																			1.000

		R	ϕ	λ	*V*	γ	σ
R 0.168	km	1.000	−0.575	0.119	−0.540	0.602	−0.500
ϕ 0.00173	deg		1.000	−0.083	0.999	−0.997	0.469
λ 0.00274	deg			1.000	−0.074	−0.072	−0.122
V 0.267	m/s				1.000	−0.995	0.459
γ 0.0000591	deg					1.000	−0.499
σ 0.0000352	deg						1.000

Table 8. Values of estimated parameters

(1) Estimated parameters	(2) Units	(3) Nominal	(4) Premaneuver[a] —no *a priori* from postmaneuver	(5) Premaneuver[a] with *a priori* from postmaneuver	(6) With *REM* constraint[a] applied to column (5) solution	(7) Postmaneuver[b] —no *a priori* from premaneuver	(8) Postmaneuver[b] with *a priori* from premaneuver	(9) With *REM* constraint[b] applied to column (8) solution
X[c]	km		−1418.9623	−1418.9958	−1418.9678	−19399.787	−19399.676	−19400.152
Y	km		5989.4127	5989.4570	5989.4875	−262236.59	−262236.45	−262237.55
Z	km		2304.4676	2304.3945	2304.3523	−124767.90	−124765.10	−124762.65
DX	m/s		−10386.613	−10386.558	−10386.544	135.94845	135.94896	135.95491
DY	m/s		−798.61810	−798.63629	−798.61087	−1209.1184	−1209.1034	−1209.1119
DZ	m/s		−3429.2467	−3429.3785	−3429.4096	−509.64416	−509.67789	−509.65973
$GM_{\oplus}$	km^3/s^2	398603.20	398600.70	398601.39	398601.42	398603.28	398601.37	398601.41
$GM_{\mathbb{C}}$	km^3/s^2	4902.7779	4901.4745	4902.7856	4902.7428	4902.6987	4902.7482	4902.6932
REM	km	6378.3254	6378.3257	6378.3044	6378.3159	6378.3248	6378.3007	6378.3156
GB	—	0.40	0.40246991	0.39515566	0.39230724	0.39993044	0.39545138	0.39205229
Station 12								
Radius	km	6372.0164	6371.9047	6371.8903	6371.8748	6371.8876	6371.8890	6371.8690
Latitude	deg	35.116540	35.117255	35.117334	35.117431	35.117354	35.117341	35.117466
Longitude	deg	243.19539	243.19443	243.19494	243.19494	243.19531	243.19488	243.19487
Station 41								
Radius	km	6372.6076	6372.6563	6372.6421	6372.6269	6372.6494	6372.6406	6372.6211
Latitude	deg	−31.212360	−31.212092	−31.212180	−31.212272	−31.212132	−31.212190	−31.212309
Longitude	deg	136.88617	136.88765	136.88809	136.88806	136.88807	136.88803	136.88799
Station 51								
Radius	km	6375.5503	6375.5454	6375.5386	6375.5386	6375.5285	6375.5353	6375.5139
Latitude	deg	−25.738763	−25.738887	−25.739083	−25.739159	−25.738857	−25.739092	−25.739190
Longitude	deg	27.685588	27.685444	27.685815	27.685793	27.685835	27.685767	27.685738

[a]Premaneuver epoch occurred on Mar. 21, 1965 at 21:49:48 GMT.

[b]Maneuver epoch (end of midcourse motor burn) occurred on March 23, 1965 at 12:30:38 GMT.

[c]Space-fixed geocentric equatorial Cartesian coordinates.

Numerical values of the estimated parameters are presented in Table 8, column 4. The encounter statistics obtained from integrating the trajectory forward to impact may be seen in Table 9, column 3. For certain parameters, the **B**-plane system (see Appendix A) is used (Ref. 4). The statistics associated with the impact parameters are given in Table 10, column 1. In this table, the semimajor axis (*SMAA*) and the semiminor axis (*SMIA*) are the square roots of the eigenvalues of the covariance matrix in the **B** plane, and *DEL T* is the uncertainty in linearized time of flight.

The conclusions of the premaneuver data analysis are that a good fit is made using the doppler data and that the solution vector of the physical constants is consistent with presently accepted values. The only really startling value is that of *GM*, which differs from all other solutions (see Table 21, estimates for $GM_{\mathbb{C}}$). It should be noted that its difference with the nominal value is still well within its associated uncertainty.

E. Postmaneuver Orbit Based on Postmaneuver Tracking Only

Table 11 summaries the data used in the postflight analysis of the postmaneuver data, and presents the statistics associated with these data. The noise level in the postmaneuver data for all stations was between 0.0013 and 0.0010 m/s when using a 60-s sampling rate. Residual plots for the postmaneuver data are given in Figs. 14–17. It should be noted that these residual plots do not pertain to this particular calculation, but, as will be pointed out in the section on combined results, they deviate by an insignificant amount from the residuals of this orbit. All postmaneuver data was compiled using the rubidium frequency standard, rather than the VCO, making the visible data noise almost entirely quantization error. Figure 18 shows the high resolution of this doppler data in the pitch turn of the spacecraft to reacquire the sun after the midcourse maneuver. The midcourse maneuver was performed during the second Goldstone (DSS 12) pass.

The *a priori* information for the postmaneuver orbital calculation is the same as that used for the premaneuver analysis. Statistics associated with the estimated parameters are shown in column 7 of Table 5. The orbital Cartesian uncertainties at maneuver epoch are for the most part greater than the uncertainties based on premaneuver data only. The reason being, the postmaneuver orbit is computed using approximately 25 h of tracking data as opposed to 41 h of tracking used in the premaneuver calculations. Another factor that should be considered is the near-earth phase versus the distant-earth phase, corresponding to premaneuver and postmaneuver data packages. The only significant change is that of $GM_{\mathbb{C}}$, which was reduced by a factor of three from the premaneuver data. The standard deviation would have been further reduced, but the last 12 min (explained in Section VI) obtained prior to impact was lost due to an equipment failure at Goldstone (DSS 12).

Table 9. Impact parameter estimates

(1) Parameters[a]	(2) Units	(3) Premaneuver data only	(4) Postmaneuver as *a priori* for premaneuver	(5) Postmaneuver data only	(6) Premaneuver as *a priori* for postmaneuver	(7) Best impact location and time of impact
B · TT	km	1629.8793	1627.9163	1561.0793	1560.8802	
B · RT	km	−447.24400	−451.17344	409.219	410.51725	
TF[b]	h	64.618977	64.618462	25.628329	25.628319	
Selenocentric latitude	deg	4.078	4.154	−12.925	−12.950	−12.817[c]
Selenocentric longitude	deg	357.796	357.751	357.634	357.632	357.667[c]
GMT[d]	hms	14:26:56:32[e]	14:26:54.46[e]	14:08:19.99[e]	14:08:19.95[e]	14:08:19.99[f]

[a]See Appendixes A and G for definitions.

[b]Time of flight for impact.

[c]Preliminary values based on analyses from ACIA (Aeronautical Chart and Information Center), U.S. Air Force.

[d]Occurred on Mar. 24, 1965.

[e]Based on a lunar radius of 1735.75 km.

[f]Time at which Station 12 recorded loss of signal from spacecraft, corrected for signal transit time.

Table 10. Statistics in the B-plane system

(1) Premaneuver data only					(2) Postmaneuver data only					(3) Premaneuver as *a priori* for postmaneuver				
Standard deviation	Correlation matrix				Standard deviation	Correlation matrix				Standard deviation	Correlation matrix			
		B • R	B • T	*TL*			B • R	B • T	*TL*			B • R	B • T	*TL*
13.620 km	B • R	1.000	0.045	0.010	32.514 km	B • R	1.000	−0.898	−0.886	8.693 km	B • R	1.000	−0.951	0.589
14.082 km	B • T		1.000	−0.956	5.670 km	B • T		1.000	0.605	2.902 km	B • T		1.000	−0.795
8.057 s	*TL*			1.000	2.573 s	*TL*			1.000	0.226 s	*TL*			1.000
SMAA = 14.239 km *SMIA* = 13.456 km *DEL T* = 8.057 s θ^b = 153.050 deg					*SMAA* = 32.912 km *SMIA* = 2.467 km *DEL T* = 2.573 s θ^b = 81.051 deg					*SMAA* = 9.125 km *SMIA* = 0.855 km *DEL T* = 0.226 s θ^b = 72.226 deg				
(4) Postmaneuver as *a priori* for premaneuver					(5) Premaneuver as *a priori* to postmaneuver with *REM* constraint[a]									
Standard deviation	Correlation matrix				Standard deviation	Correlation matrix								
		B • R	B • T	*TL*			B • R	B • T	*TL*					
6.026 km	B • R	1.000	−0.564	0.224	2.310 km	B • R	1.000	0.840	0.970					
4.239 km	B • T		1.000	−0.888	0.739 km	B • T		1.000	0.788					
1.671 s	*TL*			1.000	0.003 s	*TL*			1.000					
SMAA = 6.656 km *SMIA* = 3.175 km *DEL T* = 1.671 s θ^b = 61.302 deg					*SMAA* = 2.395 km *SMIA* = 0.387 km *DEL T* = 0.097 s θ^b = 105.45 deg									

[a] *REM* constraint is applied and results converted to selenocentric coordinate system. All other results in geocentric system.
[b] θ is measured counterclockwise from lunar equator to *SMAA*.

Table 11. Data statistics on postmaneuver data

Station	Number of doppler points[a]	No *a priori* from premaneuver			With premaneuver data as *a priori*		With premaneuver data as *a priori* plus *REM* constraint	
		Standard deviation,[b] Hz	Mean, Hz	Remarks[c]	Standard deviation, Hz	Mean, Hz	Standard deviation, Hz	Mean, Hz
12	138	0.0069	0.0002	Data taken above 17-deg elevation using rubidium frequency standard	0.0069	0.0030	0.0069	0.0037
	49	0.0086	−0.0010	Data taken below 17-deg elevation using rubidium frequency standard	0.0091	−0.0049	0.0091	−0.0076
	99	0.0077	0.0010	Data taken below 17-deg elevation using rubidium frequency standard	0.0075	0.0011	0.0074	−0.0003
	171	0.0075	0.0011	Data taken above 17-deg elevation using rubidium frequency standard	0.0071	−0.0001	0.0072	0.0001
41	481	0.0072	0.0000	Data taken above 17-deg elevation using rubidium frequency standard	0.0073	−0.0007	0.0072	−0.0005
51	426	0.0077	0.0000	Data taken above 17-deg elevation using rubidium frequency standard	0.0078	0.0003	0.0077	0.0002

[a]All 60-s sample rate.

[b]In the *Ranger IX* station configuration for L-band, 1 counted doppler cycle $\cong$ 0.156 m.

[c]Remarks concerning rubidium frequency standard refer to method used to provide ground station transmitter reference frequency.

Numerical values for the estimated parameters are given in column 7 of Table 8. A consistency check between the premaneuver and the postmaneuver orbits was made using the position vector at maneuver epoch. This check was accomplished by correcting the premaneuver position vector by an amount determined by the velocity change due to the maneuver execution, and comparing this new value with the postmaneuver value. The results of these comparisons are shown in Table 12. The solutions are well within the 1-σ uncertainties.

Table 12. Position at maneuver epoch

Premaneuver only		Postmaneuver only	Postmaneuver–premaneuver, km
X	−19400.576		
ΔX	−0.158		
$X+\Delta X$	−19400.734 ±12.6	−19399.787 ± 6.3	+0.947
Y	−262235.28		
ΔY	−0.14		
$Y+\Delta Y$	−262235.42 ±3.7	−262236.59 ± 6.6	−1.17
Z	−124767.60		
ΔZ	−0.17		
$Z+\Delta Z$	−124767.77 ±8.0	−124767.90 ±27.4	−0.13

Note: The Δs are the positional changes during maneuver motor burn from the relationship:

$$\Delta X = \frac{1}{2} a_x t^2 = \frac{\dot{v}_x t}{2}, \qquad \Delta X \rightarrow \Delta Y \rightarrow \Delta Z.$$

Encounter conditions for this orbit are shown in column 5 of Table 9. The impact time was based on a lunar radius of 1735.75 km. During flight, a radius value of 1736.6 km was used, predicted from *Rangers VI, VII, VIII*, and the U.S. Air Force ACIC (Aeronautical Chart and Information Center) Lunar Chart LAC 77. Predicted impact time was within 0.33 s of the observed impact. This prediction was made approximately 45 min from impact. The **B**-plane statistics associated with the encounter conditions are given in column 2 of Table 10.

The conclusion of the postmaneuver data analysis is that a good fit was made using doppler data and the solution vector on the physical constants is consistent with presently accepted values.

F. Combined Estimates Based on Premaneuver and Postmaneuver Tracking

1. Method of combining premaneuver and postmaneuver data. To obtain a better estimate on the postmaneuver orbit, the solution vector and its associated covariance matrix from the premaneuver data were used as *a priori* for the postmaneuver data. The same was done for the premaneuver orbit where the postmaneuver data were used as an *a priori* covariance matrix for the premaneuver data.

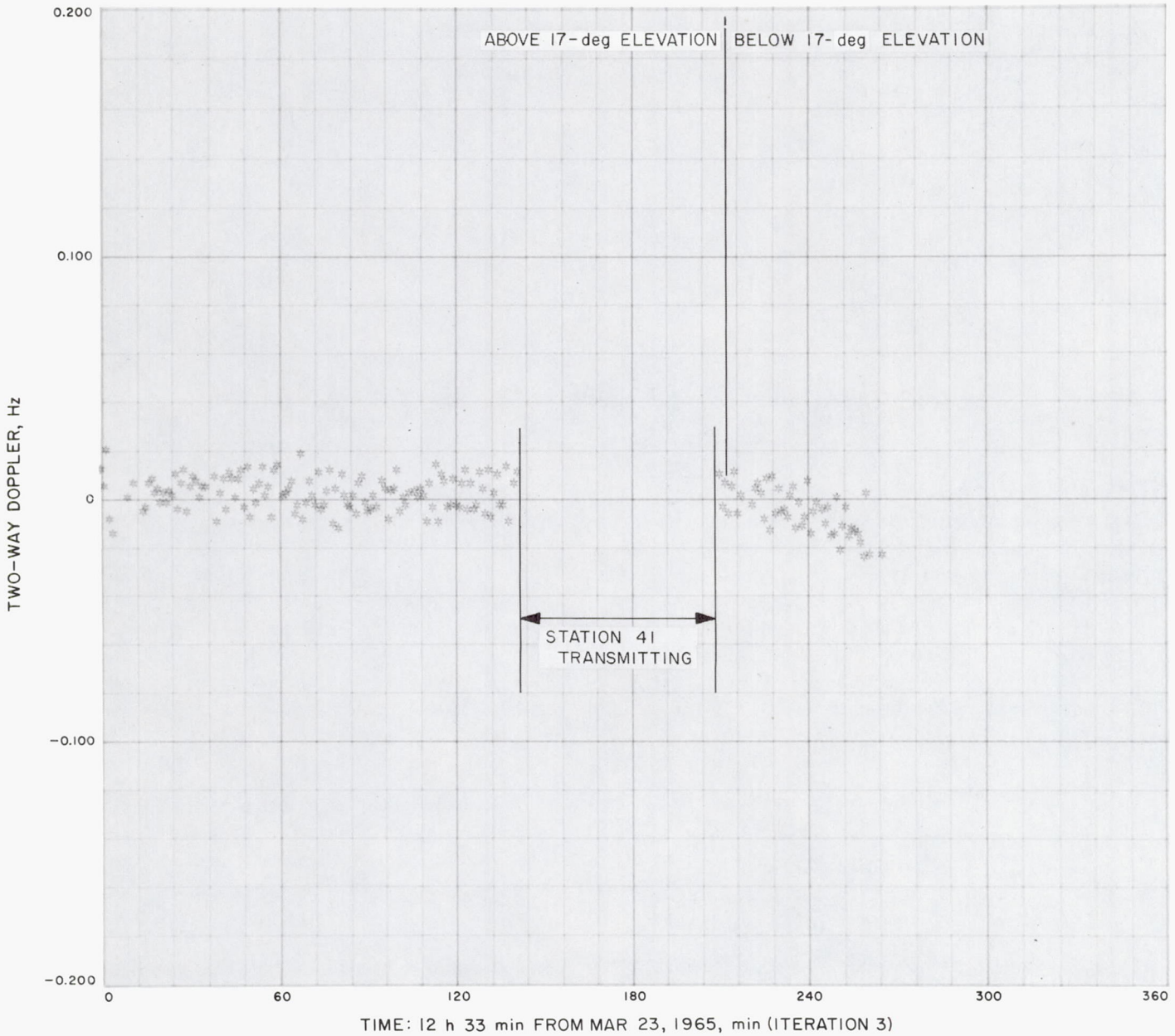


Fig. 14. Station 12 postmaneuver pass No. 1 two-way doppler residuals

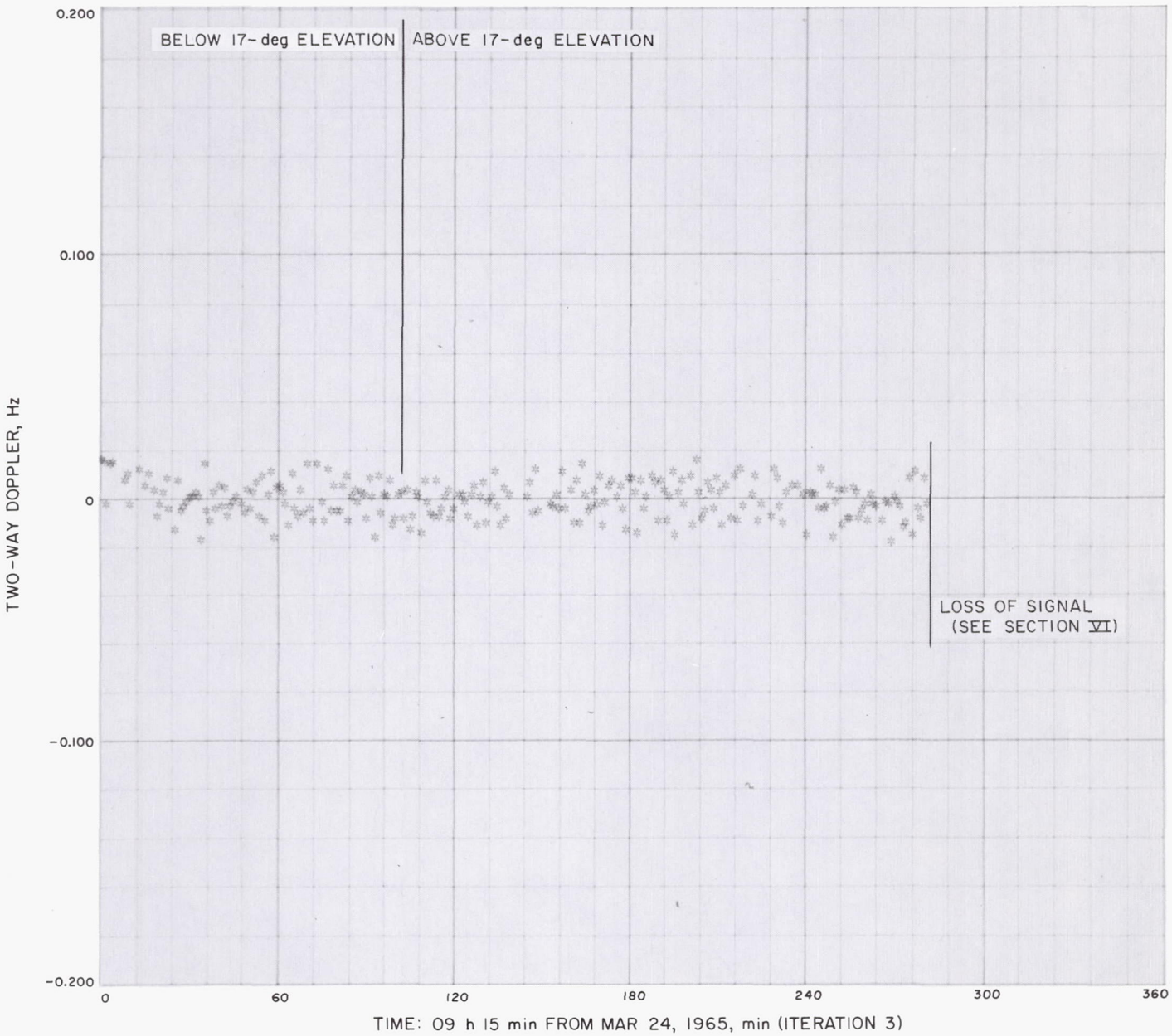


Fig. 15. Station 12 postmaneuver pass No. 2 two-way doppler residuals

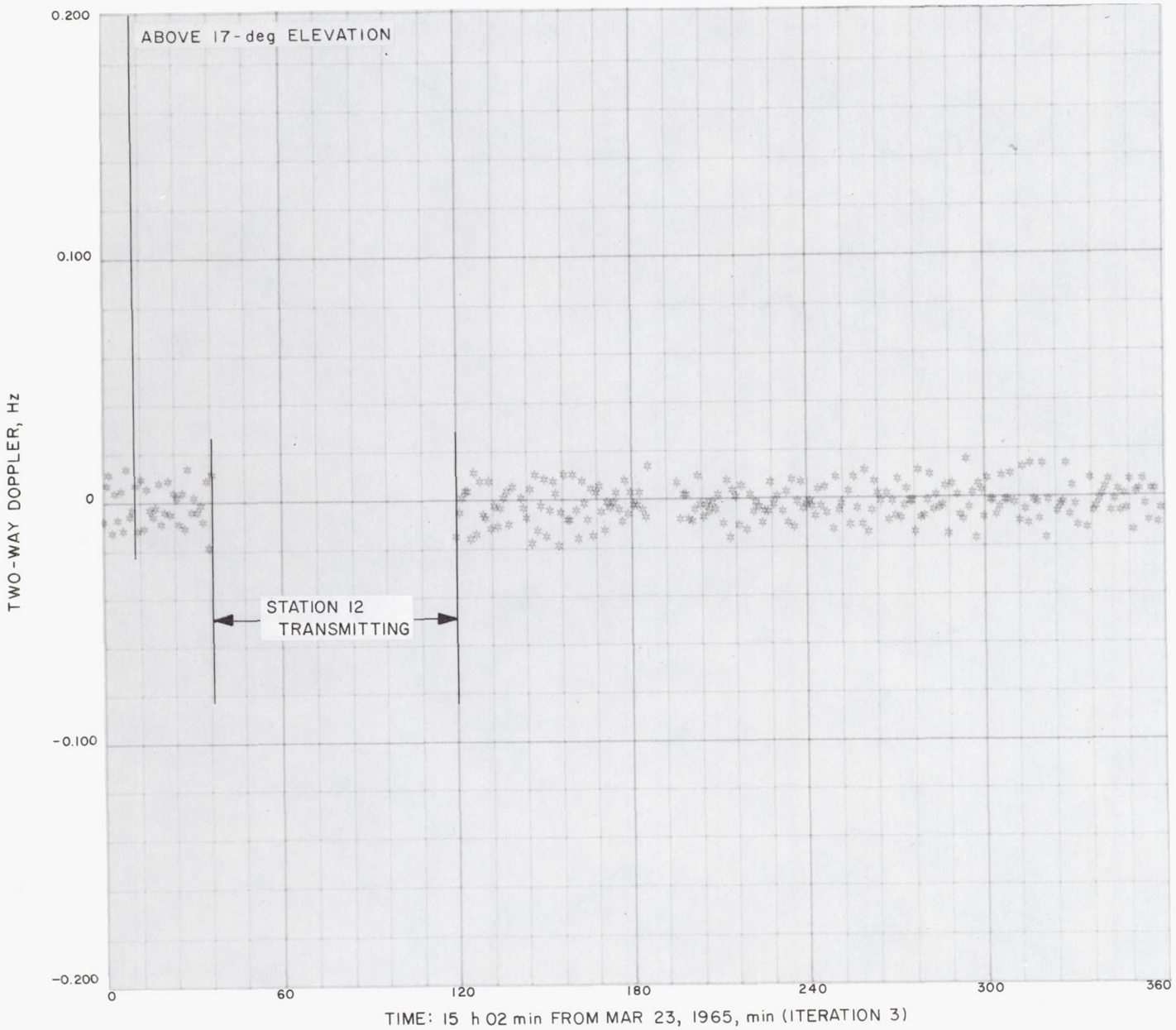


Fig. 16. Station 41 postmaneuver pass No. 1 two-way doppler residuals

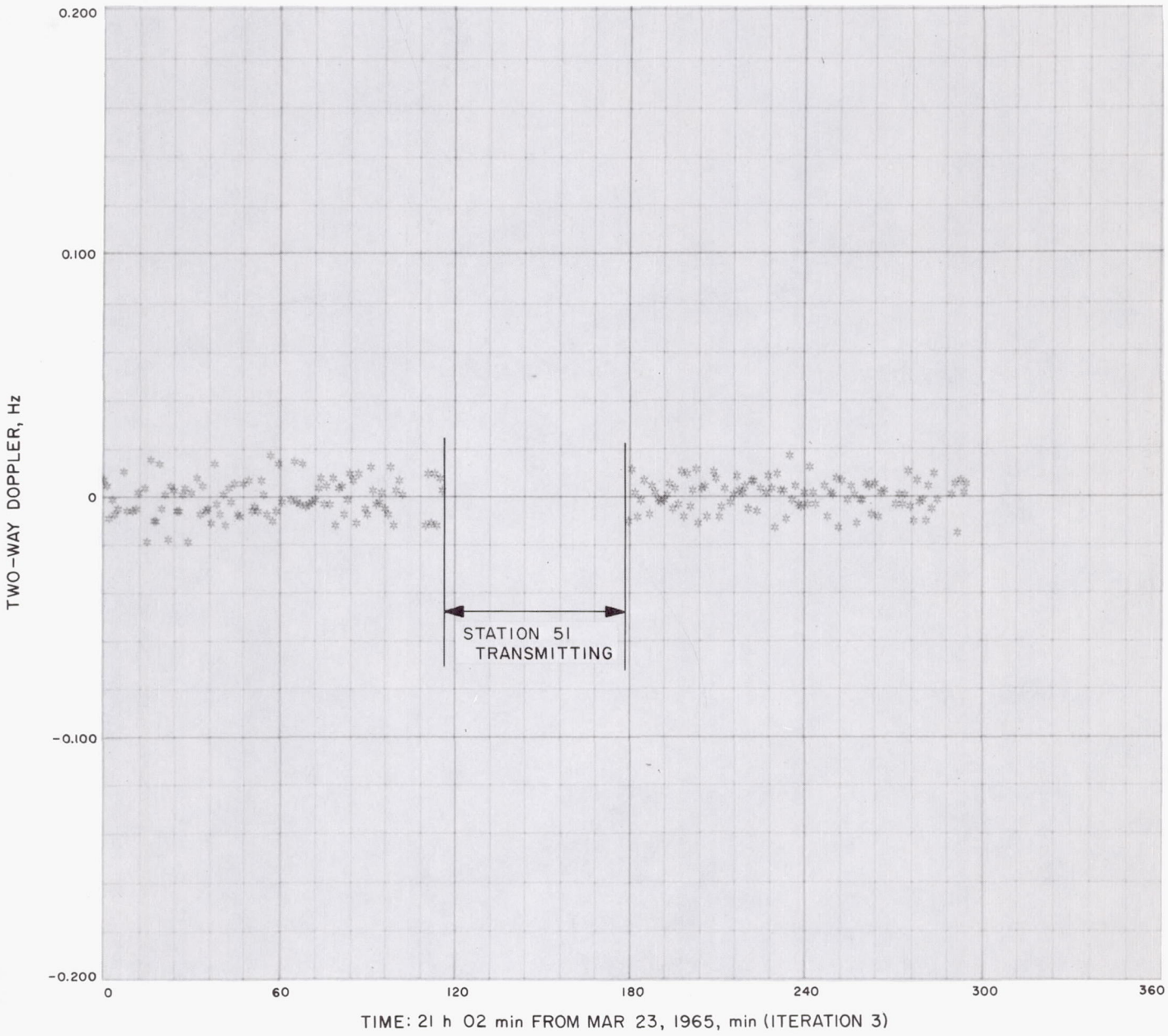

0.200
0.100
0
-0.100
-0.200
TWO-WAY DOPPLER, Hz
STATION 51
TRANSMITTING
0
60
120
180
240
300
360
TIME: 21 h 02 min FROM MAR 23, 1965, min (ITERATION 3)

Fig. 16 (contd)

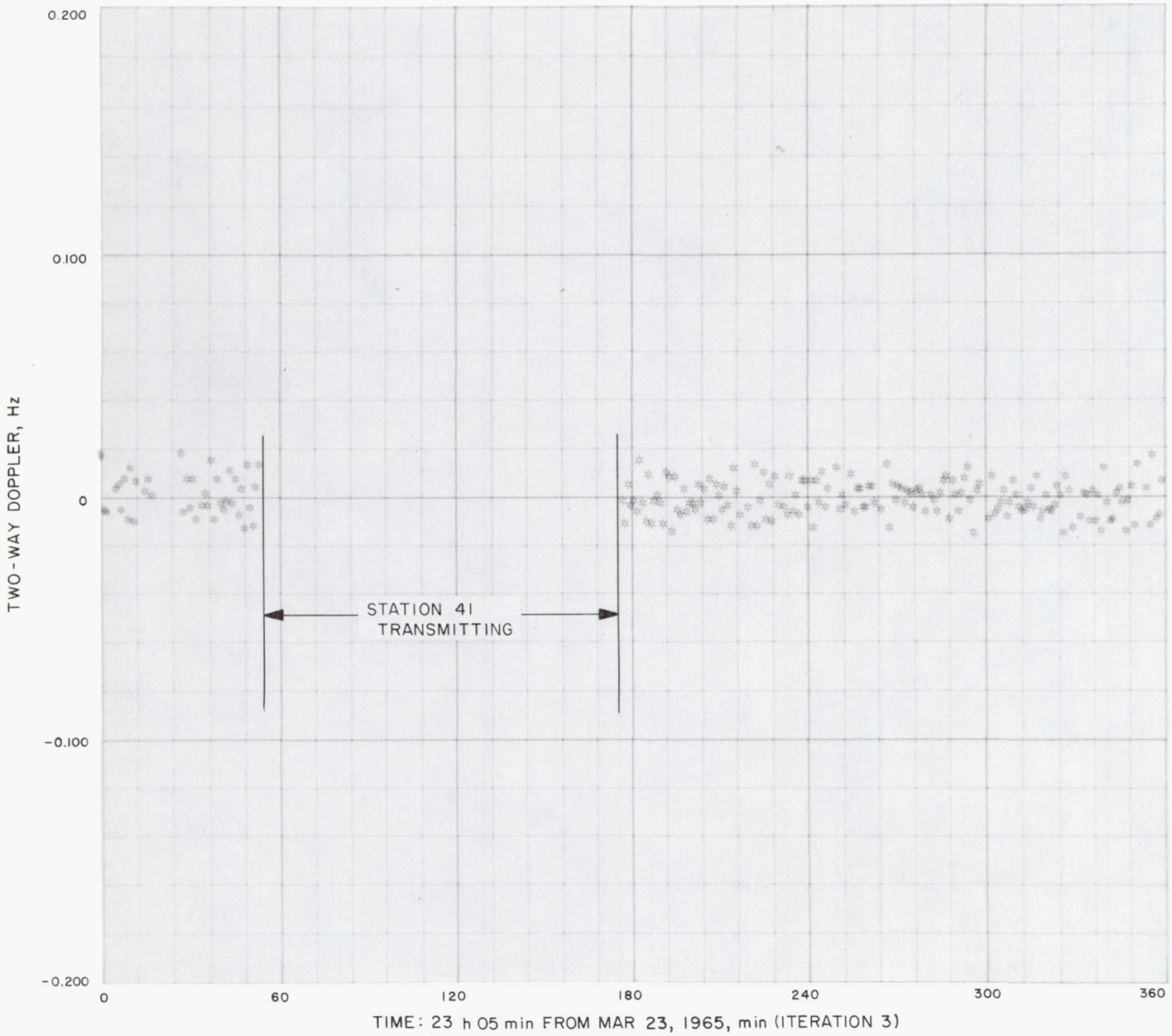


Fig. 17. Station 51 postmaneuver pass No. 1 two-way doppler residuals

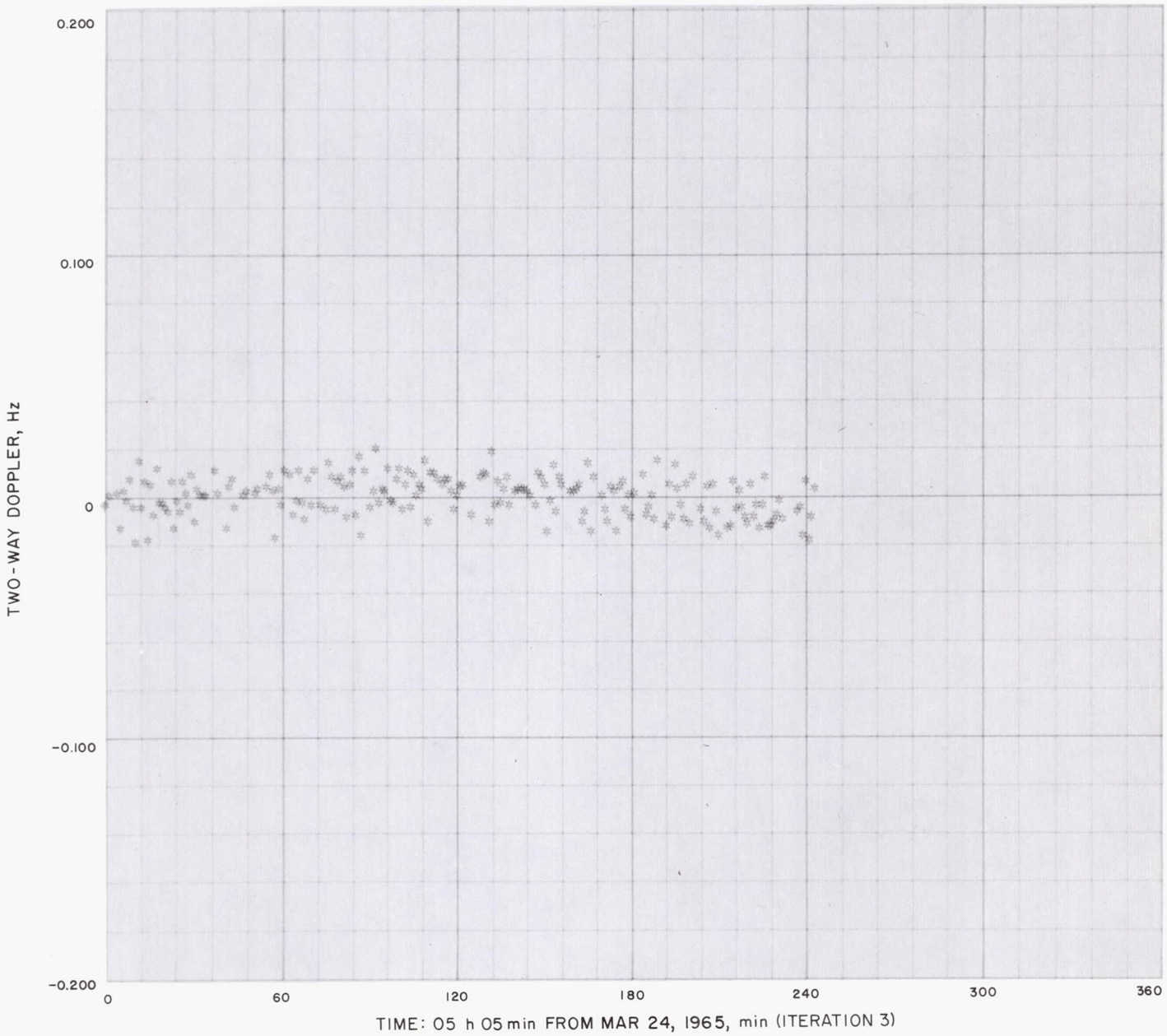

0.200
0.100
0
-0.100
-0.200
TWO-WAY DOPPLER, Hz
0
60
120
180
240
300
360
TIME: 05 h 05 min FROM MAR 24, 1965, min (ITERATION 3)

Fig. 17 (contd)

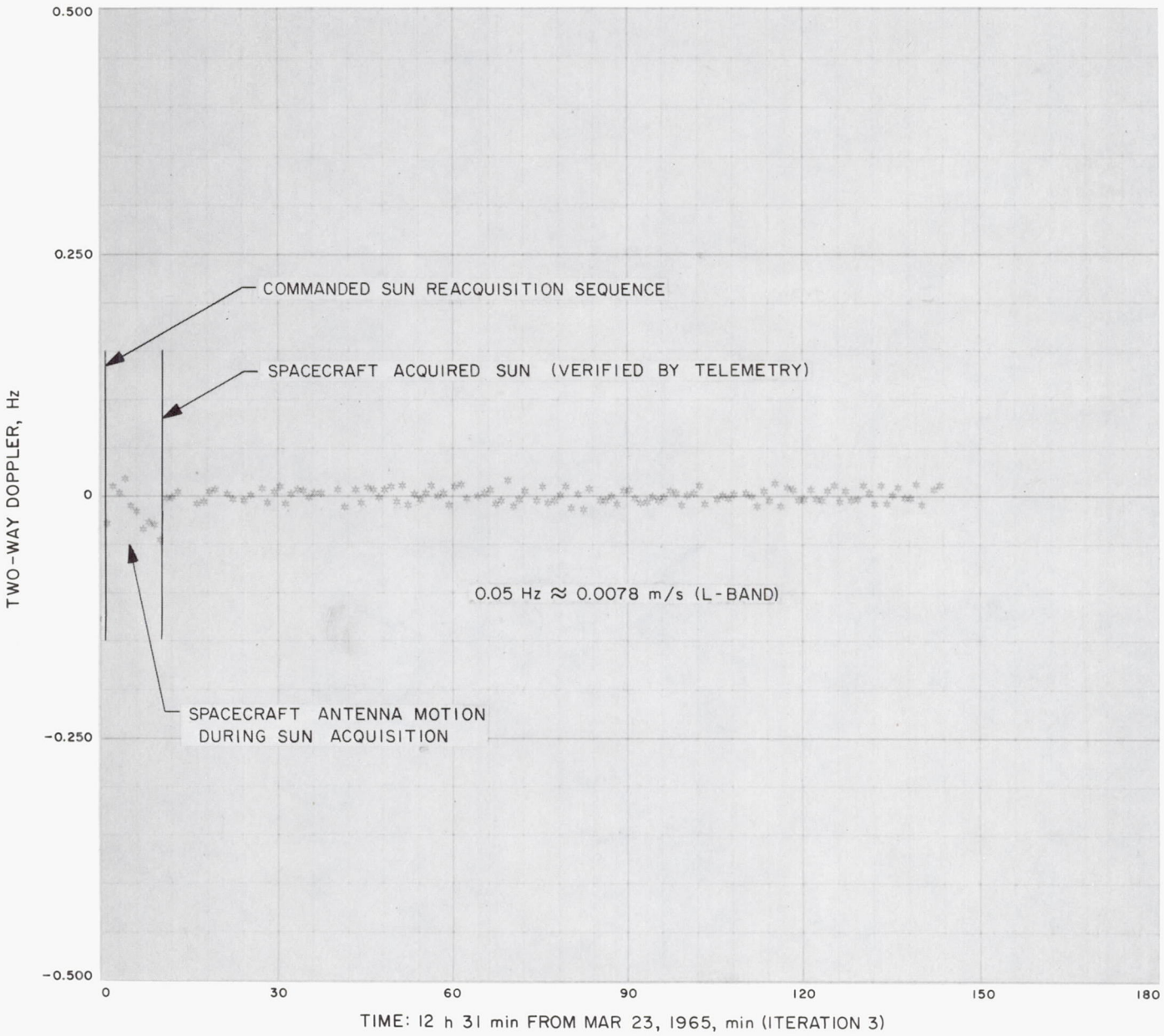
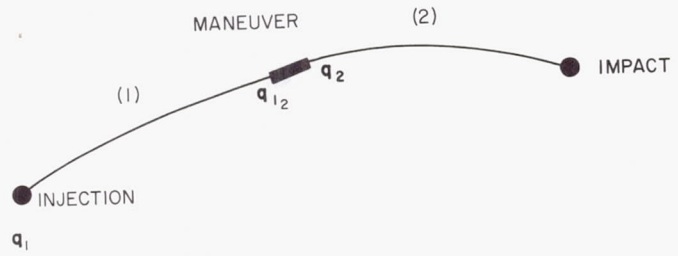


Fig. 18. Station 12 angular residuals

The method used for obtaining the premaneuver estimate, using postmaneuver data, is[2]



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

and

$\mathbf{q}_1^* = \mathbf{q}_1 + \Delta\mathbf{q}_1^* =$ best premaneuver estimate using all data

where

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

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

$U =$ matrix that maps $(\mathbf{q}_2 - \mathbf{q}_m)$ to injection

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

$$A_i = \frac{\partial \text{ observable in block } (i) \text{ (postmaneuver), } i = 1 \text{ for premaneuver}}{\partial \text{ estimated parameter, } i = 2 \text{ for postmaneuver}}$$

$\mathbf{q}_{2_1} = U(\mathbf{q}_2 - \mathbf{q}_m)$

$\mathbf{q}_2 =$ solution 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 minus calculated data)

$\Lambda_m =$ covariance of maneuver (diagonal purposely set to a very pessimistic value of 0.1 m/s)

$\mathbf{q}_m =$ maneuver estimate based on maneuver commands

Similarly the expression for the postmaneuver estimate, using premaneuver data, is

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

and

$\mathbf{q}_2^* = \Delta\mathbf{q}_2^* + \mathbf{q}_2 =$ best postmaneuver estimate using all data

[2]This method was applied by W. L. Sjogren during the postflight analysis of *Ranger VI* tracking data.

2. Results of combining premaneuver and postmaneuver data. The statistics of the estimated parameters based on combining the premaneuver data using the postmaneuver as *a priori* are given in column 5 of Table 5. It may be noted that the uncertainties have been significantly reduced from those based on using premaneuver data only (compare columns 4 and 5 of Table 5). A much stronger solution for $GM_\oplus$, $GM_\mathbb{C}$, and *REM* is indicated when combining premaneuver and postmaneuver data.

The numerical values for the estimated parameters are shown in column 5 of Table 8. The differences between the solution vectors of the premaneuver data only and those using postmaneuver data as *a priori* for the premaneuver data are essentially within the uncertainties seen in column 5 of Table 5. However, they should be the same; this error is due solely to numerical problems in handling all the matrices.

The encounter conditions for the premaneuver trajectory are in columns 3 and 4 of Table 9. A comparison of the **B**-plane statistics (Table 10, columns 1 and 4) reveals a significant reduction in the statistics for the combined estimate. The correlation matrix for the premaneuver data at maneuver epoch is given in Table 7.

The trajectory and the ODP printout, including the data weights and doppler residuals, for this orbital estimate may be seen in Appendixes B, C, E, and F. Explanations of the printout forms are given in Appendixes D and G.

For the postmaneuver orbit, using premaneuver as *a priori*, the estimated parameter statistics, (column 8 of Table 5), show a significant reduction in the uncertainties when compared to the values obtained using the postmaneuver data only. In comparing the postmaneuver orbit using premaneuver data as *a priori* with the premaneuver orbit using postmaneuver data as *a priori*, it is noted that indeed the same uncertainties on the physical constants and station locations are obtained (Table 5, columns 5 and 8). The estimated values of physical constants and station locations for that combined solution (Table 8, columns 5 and 8) are well within the 1-σ values presented in Table 5. This method of combining the two blocks of data is derived with the philosophy of establishing two methods of fitting the data.

The forward solution (postmaneuver using premaneuver data as *a priori*) is considered the most accurate due to the mechanics involved. The premaneuver orbit using the postmaneuver data as *a priori* requires mapping the postmaneuver data covariance matrix back to the injection epoch, which uses programs other than the ODP; therefore, the additional external manipulations cause numerical error to creep in. In theory, the two solutions should be directly comparable. In the Double Precision Orbit Determination Program and the Double Precision Trajectory Program, which are in the process of being developed, these small differences should not exist. For information, the correlation matrix data are given in Tables 13–16.

The difference between the solution vectors of the postmaneuver data only orbit and the postmaneuver orbit using premaneuver data as *a priori* are within the uncertainties seen in Table 5, column 8. The encounter conditions for the postmaneuver trajectory are in Table 9, columns 5 and 6. A comparison of the **B**-plane statistics (Table 10, columns 2 and 3) reveals a reduction in the statistics by a factor of 3. The trajectory and the ODP printout, including the data weights and the doppler residuals for this orbital estimate may be seen in Appendixes C and F, respectively.

The significance of combining the two phases is dramatically seen in $GM_\oplus$, $GM_\mathbb{C}$, and *REM*, which are measured to a lesser uncertainty than each separate estimate. This significance is also noted in station location uncertainties. In the orbit determination program, *REM* is estimated uncoupled from $GM_\oplus$ and $GM_\mathbb{C}$, while in reality *REM* is dependent on $GM_\oplus$ and $GM_\mathbb{C}$. *REM* is related to the *GM*s by the following constraint (Refs. 5 and 6):

$$REM = 86.315745\,(GM_\oplus + GM_\mathbb{C})^{1/3}$$

If *REM* is calculated from the constraint equation, the value obtained in Table 8 yields an *REM* equal to 6387.3156 km, which is a −9.8-m change from the nominal. The solution in the ODP is a −24.7-m change from the nominal; this change is 14.9 m from the constraint value. The correlation matrix is displayed in Table 17.

The method used to apply the *REM* constraint to both the best premaneuver and postmaneuver solutions (i.e., the premaneuver orbit with postmaneuver data as *a priori* and the postmaneuver orbit with the premaneuver data as *a priori*) was developed by D. L. Cain.[3] Briefly, this method sets the constraint equation equal to G:

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

and uses a Lagrange multiplier on the original function to be minimized and constrain G:

$$\mathbf{q}_o = A^T W(O - C)$$

$$\mathbf{q}_c = \mathrm{A}^T WA + \lambda G$$

where

$\mathbf{q}_o$ = original function

$\mathbf{q}_c$ = constrained function

A = residual = observed value − calculated value

W = diagonal weighting matrix $\begin{bmatrix} \frac{1}{\sigma_{\dot{\rho}}^2} & & \\ & \ddots & \\ & & \ddots \end{bmatrix}$

λ = vector of Lagrange multiplier

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

$$\mathbf{q}_n = \mathbf{q}_o + \delta_{\mathbf{q}}$$

where

$$\delta_{\mathbf{q}} = \Lambda_o C^T (C \Lambda_o C^T)^{-1} D$$

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

[3]D. L. Cain, "Least Squares With Side Constraint," Jan. 2, 1963 (internal communication).

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

Λ_o = the original covariance matrix

and the constraint statistics are

$$\Lambda_c = \Lambda_o - \Lambda_o C^T (C \Lambda_o C^T)^{-1} C \Lambda$$

The above computations were performed using the solutions from both the combined orbits. These results are presented in columns 6 and 9 of Table 5, in which it can be seen that the uncertainties in the Cartesian coordinates and the physical constants have been reduced. Again, it should be noted that, in both cases, the statistics in station locations and physical constants are consistent.

Statistics in the **B** plane have had the *REM* constraint applied, but, in addition, they have also been transformed from geocentric to selenocentric uncertainties,[4] giving a proper uncertainty to the impact location. These statistics are presented in Table 9. Figures 14–17 show the residuals from the postmaneuver orbit with premaneuver *a priori* plus the *REM* constraint. In both cases, deviations on the residuals seen in the previous orbital estimates were insignificant. This deviation can be verified by comparing the residuals in the figures to those listed in the ODP printouts in Appendixes E and F for the appropriate data blocks. The listings in Appendixes E and F do not have the constraint applied.

The best estimate of the maneuver can now be obtained by using the combined solutions. The numerical values are shown in Table 18, and a more complete discussion of the estimate maneuver is given in Section III-C.

The conclusions of this combining analysis are:

(1) The combined solutions are very nearly the same in estimating station locations and physical constants and their associated uncertainties.

(2) The use of the *REM* constraint gives a solution for the estimated parameters which are acceptable.

The use of the *REM* constraint as applied in this analysis has certain limitations, for example, if the original covariance matrix (Λ_o) has statistics that are small (tight statistics computed from clear or relatively noise-free data), the calculation of $(C\Lambda_o C^T)^{-1}$ presents a large value that is not realistic. For the *Ranger IX* analysis, the constrained estimates are acceptable and are presented as the final solution.

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

G. Observations and Conclusions

1. Station locations. Considerable information can be obtained from radio tracking data, especially in determining station locations. The available information is not immediately obvious, since examination of the covariance matrices from the various orbit calculations indicate that the most information compiled is on station longitude. 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. The coordinate system used to show this difference is the X_1, X_2, and X_3 system,[5] shown in Fig. 19. Where X_1 is normal to the earth spin axis, passing through the station in the station meridian plane; X_2 is similar to longitude, normal to X_1 and to the earth spin axis; and X_3 is parallel to the earth spin axis.

[5]D. L. Cain, "Tracking Station Coordinate Systems," June 24, 1964 (internal communication).

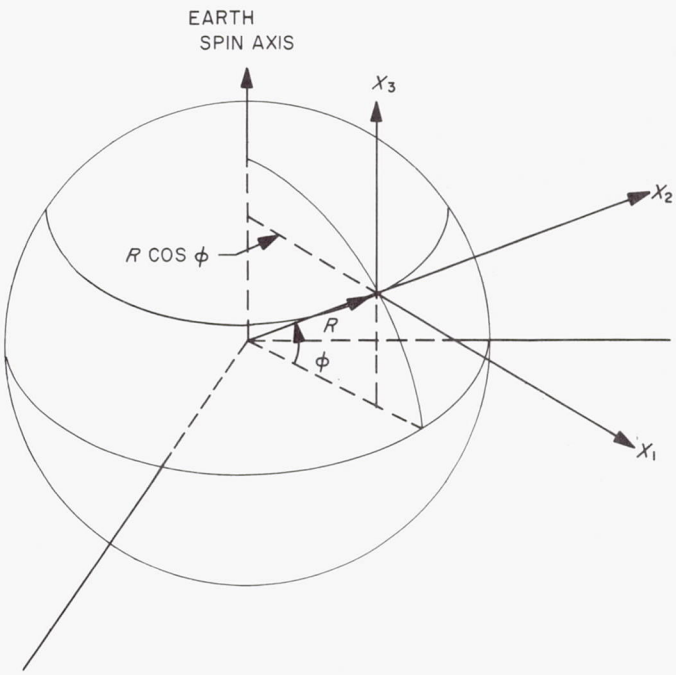


Fig. 19. X_1, X_2, and X_3 coordinate system

Table 13. Correlation matrix on postmaneuver data at maneuver epoch (March 23, 1965 at 12:30:38 GMT)

Standard deviation	Units	Correlation coefficients																		
		X	*Y*	*Z*	*DX*	*DY*	*DZ*	$GM_{\oplus}$	*REM*	*G*	$GM_{\mathbb{C}}$	*RI*(3)	*LA*(3)	*LO*(3)	*RI*(4)	*LA*(4)	*LO*(4)	*RI*(5)	*LA*(5)	*LO*(5)
X 6.326	km	1.000	0.265	−0.412	−0.945	0.419	−0.298	0.016	−0.037	0.001	0.709	0.287	−0.251	0.618	0.356	0.283	0.896	0.381	0.270	0.802
Y 6.561	km		1.000	−0.886	−0.482	0.288	−0.236	−0.027	−0.417	−0.001	−0.047	0.832	−0.729	0.666	0.849	0.671	0.306	0.838	0.598	−0.044
Z 27.362	km			1.000	0.656	−0.480	0.404	−0.152	0.066	0.003	0.006	−0.923	0.808	−0.755	−0.936	−0.739	−0.417	−0.951	−0.679	−0.002
DX 0.0745	m/s				1.000	−0.528	0.403	−0.003	0.022	0.007	−0.499	−0.525	0.458	−0.735	−0.587	−0.465	−0.835	−0.624	−0.444	−0.615
DY 0.0479	m/s					1.000	−0.988	0.397	−0.316	−0.003	0.282	0.497	−0.431	0.025	0.549	0.433	0.207	0.602	0.429	0.065
DZ 0.100	m/s						1.000	−0.452	0.359	0.004	−0.241	−0.441	0.382	0.110	−0.495	−0.391	−0.074	−0.543	−0.387	0.028
$GM_{\oplus}$ 9.725	km^3/s^2							1.000	0.045	0.010	0.422	0.162	−0.141	−0.215	0.236	0.187	−0.039	0.214	0.152	0.063
REM 0.0491	km								1.000	−0.008	−0.227	−0.129	0.113	0.181	−0.181	−0.143	0.029	−0.158	−0.113	−0.038
G 0.300	—									1.000	0.0	−0.003	0.002	0.004	−0.004	−0.003	0.005	−0.004	−0.003	0.003
$GM_{\mathbb{C}}$ 0.539	km^3/s^2										1.000	−0.043	0.037	0.123	0.028	0.023	0.651	0.003	0.0	0.804
RI(3) 0.180	km											1.000	−0.602	0.620	0.879	0.695	0.296	0.892	0.637	−0.107
LA(3) 0.00130	deg												1.000	−0.541	−0.769	−0.607	−0.260	−0.780	−0.556	0.093
LO(3) 0.00156	deg													1.000	0.615	0.486	0.749	0.622	0.443	0.403
RI(4) 0.171	km														1.000	0.522	0.336	0.918	0.655	−0.027
LA(4) 0.00117	deg															1.000	0.268	0.725	0.517	−0.021
LO(4) 0.000799	deg																1.000	0.345	0.244	−0.850
RI(5) 0.186	km																	1.000	0.509	−0.037
LA(5) 0.00113	deg																		1.000	−0.026
LO(5) 0.000697	deg																			1.000

		R	ϕ	λ	*V*	γ	σ
R 6.866	km	1.000	−0.901	0.372	−0.573	0.336	0.461
ϕ 0.00538	deg		1.000	−0.344	0.862	−0.843	−0.623
λ 0.00135	deg			1.000	−0.060	0.160	0.096
V 0.447	m/s				1.000	−0.982	−0.671
γ 0.0827	deg					1.000	0.580
σ 0.000389	deg						1.000

Table 14. Correlation matrix on premaneuver data with postmaneuver data as *a priori* at injection epoch (March 21, 1965 at 21:49:48 GMT)

Standard deviation	Units	Correlation coefficients																	
		X	*Y*	*Z*	*DX*	*DY*	*DZ*	$GM_{\oplus}$	*REM*	*G*	$GM_{\mathbb{C}}$	*RI*(3)	*LA*(3)	*LO*(3)	*RI*(4)	*LA*(4)	*LO*(4)	*RI*(5)	*LA*(5)	*LO*(5)
X 0.113	km	1.000	0.323	−0.291	−0.267	0.286	0.290	−0.291	0.648	−0.018	−0.432	−0.382	0.242	−0.291	−0.433	−0.224	−0.332	−0.757	0.158	−0.322
Y 0.117	km		1.000	−0.912	0.800	0.754	−0.740	0.470	0.757	−0.016	−0.489	−0.479	0.273	−0.159	−0.499	−0.235	−0.302	−0.596	−0.093	−0.263
Z 0.149	km			1.000	−0.722	−0.672	0.736	−0.480	−0.823	0.023	0.453	0.522	−0.299	0.059	0.541	0.265	0.217	0.429	0.459	0.170
DX 0.145	m/s				1.000	0.718	−0.976	0.576	0.310	−0.011	−0.364	−0.202	0.100	−0.134	−0.190	−0.072	−0.256	−0.082	−0.171	−0.220
DY 0.163	m/s					1.000	−0.746	0.247	0.421	−0.019	−0.839	−0.232	0.135	−0.654	−0.239	−0.099	−0.764	−0.224	−0.091	−0.739
DZ 0.343	m/s						1.000	−0.587	−0.292	0.011	0.414	0.182	−0.091	0.186	0.167	0.064	0.310	−0.051	0.337	0.274
$GM_{\oplus}$ 0.592	km^3/s^2							1.000	0.254	0.068	0.042	−0.151	0.083	0.073	−0.142	−0.074	0.021	0.045	−0.376	0.012
REM 0.0328	km								1.000	−0.021	−0.350	−0.584	0.350	0.021	−0.628	−0.321	−0.127	−0.708	−0.294	−0.083
G 0.300	—									1.000	−0.007	0.013	−0.007	0.004	0.012	0.006	0.001	0.017	0.002	−0.003
$GM_{\mathbb{C}}$ 0.300	km^3/s^2										1.000	0.200	−0.120	0.790	0.173	0.074	0.865	0.134	0.084	0.833
RI(3) 0.0752	km											1.000	0.481	−0.043	0.393	0.200	0.015	−0.452	0.157	−0.016
LA(3) 0.00079	deg												1.000	0.046	−0.233	−0.119	−0.015	−0.271	−0.091	0.0
LO(3) 0.00049	deg													1.000	−0.066	−0.046	0.945	−0.098	−0.034	0.952
RI(4) 0.0681	km														1.000	−0.480	0.013	0.499	0.162	−0.006
LA(4) 0.00082	deg															1.000	0.002	0.249	0.095	−0.016
LO(4) 0.00052	deg																1.000	−0.025	0.031	0.967
RI(5) 0.0650	km																	1.000	−0.397	−0.062
LA(5) 0.00082	deg																		1.000	0.021
LO(5) 0.00049	deg																			1.000

		R	ϕ	λ	*V*	γ	σ
R 0.0600	km	1.000	−0.706	−0.110	−0.986	0.241	0.783
ϕ 0.00152	deg		1.000	0.440	0.701	−0.039	−0.701
λ 0.00113	deg			1.000	0.212	0.730	0.188
V 0.491	m/s				1.000	−0.132	−0.712
γ 0.000514	deg					1.000	0.686
σ 0.00221	deg						1.000

Table 15. Correlation matrix on premaneuver data with postmaneuver data as *a priori* at maneuver epoch (March 23, 1965 at 12:30:38 GMT)

Standard deviation	Units	Correlation coefficients																	
		X	*Y*	*Z*	*DX*	*DY*	*DZ*	$GM_{\oplus}$	*REM*	*G*	$GM_{\mathbb{C}}$	*RI*(3)	*LA*(3)	*LO*(3)	*RI*(4)	*LA*(4)	*LO*(4)	*RI*(5)	*LA*(5)	*LO*(5)
X 2.91	km	1.000	0.196	−0.309	0.993	0.449	−0.390	−0.004	−0.313	−0.014	0.937	0.155	−0.098	0.836	0.162	0.067	0.904	0.106	0.107	0.899
Y 2.55	km		1.000	−0.992	0.202	0.932	−0.950	−0.294	−0.951	0.023	0.225	0.606	−0.356	−0.141	0.648	0.329	−0.013	0.742	0.280	−0.054
Z 5.64	km			1.000	−0.313	−0.955	0.969	0.265	0.956	−0.021	−0.329	−0.609	0.358	0.055	−0.648	−0.327	−0.079	−0.742	−0.265	−0.039
DX 0.014	m/s				1.000	0.470	−0.412	−0.056	−0.313	−0.090	0.925	0.156	−0.097	0.811	0.163	0.066	0.887	0.069	0.163	0.878
DY 0.013	m/s					1.000	−0.993	−0.385	−0.912	0.028	0.453	0.570	−0.331	0.091	0.605	0.298	0.239	0.637	0.306	0.194
DZ 0.030	m/s						1.000	0.389	0.919	−0.020	−0.400	−0.585	0.339	−0.001	−0.615	−0.305	−0.152	0.648	−0.310	−0.107
$GM_{\oplus}$ 0.300	km^3/s^2							1.000	0.254	0.068	0.042	−0.151	0.083	0.073	−0.142	−0.074	0.021	0.045	−0.376	0.0118
REM 0.033	km								1.000	−0.021	−0.350	−0.583	0.350	0.021	−0.628	−0.321	−0.127	−0.708	−0.294	−0.083
G 0.300	—									1.000	−0.007	0.013	−0.007	0.004	0.012	0.006	0.001	0.017	0.002	−0.003
$GM_{\mathbb{C}}$ 0.300	km^3/s^2										1.000	0.200	−0.121	0.790	0.173	0.074	0.865	0.134	0.084	0.833
RI(3) 0.075	km											1.000	0.482	−0.043	0.393	0.200	0.015	0.452	0.158	−0.016
LA(3) 0.00079	deg												1.000	0.046	−0.233	−0.119	−0.015	−0.271	−0.091	0.0
LO(3) 0.00049	deg													1.000	−0.066	−0.046	0.945	−0.098	−0.034	0.952
RI(4) 0.068	km														1.000	−0.480	0.013	0.499	0.162	−0.006
LA(4) 0.00082	deg															1.000	0.002	0.249	0.095	−0.016
LO(4) 0.00052	deg																1.000	−0.025	0.031	0.967
RI(5) 0.065	km																	1.000	−0.397	−0.062
LA(5) 0.00082	deg																		1.000	0.021
LO(5) 0.00049	deg																			1.000

		R	ϕ	λ	*V*	γ	σ
R 0.168	km	1.000	−0.462	0.585	−0.415	0.494	−0.341
ϕ 0.00122	deg		1.000	−0.241	0.999	−0.997	0.370
λ 0.000625	deg			1.000	−0.213	0.272	−0.428
V 0.189	m/s				1.000	−0.995	0.364
γ 0.0000409	deg					1.000	−0.400
σ 0.0000263	deg						1.000

Table 16. Correlation matrix on postmaneuver data with premaneuver data as *a priori* at maneuver epoch (March 23, 1965 at 12:30:38 GMT)

Standard deviation	Units	Correlation coefficients																		
		X	*Y*	*Z*	*DX*	*DY*	*DZ*	$GM_{\oplus}$	*REM*	*G*	$GM_{\mathbb{C}}$	*RI*(3)	*LA*(3)	*LO*(3)	*RI*(4)	*LA*(4)	*LO*(4)	*RI*(5)	*LA*(5)	*LO*(5)
X 2.907	km	1.000	0.196	−0.309	−0.967	0.388	−0.237	−0.004	−0.313	−0.016	0.938	0.155	−0.098	0.837	0.162	0.067	0.904	0.106	0.107	0.899
Y 2.549	km		1.000	−0.992	−0.358	0.819	−0.843	−0.294	−0.952	0.024	0.225	0.606	−0.355	−0.141	0.647	0.329	−0.013	0.741	0.279	−0.054
Z 5.639	km			1.000	0.462	−0.841	0.850	0.266	0.957	−0.022	−0.329	−0.608	0.357	0.054	−0.647	−0.327	−0.080	−0.741	−0.265	−0.040
DX 0.0271	m/s				1.000	−0.515	0.381	0.075	0.444	0.031	−0.856	−0.236	0.149	−0.730	−0.268	−0.121	−0.820	−0.227	−0.159	−0.819
DY 0.0197	m/s					1.000	−0.986	−0.180	−0.941	0.014	0.387	0.506	−0.316	0.026	0.559	0.286	0.193	0.620	0.272	0.160
DZ 0.0423	m/s						1.000	0.184	0.943	−0.016	−0.243	−0.517	0.321	0.136	−0.571	−0.294	−0.028	−0.643	−0.272	0.005
$GM_{\oplus}$ 0.5918	km^3/s^2							1.000	0.253	0.068	0.044	−0.151	0.083	0.073	−0.143	−0.075	0.021	0.045	−0.376	0.012
REM 0.0328	km								1.000	−0.019	−0.349	−0.584	0.350	0.020	−0.629	−0.321	−0.127	−0.708	−0.294	−0.084
G 0.2998	—									1.000	−0.014	0.014	−0.008	0.0	0.013	0.006	−0.003	0.018	0.002	−0.007
$GM_{\mathbb{C}}$ 0.2996	km^3/s^2										1.000	0.200	−0.121	0.791	0.173	0.074	0.866	0.134	0.084	0.834
RI(3) 0.0752	km											1.000	0.482	−0.042	0.393	0.199	0.015	0.451	0.158	−0.016
LA(3) 0.00078	deg												1.000	0.045	−0.233	−0.119	−0.016	0.270	−0.090	0.0
LO(3) 0.00049	deg													1.000	−0.066	−0.046	0.945	−0.098	−0.034	0.952
RI(4) 0.0681	km														1.000	−0.480	0.013	0.499	0.162	−0.005
LA(4) 0.00082	deg															1.000	0.002	0.249	0.095	−0.016
LO(4) 0.00052	deg																1.000	−0.025	0.031	0.967
RI(5) 0.0649	km																	1.000	−0.398	−0.061
LA(5) 0.00082	deg																		1.000	0.021
LO(5) 0.00049	deg																			1.000

		R	ϕ	λ	*V*	γ	σ
R 0.168	km	1.000	−0.461	0.585	−0.296	0.384	−0.220
ϕ 0.00122	deg		1.000	−0.241	0.970	−0.986	0.399
λ 0.000625	deg			1.000	−0.004	0.084	−0.051
V 0.177	m/s				1.000	−0.993	0.389
γ 0.0000382	deg					1.000	−0.416
σ 0.0000811	deg						1.000

Table 17. Correlation matrix on postmaneuver data with premaneuver data as *a priori* and the *REM* constraint applied at maneuver epoch (March 23, 1965 at 12:30:38 GMT)

Standard deviation	Units	Correlation coefficients																	
		X	*Y*	*Z*	*DX*	*DY*	*DZ*	$GM_{\oplus}$	*REM*	*G*	$GM_{\mathbb{C}}$	*RI*(3)	*LA*(3)	*LO*(3)	*RI*(4)	*LA*(4)	*LO*(4)	*RI*(5)	*LA*(5)	*LO*(5)
X 2.714	km	1.000	−0.421	0.105	−0.970	0.162	0.306	0.057	0.427	−0.027	0.928	−0.070	0.030	0.887	−0.084	−0.053	0.916	−0.234	0.014	0.922
Y 0.899	km		1.000	−0.933	0.291	−0.559	0.277	−0.425	−0.559	0.002	−0.469	0.220	−0.087	−0.465	0.228	0.095	−0.496	0.276	0.099	−0.488
Z 1.785	km			1.000	0.029	0.521	−0.363	0.377	0.399	0.004	0.179	−0.225	0.089	0.245	−0.222	−0.085	0.264	−0.264	−0.051	0.251
DX 0.0239	m/s				1.000	−0.216	−0.223	0.0	−0.336	0.049	−0.826	0.058	−0.022	−0.818	0.046	0.037	−0.853	0.193	−0.039	−0.872
DY 0.0065	m/s					1.000	−0.875	−0.099	−0.076	−0.029	0.025	−0.158	0.044	0.006	−0.120	−0.045	0.098	−0.265	0.077	0.128
DZ 0.0147	m/s						1.000	0.111	0.268	0.021	0.423	0.101	−0.020	0.461	0.056	0.012	0.386	0.137	−0.077	0.355
$GM_{\oplus}$ 0.584	km^3/s^2							1.000	0.915	0.073	0.118	−0.075	0.031	0.078	−0.059	−0.027	0.049	0.229	−0.352	0.032
REM 0.0035	km								1.000	0.052	0.508	−0.083	0.036	0.414	−0.095	−0.048	0.402	0.099	−0.315	0.379
G 0.300	—									1.000	−0.027	0.0	0.001	0.0	−0.003	−0.002	−0.007	0.0	−0.004	−0.010
$GM_{\mathbb{C}}$ 0.274	km^3/s^2										1.000	−0.044	0.022	0.853	−0.109	−0.062	0.884	−0.244	−0.025	0.862
RI(3) 0.0612	km											1.000	0.897	−0.070	0.048	0.019	−0.105	0.059	0.007	−0.109
LA(3) 0.00074	deg												1.000	0.058	−0.020	−0.009	0.047	−0.030	0.001	0.047
LO(3) 0.00049	deg													1.000	−0.104	−0.057	0.955	−0.167	−0.042	0.957
RI(4) 0.0532	km														1.000	−0.917	−0.121	0.091	−0.002	−0.107
LA(4) 0.00078	deg															1.000	−0.055	0.029	0.012	−0.059
LO(4) 0.00051	deg																1.000	−0.216	−0.014	0.967
RI(5) 0.0451	km																	1.000	−0.877	−0.220
LA(5) 0.00079	deg																		1.000	−0.013
LO(5) 0.00049	deg																			1.000

		R	ϕ	λ	*V*	γ	σ
R 0.151	km	1.000	−0.147	0.528	0.277	−0.072	0.071
ϕ 0.000387	deg		1.000	0.147	0.824	−0.902	−0.712
λ 0.000596	deg			1.000	0.666	−0.532	0.176
V 0.07473	m/s				1.000	−0.960	−0.490
γ 0.0000146	deg					1.000	0.488
σ 0.0000642	deg						1.000

Table 18. *Ranger IX* maneuver estimate based on combined solutions

Premaneuver position and velocity[a]	Postmaneuver position and velocity[b]	Position and velocity change due to maneuver (postmaneuver–premaneuver)	Velocity changes based on maneuver changes vs orbit estimates, %
$X = -19399.532$			
$\Delta X = \underline{-0.158}$			
$X + \Delta X = -19399.690 \pm 2.90$ km	-19399.676 ± 2.90 km	$+0.014$ km	
$Y = -262236.40$			
$\Delta Y = \underline{-0.14}$			
$Y + \Delta Y = -262236.54 \pm 2.55$ km	-262236.45 ± 2.55 km	$+0.09$ km	
$Z = -124765.27$			
$\Delta Z = \underline{-0.17}$			
$Z + \Delta Z = -124765.44 \pm 5.66$ km	-124765.10 ± 5.64	$+0.34$ km	
$DX = 0.14653538 \pm 0.0000135$ km/s	0.13594896 ± 0.0000271 km/s	-10.5864 m/s	-0.379
$DY = -1.2000017 \pm 0.0000125$ km/s	-1.2091034 ± 0.0000197 km/s	-9.1017 m/s	$+0.191$
$DZ = -0.49806944 \pm 0.0000300$ km/s	$-0.50967789 \pm 0.0000423$ km/s	-11.6084 m/s	$+0.057$

[a]Based on premaneuver orbit calculations using postmaneuver data as *a priori*.

[b]Based on postmaneuver orbit calculations using premaneuver data as *a priori*.

Note: Δs are the position changes during maneuver motor burn from the relationship:

$$\Delta X = \frac{1}{2} a_x t^2 = \frac{\dot{v}_x t}{2}, \qquad \Delta X \rightarrow \Delta Y \rightarrow \Delta Z.$$

As previously mentioned, X_1 and X_2 can be well determined, but X_3, which is parallel with the earth spin axis, is not well determined as is evident in Table 19. This table shows the 9×9 normalized covariance matrix of the station location rotated from the radius, latitude, and longitude system into the X_1, X_2, and X_3 system (i.e., lower part of Table 17 rotated). The 1-σ *a priori* used in the initial estimation was 500, 500, and 100 m for X_1, X_2, and X_3, respectively. From the uncertainties in the final estimate, it can be seen that no new information was available for X_3. The best estimates of X_1 and X_2 are obtained when the tracking station is provided with long coverage of the spacecraft (essentially from horizon to horizon). It is evident from Fig. 1 that the rise and set data were not obtained during the *Ranger IX* mission; therefore, this loss of valuable information degrades to the station location estimates.

Table 20 shows that the *Ranger IX* statistics for X_1 and X_2 are in most cases larger than the *Rangers VI, VII,* and

Table 19. Station location statistics

Standard deviation, m	Coordinate (station)	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)
22.897	X_1 (12)	1.000	−0.277	0.056	0.526	−0.334	0.005	0.428	−0.343	−0.030
44.979	X_2 (12)		1.000	0.014	−0.393	0.955	−0.013	−0.423	0.957	−0.001
99.906	X_3 (12)			1.000	0.011	−0.005	−0.001	0.008	−0.007	0.002
18.418	X_1 (41)				1.000	−0.434	0.055	0.656	−0.407	−0.040
48.944	X_2 (41)					1.000	−0.007	−0.472	0.967	0.032
99.766	X_3 (41)						1.000	0.013	−0.014	0.008
19.693	X_1 (51)							1.000	−0.476	0.041
49.130	X_2 (51)								1.000	0.034
97.130	X_3 (51)									1.000

Table 20. Station location comparison

Station[a]	(12)	(41)	(51)	(12-41)	(12-51)	(41-51)
Mariner II Δ^b = (*Mariner II*) − (old survey)						
Δx_1	−157.8					
Δx_2	−93.2					
Δx_3	−110.4					
σx_1	13.5					
σx_2	44.0					
σx_3	99.9					
New survey Δ = (new survey) − (old survey)						
Δx_1	−133.3	−63.5	−17.8			
Δx_2	−103.2	−3.3	0.0			
Δx_3	191.0	41.4	−16.1			
σx_1	26.0	26.0	26.0	36.8	36.8	36.8
σx_2	26.0	26.0	26.0	36.8	36.8	36.8
σx_3	26.0	26.0	26.0	36.8	36.8	36.8
Ranger VIII Δ = (*Ranger VIII*) − (old survey)						
Δx_1	−166.7	13.5	−55.7	−180.2	111.0	69.2
Δx_2	−92.1	156.5	−11.7	−248.6	−80.4	168.2
Δx_3	−2.7	1.3	−27.6	−4.0	24.9	28.9
σx_1						
σx_2						
σx_3						

Station	(12)	(41)	(51)	(12-41)	(12-51)	(41-51)
Ranger VI Δ = (*Ranger VI*) − (old survey)						
Δx_1	−169.5	25.0	−81.9	−194.5	−87.6	160.9
Δx_2	−123.2	122.1	−45.5	245.3	−77.7	167.6
Δx_3	1.6	48.3	−49.0	−49.9	47.4	97.3
σx_1	9.6	38.0	19.0	39.2	21.6	43.6
σx_2	35.5	43.3	40.0	21.5	18.8	22.2
σx_3	99.8	83.0	92.0	128.4	135.9	111.3
Ranger VII Δ = (*Ranger VII*) − (old survey)						
Δx_1	−166.4	2.7	−63.4	−169.1	−103.0	66.1
Δx_2	−112.1	143.2	−38.9	−255.3	−73.2	182.1
Δx_3	2.7	−12.7	−30.6	15.4	33.3	17.9
σx_1	8.8	29.2	21.6	30.5	23.3	36.3
σx_2	23.5	30.9	28.3	22.9	17.7	22.2
σx_3	99.9	98.5	100.0	140.3	141.4	140.4
Ranger IX Δ = (*Ranger IX*) − (old survey)						
Δx_1	−173.9	26.5	−47.6	−200.4	−126.3	74.1
Δx_2	−54.4	205.3	20.2	−259.7	−74.6	185.1
Δx_3	−0.2	−1.8	−26.5	1.6	26.3	24.7
σx_1	22.9	18.4	19.7	20.5	22.9	15.8
σx_2	44.9	48.9	49.1	14.6	14.4	12.6
σx_3	99.9	99.8	97.1	141.3	139.2	138.7

[a]DSS 12—Goldstone Echo Site, California.
DSS 41—Woomera, Australia.
DSS 51—Johannesburg, South Africa.

[b]All values are in meters.

VIII missions. Table 20 also contains a summary of solutions obtained from tracking data taken during actual missions compared to land survey locations (old survey). The "new survey" refers to a reevaluation[6] of locations when the basic reference, the Clarke spheroid of 1866, was changed to the "Kaula" or "165" spheroid.

The quality of the data on *Ranger IX* is increased as compared to *Rangers VI* and *VII*, since essentially all tracking was obtained using the rubidium frequency standard, which significantly reduces the noise level of the data. The estimates for *Rangers VI, VII, VIII,* and *IX* are all within each 1-σ estimate.

2. *Physical constants.* Estimates on three physical constants were obtained from the tracking data. $GM_\oplus$, $GM_\mathbb{C}$, and *REM* were estimated with uncertainties and values near those computed for *Rangers VI, VII,* and *VIII.*

This comparison may be seen in Table 21 and Figs. 20 and 21. Results of *Rangers III, IV,* and *V* have been included to show the consistency obtained from the *Ranger* missions. Solution uncertainties for *Rangers IV* and *V* were largely due to the limited amount of available tracking data. Note that the uncertainty for $GM_\mathbb{C}$ for *Ranger IX* was not reduced from the nominal JPL value adopted after the *Mariner II* mission. The reason for this large uncertainty was due to a loss of signal (two-way doppler) 12 min prior to impact. The loss was due to a malfunction at the tracking station.

Comparison of the *Rangers VI, VII, VIII,* and *IX* solutions (Table 21 and Figs. 20 and 21) showed agreement in $GM_\oplus$ and $GM_\mathbb{C}$. The consistency of the four *Rangers* and the *Mariner* was of significant interest, since they

[6]J. Heller and H. Kieffer, "DSIF Station Locations," May 1964 (internal communication).

Table 21. Physical constants estimate

Source	Value, km^3/s^2	Standard deviation, km^3/s^2	Remarks
GM_{earth} estimate = $GM_{\oplus}$			
Nominal JPL[a]	398603.20	± 4.0	
Ranger III	398600.49	± 4.1	4 days of tracking
Ranger IV	398601.87	±13.3	8 h of tracking
Ranger V	398599.20	±13.2	8 h of tracking
Ranger VI[b]	398600.61	± 1.1	65 h of tracking
Ranger VII[b]	398601.29	± 1.5	68 h of tracking
Ranger VIII[b]	398601.08	± 0.70	65 h of tracking
Ranger IX[b]	398601.41	± 0.58	64 h of tracking
GM_{moon} estimate = $GM_{\leftmoon}$			
Nominal JPL (prior to *Mariner II*)	4900.7589	± 5.0	
Nominal JPL (after *Mariner II*)	4902.7779	± 0.3	Venus cruise data taken during *Mariner II*
Ranger VI[b]	4902.6182	± 0.14	65 h of tracking
Ranger VII[b]	4902.5801	± 0.17	68 h of tracking
Ranger VIII[b]	4902.6351	± 0.12	65 h of tracking
Ranger IX[b]	4902.6932	± 0.24	64 h of tracking
Mariner IV	4902.7560	± 0.10	Mars cruise data taken during *Mariner IV*

[a]Kaula, 1961 (adapted by the Ad Hoc NASA Standard Constants Committee, Ref. 11).
[b]With *REM* constraint applied.

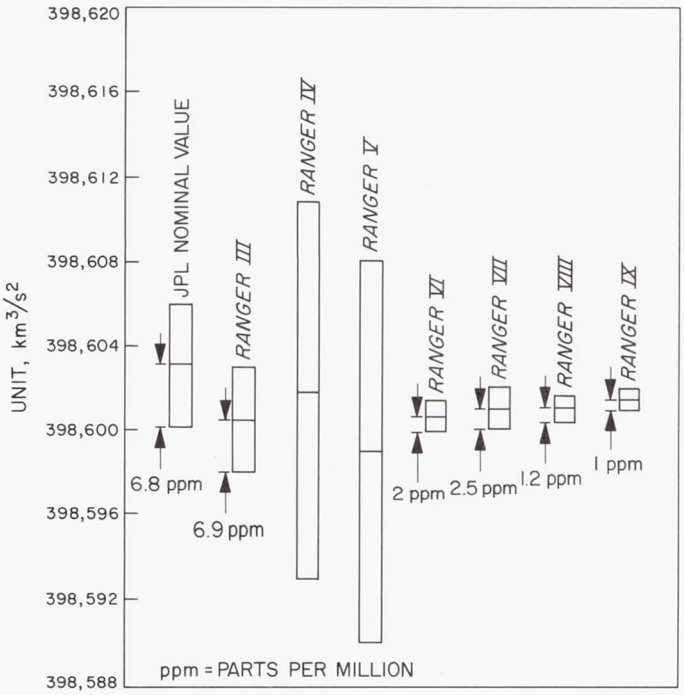


Fig. 20. $GM_{\oplus}$ with probable errors

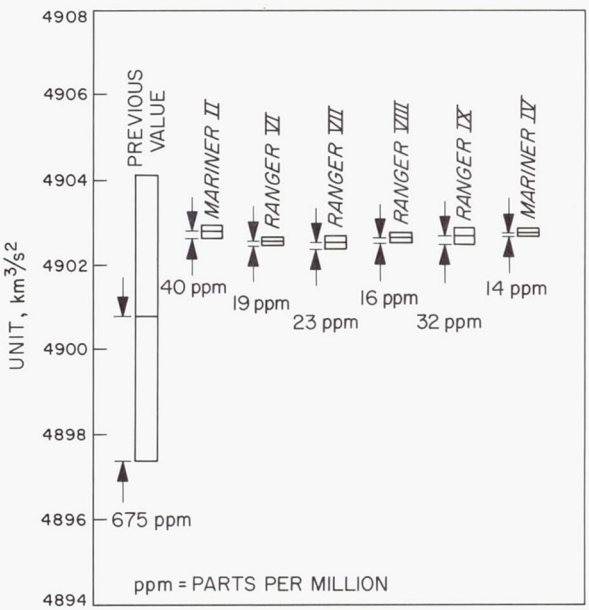


Fig. 21. $GM_{\leftmoon}$ with probable errors

were obtained from two different methods. That is, the *Mariner* solution was obtained by the 28-day periodic effect of the moon in the *Mariner* cruise phase data (Ref. 7); whereas, the *Ranger* solutions (Refs. 8–10) were derived solely from the direct gravitational force of the moon. These estimates were truly determined from the tracking data, for as seen in Table 5, the *a priori* assumptions were a magnitude larger than the final uncertainties.

With these estimates on $GM_{\oplus}$ and $GM_{\leftmoon}$, an earth–moon mass ratio can be determined as follows:

$$\mu^{-1} = \frac{GM_{\oplus}}{GM_{\leftmoon}}$$

Table 22 shows the *Ranger* earth–moon mass ratios compared to nominal and *Mariner* estimates.

3. Impact point. During the *Ranger* flights, there has been a significant difference between the ODP-predicted and the station-observed impact time. This difference has caused considerable reexamination of the JPL trajectory program, the ODP, the mathematical models used within these programs, and the physical system at the tracking

Table 22. Earth–moon mass ratio

Source	Ratio	Standard deviation
Mariner II	81.3015	±0.0034
Ranger VI	81.3036	±0.0023
Ranger VII	81.3044	±0.0026
Ranger VIII	81.3034	±0.0018
Ranger IX	81.3025	±0.0040
Mariner IV	81.3015	±0.0016

stations. No significant error sources have been found which could account for the time difference. This led to the hypothesis that the actual lunar elevation at the impact point differed from the values that were shown on the Lunar Charts (Refs. 12–14). The results of these differences for each of the *Ranger* missions may be seen in Tables 23 and 24. The sub-heading titled "JPL estimate" and "Service estimate," which are under U. S. Army Lunar Map and U. S. Air Force (ACIC) Lunar Charts headings, refer to those used during the actual mission (JPL estimate) and those evaluated after the flight by the map personnel themselves, respectively. The differences

Table 23. Lunar radius comparison

Mission	Lunar elevation, km					Difference in elevation, km	
	U.S. Army Lunar Map Service		U.S. Air Force ACIC		*Ranger* flight data	*Ranger*–Army (Service or JPL)	*Ranger*–ACIC (Service or JPL)
	JPL estimate[a]	Service estimate[b]	JPL estimate[c]	Service estimate[d]			
Ranger VI LAC 60	1738.9	1743.2	1738.4	1738.4	1735.3	−7.9	−3.1
Ranger VII LAC 76	1739.9	1737.7	1737.9	1738.1	1735.5	−2.2	−2.6
Ranger VIII LAC 60	1739.2	1741.6	1737.6	1737.2	1735.2	−6.4	−2.2
Ranger IX LAC 77	1741.0	1738.1	1739.9	1737.4	1735.7	−2.4	−1.7

[a]Based on Ref. 12.
[b]Based on 1964 control points and computed by Army Map Service.
[c]Based on Refs. 13–15 (all charts at scale of 1:1,000,000 with probable error of ± 1.9 km).
[d]Based on Bridged method from current control points.

Table 24. Lunar elevation results (*Ranger* impact point from center of gravity)

Mission	Recorded impact time,[a] GMT	Calculated impact time,[b] GMT	ΔT = recorded minus calculated	VN = velocity normal to lunar surface	$VN \times \Delta T$, km	Radius of moon to match recorded impact time, km	Best radius R from Air Force Lunar Map, km	R (ACIC Lunar Map minus *Ranger*), km	Latitude of impact, deg	Longitude of impact, deg
Ranger VI	09:24:31.86 (±0.005[s])	09:24:30.29 (±0.15[s])	1.57	1.80 km/s	2.83 (±0.3)	1735.3 (±0.3)	1738.4	3.1	9.44	21.50
Ranger VII	13:25:48.80 (±0.005[s])	13:25:47.66 (±0.19[s])	1.14	2.35 km/s	2.68 (±0.4)	1735.5 (±0.4)	1738.1	2.6	−10.70	−20.67
Ranger VIII	09:57:36.755 (±0.005[s])	09:57:35.140 (±0.08[s])	1.615	1.76 km/s	2.84 (±0.4)	1735.2 (±0.4)	1737.2	2.2	2.717	24.617
Ranger IX	14:08:19.998 (±0.005[s])	14:08:19.634 (±0.23[s])	0.364	2.41 km/s	0.877 (±0.4)	1735.75 (±0.4)	1733.7	1.7	−12.99	357.64

[a]Recorded impact time corrected for signal transit time.
[b]ODP calculated impact time based on the nominal lunar radius of 1738.09 km.

in elevation values shown in Table 24 are greater for the *Ranger IX* than for the other missions. This greater difference may be attributed to the uncertainty in the lunar elevation in a crater that was not used in the initial calibration as opposed to Maria area. It is significant to note that all *Ranger* missions computed the lunar radius to be 1735.2 ± 0.5 km, as compared to 1740.1 ± 3.1 km for U. S. Army Lunar Map Service and 1737.8 ± 0.6 km for U. S. Air Force ACIC.

The best ODP estimate of the lunar latitude and longitude of the *Ranger IX* impact point is -12.992 and 357.639 deg, respectively, which were obtained from the postmaneuver data using premaneuver as *a priori* with *REM* constraint. The preliminary values of the latitude and longitude, based on analysis of *Ranger IX* lunar TV photos using Air Force Lunar Charts, are -12.839 and 357.625 deg. The differences in the *Ranger* impact point as computed by JPL Orbit Determination Program and the analysis of *Ranger IX* TV photos and Air Force Lunar Charts are shown in Table 25. The uncertainty on the values computed from the postmaneuver data using premaneuver as *a priori* is bound by the selenocentric dispersion ellipse having a *SMAA* of 2.39 km and a *SMIA* of 0.38 km (Table 10, column 5).

Table 25. Lunar impact location comparison

Impact location	TV photos and ACIC	Orbit determination (OD)	Difference OD − TV, km
Latitude	−12.839 deg	−12.992 deg	−4.61
Longitude	357.625 deg	357.639 deg	0.42
Elevation	1737.4 km	1735.7 km	−4.2

Note: 1 deg ≈ 30 km on lunar surface.

H. Limitations and Future Plans

This section discusses the limitations of the *Ranger IX* flight path analysis described in this report, predicts the results realizable from the DSIF tracking data obtained during the *Ranger* missions, and indicates some of the plans for follow-on or "summary" analysis.

Two immediate areas of the follow-on analysis are the statistical combination of the results from the *Ranger* flights (in particular *Rangers VI, VII, VIII,* and *IX*), and the development of a "next generation" ODP to eliminate some of the shortcomings of the Single Precision ODP. The next generation ODP is called the Double Precision Orbit Determination Program (DPODP) and is described in a series of articles presented in Volume III of the JPL Space Programs Summaries commencing with issue SPS 37-38 (Ref. 16).

The additional capabilities incorporated into the DPODP which are of interest for this postflight type of analysis are summarized in Table 26. It is significant to note that errors introduced during computations due to interpolation and the buildup of roundoff error are the major contributions of the two-way doppler weighting sigma for the SPODP in Section II-C. This use of SPODP versus DPODP means that the full potential of the DSIF tracking data has not been realized in the *Ranger* analysis to date. The two-way doppler weighting sigma (for one sample/min) can be reduced from 13 mm/s to less than 5 mm/s 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 shown in Figs. 8–13. These plots tend to illustrate only the high-frequency noise sources.

In addition to the computing noise, 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 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 as *a priori* information when processing premaneuver data, in that both orbits use the same set of data, but in a different order. Table 8 compares the physical constant solutions from these two orbits. Although the standard deviation of each physical constant shown in Table 5 exceeds the discrepancy between the two solutions, it is still clear that numerical difficulties do exist. For example, $\Delta GM_{\mathbb{C}} = 0.05$ km^3/s^2 is a variation in the *6th* digit where a variation in the *8th* digit may be expected due to roundoff, in that although the same computations are performed, they are accomplished in a different sequence for the two solutions. Notice that $\Delta GM_{\mathbb{C}}$ is overshadowed by the $\sigma_{GM_{\mathbb{C}}} = 0.27$ for this analysis, but it will not be acceptable for the summary analysis, which should yield $\sigma_{GM_{\mathbb{C}}} = 0.02$.

[7]Value obtained via letter from O. S. Jakulis, ACIC, St. Louis, Missouri, 1 Nov. 1965 to W. Kirhofer, JPL.

Table 26. Limitations of *Ranger* analysis which will be overcome with the "next generation" ODP

Limitation of ODP used for the *Ranger* analysis to date	Characteristics of "next generation" ODP
1. Trajectory and most other computations are in single precision. Errors are introduced during computations due to interpolation and the buildup of roundoff error, which are the main contributions to the data weighting sigma, e.g., computing noise contributed 0.012 m/s out of a total station weighting sigma of 0.013 m/s for two-way doppler near lunar encounter (for a DSIF station with a rubidium frequency standard).	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 $GM_{\oplus}$, $GM_{\leftmoon}$, and *REM* constraints (maintains the "calculated" period consistent with the "observed" period of the moon).[a] 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 position 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 that were treated separately for this report.
4. Size of solution vector is limited to 20 parameters. As an example, nineteen parameters were used for the *Ranger IX* analysis, which did not include the maneuver velocity increments in the solution vector.	4. Size of solution vector will be nominally 50 parameters, but will vary depending on nature of run. This will allow the inclusion of added parameters mentioned under item 3.
5. Eckert's latest corrections on the transformation of coordinates were not included (Ref. 17).	5. The ephemeris tapes will be updated and should result in a smoother fit of premaneuver data with postmaneuver data.
6. Wandering of the polar axis is not included in the model.	6. Polar motion will be in the model and should improve the consistency of station location solutions.

[a]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 $GM_{\oplus}$, $GM_{\leftmoon}$, and *REM* solutions.

The discrepancies in spacecraft position at the midcourse maneuver epoch are shown in Table 18, in which, for example, the spacecraft is displaced 0.34 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 constraint among $GM_{\oplus}$, $GM_{\leftmoon}$, and *REM* is applied as a side condition (Section II-F-2) 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 applied after the orbit has converged without recognizing the constraint.

Although the effective weighting scheme employed for this analysis compensates for model inadequacies, this method is not the most effective way to handle the problem. Certain model errors may be known to exist, but models cannot be effectively modeled with the present estimates. This ineffectiveness of modeling usually exists because of practical reasons, in that the number of parameters required in the solution vector would be unreasonable. Work is presently underway at JPL to mechanize an estimator that more properly accounts for these types of model errors or "process noise." In addition to computational noise, model errors may take the form of forces that are not accounted for, such as:

(1) Unbalanced attitude control forces (not pure couples, i.e., they cause a translational acceleration of the spacecraft center of gravity).

(2) Varying solar pressure force (either because the spacecraft presents a variable effective area to the sun or the sun expells a variable photon flux).

(3) Incorrect ephemerides.

(4) An inadequate model for the correction that must be applied to the tracking data, such as refraction due to the earth atmosphere (tropospheric and ionospheric), as well as the effects of space plasma.

Even though the effects of the attitude control system, varying solar pressure, and space plasma are significant items for planetary missions such as *Mariner II* (Venus) and *Mariner IV* (Mars) flights, they are of minor concern for a lunar mission such as *Ranger IX*. However, these effects should be kept in mind when comparing the *Mariner II* and *Mariner IV* $GM_{\mathbb{C}}$ solutions to the solutions obtained from the *Ranger* missions shown in Fig. 21. As an example, the *Mariner II* attitude control forces that existed during the flight are rather ill-defined. A solution of $GM_{\mathbb{C}}$ using cruise data and assuming no attitude control forces differed by 0.2 km^3/s^2 from a solution obtained when a "reasonable" attitude control force–time history was assumed.

The expected effects on observed range due to the ionosphere at the L-band are illustrated in Fig. 22. The DSIF two-way doppler is really the range difference accumulated over a fixed time interval and, as such, the slope of the curve shown in Fig. 22 is a measure of the two-way doppler error caused by the ionosphere. The "night time" curve is essentially flat for elevation angles greater than 30 deg. For *Ranger IX*, a nominal[8] DSS 12 pass ran from 1:00 to 10:00 a.m. local time with a maximum elevation angle (γ_{max}) of 30 deg, while for DSS 41, the pass ran from 23:45 p.m. to 11:45 a.m. with γ_{max} = 85 deg. The omission of the ionosphere from the model in the SPODP may cause errors of up to 10–20 m in a direction normal to the earth spin axis (X_1). However, the tracking geometry is similar for all the *Ranger* flights, thus the error is probably consistent from flight to flight. The fact that the polar motion is not included in the ODP will also cause error in X_1 and longitude solutions.

[8]Defined in Table 2, Section VI; also see Figs. 2, 3, and 4 for the stereographic projection of the spacecraft tracks over the DSIF stations.

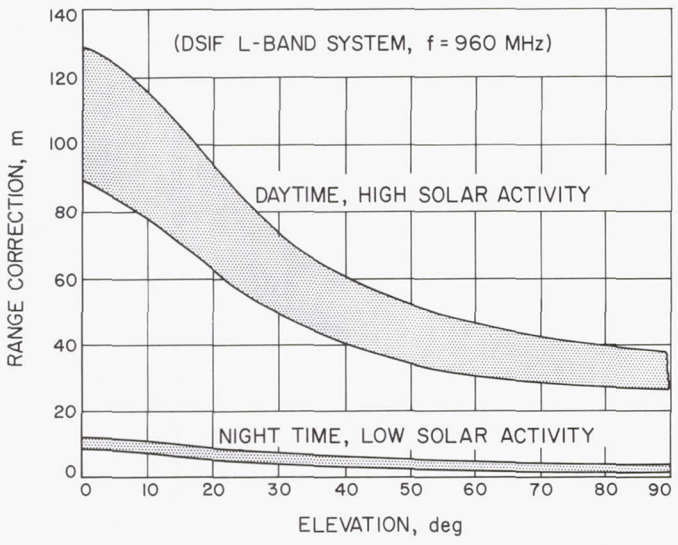


Fig. 22. Effect of ionosphere on range measurements

The statistical combination of the *Rangers VI–IX* results should effect a factor of two improvement over the individual results. At the same time, reasonable residual ($O - C$) should be realized for each mission when the data are refit using the physical constant "combined solutions." However, the residuals thus far produced by these combined solutions seem unrealistic. The suspected causes include the earth–moon ephemerides and uncertainties among the time relationships utilized in the ODP process. Known discrepancies in the Improved Lunar Ephemeris are pointed out by Dr. W. J. Eckert, et al., in Ref. 17. These errors were incurred when sufficient accuracy was not maintained in transforming from the original coordinates computed in the Brown Lunar Theory to the presently accepted coordinates. The discrepancies in earth–moon distance and the lunar longitude that existed at lunar encounter for *Rangers IV–IX* are shown in Table 27.[9] For *Ranger IX*, the earth–moon distance had a known error of 500 m. These errors have a relatively high frequency and can change by 100 m over a day. The lunar ephemeris errors affect the $GM_{\oplus}$ and $GM_{\mathbb{C}}$ solutions through the *REM* constraint. If *RE* (the artificial earth radius that scales the ephemeris) shifts to yield the correct earth–moon distance ($a_{\mathbb{C}}$), a 1-km error in $a_{\mathbb{C}}$ will cause a 3.0 km^3/s^2 shift in $GM_{\oplus} + GM_{\mathbb{C}}$ if the constraint is honored. A 1-km error in lunar longitude will tend to shift the tracking station longitude solution by 16 m. Although Ref. 17 deals with "known" lunar ephemeris errors, the unknown errors may be as large as the known errors, if not larger (although generally conceded to be 1 km, 1 σ). The relatively small variation in $GM_{\oplus} + GM_{\mathbb{C}}$

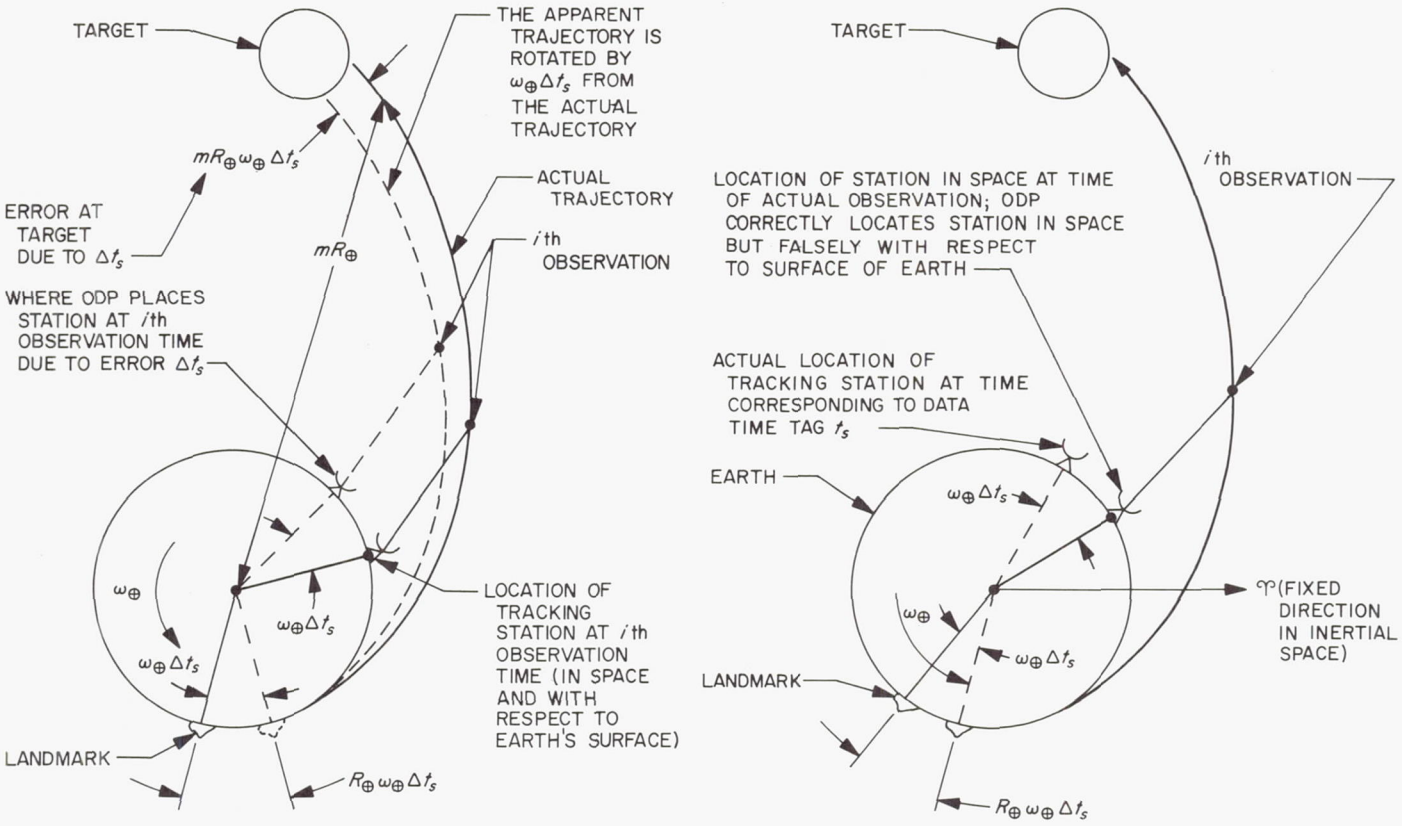
[9]These values are based on a letter from Dr. W. J. Eckert, dated Mar. 7, 1966.

Table 27. Eckert's corrections to Brown's Lunar Ephemeris

Mission	Encounter date	Correction ~ meters	
		Earth–moon distance $\Delta_{a_{\mathbb{C}}} = \frac{-a_{\mathbb{C}}^2}{a_{\oplus}} \Delta \left(\sin \frac{a_{\oplus}}{a_{\mathbb{C}}} \right)$	Lunar longitude $a_{\mathbb{C}} \Delta \Psi$
Ranger VI	2 Feb. 1964	244	+64
Ranger VII	31 July 1964	410	−24
Ranger VIII	20 Feb. 1965	1024	+63
Ranger IX	24 Mar. 1965	500	−11

of 0.8 km³/s² over the *Rangers VI–IX* flights indicates that, if the lunar ephemeris errors are really that large, the gravitational determinations of $GM_\oplus$ and $GM_\mathbb{C}$ are strong enough to keep *REM* from representing the true earth–moon distance, and the spacecraft positional discontinuities allowed at the midcourse epoch absorb the errors.

The station location solutions are sensitive to the timing relationships assumed in the orbit determination process. Examples of this sensitivity are illustrated in Fig. 23. At the start of a mission, either an error in station longitude or an error in station time will cause a compensating rotation of the spacecraft orbit in space. That is, even if station time is assumed to be perfectly known, the station longitude cannot be determined and vice versa. However, if the station times are perfectly known, *relative* station longitudes can be determined or, conversely, an error between the two station clocks will cause an error in the relative longitude. For the DSIF stations (located $\sim \pm 35$-deg latitude), a 1-s time error results in a 400-m longitude error. As the spacecraft approaches the moon, the orbit becomes determined in space (i.e., the right ascension of the probe and the right ascension of the moon) and the absolute station longitude is determined, if the station time is known with respect to ephemeris time (defining the location of the moon in space) and with respect to Universal Time (defining the rotational orientation of the earth). A more complete description of the role these time systems play in the orbit determination process and the likely errors among these time systems are discussed in Ref. 18.



CASE 1. ASSUME THAT:

(1) STATION LOCATION IS PERFECTLY KNOWN AND FIXED WITH RESPECT TO THE EARTH

(2) NO *A PRIORI* KNOWLEDGE OF SPACECRAFT TRAJECTORY

(3) ONLY NEAR-EARTH TRACKING DATA IS PROCESSED (i.e., THE EARTH IS THE ONLY EFFECTIVE ATTRACTING BODY)

CASE 2. ASSUME THAT:

(1) SPACECRAFT TRAJECTORY IS PERFECTLY KNOWN

(2) STATION LOCATION IS INCLUDED IN THE ODP SOLUTION VECTOR

Fig. 23. Effect of an error (δt) in UT 1 — t_s

The next generation ODP will be formulated and the trajectory integration step size will be selected to ensure that, during postflight analysis, computing noise will be a minor contributor to the data weighting sigma. The maneuver velocity increments will be added to the list of "solve for" parameters. The equations that constrain the spacecraft positions at maneuver epoch and that constrain the $GM_{\oplus}$, $GM_{\mathbb{C}}$, and REM parameters will be added to the regression model. Also, the atmospheric refraction model will be improved by adding ionospheric effects and increasing the sophistication of the tropospheric model. In addition, 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 of the timing biases. These time biases include discrepancies among the tracking stations, or between the adopted time references for the tracking net and the timing systems used to locate the celestial bodies in space (ephemeris time) or the rotational orientation of the earth (Universal Time). It is desirable to develop a model complete enough so that the "fitters universe" will contain all the parameters necessary to represent the "real universe" data (remove all trends from the residuals) and to associate realistic statistics with the solution vector parameters.

Table 28 is a comparison of the physical constant statistics between the *Ranger IX* postflight analysis and "ultimate" *Ranger* analysis where an improvement factor of 3 is realized for $GM_{\oplus}$. The improvement factor of 15 for $GM_{\mathbb{C}}$ is misleading because no two-way doppler was obtained beyond 12 min before lunar impact in the case of *Ranger IX*.

The slow relative motion of points on the earth crust (which will not be included in the ODP model) may limit the knowledge of station locations, but the effect of the wandering of the polar axis with respect to the mean pole of 1900–1905 will definitely be included and possibly estimated. 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, improved lunar ephemeris, and an estimator that more properly accounts for known model discrepancies), as well as the statistical combination of the independent solution.

III. Midcourse and Terminal Maneuver Analysis

A. Introduction

The function of the Maneuver Analysis Group (MAG) of the Flight Path Analysis and Command Team was fully described in the maneuver part of the report on the flight path of *Ranger VI* (Ref. 8). Summarized briefly here are the guidelines under which the exploration of maneuver alternatives is carried out for both standard and nonstandard flight sequences. The constraints and restraints imposed are as follows.

(1) Mission.

(a) The impact location must have suitable lighting conditions at arrival. A precise quantitative criteria for measuring these conditions is given in Ref. 19, which predicts best results for regions with a lighting angle of 50–80 deg.

(b) It is desirable to land in a Highland area not far from the lunar equator to photograph a generally different type region than that taken by the previous *Ranger* missions.

(c) If no suitable impact location can be achieved, it is desirable to maximize camera coverage

Table 28. Physical constant statistics: comparison between this analysis and that ultimately realizable with DSIF tracking data from *Ranger* mission

Physical constant	Standard deviation	
	Ranger IX analysis[a]	"Summary" analysis[a]
$GM_{\oplus}$	0.6 $km^3/s^2 = (2.5 \times 10^{-6}) GM_{\oplus}$	0.2 $km^3/s^2 = (0.5 \times 10^{-6}) GM_{\oplus}$
$GM_{\mathbb{C}}$	0.3 $km^3/s^2 = (30 \times 10^{-6}) GM_{\mathbb{C}}$	0.02 $km^3/s^2 = (4 \times 10^{-6}) GM_{\mathbb{C}}$
Station locations[b]		
X_1 (outward radial distance normal to the earth spin axis)	23 m	1–5 m
$X_{2_{41}} - X_{2_{12}} \sim$ (difference in longitude between two stations)	15 m	1–5 m

[a]Combines data from *Rangers VI–IX*.

[b]The current analysis quotes results for DSS 12 and ignores the effect of the ionosphere. The majority of the DSS 12 doppler were obtained at night when ionospheric effects were at a minimum.

of previously unphotographed portions of the moon with a west-side flyby.

(2) Spacecraft and geometrical.

(a) The magnitude of the corrective maneuver cannot exceed the maximum available.

(b) The earth–probe–near limb of the moon angle must not fall below 15 deg in order to maintain earth-lock.

(c) It is desirable 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 prior to impact.

(d) The angle that the roll axis of the spacecraft makes with the probe–earth line should not be less than 40 deg during the entire midcourse maneuver sequence. Violation of this constraint may or may not result in loss of telemetry during this critical time. Coordination with the Spacecraft Performance Analysis and Command Team (SPACT) is required in flight to determine the severity of the loss, if any, should the null cone be entered. In the event that (c) and (d) may not be simultaneously attained, the timer takes preference over the telemetry.

(e) It is desirable that both the midcourse and terminal phases occur well within a Goldstone (DSS-12) viewing period.

(f) In the terminal maneuver sequence, the second pitch turn may not be less than −47 deg. In addition, it may not be greater than +55 deg if accurate roll stabilization is required.

Figure 24 shows several of these constraints mapped onto the **B**-plane.

If telemetry indicates that the turns being executed are significantly different from those commanded, the MAG is able to evaluate in real time, during the execution of the midcourse maneuver sequence, the consequence of any roll and pitch (with some assumed velocity magnitude increment). The evaluation, using linear analysis, estimates target parameters for the maneuver being performed and weighs these against the target parameters for the trajectory with no midcourse perturbation. In carrying out the evaluation, a representative from the JPL Space Sciences Division is consulted before the recommendation is made as to whether or not the maneuver is to be inhibited and the spacecraft returned to its cruise mode by sending real-time command (RTC) 8.

The investigation as to the most desired terminal maneuver can be broken into four 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 by performing in sequence a pitch, a yaw, and a second pitch.

(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) A restricted maneuver, which pitches the spacecraft an amount equaling only the algebraic sum of the first and second pitch computed in (1) above, thus increasing reliability over (1) and (2) while reducing the smear of (4).

(4) No terminal maneuver at all, which further increases reliability.

The constraints on the midcourse maneuver mentioned in the preceding sections also apply here in choosing the proper terminal maneuver. Figures 25 and 26 depict the midcourse and the terminal turning sequences, respectively.

B. Inflight Maneuver Considerations

The primary site considered as a destination for *Ranger IX* for the March 21, 1965 launch was the crater Alphonsus. In flight, the particular location of 13.0-deg south latitude and 2.5-deg west longitude was chosen to provide the desired camera coverage of the crater rim and the central peak, while having a fairly low probability of impacting in the shadow of the central peak.

The first orbit computation early in the mission made it clear that the selected impact point could be achieved with much less than the total 60 m/s capability of the midcourse motor, performing the midcourse maneuver at either the first (L + 17 h) or second (L + 39 h) Goldstone pass. Analysis revealed that the expected dispersions at the target due to midcourse execution errors did not change appreciably by performing the midcourse maneuver on the second Goldstone pass. The additional tracking data available by waiting for a second Goldstone pass would result in a decrease in the orbit uncertainties, besides possibly uncovering any obscure tracking

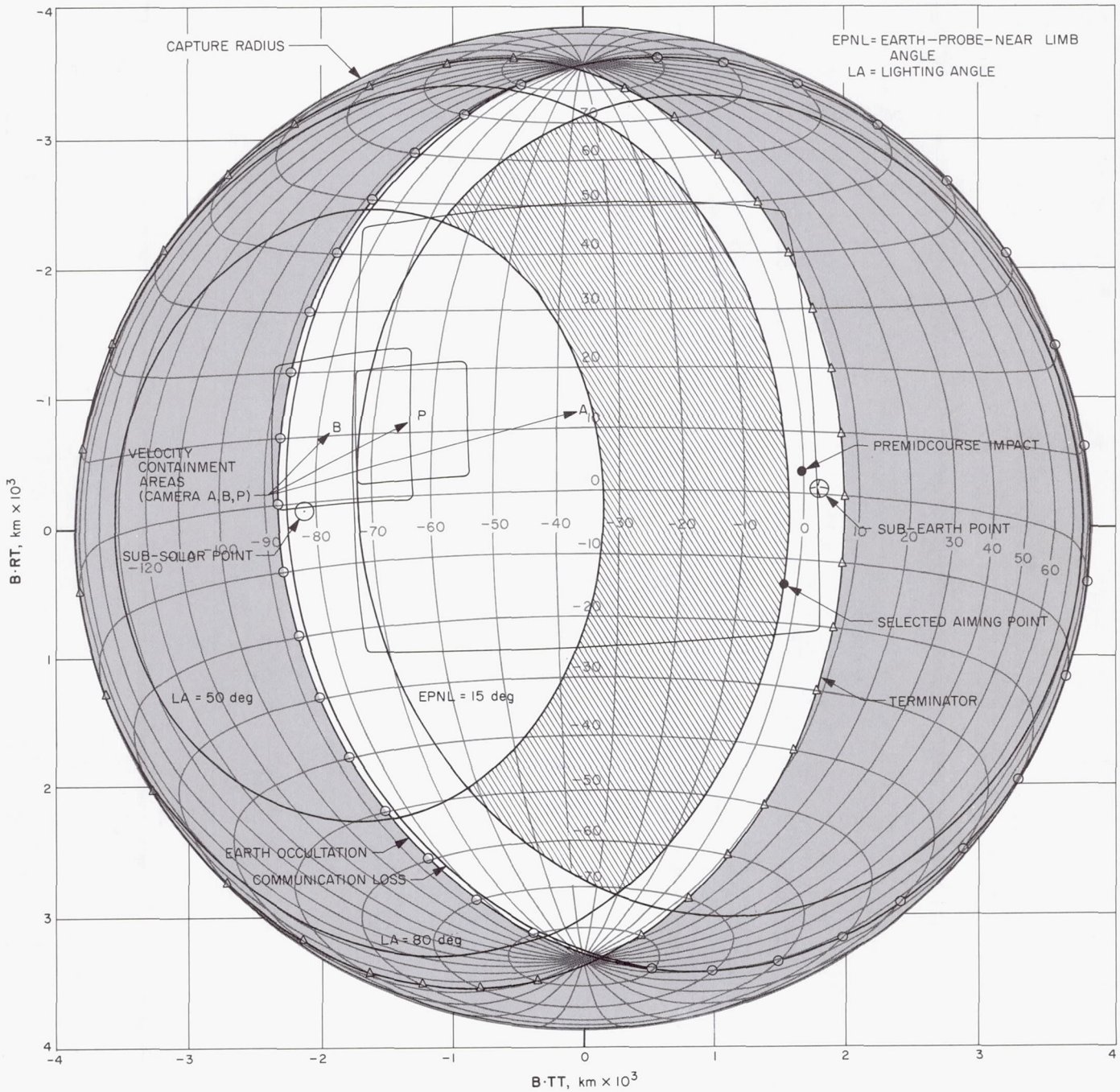


Fig. 24. Constraints in B-plane for Mar. 21, 1965 launch and Mar. 24, 1965 arrival

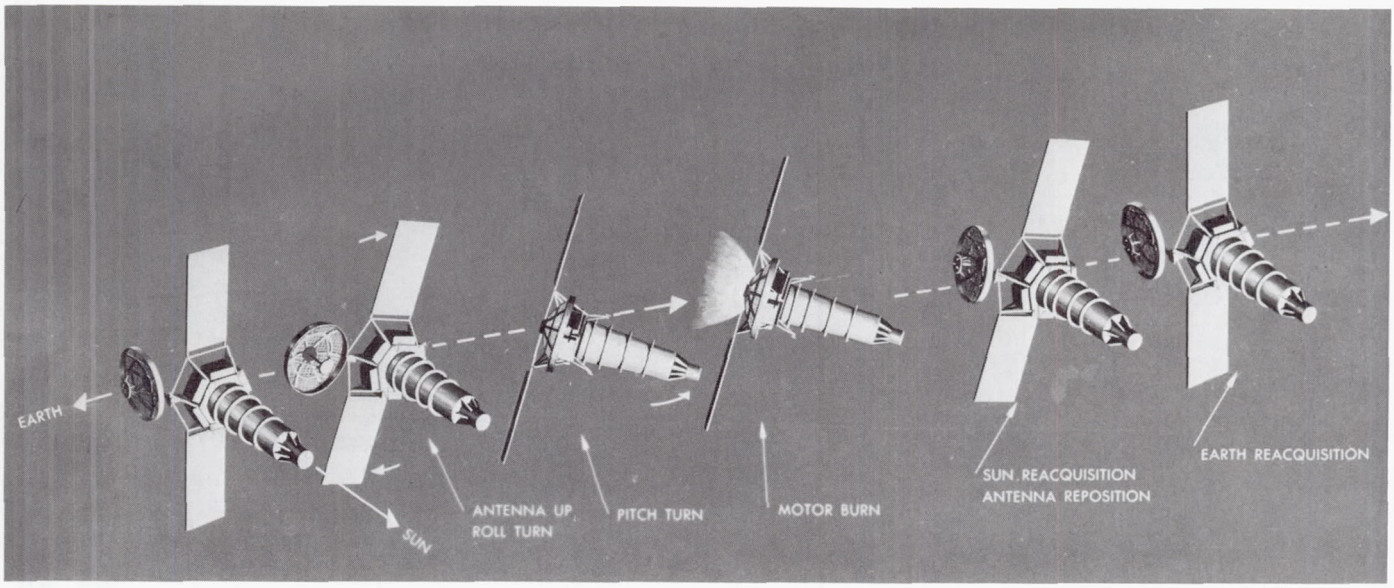


Fig. 25. *Ranger IX* midcourse maneuver

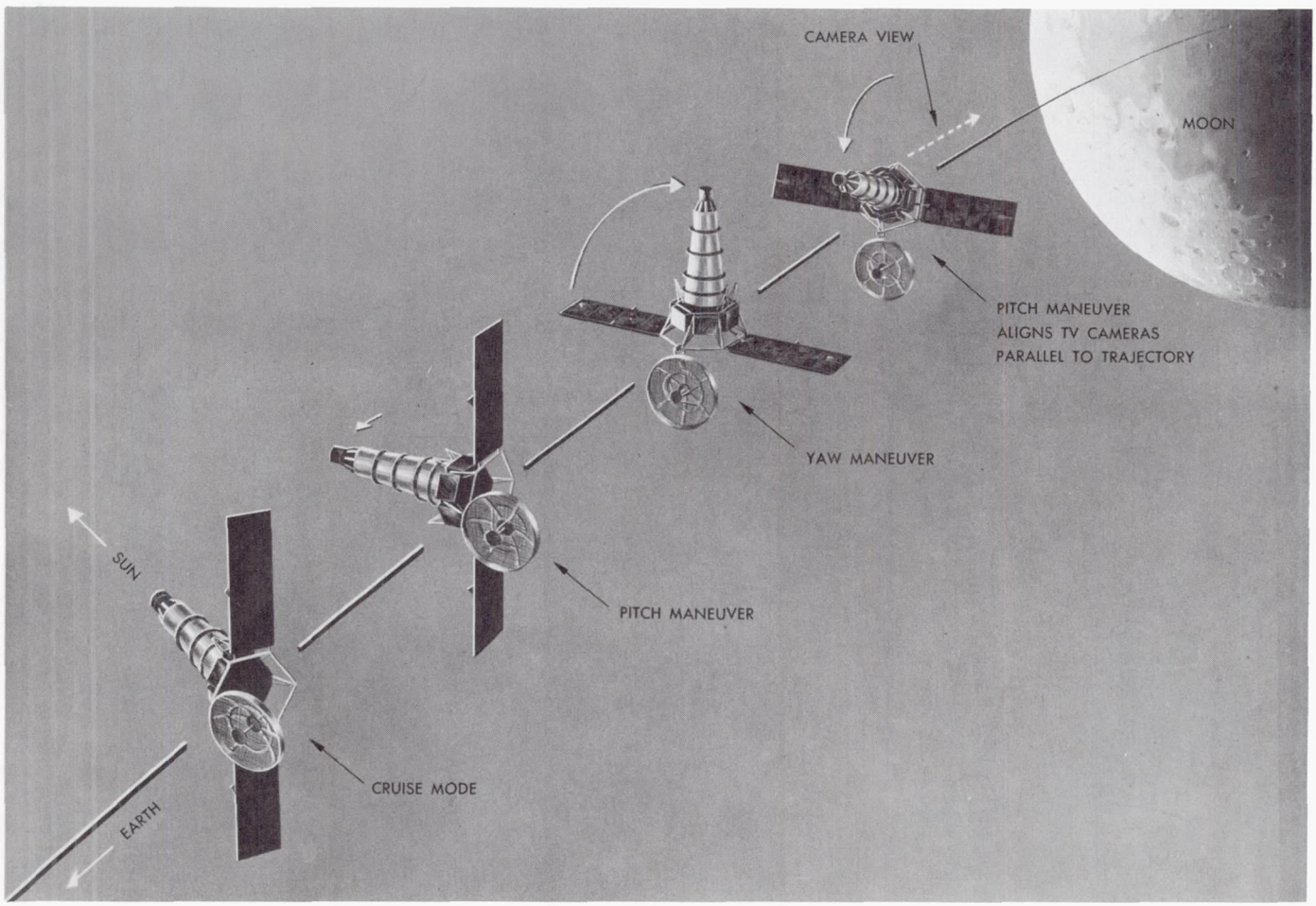


Fig. 26. *Ranger IX* terminal maneuver

data discrepancies. Because of the extreme accuracy required for the selected target and since no other factors considered indicated a degradation in final results, the decision was reached to make the midcourse maneuver on the second Goldstone pass.

Table 29. Maneuver target conditions

Condition	B • RT, km	B • TT, km	T_f,[a] h
Aiming point at launch	−299	−320	64.30
Premaneuver orbit	−450	1628	64.62
Desired arrival point	413	1557	64.31
Correction required	863	−71	0.31

[a]From injection.

Table 29 shows the estimate of the arrival parameters of the pre-midcourse orbit, the target parameters of launch, the desired impact parameters prior to midcourse, and the required change in the terminal conditions. The target point at launch differs by 1989 km from the target point at midcourse. The difference is that the target point at launch is chosen to optimize the probability of impacting in the visible lighted portion of the moon should a spacecraft malfunction preclude a midcourse maneuver, while the target point at midcourse is chosen by the criterion outlined previously. The ellipses shown in Fig. 27 center on the estimate of the target

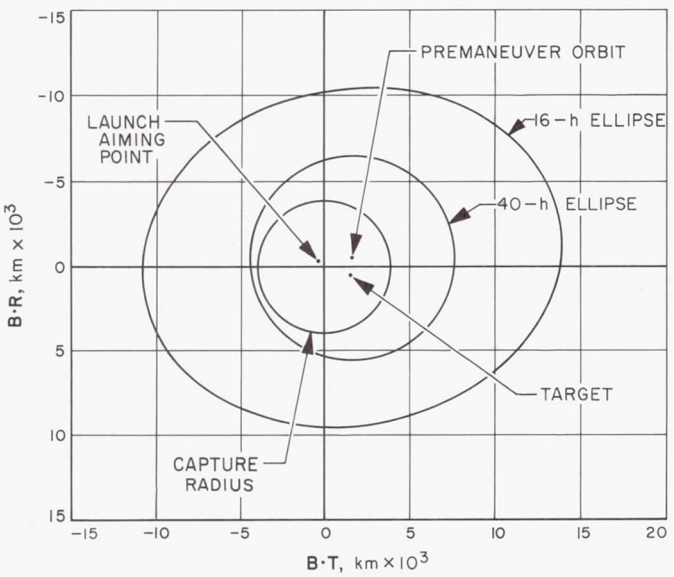


Fig. 27. Capability ellipse of target parameters 16 and 40 h after injection

parameters from the nominal pre-midcourse orbit and describe the total range of the ability to alter these parameters with the 60 m/s capability of the midcourse rocket, performing the maneuver at 16 and 40 h after injection.

A summary of statistics of dispersion at the target for the maneuver required is given in Table 30. Listed are the 1-σ values for the semimajor and semiminor axes of the dispersion ellipse in the **B**-plane along with the uncertainty in time of flight. These quantities are given as contributed by orbit determination uncertainties, maneuver execution uncertainties, and the combined contribution.

Table 30. Expected target dispersions from orbit determination and midcourse maneuver execution errors

Error \ 1-σ	Semimajor axis, km	Semiminor axis, km	Flight time uncertainty, s	Orientation angle,[a] deg
Orbit determination	9.2	4.5	3.1	−70.7
Maneuver execution	10.2	6.7	6.5	67.2
Combined	13.1	9.0	7.2	89.4

[a]From +T axis to +R.

The flight time of *Ranger IX* was to have been adjusted so that impact would occur 30 min after the back-up clock turned on the F channel cameras. The maneuver to achieve the impact point and the desired flight time, however, did violate the nominal antenna constraint angle of 40 deg. Because of the particular rotations to be performed by the spacecraft, the number of channels and the time spent by each in the antenna nulls could be reduced by modifying the maneuver to yield different flight times. Several maneuvers for varying arrival times were computed; each was examined in detail by the SPACT for expected telemetry loss.

The overall analysis determined that longer flight times would result in:

(1) Less serious loss of telemetry (worst loss occurred for a flight time with impact occurring about 25 min after clock turn-on).

(2) Smaller dispersions at the target due to maneuver execution errors.

(3) Longer TV running times.

To realize the smaller dispersions at the target and to improve the telemetry recovery, a longer flight time was selected for which the back-up clock would turn on the F channel TV at 45 min prior to impact. This TV running time was considered as a reasonable upper limit from a reliability standpoint.

Once the terminal maneuver was initiated, the back-up clock could be inhibited from turning on the TV at impact minus 45 min. This delay would leave two methods for TV turn-on at the more desirable time of impact minus 17 to 20 min:

(1) Using the clock in the central computer and sequencer (started at initiation of the terminal maneuver.

(2) Using a real-time command (No. 7).

The flight time from injection to impact was to be reduced by 0.309 h from 64.618 to 64.309 h.

Approximately 3 h prior to the initiation of the midcourse maneuver at 09:04:00 GMT, the final computation was made, using the latest determination of the orbit. The resulting required maneuver parameters are entered in Table 31.

Table 31. Commanded midcourse maneuver

Parameter	Magnitude	Duration, s	Initiated at GMT
Roll turn	−27.41 deg	126	12:03:46
Pitch turn	127.96 deg	587	12:13:09
Velocity increment	18.15 m/s	30	12:30:09

An effort to further reduce the expected error at the target was made by employing an operational scheme designed to minimize the effects of the known errors evaluated in near real-time prior to executing the maneuver. Once the three commands of the maneuver have been computed, encoded, and entered in the register of the spacecraft, there remains one control parameter with which to try to minimize the effects of known errors. This parameter is the real-time command 4, which initiates the midcourse maneuver sequence. By selective timing of the initiation of the maneuver, the largest contributor to the maneuver execution errors, the pointing error caused by the roll limit cycle,[10] may be reduced.

Furthermore, other error sources, such as resolution errors, may be compensated for, as well as taking into account a more recent orbit determination that was not available at the time of the maneuver computation. With linear mapping and with compensation for the resolution errors and the current orbit determination solution, the effect of the roll limit cycle on the target parameters was plotted as the cycle evolved in time (Fig. 28). Using this plot and a real-time computer verification,[11] the time to transmit RTC-4 was chosen to minimize the expected error at the target. This time was selected to be 12:03:00 GMT. This real-time operational scheme required close cooperation between the MAG, the FPAC director, the operations director, and the cognizant engineer for attitude control.

Well before the maneuver was to be executed, consideration was given to the possibility of stopping the maneuver sequence with RTC-8. This command interrupts the maneuver and returns the spacecraft to its cruise mode attitude, if a malfunction should occur during the turning sequence of the midcourse maneuver. This decision of whether or not to halt the maneuver is a particularly difficult one to make in real time because once the maneuver is stopped, a period of 10,000 s must elapse before a second attempt is undertaken. This delay, due to the recycling period, presents the possible problem of having to perform the maneuver over an overseas station with the possibility that the same malfunction of the previous attempt might occur in the second attempt. Furthermore, the delay decreases the capability of the midcourse motor.

Taking these considerations into account, the MAG was then prepared to evaluate, in real time, the direct telemetry readings on the duration and polarity of the turns, assuming the correct motor burn. Fortunately, such preparation was never used, since the measurements, observed in real time, indicated that the commanded maneuver was performed with the correct polarities and, within the accuracy of these measurements, was of the exact duration. This measurement coupled with the real-time doppler reduction (discussed elsewhere in this report) gave almost instant verification that the maneuver had been executed correctly.

After subsequent tracking and determination of the postmaneuver orbit showed that the correction to the trajectory was indeed very close to that desired, consideration was given to performing a terminal orienting

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

[11]D. W. Curkendall, "A Technique for Reducing the *Ranger* Midcourse Execution Errors," JPL internal document, June 1964.

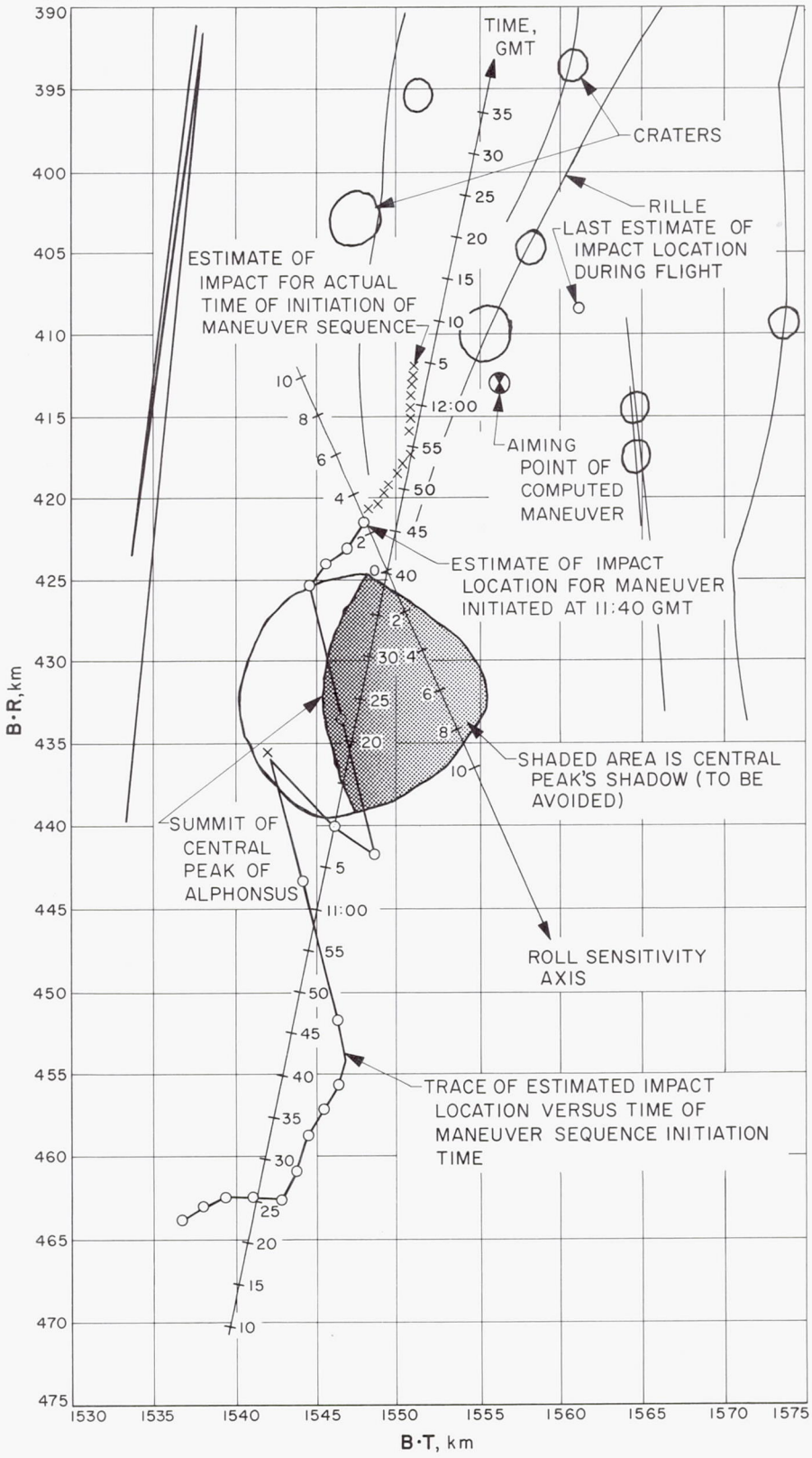


Fig. 28. Effects of roll limit cycle on target parameters

maneuver. Prior to computing a terminal maneuver, the best estimate of the impact parameters was as follows:

(1) Latitude of impact = 12.88 deg South.

(2) Longitude of impact = 2.38 deg West.

(3) GMT of impact = 24 day 3 mo 65 yr 14 h 08 min 20 s.

(4) Automatic camera turn-on = 24 day 3 mo 65 yr 13 h 23 min 39 s.

Figure 29 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. Vectors **A** and **B** represent the pointing directions for the 25- and 8.4-deg field of view F cameras, respectively.

The nominal terminal maneuver aligned the **C** vector with the impact velocity vector **V**. In the cruise mode, the **C** vector was 18.3 deg from the velocity vector, and with the path angle of 64.9 deg, an impact velocity of 2.62 km/s, and a shutter speed of 2 ms, the resultant blurring due to camera motion was 2.2 m. That is, the center of the field of view at the time that the shutter closed would be observing a point on the surface 2.2 m away from the point viewed at the time that the shutter opened.

Evaluation of the four main terminal maneuver considerations (see subsection A) revealed that the nominal terminal maneuver, aligning the camera reference direction with the impact velocity vector, not only minimized the image motion in the pictures but also resulted in a most desirable coverage on areas of scientific interest of Alphonsus. These facts coupled with a perfectly functioning spacecraft led to the decision to perform the nominal terminal maneuver.

C. Comparison of Commanded and Actual Maneuver

This section examines quantitatively the midcourse maneuver execution errors in terms of effective pitch, yaw pointing, and midcourse motor shutoff errors, and the uncertainties associated with the estimates of these errors.

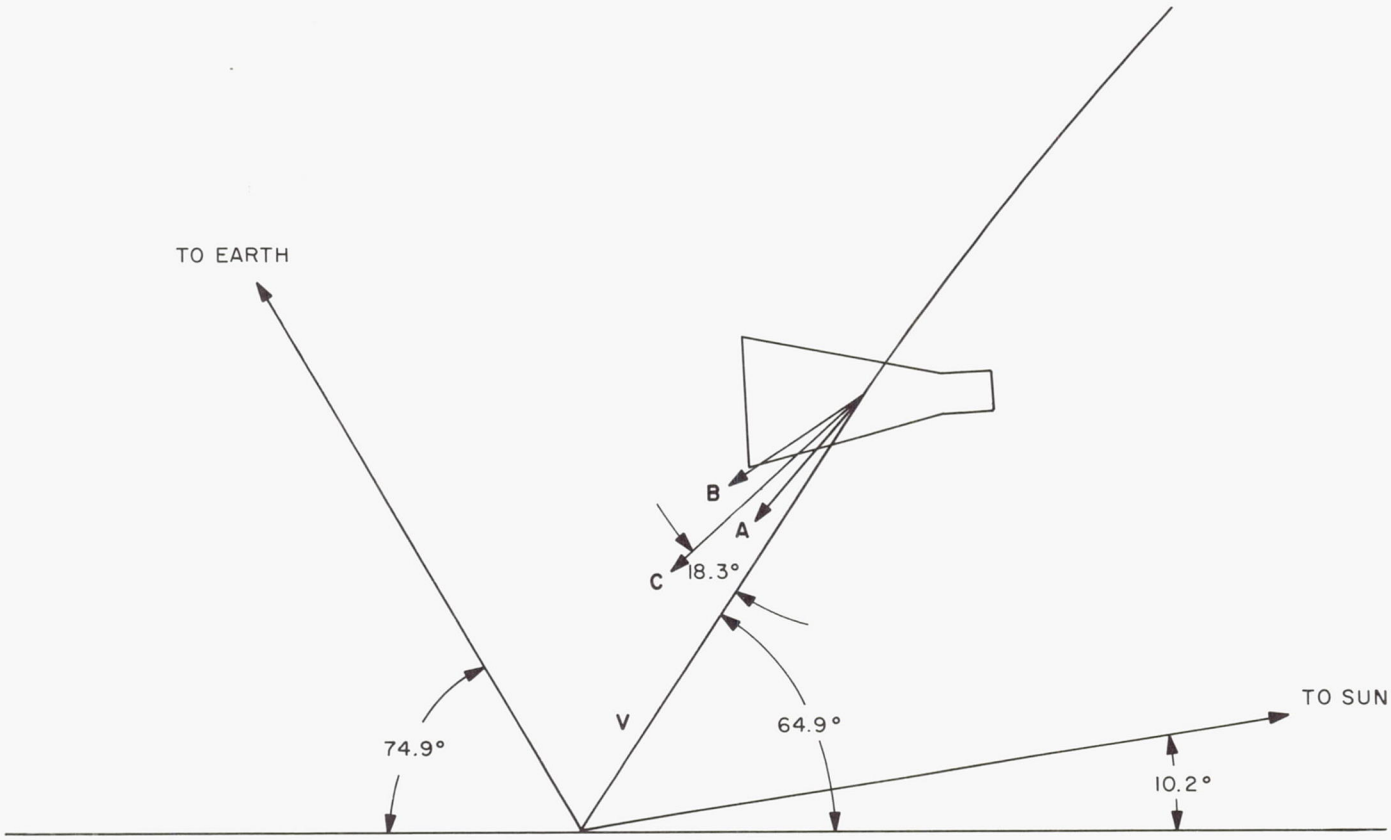


Fig. 29. No terminal maneuver approach geometry

Using the estimate of the executed maneuver obtained from Section II-F-2, the estimated errors may be summarized as follows:

(1) Estimated error in yaw: 0.42 mrad or 0.024 deg.

(2) Estimated error in pitch: −2.22 mrad or −0.127 deg.

(3) Estimated error in velocity magnitude: 0.002 m/s.

Mapping these errors to the target results in a miss of 5.8 km in **B** • **RT**, 4.3 km in **B** • **TT**, and 3 s in time of flight. The estimated errors compare with the expected standard deviation for the maneuver performed as follows:

Error	*Standard deviation*	*Uncertainty of estimate*
$1\text{-}\sigma_{yaw}$	= 5.85 mrad (0.335 deg)	7.50 mrad
$1\text{-}\sigma_{pitch}$	= 3.57 mrad (0.205 deg)	2.50 mrad
$1\text{-}\sigma_{vel.\ mag.}$	= 0.077 m/s	0.080 m/s

Some of the errors involved in executing the maneuver may be accounted for in postflight analysis. These errors consist of the limit cycle errors in roll, pitch, and yaw, and the resolution errors in the roll and pitch commanded and the magnitude of the velocity added. If these identifiable error sources are removed, then the resulting estimate in the errors is as follows:

Error	*Estimate*
Estimated error in yaw with identifiable error sources removed	1.44 mrad (0.082 deg)
Estimated error in pitch with identifiable error sources removed	−6.03 mrad (−0.346 deg)
Estimated error in velocity magnitude with identifiable error sources removed	0.015 m/s

Table 32 shows the data used to arrive at all of the results, which are then summarized in Table 33.

The estimate of the velocity added at midcourse $\mathbf{V}_E$ and the covariance matrix of uncertainties Λ_v associated with it were obtained from the best orbit determination. In this estimate of $\mathbf{V}_E$, tracking data alone were used; no use was made of the spacecraft maneuver doppler data. (Further details of this orbit appear elsewhere in this report.) Communications by C. D. Pace[10] and R. E. Hill[12] were used as the source for estimating the value of the standard deviation for the pitch and yaw pointing error and for the velocity magnitude error, while the estimates for the resolution and the limit cycle errors were obtained from a communication by T. Almaguer.[13]

Table 32. Data used in computations

Source	Roll, deg	Pitch, deg	Yaw, deg
Ideal turn	−24.410	127.945	—
Resolution errors	−0.017	−0.075	—
Limit cycle errors	0.118	−0.143	0.034

Ideal velocity magnitude = 18.1460 m/s.
Resolution velocity magnitude error = −0.0115 m/s.
$\mathbf{V}_E$ (estimated midcourse velocity vector m/s) = (−10.5748, −9.1028, −11.6052).

$$[\Lambda_v] = \begin{bmatrix} 0.39895066E-8 & -0.2405324E-8 & 0.48255334E-8 \\ & 0.4444773E-8 & -0.90854763E-8 \\ & & 0.18617625E-7 \end{bmatrix}$$

[12]R. E. Hill, "*Ranger IX* Attitude Control System Pointing Errors," Mar. 17, 1965 (internal communication).

[13]T. Almaguer, "*Ranger IX* Attitude Control Flight Performance," Apr. 13, 1965 (internal communication).

Table 33. *Ranger IX* maneuver execution errors estimates

Source	Yaw			Pitch			Velocity magnitude		Remarks
	mrad	deg	ratio to standard deviation	mrad	deg	ratio to standard deviation	m/s	ratio to standard deviation	
Estimated error	0.42	0.024	0.07	−2.22	−0.127	0.62	0.002	0.03	All error sources included
Standard deviation of expected errors	5.85	0.335	—	3.57	0.205	—	0.077	—	
Estimated error	1.44	0.082	0.35	−6.03	−0.346	2.04	0.015	0.21	All identifiable error sources removed
Standard deviation of expected errors	4.08	0.234	—	2.96	0.170	—	0.075	—	
Standard deviation of error in estimate	7.50	0.430	—	2.50	0.143	—	0.080	—	Applicable to both sets of results

D. Evaluation of Terminal Maneuver Performance

By analyzing the photographs of *Ranger IX*, it was determined that the pointing error in the terminal maneuver was approximately 0.65 deg. It is impossible, however, to identify the contribution of the individual error sources.

IV. *Ranger IX* Trajectory

A. Launch Phase

The *Ranger IX* spacecraft was launched from the Air Force Eastern Test Range (AFETR) at Cape Kennedy, Florida, on Sunday, 21 March, 1965, using an *Atlas D/Agena B* boost vehicle. Launch occurred at 21:37:02:455 GMT with an inertial launch azimuth of 93.6 deg East of North. After liftoff, the booster rolled to an azimuth of 94.3 deg and performed a programmed pitch maneuver until booster cutoff. During 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 of the *Atlas* vernier engine cutoff.

After *Atlas/Agena* separation, there was a short coast period, followed by 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/*spacecraft combination was coasting in a nearly circular parking orbit and in a southeasterly direction at an altitude of 187 km and an inertial speed of 7.80 km/s.

After a parking orbit coast time of 2.97 min as determined by the ground guidance computer and transmitted to the *Agena* during the *Atlas* vernier stage, a second ignition of the *Agena* engine occurred. After 86 s, the *Agena* engine was cut off, and the *Agena/*spacecraft combination was in a nominal earth–moon transfer orbit.

The launch phase ascent trajectory profile is illustrated in Fig. 30, and a sequence of events from launch to acquisition of the earth by the spacecraft is shown in Fig. 31.

B. Premaneuver Cruise Phase

Injection (second *Agena* cutoff) occurred at 21:49:48 GMT over the Atlantic Ocean at a geocentric latitude

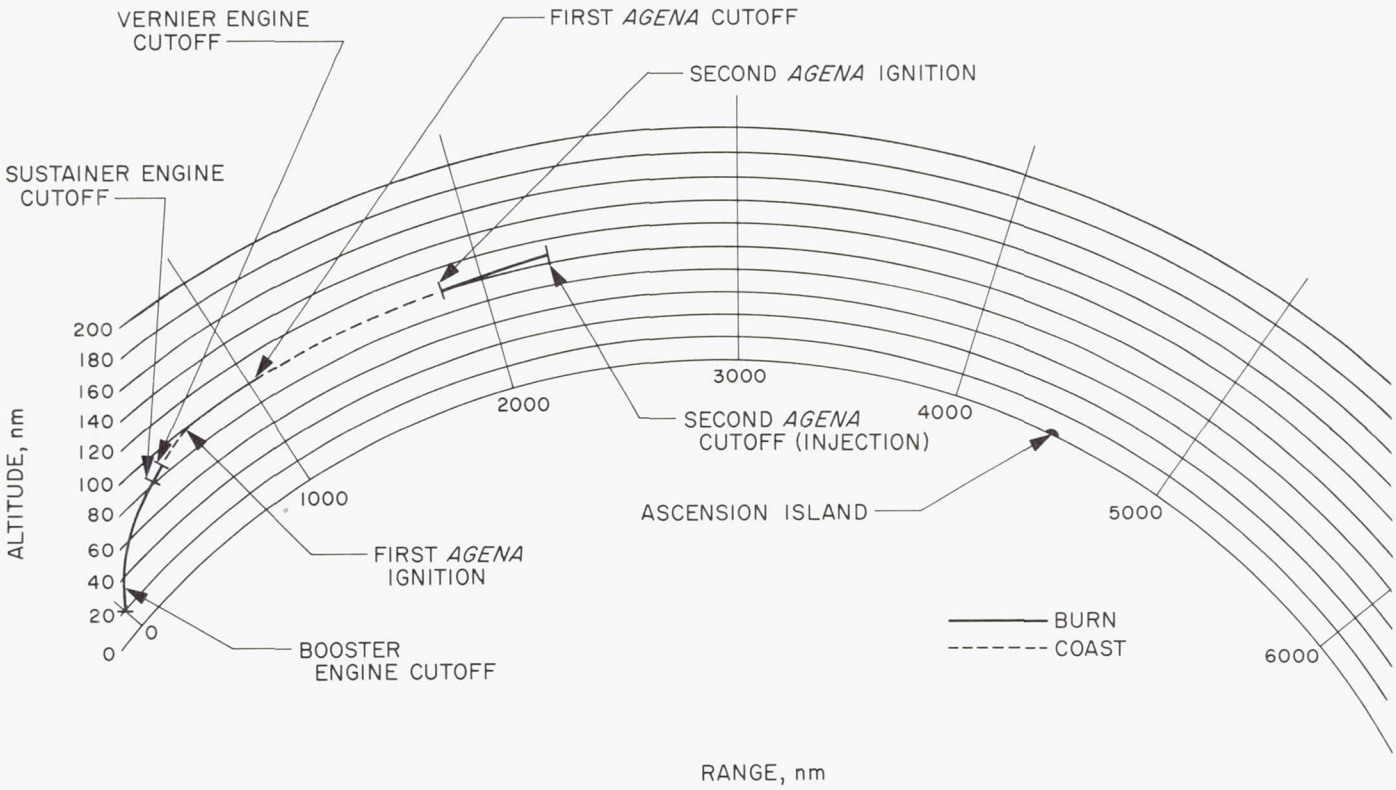


Fig. 30. Ascent trajectory profile

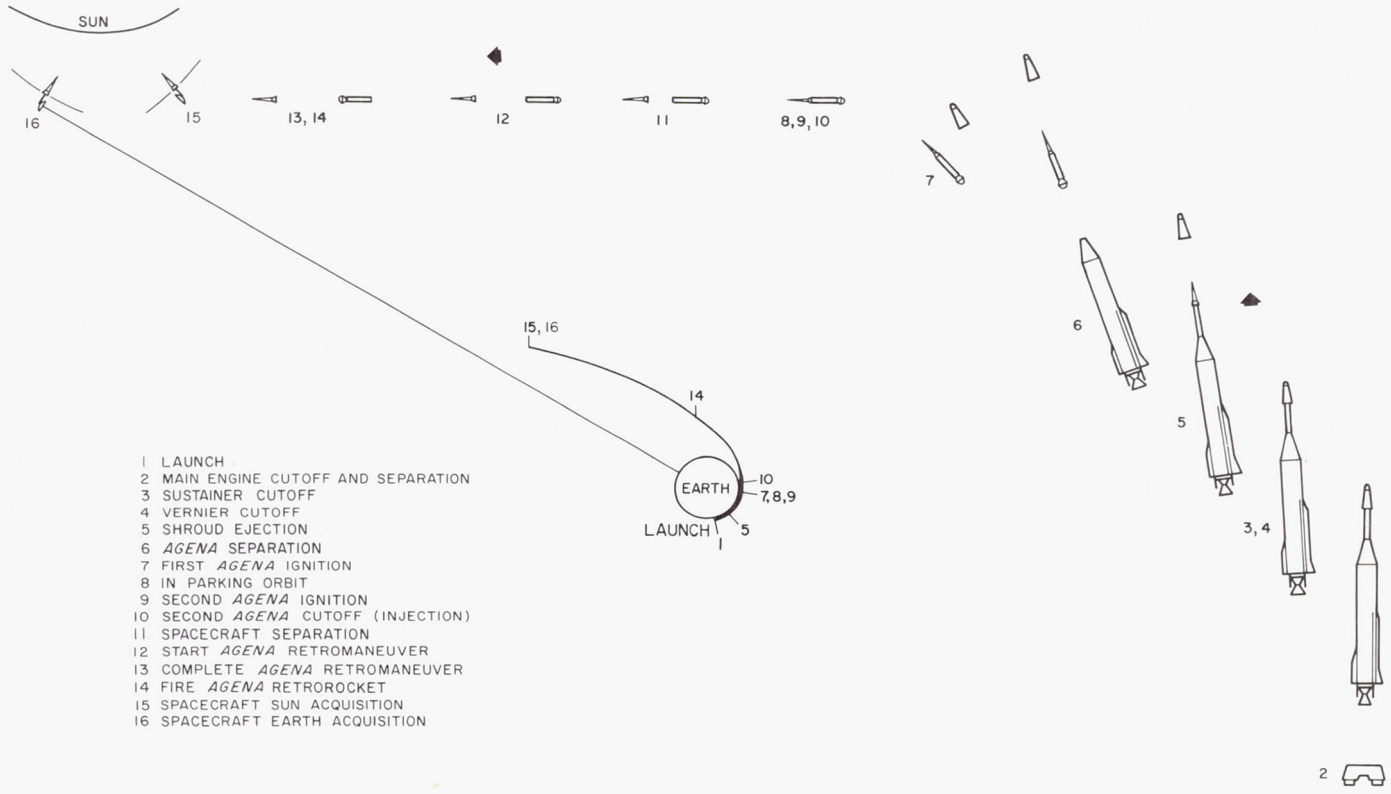


Fig. 31. Sequence of events to earth acquisition

and longitude of 20.53 and 316.68 deg, respectively. The *Agena*/spacecraft combination was at an altitude of 197 km, and was traveling at an inertial speed of 10.967 km/s. At 35 s after injection, the *Agena*/spacecraft combination entered the earth's shadow. The *Agena* separated from the spacecraft 2 min, 38 s after injection, performed a programmed yaw maneuver, and ignited its retrorocket. The retrorocket impulse was designed to eliminate interference with the spacecraft operation and reduce the chance of impact of the *Agena* with the moon. Tracking data indicated that the *Agena* passed the upper trailing edge of the moon at an altitude of 5353 km about 5 h after the impact of *Ranger IX*.

Ranger IX left the earth's shadow 34 min 19 s after injection for a total shadow duration of 33 min, 44 s. Sun acquisition occurred 57 min 42 s after injection. Within an hour after injection, the spacecraft was receding from the earth in almost a radial direction with decreasing speed. This reduced the geocentric angular rate of the spacecraft (in inertial coordinates) until, at 1.5 h after injection, the angular rate of the earth rotation exceeded that of the spacecraft. This caused the earth track of the spacecraft (Fig. 32) to reverse its direction from increasing to decreasing earth longitude. The spacecraft acquired the earth 3 h, 22 min, 2 s after injection, thus entering the designed cruise mode.

Tracking data gathered and analyzed prior to the midcourse maneuver indicated that, without a correction, impact of the spacecraft with the moon would occur at 518 km from the desired aiming point and at a selenocentric latitude and longitude of 4.1 and 357.7 deg, respectively. The transit time from injection would then have been 64.62 h.

Plots of geocentric distance and inertial speed for *Ranger IX* as well as earth-probe-sun, sun-probe-moon, and earth-probe-moon angles as a function of time from launch to impact are presented in Figs. 33–35.

C. Midcourse Maneuver Phase

In order to alter the trajectory to ensure impact a selected aiming point at a selenographic latitude of −13 deg and longitude of −2.5 deg, midcourse maneuver calculations indicated a requirement of 18.15 m/s increment of velocity (60.09-m/s maximum capability).

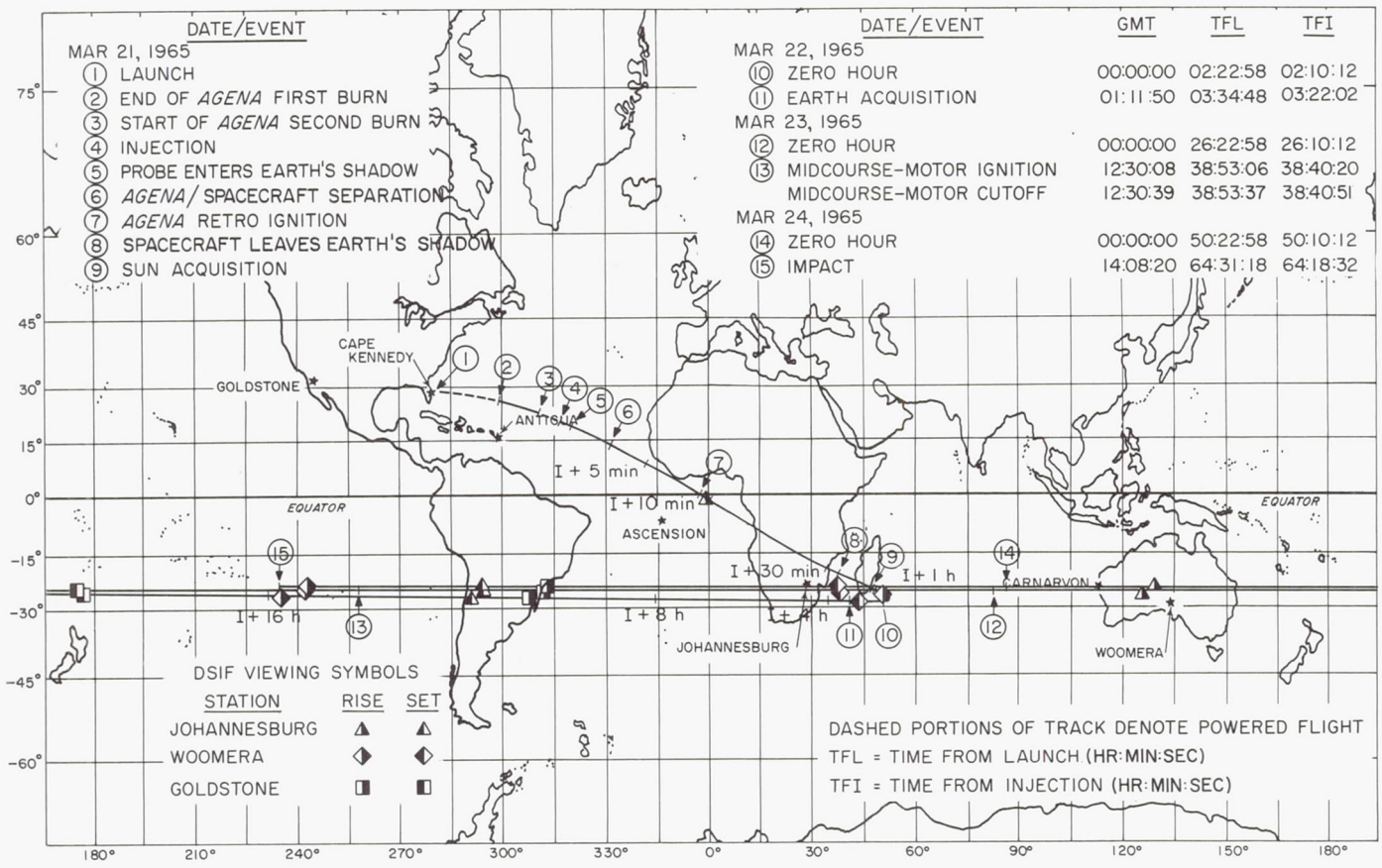


Fig. 32. Earth track of *Ranger IX* trajectory

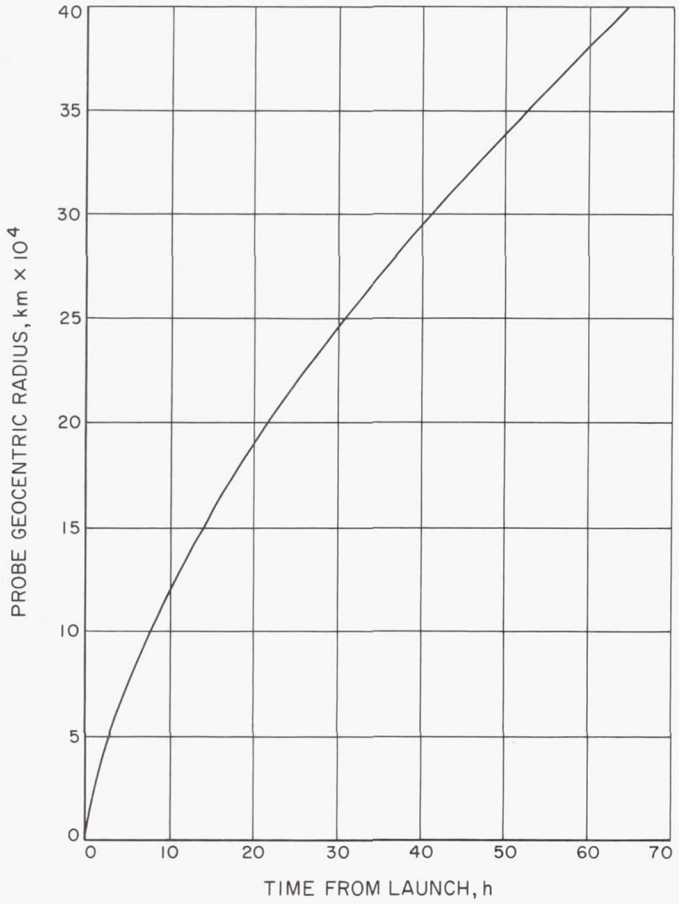


Fig. 33. Probe geocentric radius vs time from launch

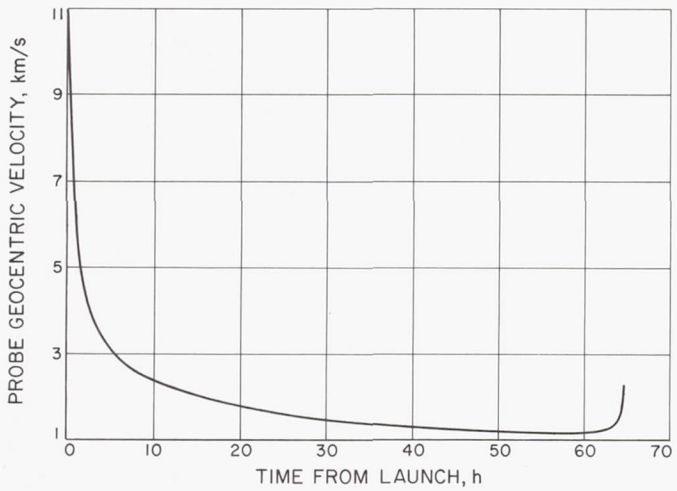


Fig. 34. Probe geocentric velocity vs time from launch

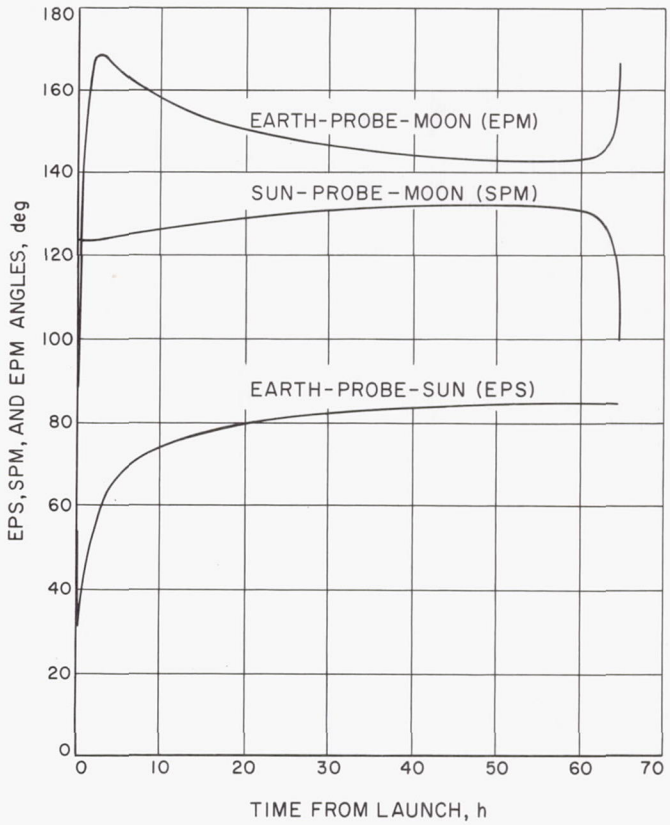


Fig. 35. Angular relationships among bodies vs time from launch

In addition, this correction for adjusting the flight time from injection to impact was selected to be 64.309 h to allow the TV camera backup turn-on clock to be utilized as designed. To ensure proper alignment of the thrust direction of the midcourse motor for a burn, a −27.41-deg roll turn and a 127.96-deg pitch turn were required. The midcourse motor was ignited at 12:30:08 on 23 March 1965 GMT, at which time the spacecraft was at a geocentric distance of 291,014 km and traveling with an inertial speed of 1.308 km/s relative to earth. At the end of a 31-s duration burn of the midcourse motor, the geocentric distance had increased to 291,054 km and the inertial speed, relative to earth, had increased to 1.319 km/s.

Analog data received at the Goldstone tracking station and relayed to the Space Flight Operations Facility (SFOF) at JPL gave positive indication that the midcourse maneuver and motor burn had been executed accurately. This was further verified when the doppler data was observed to be essentially the same as predicted.

Injection and encounter conditions for the pre-midcourse orbit are given in Table 34. Terms used in Table 34 are defined in Table 35.

Table 34. *Ranger IX* pre-midcourse orbit

Parameter	Value
Initial conditions[a]	
Epoch	21 March 1965; 21:49:48 GMT
Earth fixed sphericals	
R	6572.4000 km
ϕ	20.525267 deg
θ	316.68299 deg
V	10.547199 km/s
γ	1.6968853 deg
σ	111.00130 deg
Inertial Cartesian	
x	−1418.9946 km
y	5989.3706 km
z	2304.4179 km
$\dot{x}$	−10.386731 km/s
$\dot{y}$	−0.79878218 km/s
$\dot{z}$	−3.4289787 km/s

Parameter	Value
Initial conditions[a]	
Orbital elements	
a	392638.81 km
e	0.98327464 km
i	28.461476 deg
Ω	327.00969 deg
ω	129.34037 deg
ν	3.2915287 deg
Impact parameters	
Impact epoch	24 March 1965; 14:26:54 GMT
Selenocentric latitude	4.14 deg
Selenocentric longitude	357.73 deg
Time of flight from injection[b]	64.62 h
$\mathbf{B}$[c]	1690 km
$\mathbf{B} \cdot \mathbf{T}$[d]	1629 km
$\mathbf{B} \cdot \mathbf{R}$[d]	−451 km

[a]See Table 35 for definition of terms.

[b]1-σ uncertainty of 3.087 s.

[c]1-σ uncertainty of 10.271 km.

[d]$\mathbf{B} \cdot \mathbf{T}$ and $\mathbf{B} \cdot \mathbf{R}$ are referenced to the true lunar equator (see Appendix A). For *Ranger IX* work, the true lunar equator is used as the reference plane. If $\mathbf{N}$ is a unit vector in the lunar North direction, then $\mathbf{T} = \mathbf{S}_I \times \mathbf{N}$ and $\mathbf{R} = \mathbf{S}_I \times \mathbf{T}$.

Table 35. Definition of terms

Parameter	Definition (earth as central body)
R	Probe radius distance, km
ϕ	Probe geocentric latitude, deg
θ	Probe East longitude, deg
V	Probe earth-fixed velocity, km/s
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
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, the principal plane (x, y) is the earth equatorial plane of date, and z is along the direction of the earth 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/s
a	Semimajor axis, km
e	Eccentricity
i	Inclination, deg
Ω	Longitude of the ascending node, deg
ω	Argument of pericenter, deg
ν	True anomaly, deg

D. Post-midcourse Phase

Following the midcourse maneuver, the spacecraft reacquired the sun and earth, thus returning to the cruise mode. At about 58 h from injection and at a geocentric distance of 373,336 km, the spacecraft inertial speed, relative to the earth, reached a minimum value of 1.120 km/s. At this point, the spacecraft was about 33,625 km from the lunar surface with an inertial speed of 1.33 km/s relative to the moon. Because of the lunar gravitational field, the spacecraft velocity then began to increase.

Post-midcourse tracking data was analyzed, and the lunar encounter conditions of the trajectory were resolved with a high degree of accuracy. It was predicted that lunar impact would occur at a selenocentric latitude and longitude of −12.91 and −2.38 deg, respectively, and that flight time from injection would be 64.52 h. The encounter conditions along with the corresponding post-midcourse initial conditions are presented in Table 36. The geocentric spatial trace of the trajectory from injection to impact is illustrated in Fig. 36.

Table 36. Post-midcourse orbit of *Ranger IX*

Parameter	Value
Post-midcourse conditions[a]	
Epoch	23 March 1965; 12:30:38 GMT
Earth-fixed sphericals	
R	291051.08 km
ϕ	−25.382973 deg
θ	257.32602 deg
V	18.994623 km/s
γ	3.9208555 deg
σ	270.15758 deg
Inertial Cartesian	
x	−19401.815 km
y	−262237.06 km
z	−124763.90 km
$\dot{x}$	0.13595686 km/s
$\dot{y}$	−1.2091069 km/s
$\dot{z}$	−0.50967493 km/s
Orbital elements	
a	339059.45 km
e	0.98571852 km
i	28.343391 deg
Ω	327.36181 deg
ω	128.28277 deg
ν	167.17228 deg
Impact parameters	
Impact epoch	24 March 1965; 14:08:20 GMT
Selenocentric latitude	−12.91 deg
Selenocentric longitude	357.62 deg
Time of flight from injection[b]	64.524 h
$\mathbf{B}$[c]	1614 km
$\mathbf{B} \cdot \mathbf{T}$[d]	1561 km
$\mathbf{B} \cdot \mathbf{R}$[d]	409 km

[a] See Table 35 for definition of terms.

[b] 1-σ uncertainty of 0.67 s.

[c] 1-σ uncertainty of 9.99 km.

[d] $\mathbf{B} \cdot \mathbf{T}$ and $\mathbf{B} \cdot \mathbf{R}$ are referenced to the true lunar equator (Appendix A). For *Ranger IX* work, the true lunar equator is used as the reference plane. If $\mathbf{N}$ is a unit vector in the lunar North direction, then $\mathbf{T} = \mathbf{S}_I \times \mathbf{N}$ and $\mathbf{R} = \mathbf{S}_I \times \mathbf{T}$.

E. Encounter Phase

During the encounter phase of *Ranger IX*, the spacecraft raced toward destruction through impact with the lunar surface with increasing acceleration as the result of the attraction of the lunar gravity field. At 1 h, 5 min, 46 s before impact, while at a selenocentric altitude of 7211 km and at a speed, relative to the moon, of 1.606 km/s, the *Ranger IX* nominal terminal maneuver sequence was initiated. Thus, to align the reference direction of the camera along the velocity vector at impact, the spacecraft pitched 5.20 deg, yawed −16.30 deg, and pitched again −20.50 deg. At the completion of the second pitch turn, 37 min 3 s before impact, the speed of the probe had increased to 1.758 km/s and its altitude was 4360 km.

At 13:49:33 on 24 March 1965 GMT, while at an altitude of 2376 km above the lunar surface, full power on Channels F and P was verified. Minutes later, at 14:08:19.999 GMT, *Ranger IX* crashed into the crater Alphonsus at an impact speed of 2.671 km/s and at a path angle of −64.9 deg. Impact of the spacecraft with the moon had been in a direct motion along a hyperbolic trajectory, the incoming asymptote direction being at an angle of −5.59 deg to the lunar equator, and with the orbit plane inclined 15.67 deg to the lunar equator.

The trace of the trajectory on the lunar surface from injection to impact is given in Fig. 37, while the traces of the lunar approach portions of the pre-midcourse and post-midcourse orbits are illustrated in Fig. 38. The probe geocentric distance and velocity are given in Figs. 39 and 40, respectively, for the last few hours of flight. The selenocentric altitude and velocity are given in Figs. 41 and 42. Figure 43 shows the earth-probe-sun, sun-probe-moon, and earth-probe-moon angles for the last hours of flight.

A study of the *Ranger IX* trajectory can be made by examining the detailed trajectory printout (Appendixes B and C). Appendix B contains the trajectory listing for the pre-midcourse orbit from the initial epoch to the midcourse epoch and a lunar impact printout. Appendix C contains the trajectory listing for the post-midcourse orbit from midcourse to lunar encounter. Appendix D, Table D-1, is a key to the trajectory printout. Table D-2 contains the definitions of the trajectory printed quantities. Constants and conversion factors used in *Ranger IX* trajectory computation are listed in Table D-3. The miss parameter $\mathbf{B}$, used to measure the miss distance for the lunar trajectory, is defined in Appendix A.

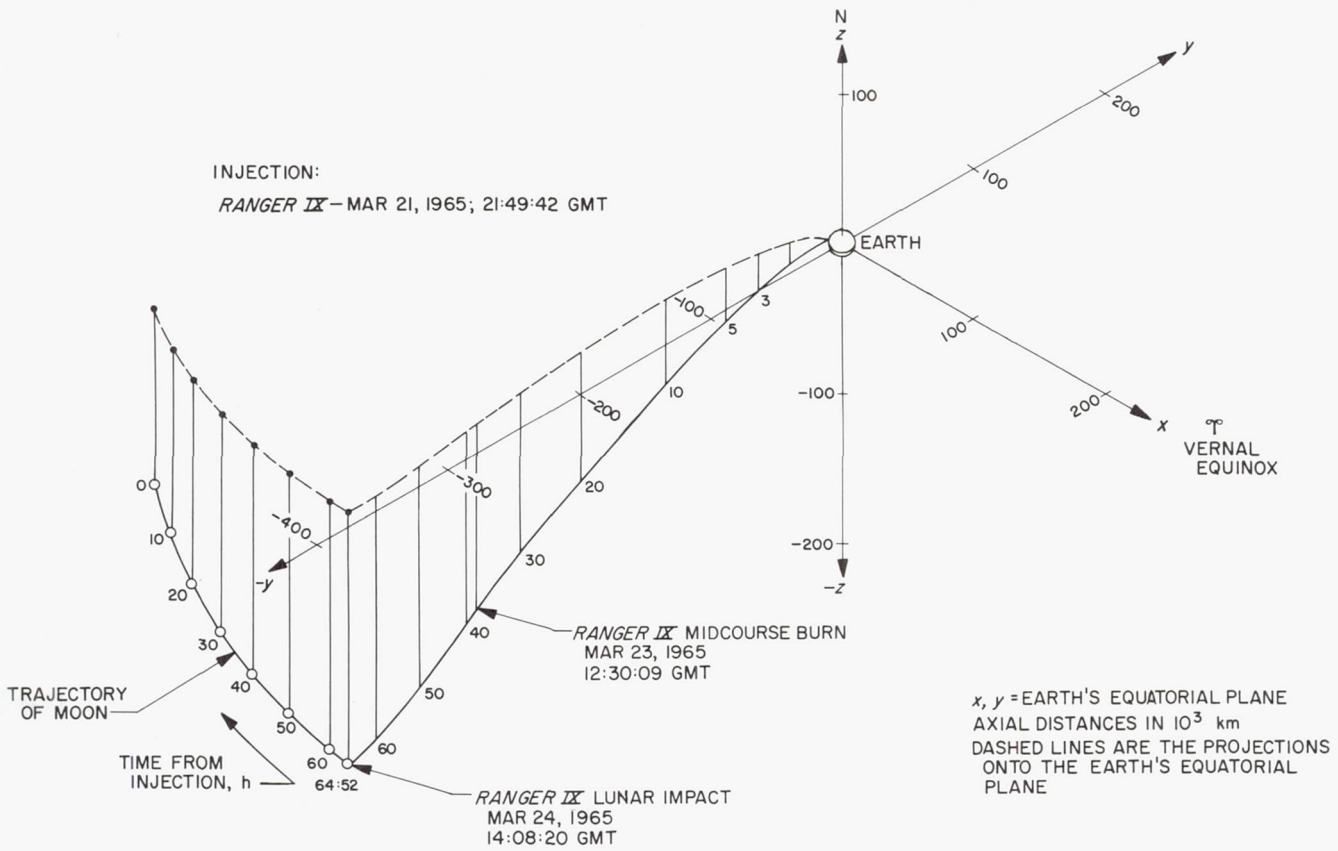


Fig. 36. Geocentric spatial trace of *Ranger IX* trajectory

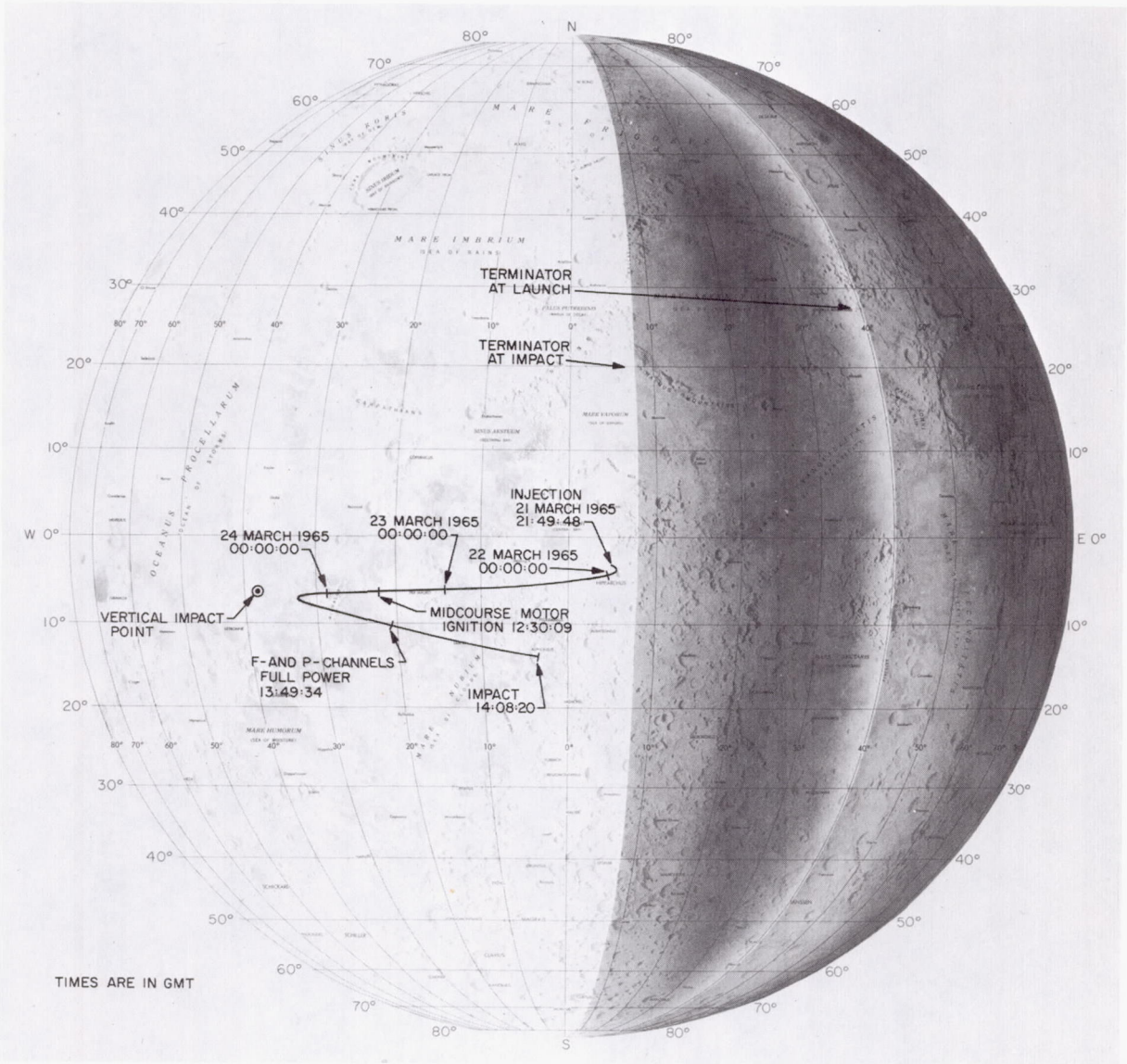


Fig. 37. Trace of *Ranger IX* trajectory on the lunar surface

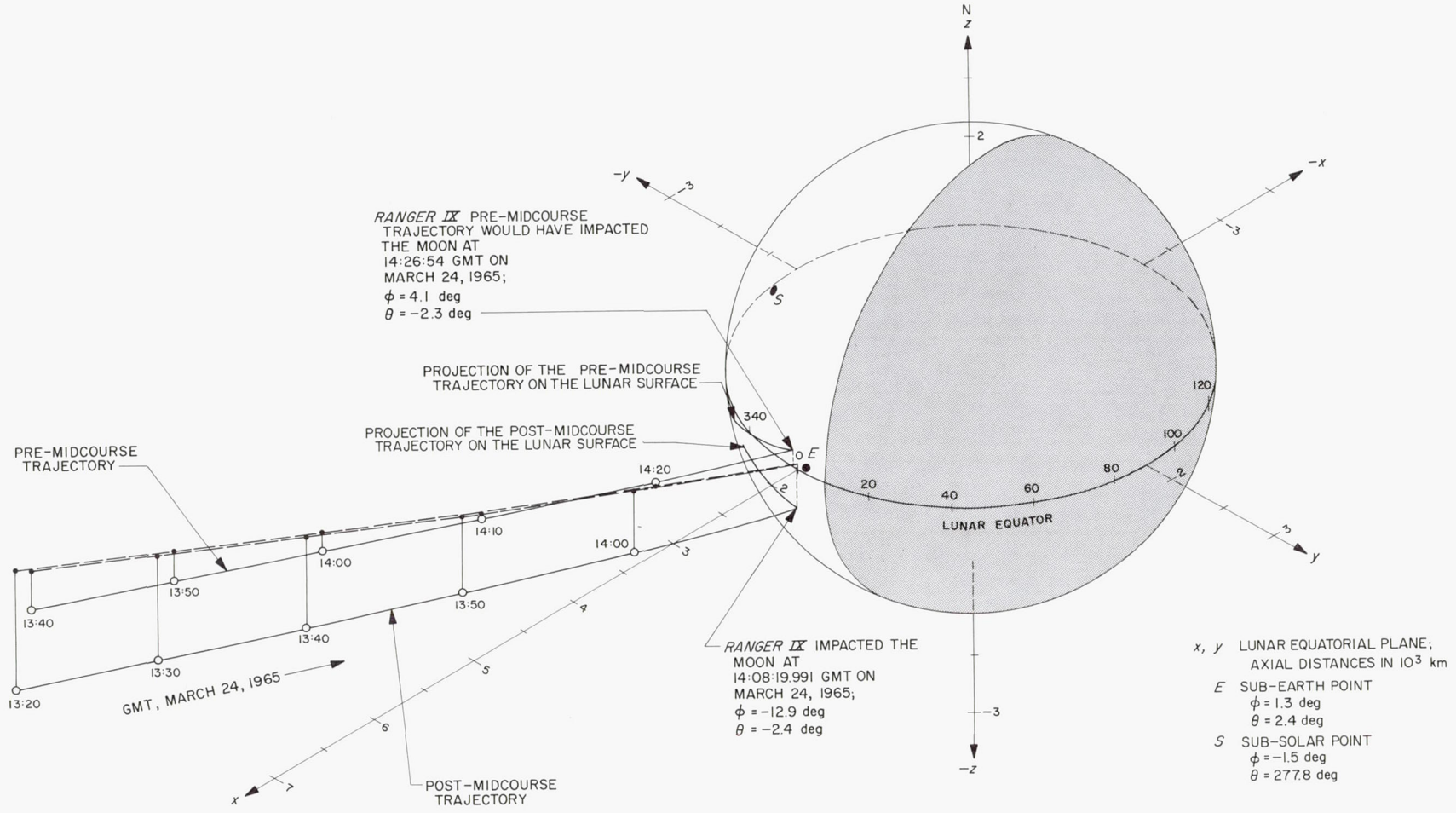


Fig. 38. Traces of lunar trajectory for pre-midcourse and post-midcourse orbits

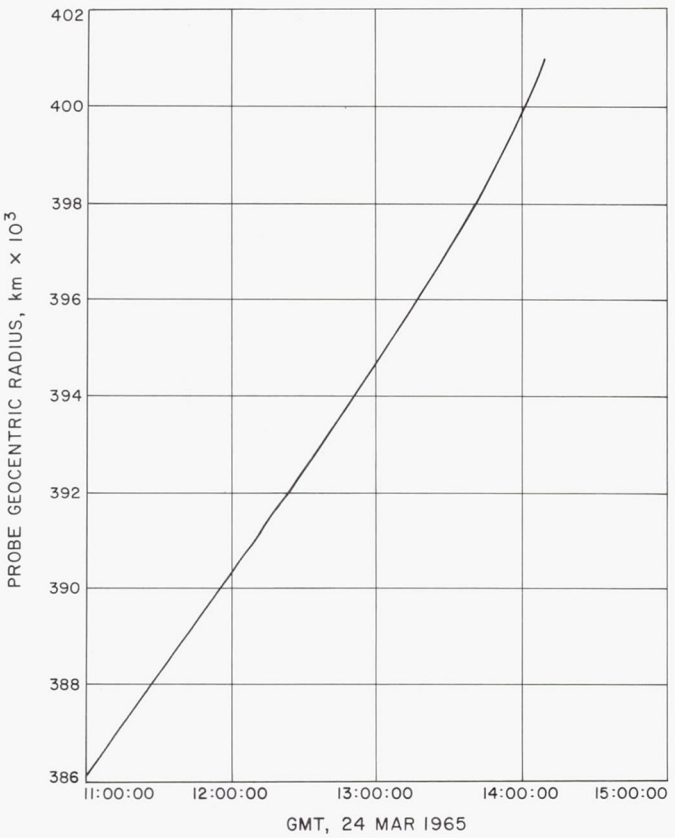


Fig. 39. Probe geocentric radius vs GMT

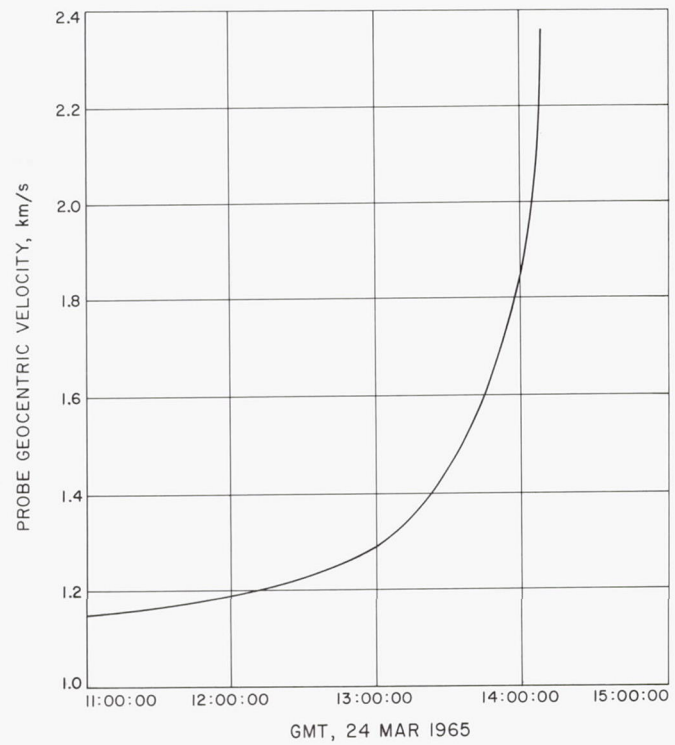


Fig. 40. Probe geocentric velocity vs GMT

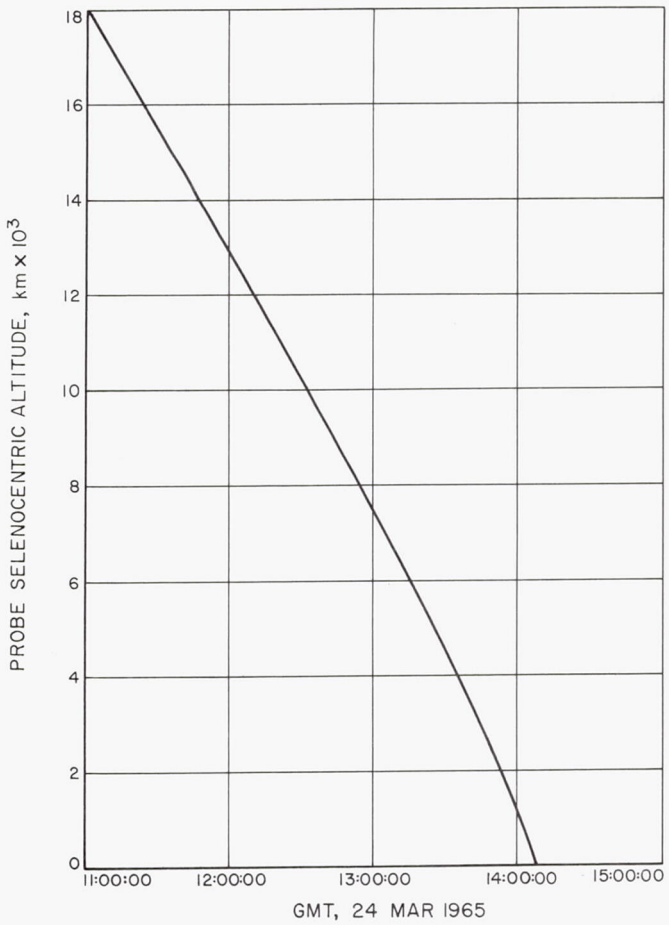


Fig. 41. Probe selenocentric altitude vs GMT

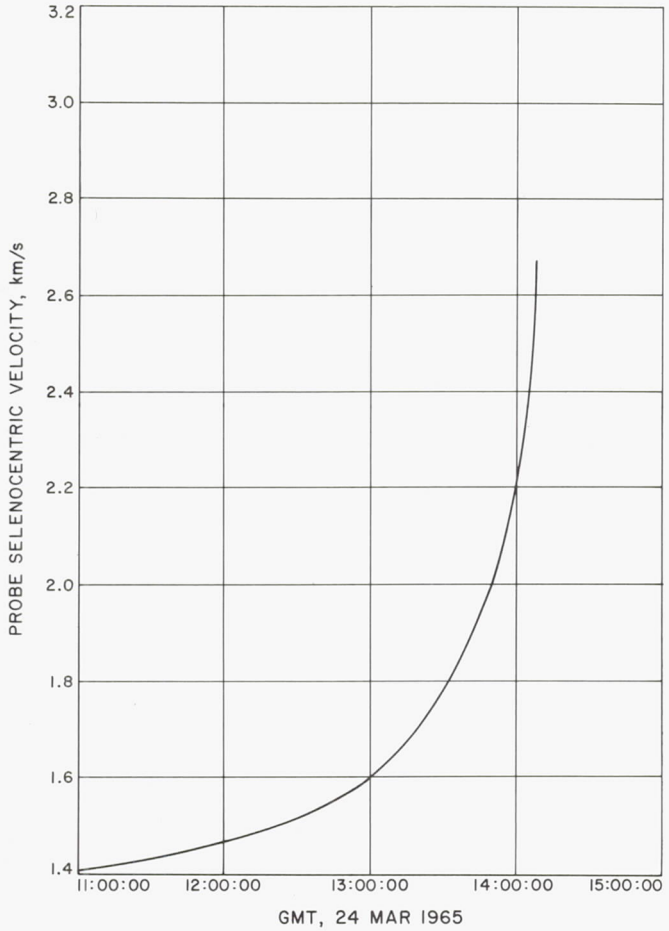


Fig. 42. Probe selenocentric velocity vs GMT

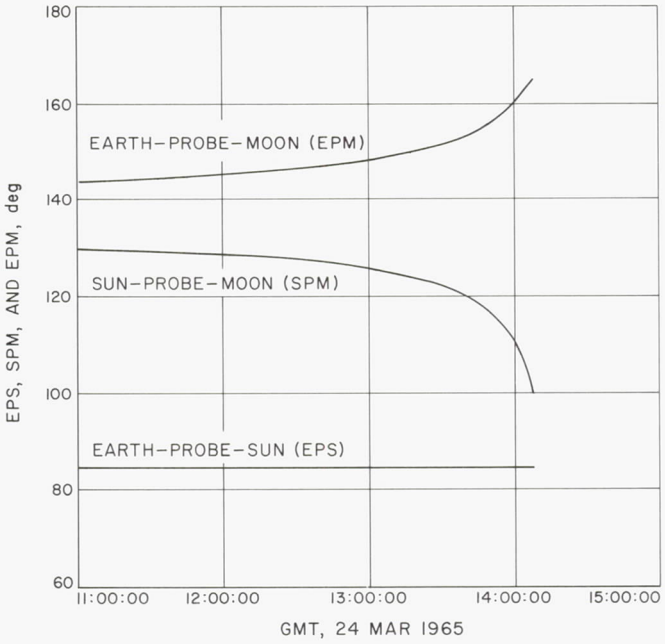


Fig. 43. Angular relationships among bodies vs GMT

V. Analysis of Air Force Eastern Test Range Tracking Data

A. Introduction

For the *Ranger* missions, the AFETR was responsible for providing classical orbital elements for both the parking and transfer orbits, and for providing initial acquisition information to the DSIF tracking stations. These calculations were performed at AFETR using *Agena* vehicle tracking data obtained from the downrange AFETR tracking stations. Results of these calculations were transmitted to the JPL SFOF in Pasadena. The acquisition information was relayed to the DSIF stations, and the initial orbital elements were used in the JPL orbital calculations.

In addition to fulfilling these requirements, AFETR transmitted tracking data obtained during the parking orbit, transfer orbit, and *Agena* postretro orbit to the SFOF. The parking orbit data were very useful for detecting nonstandard flight conditions, and the transfer orbit data were used during flight operations to verify the initial orbital estimates based on DSIF data. *Agena* postretro data were important for verifying *Agena* retrofiring, and were further used to establish the *Agena* vehicle postretro orbit.

The *Agena* second stage was tracked continuously by AFETR and NASA C-band radars from 21:40:12 to 22:44:24 GMT on 21 March 1965. Tracking data in the form of range, azimuth, and elevation were received at JPL at the rate of 1 point/6 s with the exception of Twin Falls Victory (TFV) ship data, which were received at a rate of 1 point/3 s. Figure 44 shows the tracking coverage and the elevation pattern for each of the stations.

B. Parking Orbit

Parking orbit data from the FPS-16 (modified) radar at Bermuda from 21:40:12 to 21:48:12 GMT on 21 March 1965 and the FPQ-6 radar at Antigua from 21:43:48 to 21:48:18 GMT were received. Because of the short coast, these data were not processed in real time.

In postflight analysis however, it was possible to obtain a good two-station fit to the parking orbit, by using data after 21:45:36 GMT. The amount of data used and quality are summarized in Table 37. Figures 45 and 46 show the observed minus computed residuals of range, azimuth, and elevation from Antigua and Bermuda for the two-station solution.

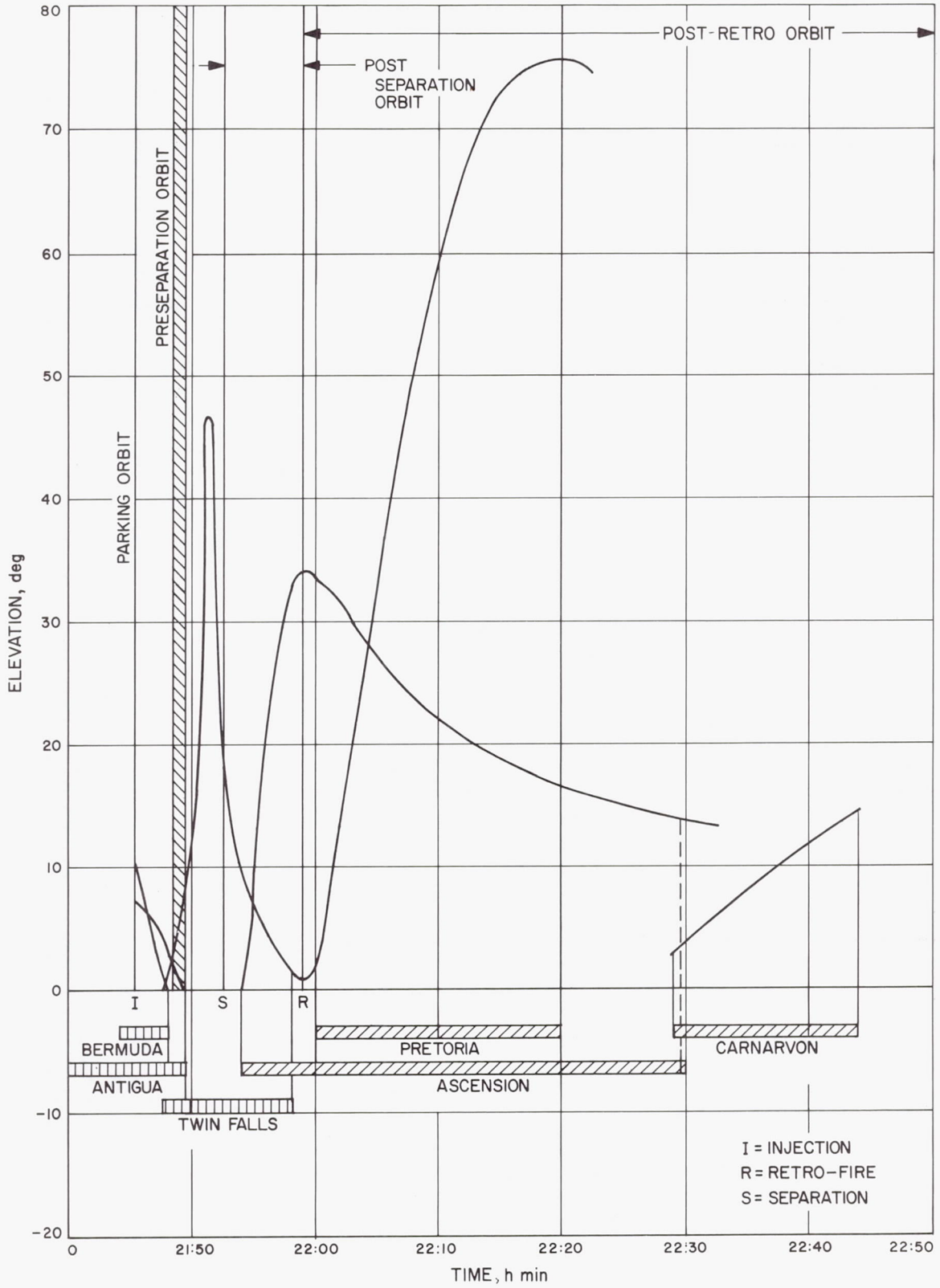


Fig. 44. AFETR data coverage of *Ranger IX*

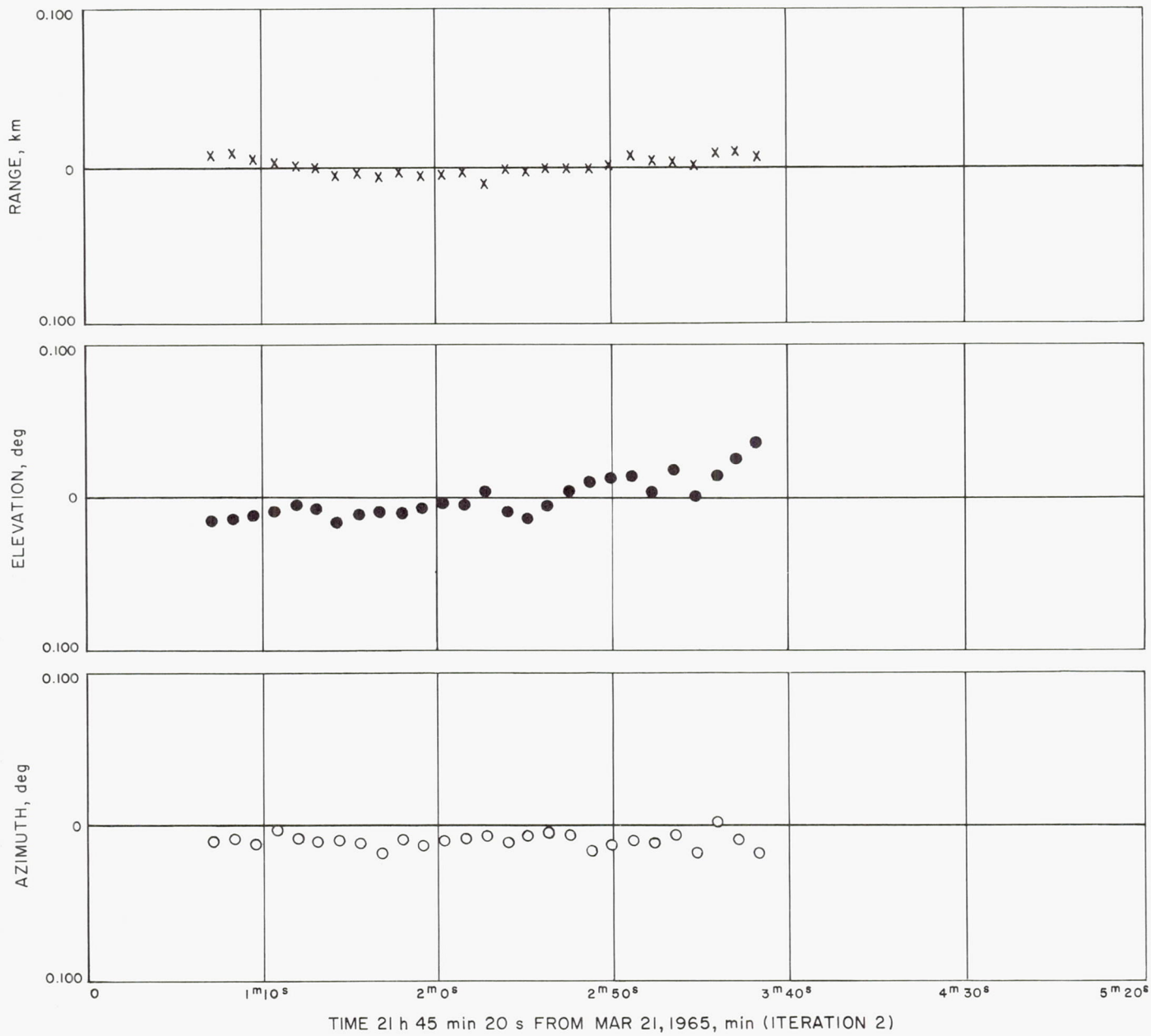


Fig. 45. Antigua parking orbit residuals (two-station fit)

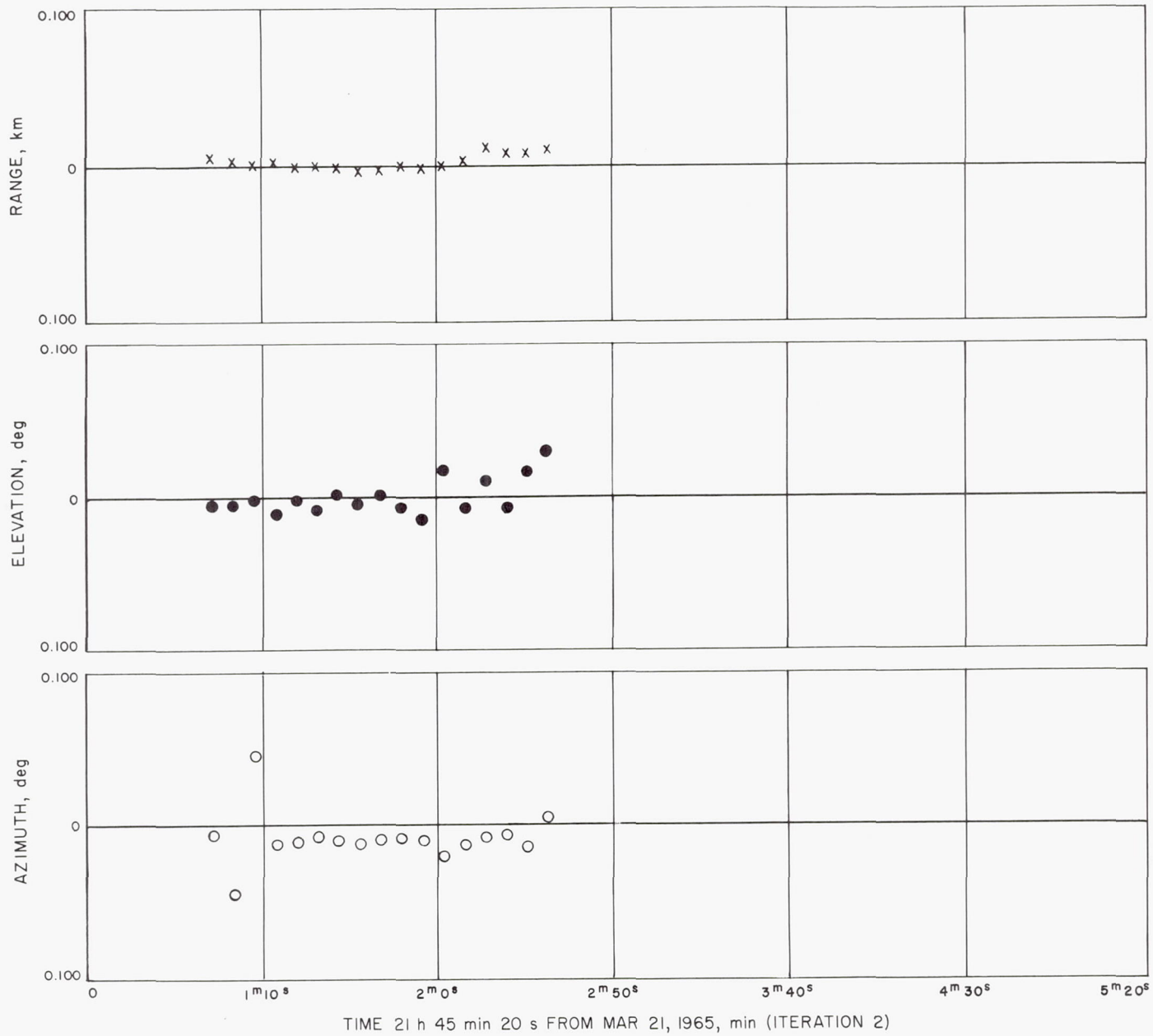


Fig. 46. Bermuda parking orbit residuals (two-station fit)

Table 37. *Ranger IX* parking orbit data quality

Station/data	Number of points	Standard deviation	Mean
Bermuda			
Range, m	17	4.0	3.0
Azimuth, deg	17	0.016	0.0
Elevation, deg	17	0.011	0.0
Antigua			
Range, m	27	5.0	0.9
Azimuth, deg	27	0.004	0.0
Elevation, deg	27	0.012	0.0

Table 38. *Ranger IX* parking orbit solutions

Orbital parameter	AFETR real-time solution[a]	JPL ODP solution[b]
Epoch = 3/21/65, GMT	21:45:47.4	21:45:34
Radius, km	6564.0	6562.0573
Latitude, deg	25.510	25.715587
Longitude, deg	299.615	298.69171
Velocity, km/s	7.374	7.3754901
Path angle, deg	0.111	0.079806490
Azimuth, deg	103.702	103.30741
Semimajor axis, km	6569.0	6565.2094
Eccentricity	0.0019707	0.0014104272
Inclination, deg	28.43595	28.437604
Longitude of node, deg	327.0536	327.06279
Argument of perigee, deg	46.25868	44.274442
C_3, km/s^2	−60.67	−60.714076

[a]Solution from Antigua data.

[b]Solution from Antigua and Bermuda data.

Table 38 lists the spherical initial conditions and orbital elements from this solution along with the AFETR orbit reported in real time. The agreement is quite close. Argument of perigee differs by about 2 deg; however, because the orbit is so nearly circular, this parameter does not have too much significance.

C. Transfer Orbit

The preseparation data from the TFV ship were combined with the postseparation data from the new FPQ-6 radar at Ascension Island for a two station fit of the transfer orbit. The data were combined in this fashion instead of fragmenting the orbit into a preseparation–postseparation orbit in order to see if a consistent two station solution would be possible. The effect of spring separation between the *Agena* second stage and the *Ranger IX* spacecraft should be negligible, since the Ascension data (Fig. 47) were taken immediately after spring separation and because the *Agena* was more massive than the spacecraft. Figure 48 shows the results of such a solution, which includes the relocation of the TFV ship by 10 km in longitude and 3 km in latitude.

Data were received from Ascension starting from 21:53:54 GMT on 21 March 1965 and from the TFV ship from 21:48:40 to 21:57:05 GMT. Data before 21:49:48 GMT were considered to be taken during the *Agena* second burn and were ignored. Two other orbits were determined using data from Ascension and TFV ship, exclusive of each other.

All three solutions were mapped to impact upon the moon, and compared to an orbit obtained from AFETR during real time as well as a spacecraft orbit determined from DSIF tracking. This latter orbit was given a nominal spring separation velocity of 0.5 m/s along the velocity vector and taken out to impact. Figure 49 illustrates the **B**-plane points of impact from these various orbits. The point labelled AFETR refers to the AFETR orbit obtained in real time, the point labelled DSIF refers to the orbit of the spacecraft, the point labelled NOM refers to the *Agena* orbit obtained by decreasing the spacecraft velocity 0.5 m/s along the velocity vector, and the points labelled 2 STAT, SHIP, and ASCENSION refer to a two-station fit using TFV ship and Ascension data, a one-station fit using TFV ship data only, and a one-station fit using Ascension data only, respectively. The observed minus computed residuals from the latter two cases are shown in Figs. 50–52. Table 39 summarizes the orbital solutions from AFETR and the results from the three ODP solutions. The amount and quality of the data from Ascension and the TFV ship are tabulated in Table 40.

The JPL ODP solution, labelled "Ascension" in Table 39, agrees quite closely with the real-time AFETR solution, because both orbits used the Ascension data; however, both disagree quite significantly with orbits using DSIF data (Fig. 49). This discrepancy, which cannot be attributed to spring separation, points out an inconsistency between the DSIF data and the data from the new FPQ-6 radar at Ascension. According to Ref. 20, the data received from Ascension had been incorrectly labelled in time by 0.050 s.

D. Postretro Orbit

Data received from AFETR during the postretro orbit on 21 March, 1965 were from Ascension (data that ended at 22:33:18 GMT), from the FPS-16 radar at Pretoria (from 21:59:57 to 22:25:45 GMT), and from Carnarvon (from 22:29:00 to 22:44:30 GMT).

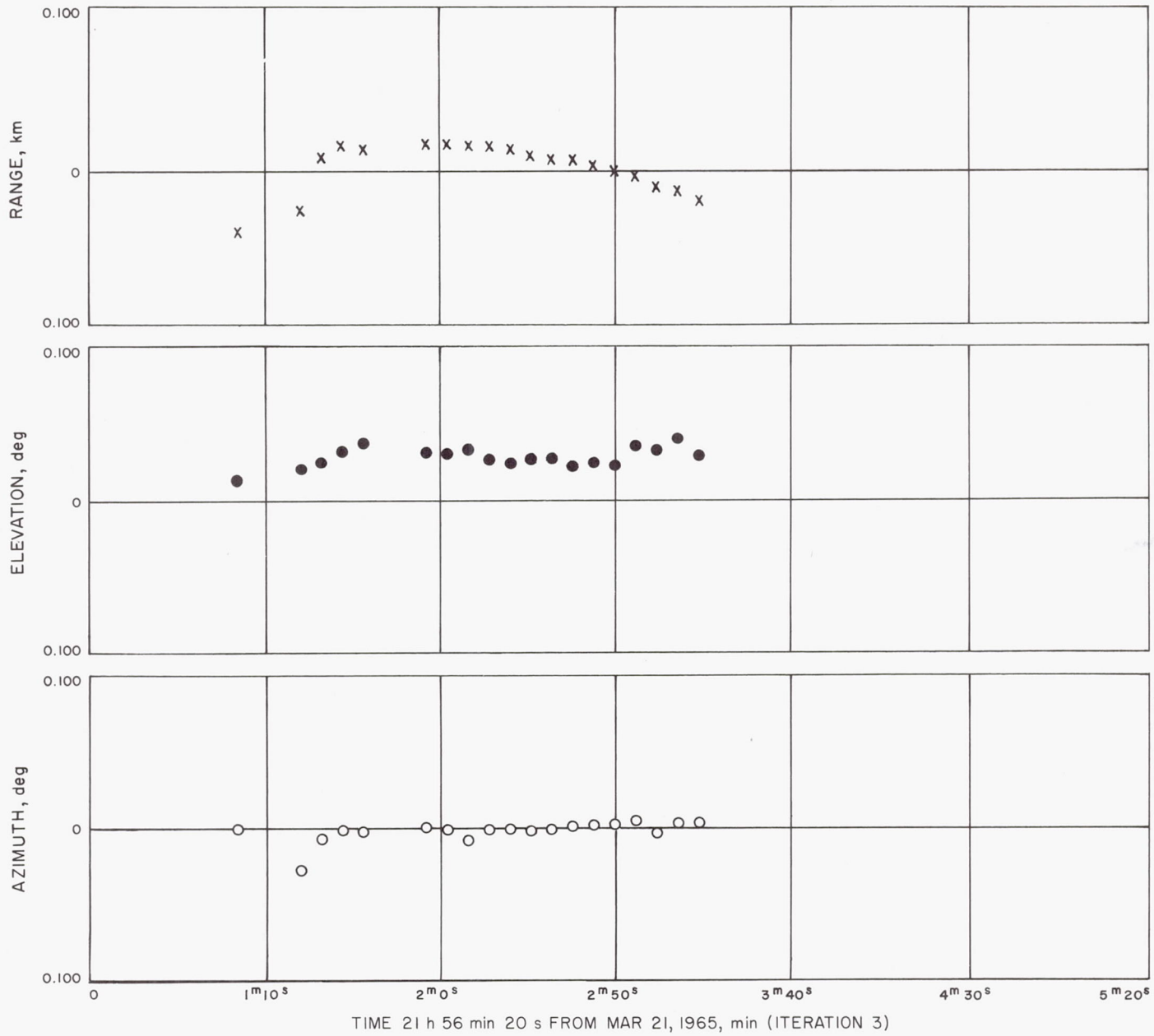


Fig. 47. Ascension Island transfer orbit residuals (two-station fit)

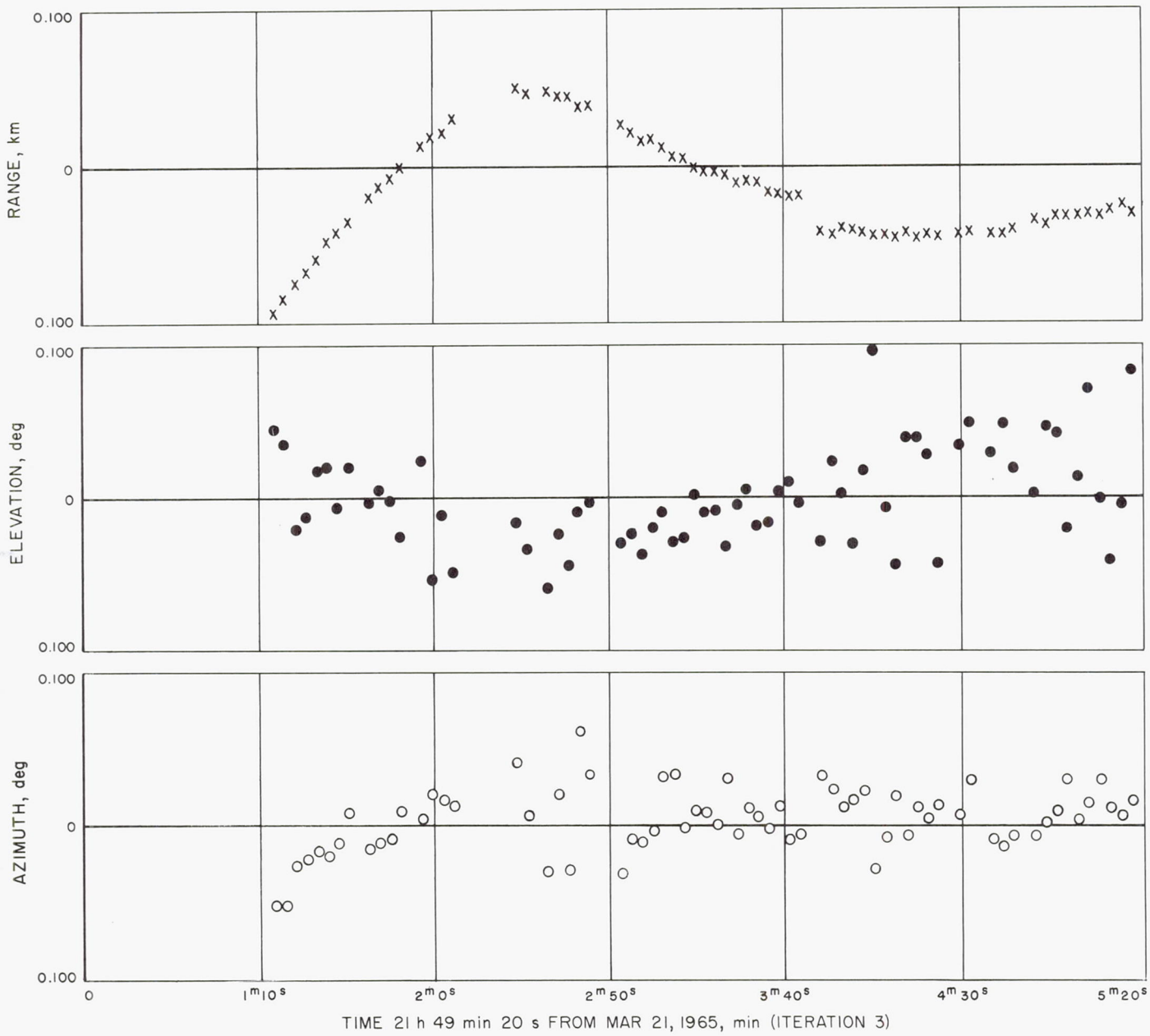


Fig. 48. TFV ship transfer orbit residuals (two-station fit)

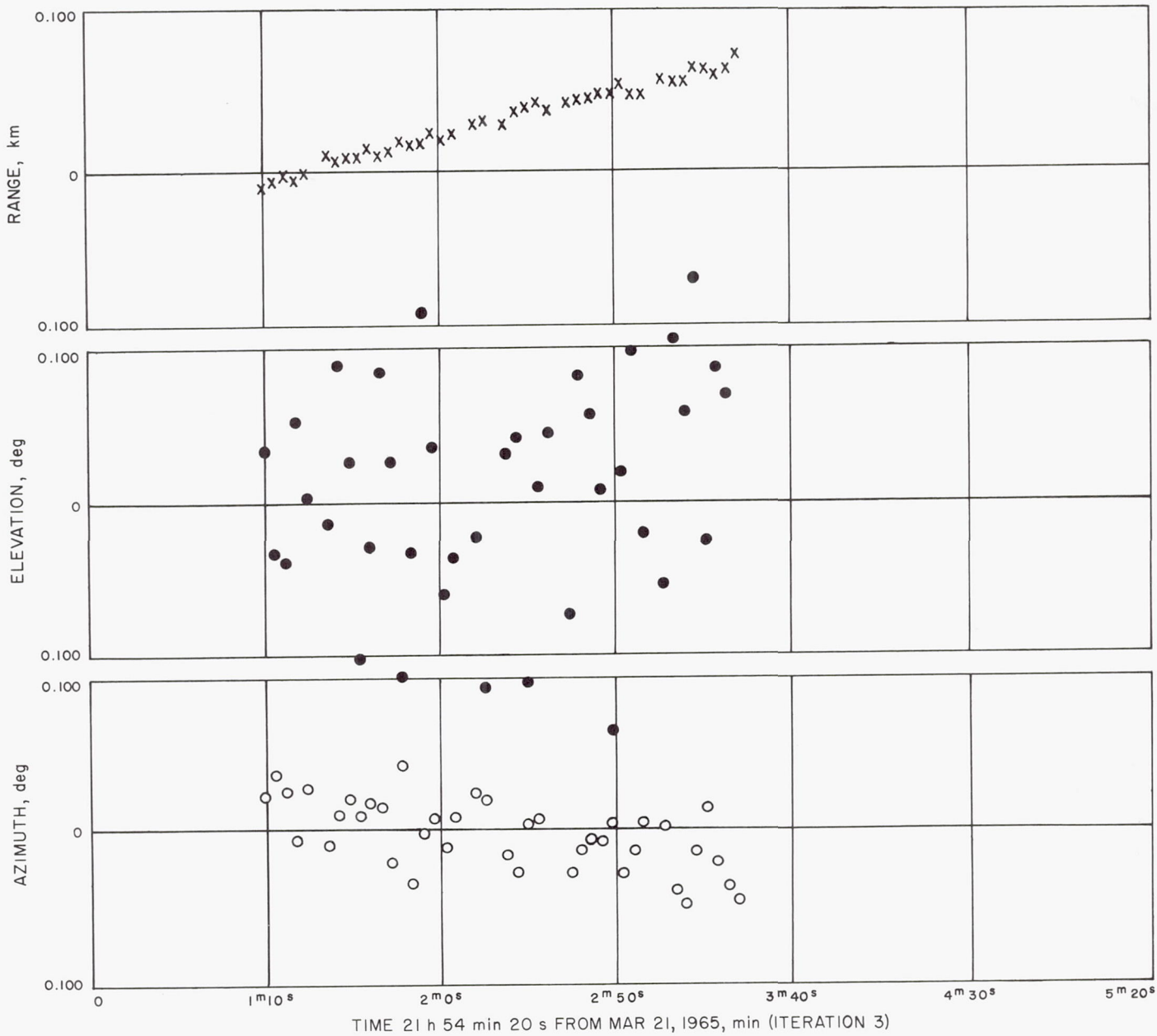

RANGE, km
0.100
0
0.100
ELEVATION, deg
0.100
0
0.100
AZIMUTH, deg
0.100
0
0.100
0
1m10s
2m0s
2m50s
3m40s
4m30s
5m20s
TIME 21 h 54 min 20 s FROM MAR 21, 1965, min (ITERATION 3)

Fig. 48 (contd)

Table 39. *Ranger IX* transfer orbit solutions

Orbital parameter	Orbit from AFETR	Ascension data only	Ship data only	Two-station fit
Epoch = 3/21/65, GMT	21:57:47.9	21:49:48	21:49:48	21:49:48
Radius, km	7649.0	6572.0000	6573.3752	6572.5448
Latitude, deg	20.964	20.499784	20.507766	20.500327
Longitude, deg	352.836	316.74323	316.73947	316.73379
Velocity, km/s	9.708	10.545706	10.545007	10.546625
Path angle, deg	23.081	1.7421114	1.6676701	1.7196632
Azimuth, deg	120.023	111.02435	111.00232	111.00960
Semimajor axis, km	381995.5	377480.12	382247.95	389254.63
Eccentricity	0.9828112	0.98260482	0.98281696	0.98312923
Inclination, deg	28.46928	28.458760	28.449807	28.449531
Longitude of node, deg	326.9725	327.00205	327.04186	327.01518
Argument of perigee, deg	129.35650	129.31997	129.42375	129.34440
C_3 km/s^2	−1.04	−1.0559513	−1.0427803	−1.0240100
B, km	2945.5194	2837.0355	1976.9812	1896.9244

Table 40. *Ranger IX* transfer orbit data quality

Station/data	Number of points	Standard deviation	Mean
Ascension			
Range, m	19	6.34	0.2
Azimuth, deg	19	0.006	0.0
Elevation, deg	19	0.005	0.0
TFV ship			
Range, m	109	28.1	0.9
Azimuth, deg	109	0.0219	0.0
Elevation, deg	109	0.0637	0.0160

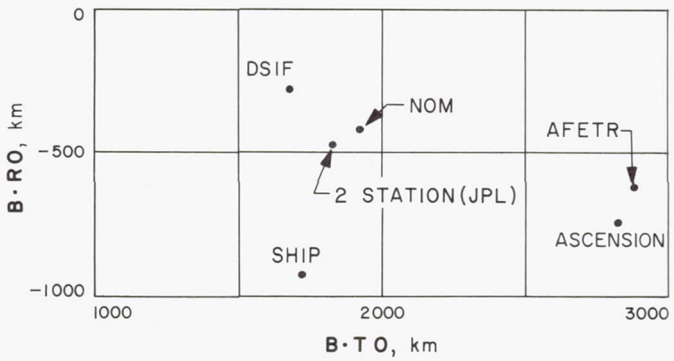


Fig. 49. Transfer orbit impact points

Table 41. Postretro data quality

Station/data	Number of points	Single station		Three stations	
		Standard deviation	Mean	Standard deviation	Mean
Carnarvon					
Range, m	143	6.0	0.0	125.0	77.1
Azimuth, deg	143	0.013	0.0	0.013	−0.08
Elevation, deg	143	0.013	0.0	0.014	0.0
Pretoria					
Range, m	108	6.0	0.0	258.0	78.8
Azimuth, deg	108	0.04	0.0	0.06	−0.113
Elevation, deg	108	0.01	0.0	0.04	0.076
Carnarvon					
Range, m	208	6.0	0.0	138.0	−45.0
Azimuth, deg	208	0.01	0.0	0.014	0.081
Elevation, deg	208	0.01	0.0	0.014	0.040

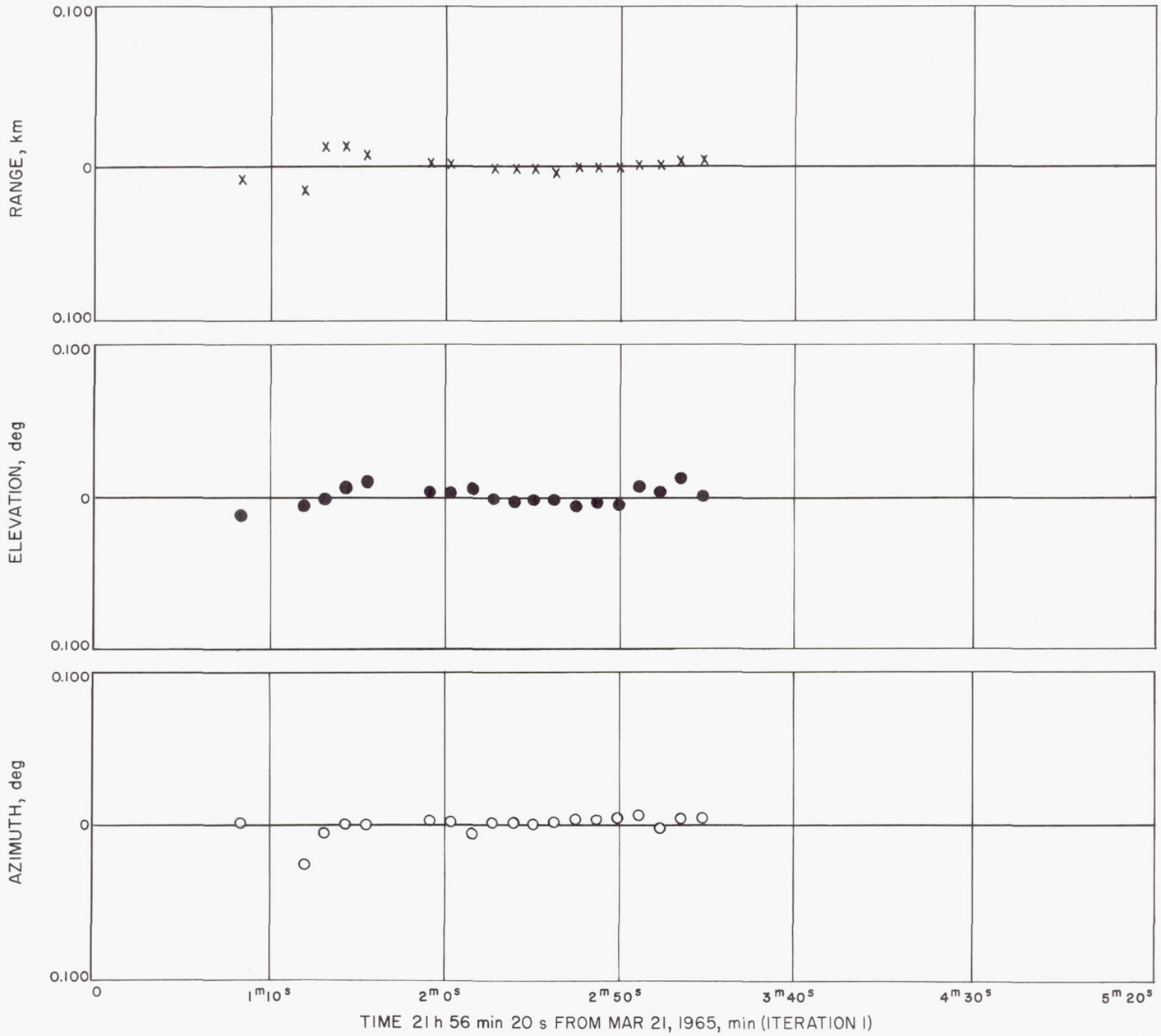


Fig. 50. Ascension Island transfer orbit residuals (Ascension data only)

Data from the FPQ-6 radars at Ascension and Carnarvon and the FPS-16 radar at Pretoria were received at JPL at a rate of 1 point/6 s. These data were used in a combined three-station fit to the *Agena* orbit.

The resultant solution produce observed minus computed residuals in excess of 200 m from each of the three stations (Figs. 53–55 are plots of these residuals), and are to be contrasted with residuals obtained from each station by itself (Figs. 56–64). Table 41 compares the standard deviation and the mean from the three-station fit with the standard deviation and the mean from the single-station fit. Such discrepancy indicates internal inconsistency between each of the three radars. Reference 20 indicates an incorrect time tag from Pretoria of 0.550 s. The mistagging of the data causes the sizeable range residuals of the Pretoria data, which can be seen in Fig. 63. The point where the residuals cross the zero axis is the point of closest approach of the *Agena* with respect to Pretoria.

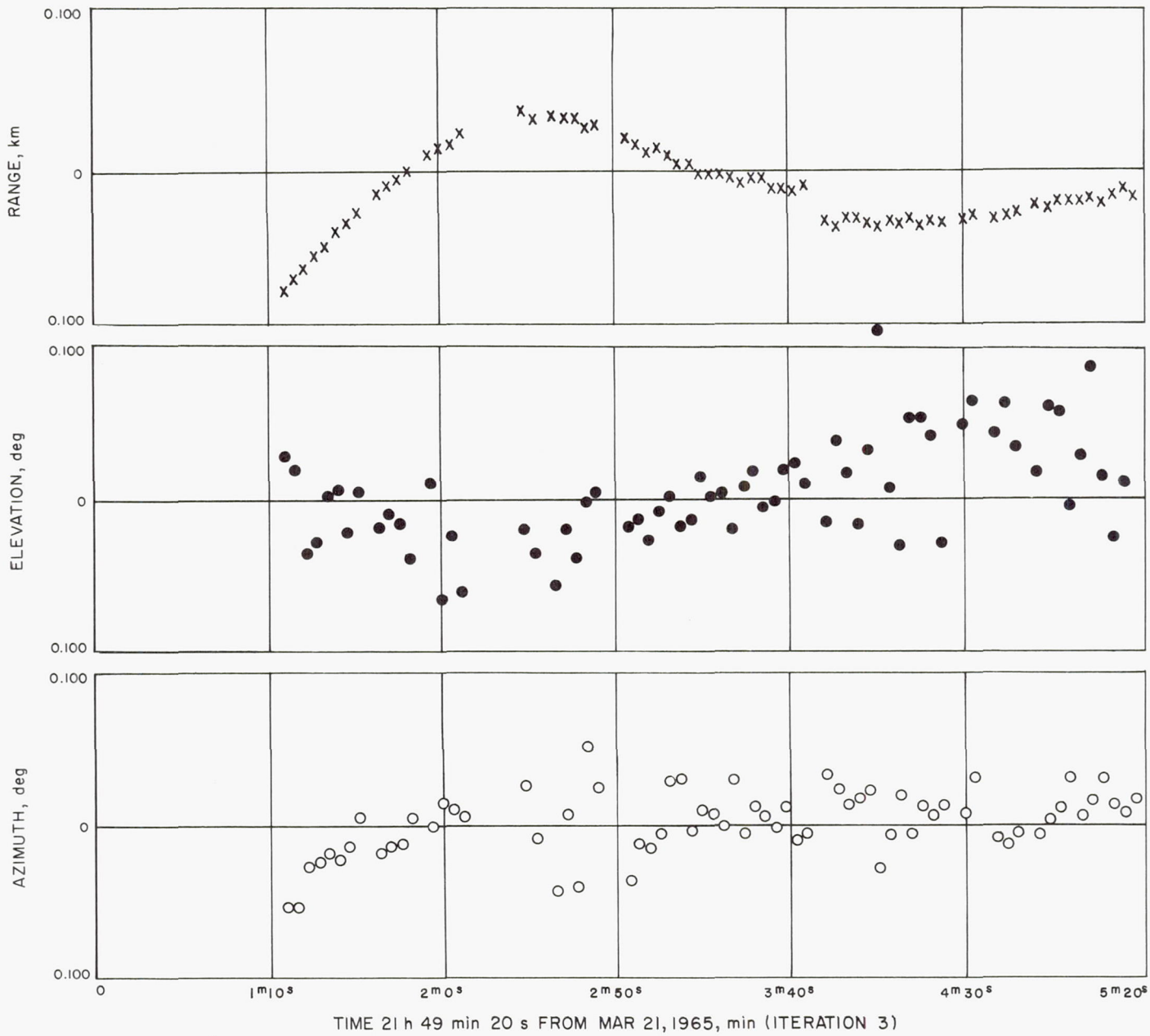


Fig. 51. TFV ship transfer orbit residuals (TFV data only)

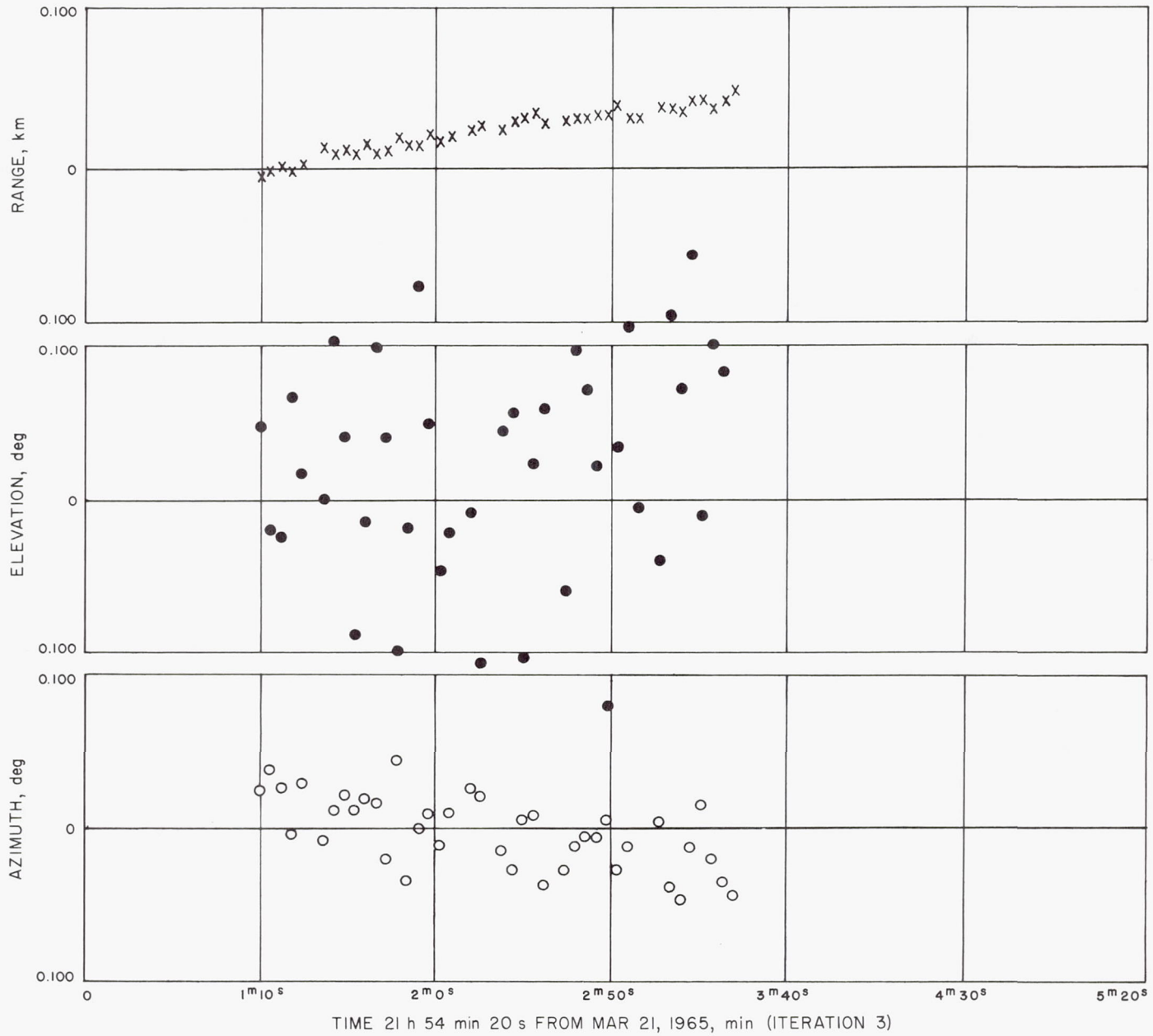

0.100
0
0.100
RANGE, km
0.100
0
0.100
ELEVATION, deg
0.100
0
0.100
AZIMUTH, deg
0
1m10s
2m0s
2m50s
3m40s
4m30s
5m20s
TIME 21 h 54 min 20 s FROM MAR 21, 1965, min (ITERATION 3)

Fig. 51 (contd)

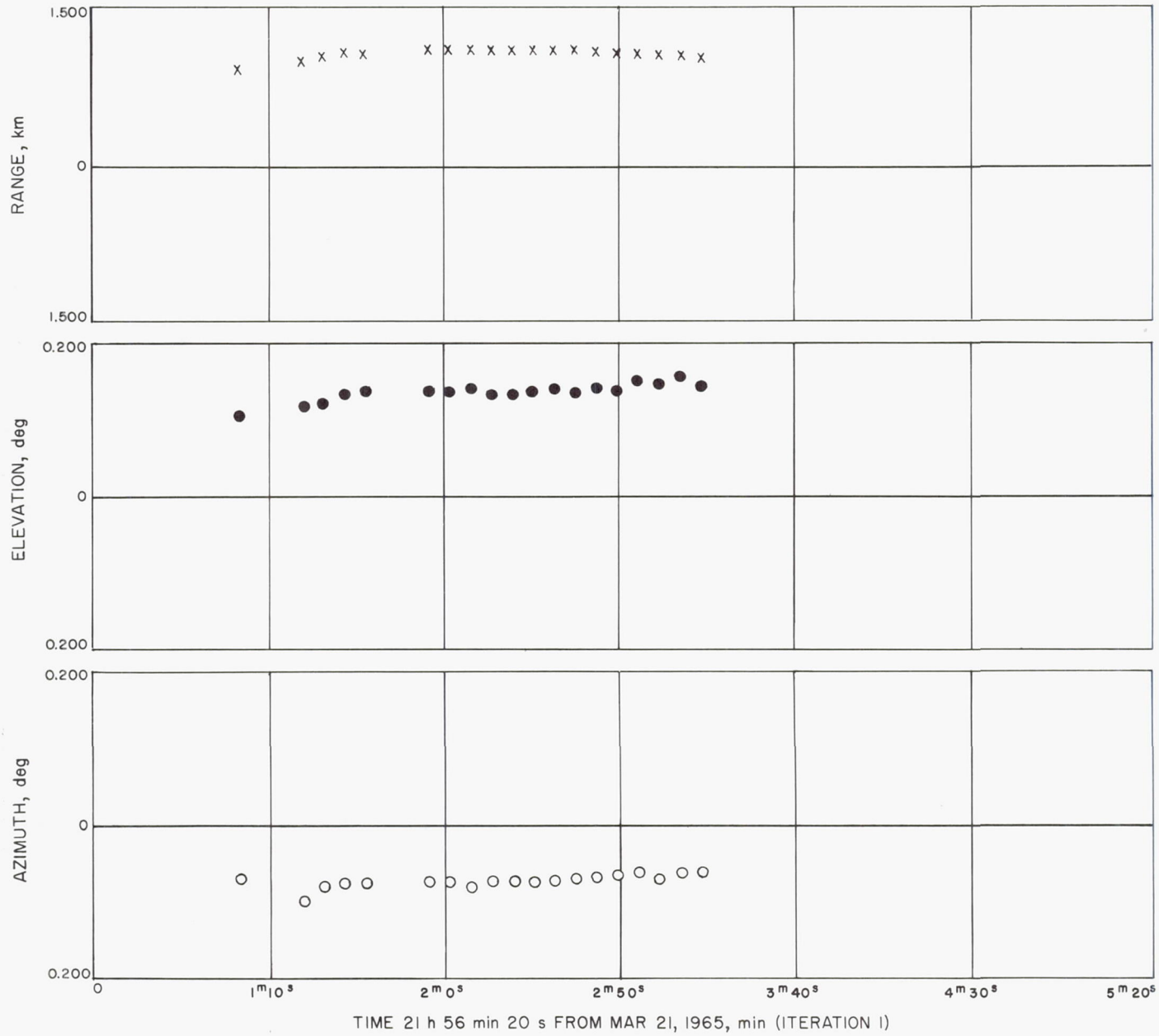


Fig. 52. Ascension Island transfer orbit residuals (TFV data only)

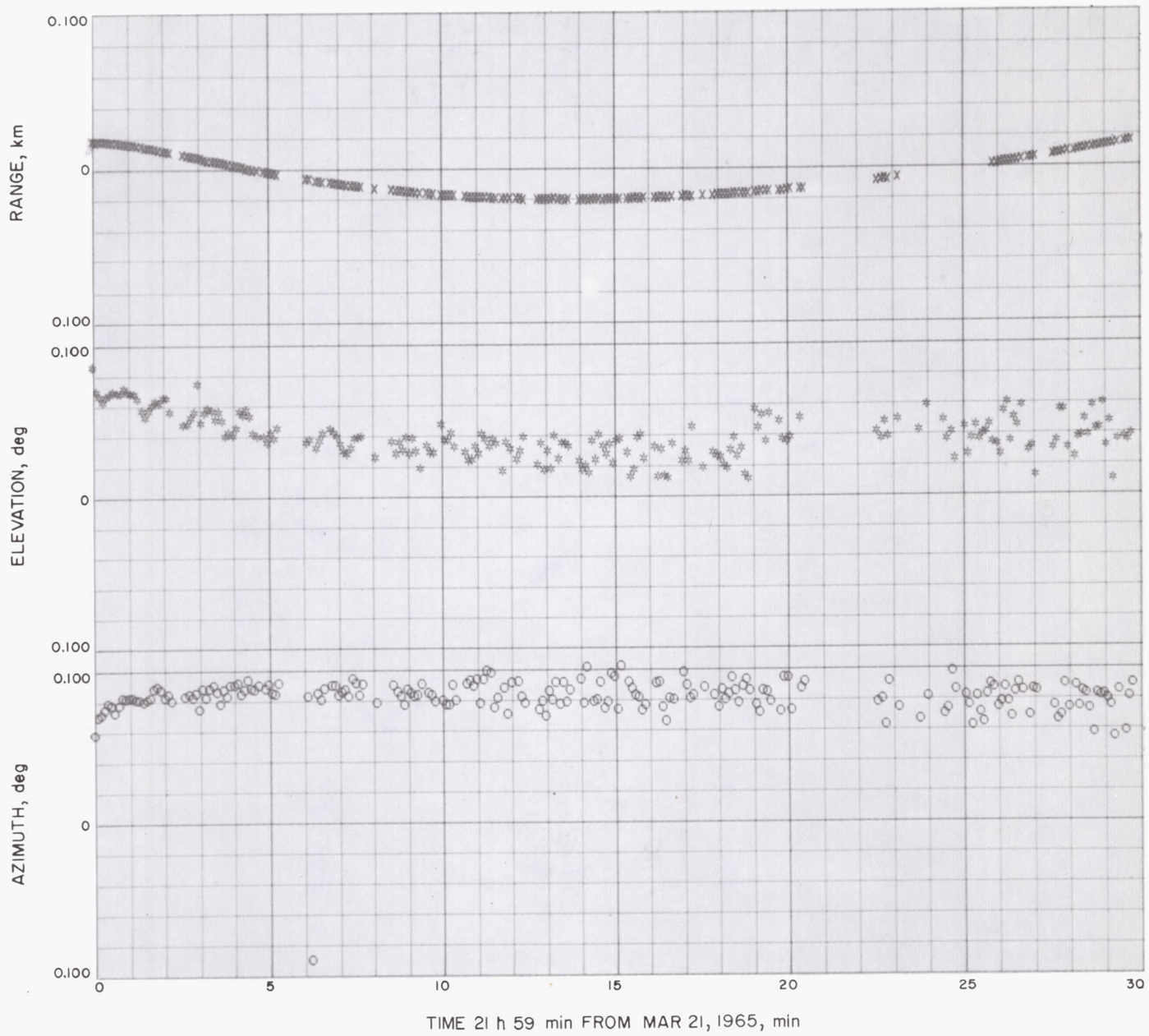


Fig. 53. Ascension Island postretro orbit residuals (three-station fit)

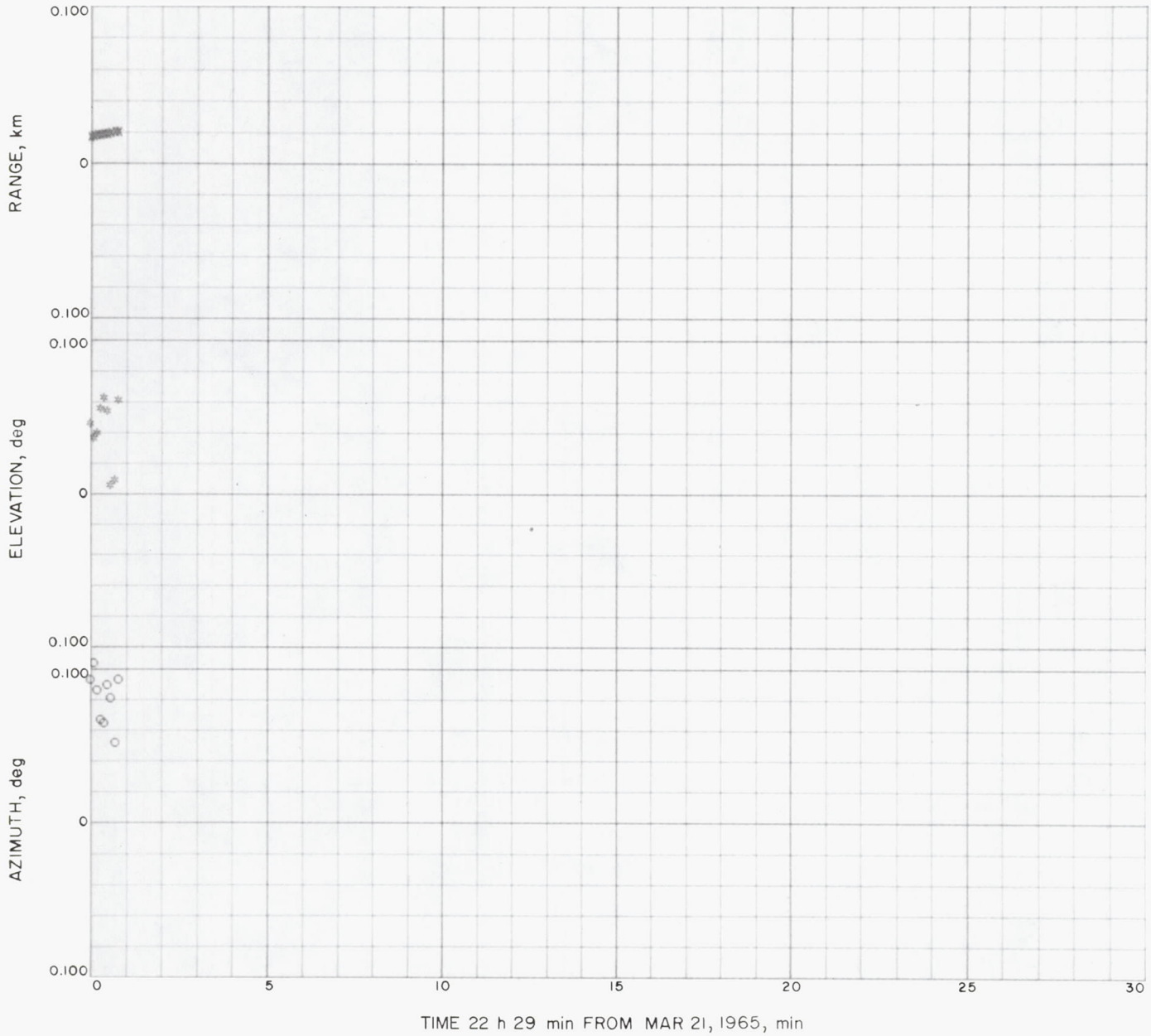

RANGE, km
0.100
0
0.100
ELEVATION, deg
0.100
0
0.100
AZIMUTH, deg
0.100
0
0.100
0
5
10
15
20
25
30
TIME 22 h 29 min FROM MAR 21, 1965, min

Fig. 53 (contd)

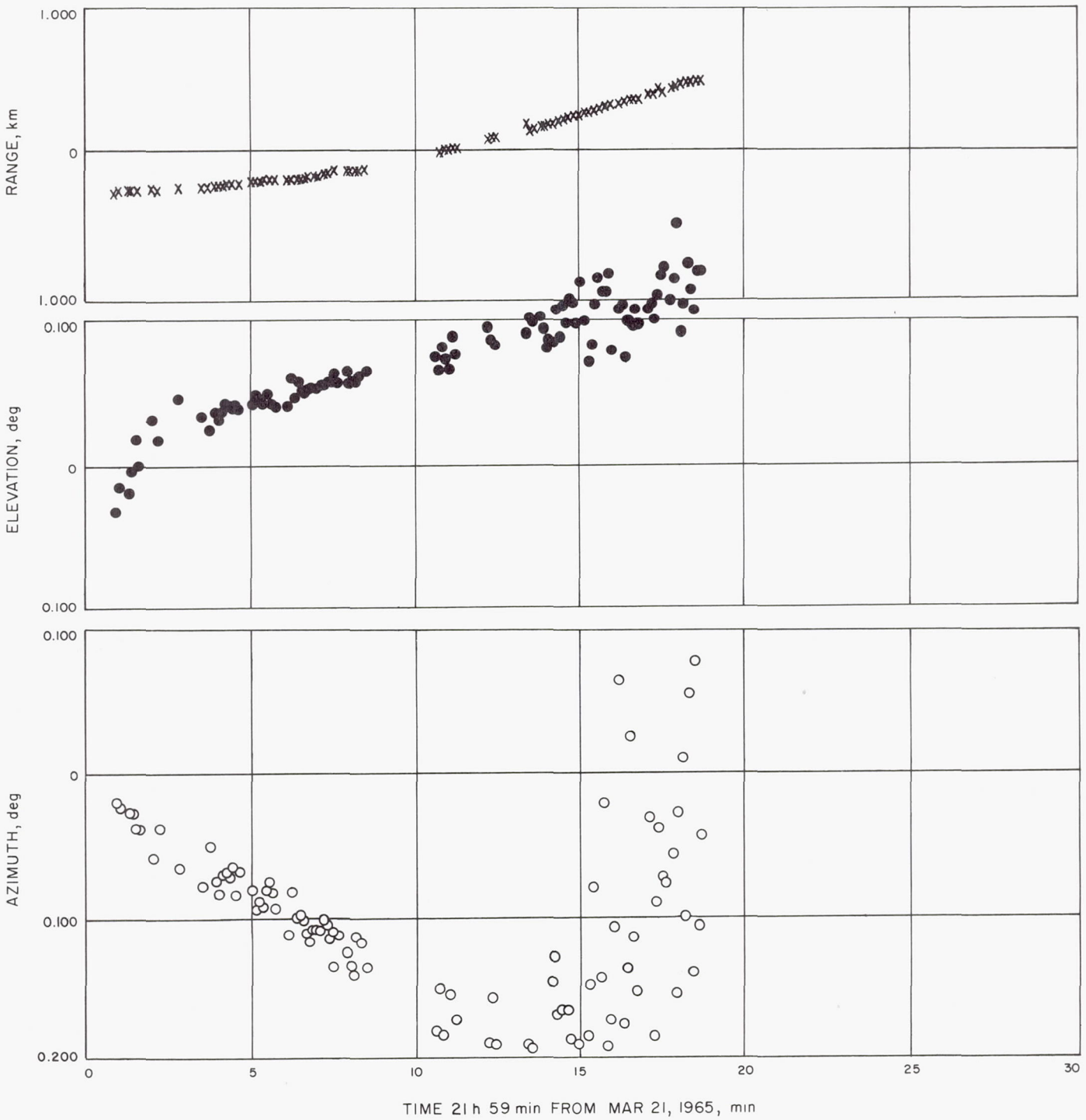


Fig. 54. Pretoria postretro orbit residuals (three-station fit)

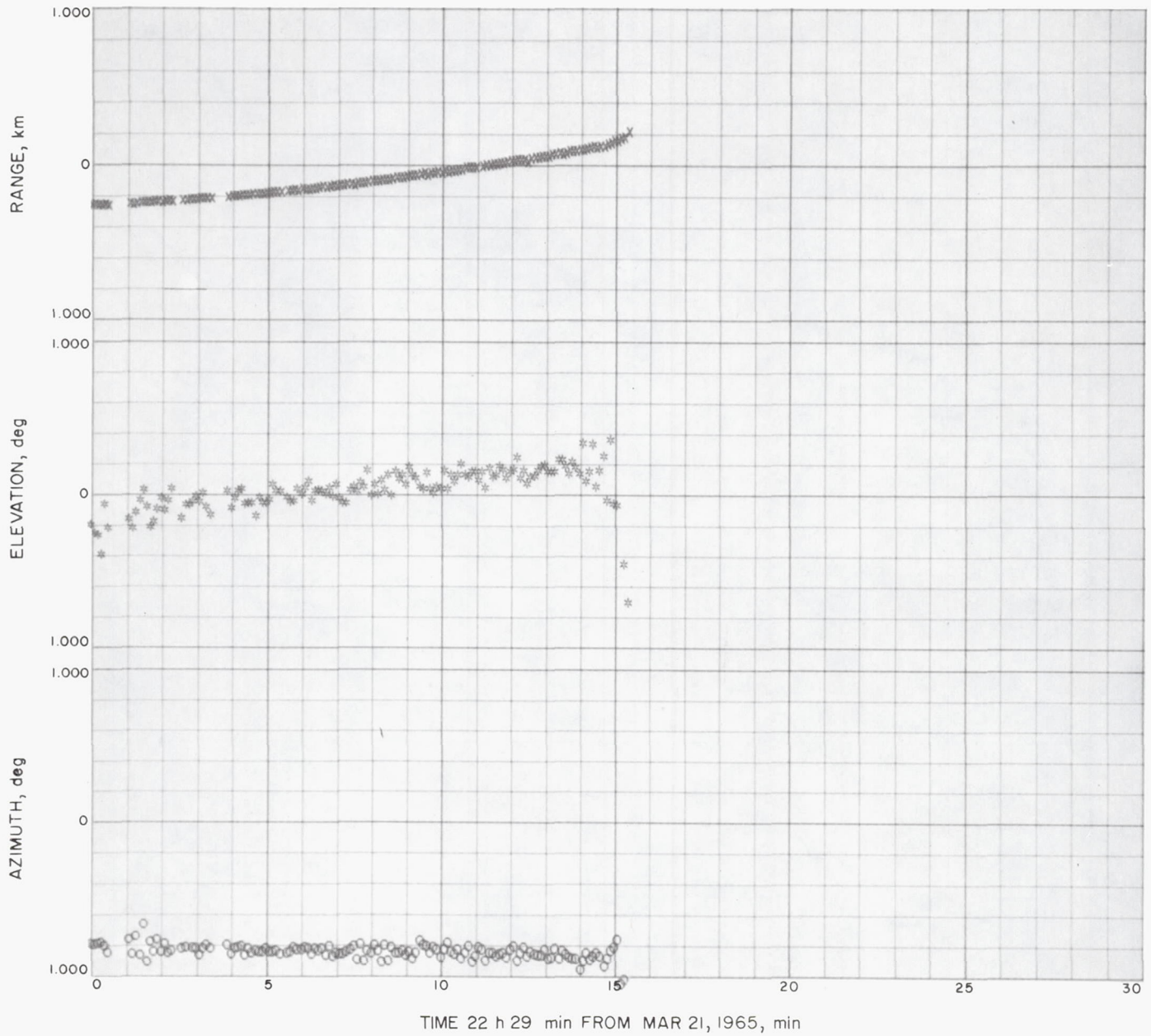


Fig. 55. Carnarvon postretro orbit residuals (three-station fit)

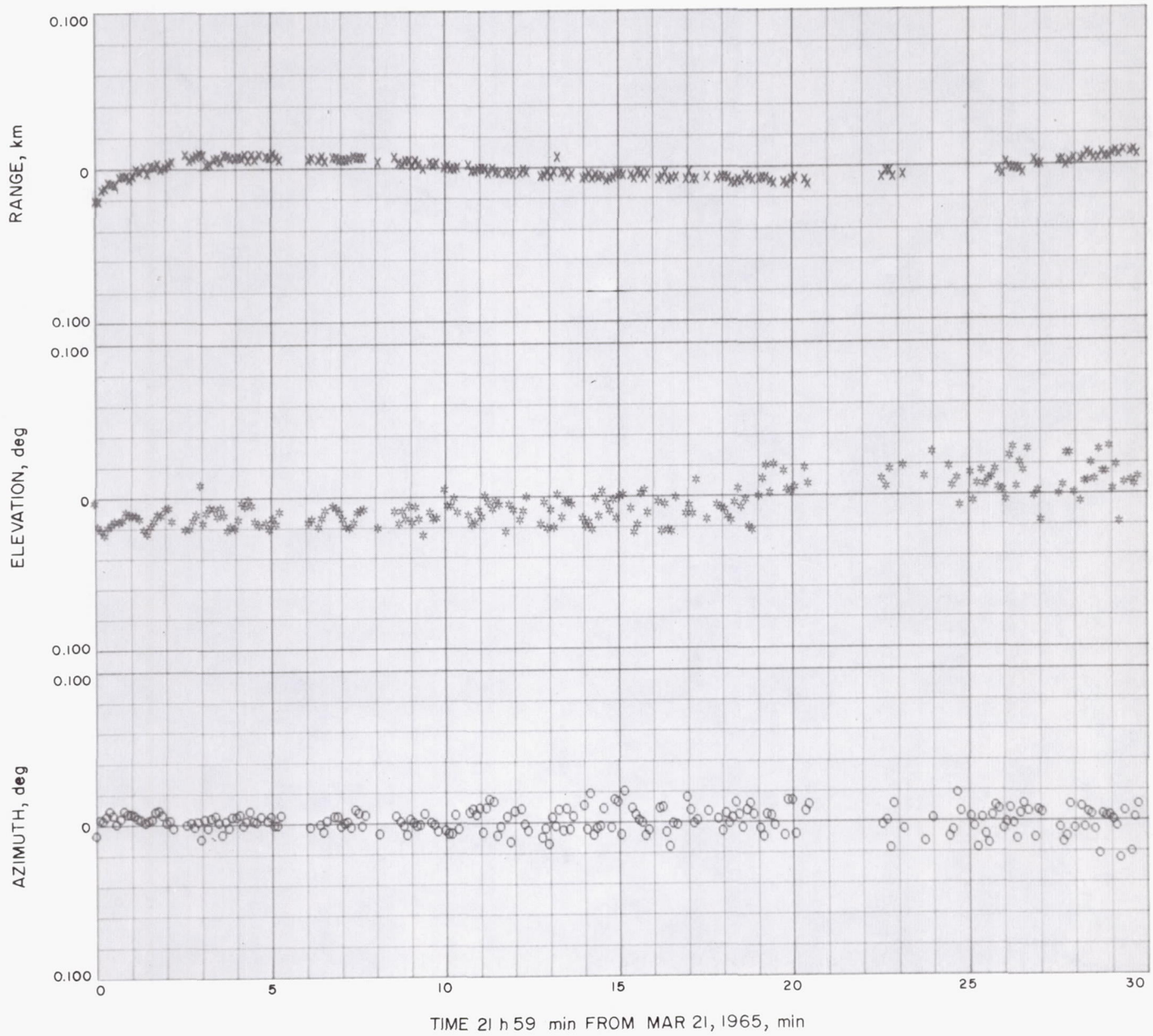


Fig. 56. Ascension Island postretro orbit residuals (Ascension data only)

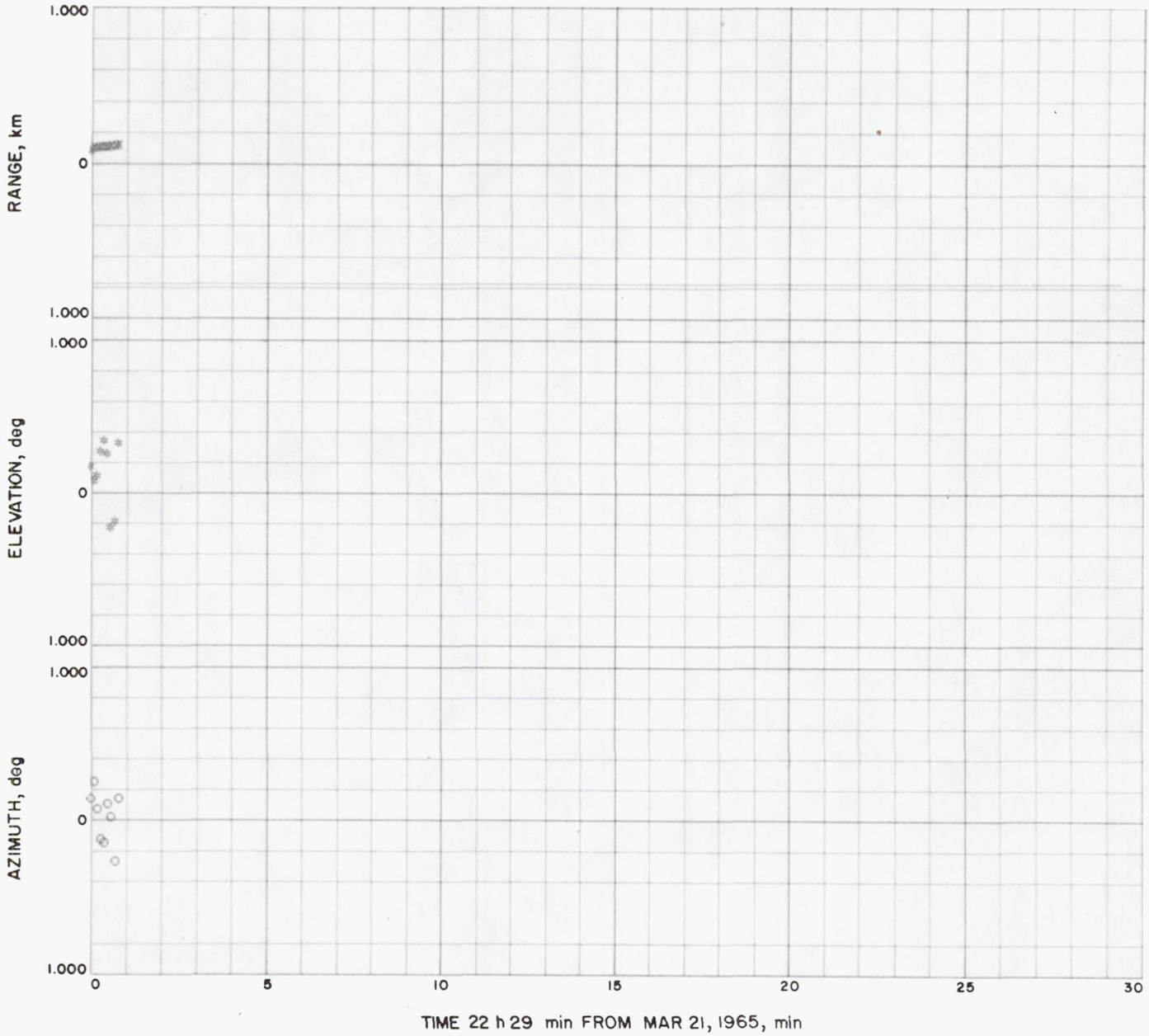

RANGE, km
1.000
0
1.000
ELEVATION, deg
1.000
0
1.000
AZIMUTH, deg
1.000
0
1.000
0
5
10
15
20
25
30
TIME 22 h 29 min FROM MAR 21, 1965, min

Fig. 56 (contd)

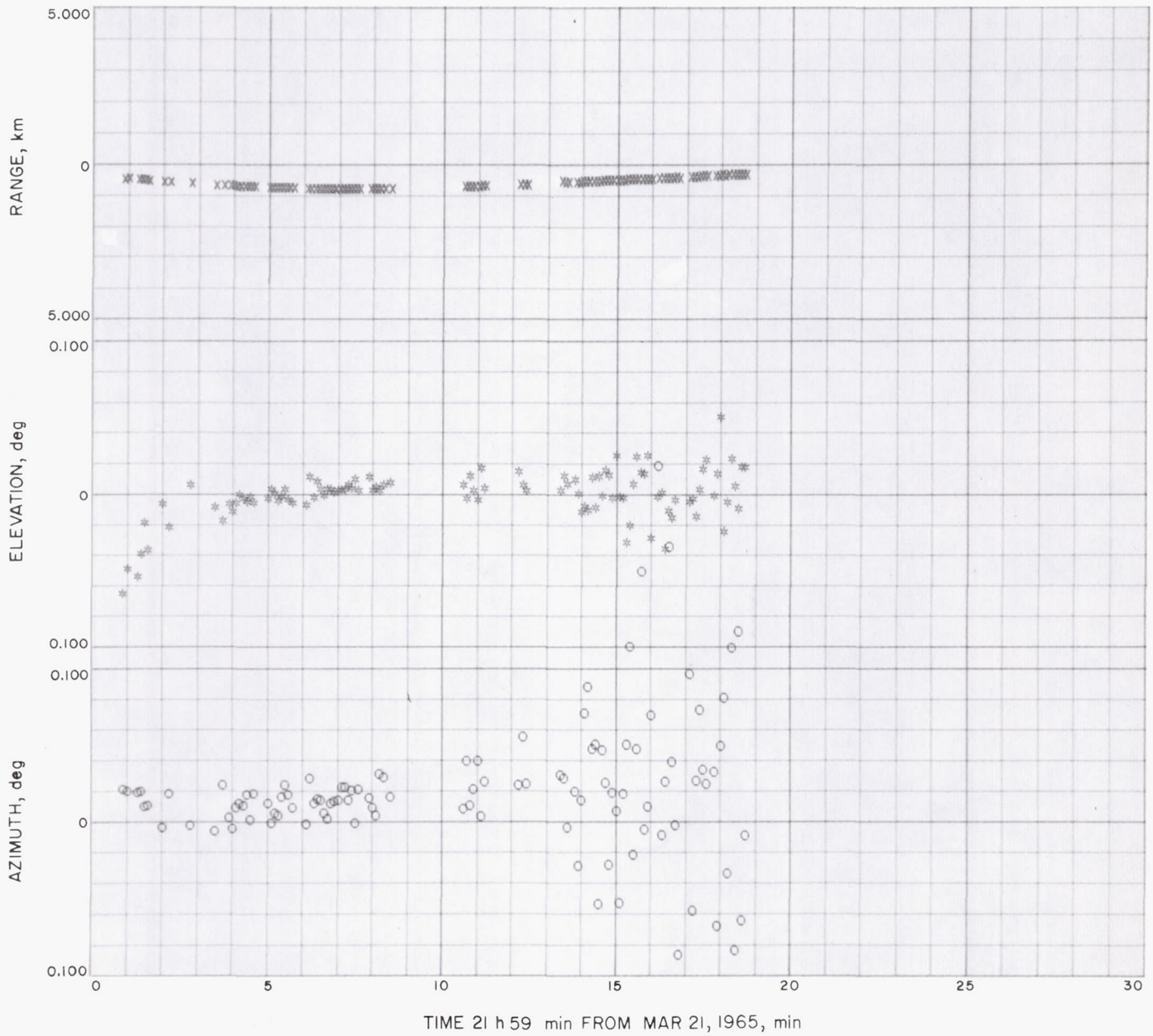


Fig. 57. Pretoria postretro orbit residuals (Ascension data only)

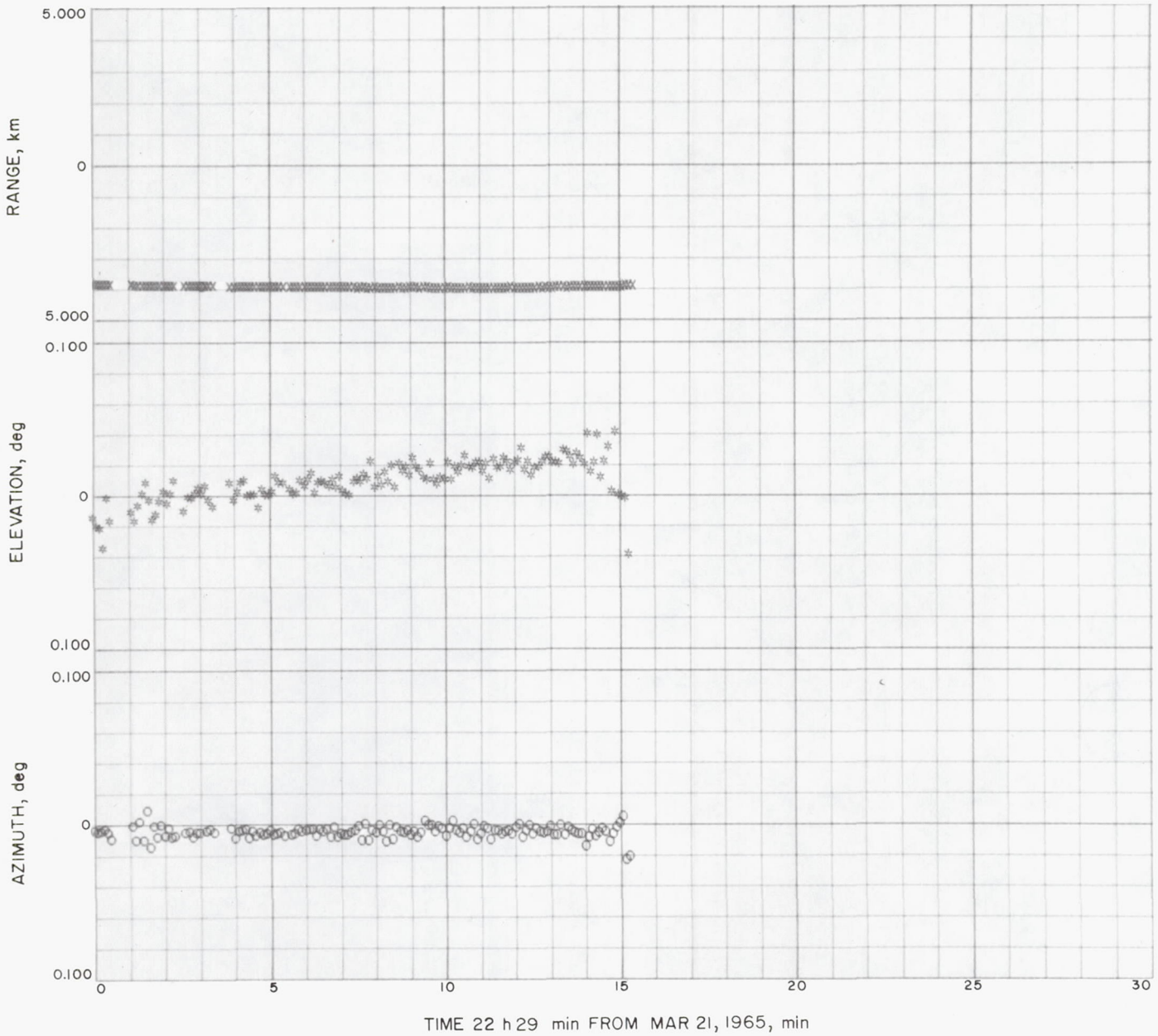


Fig. 58. Carnarvon postretro orbit residuals (Ascension data only)

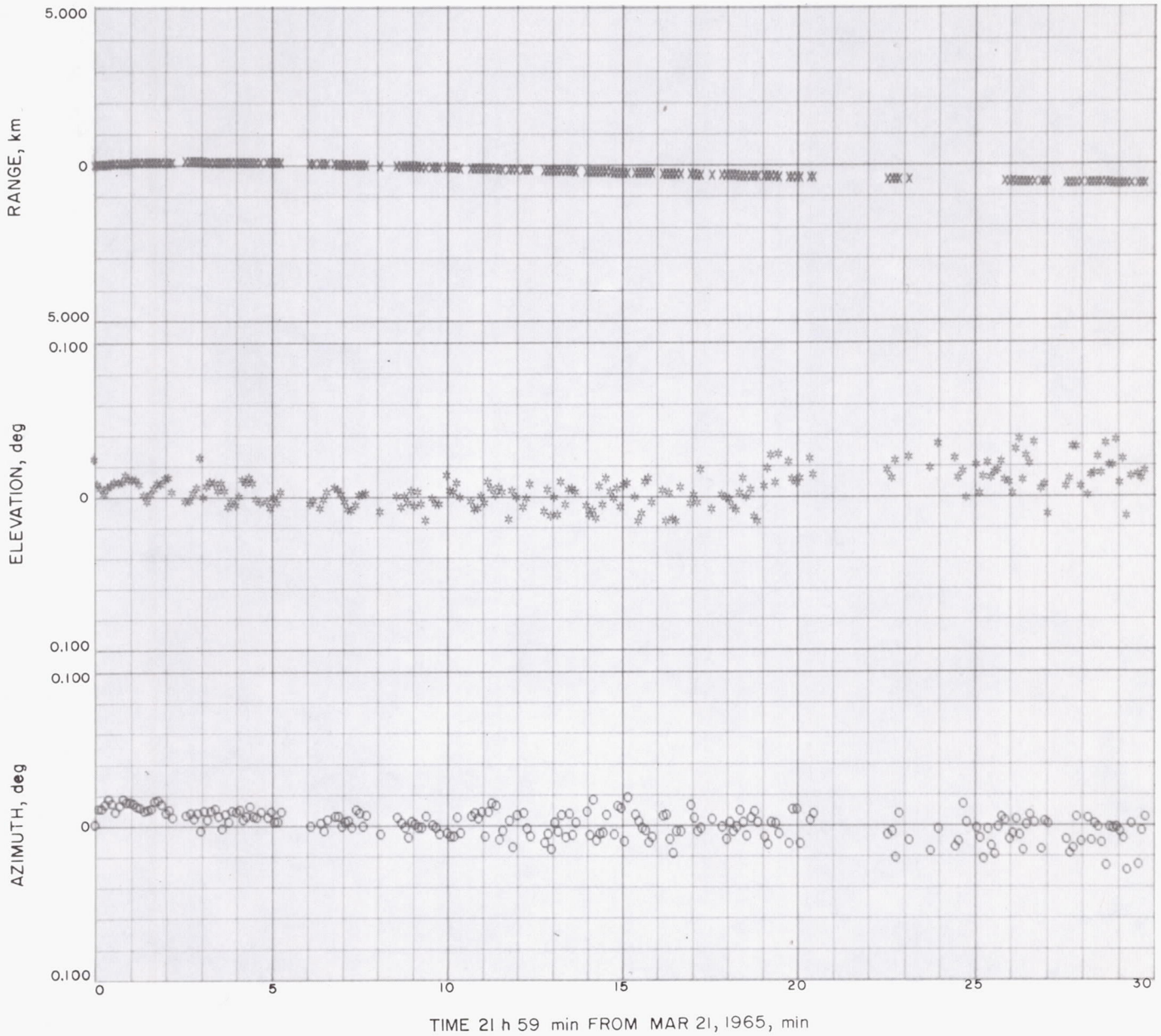


Fig. 59. Ascension postretro orbit residuals (Pretoria data only)

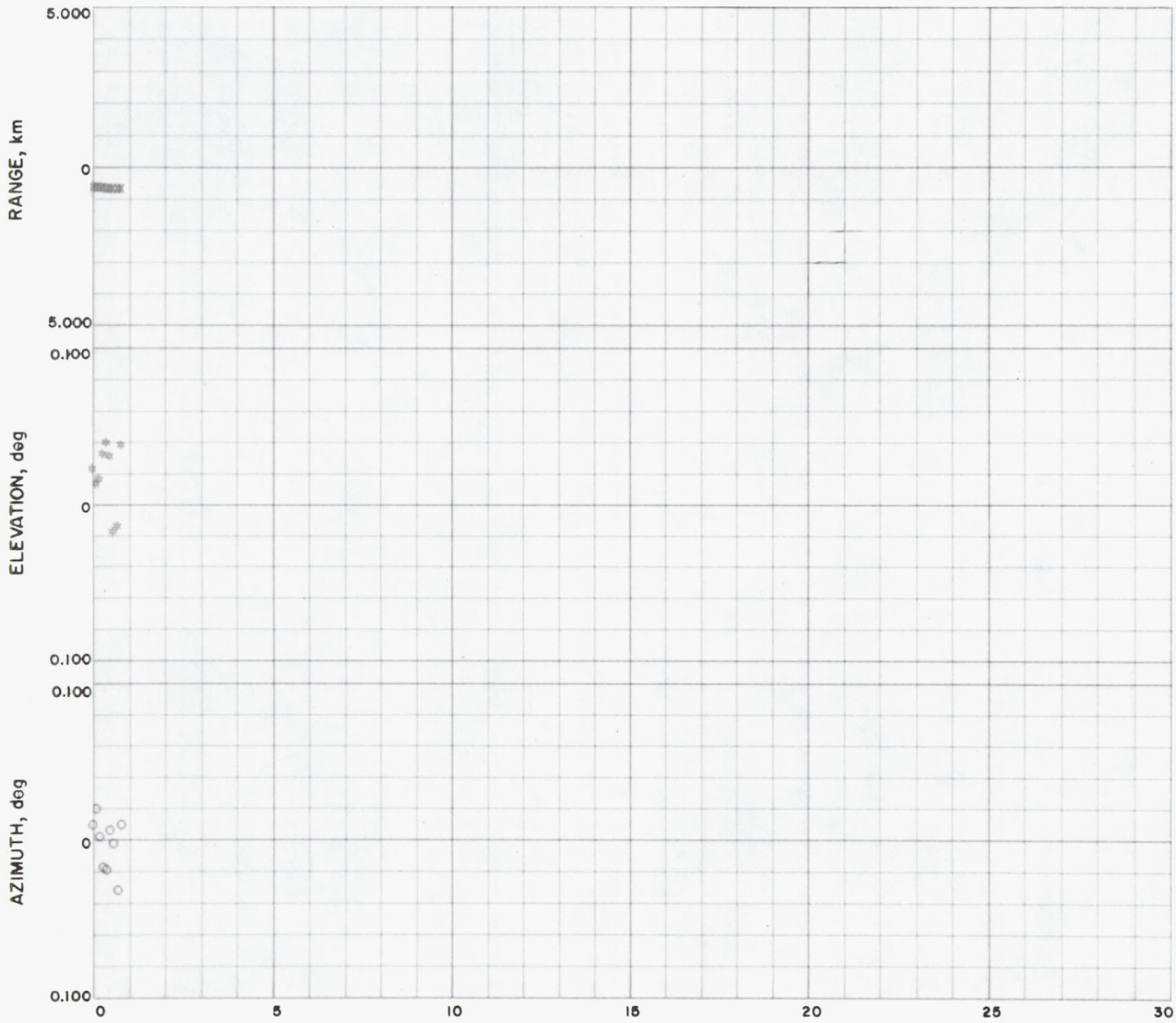

RANGE, km
5.000
0
5.000
ELEVATION, deg
0.100
0
0.100
AZIMUTH, deg
0.100
0
0.100
0
5
10
15
20
25
30
TIME 22 h 29 min FROM MAR 21, 1965, min

Fig. 59 (contd)

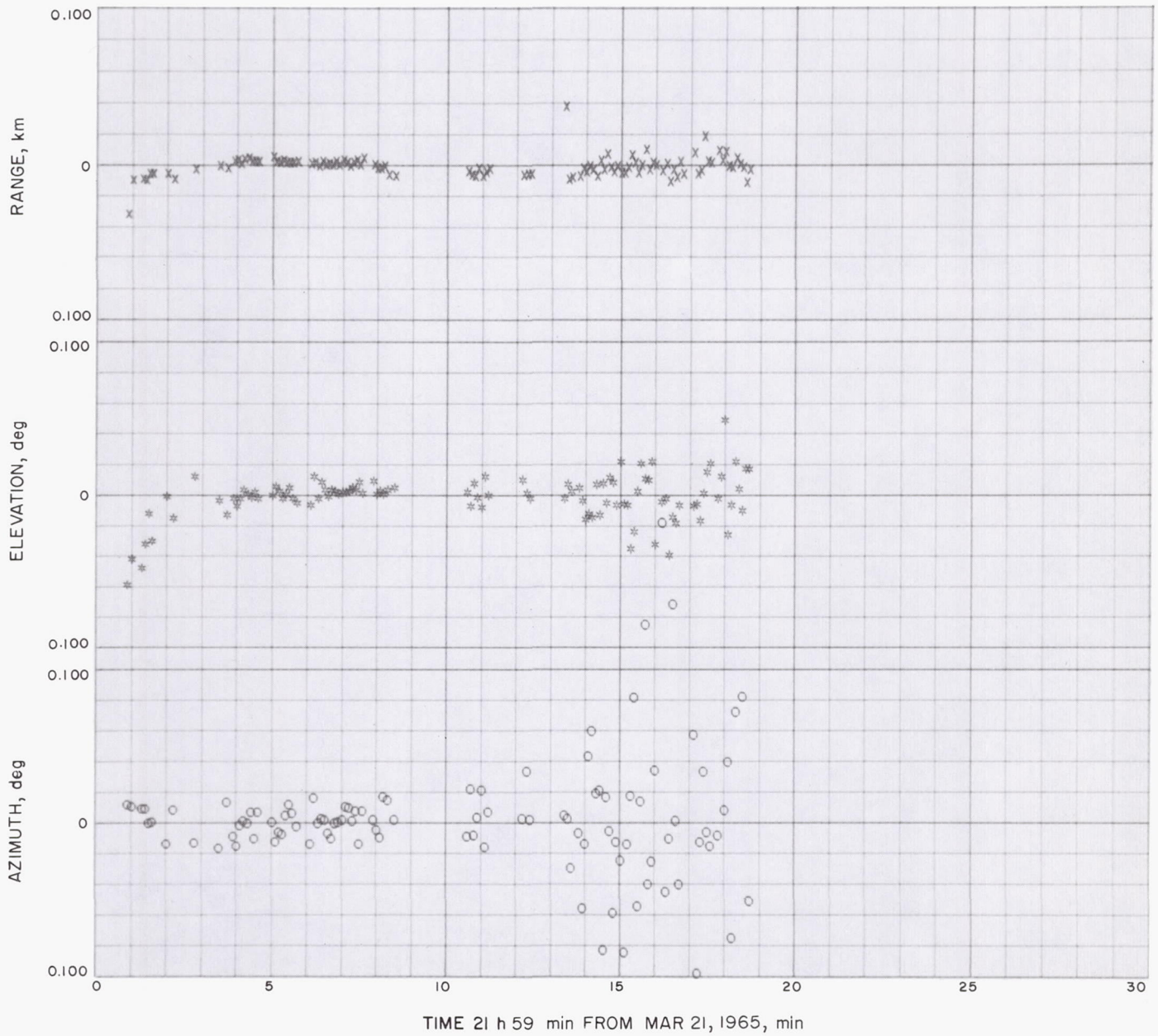


Fig. 60. Pretoria postretro orbit residuals (Pretoria data only)

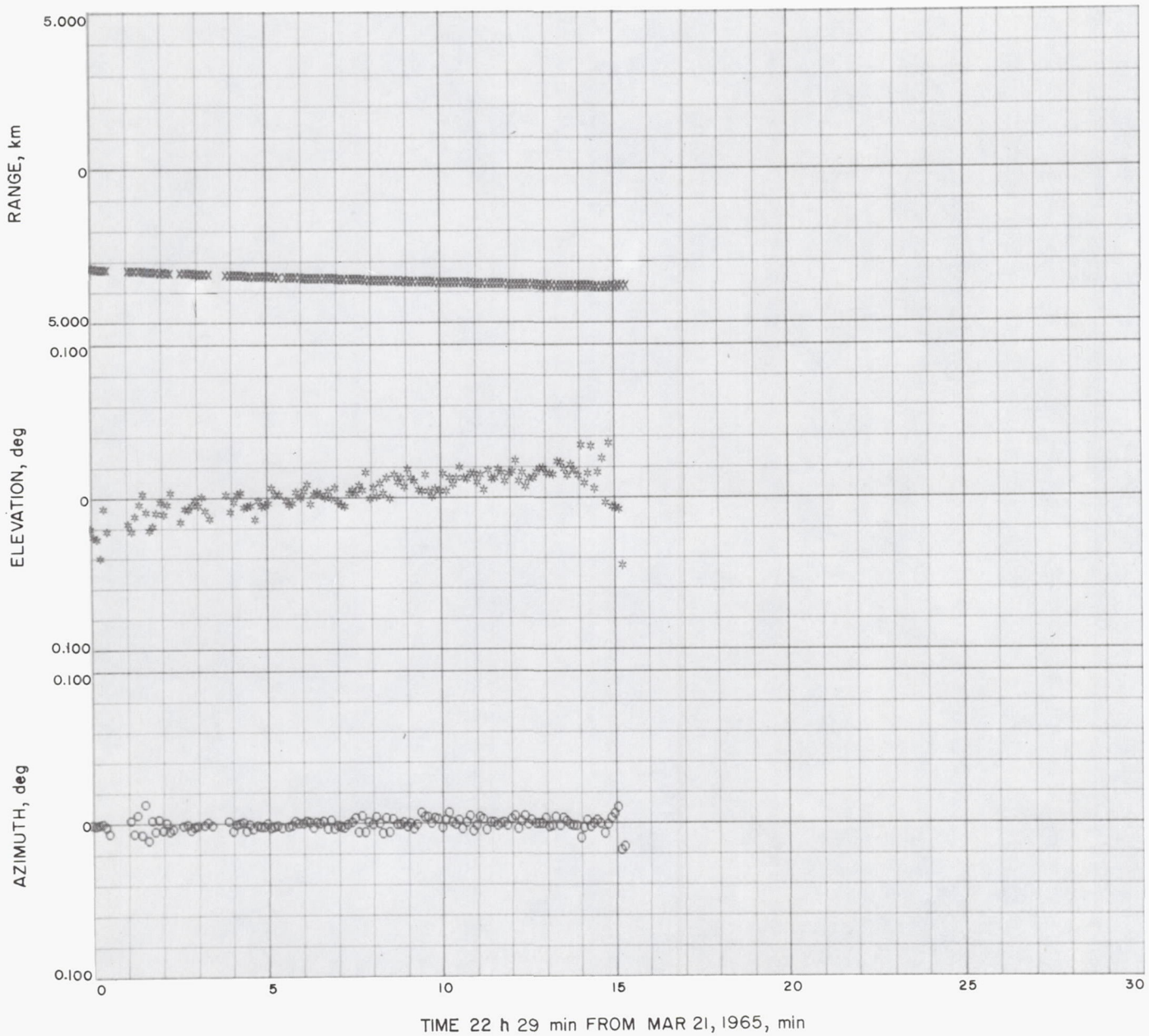


Fig. 61. Carnarvon postretro orbit residuals (Pretoria data only)

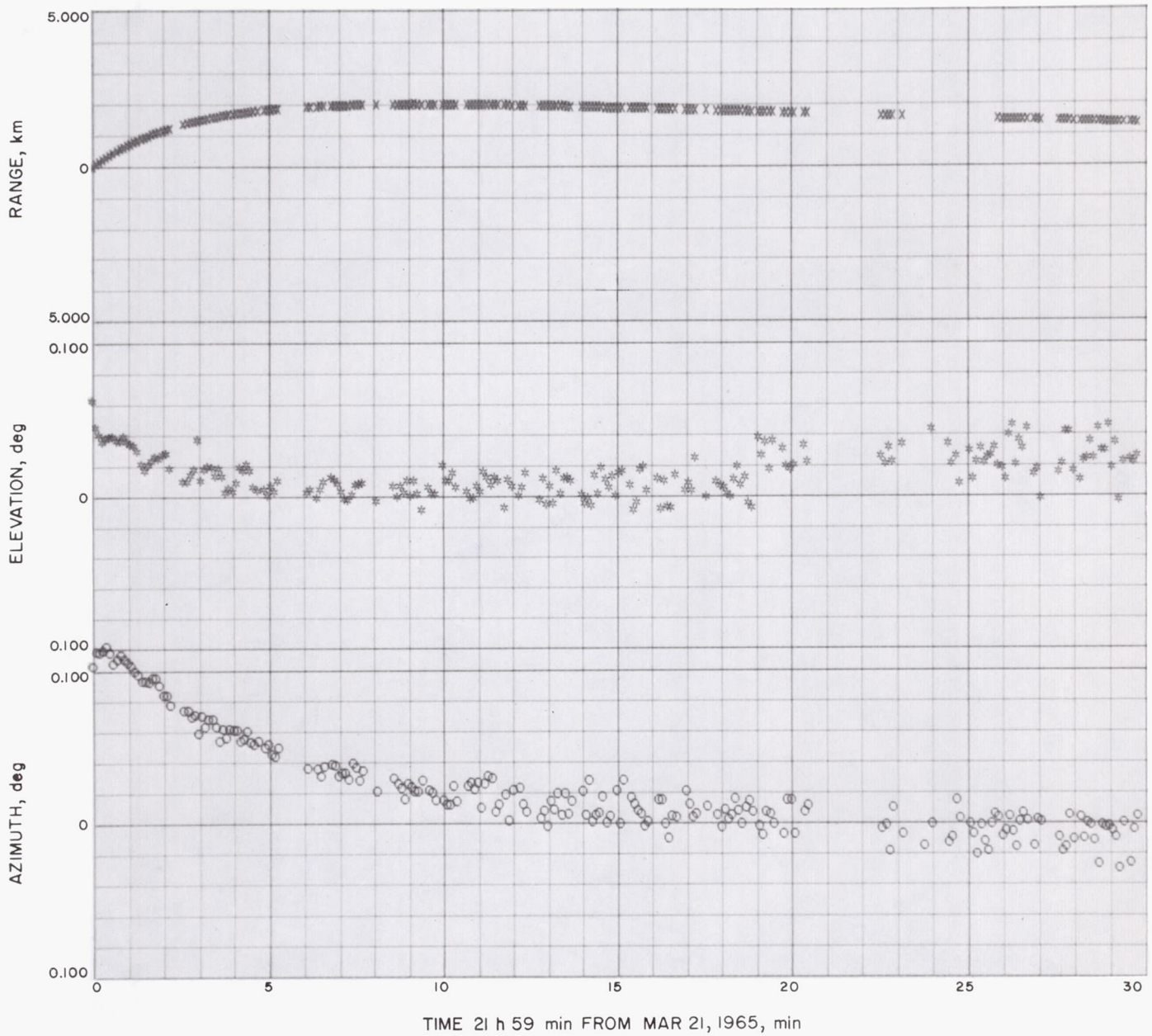


Fig. 62. Ascension postretro orbit residuals (Carnarvon data only)

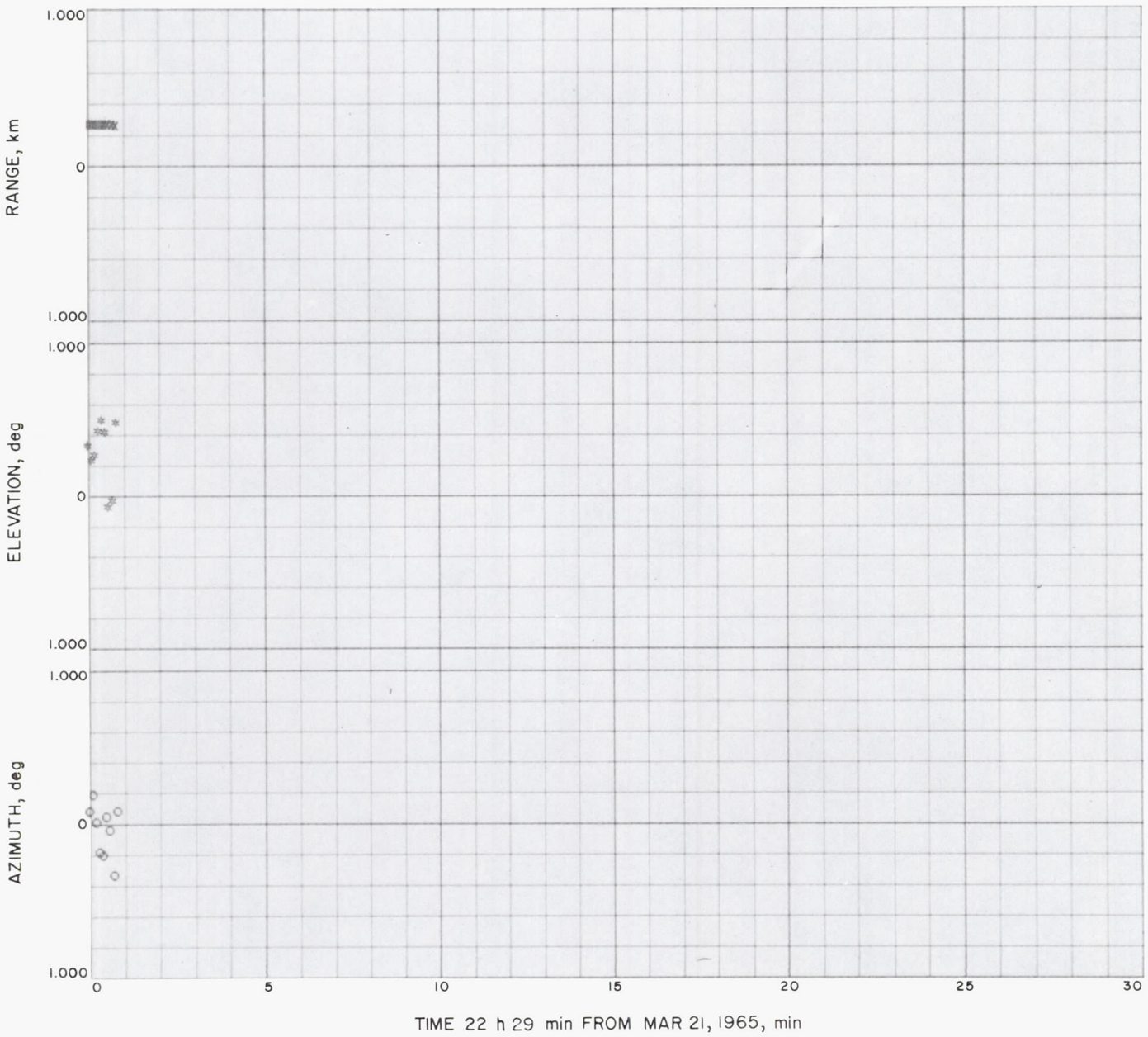

RANGE, km
1.000
0
1.000
ELEVATION, deg
1.000
0
1.000
AZIMUTH, deg
1.000
0
1.000
0
5
10
15
20
25
30
TIME 22 h 29 min FROM MAR 21, 1965, min

Fig. 62 (contd)

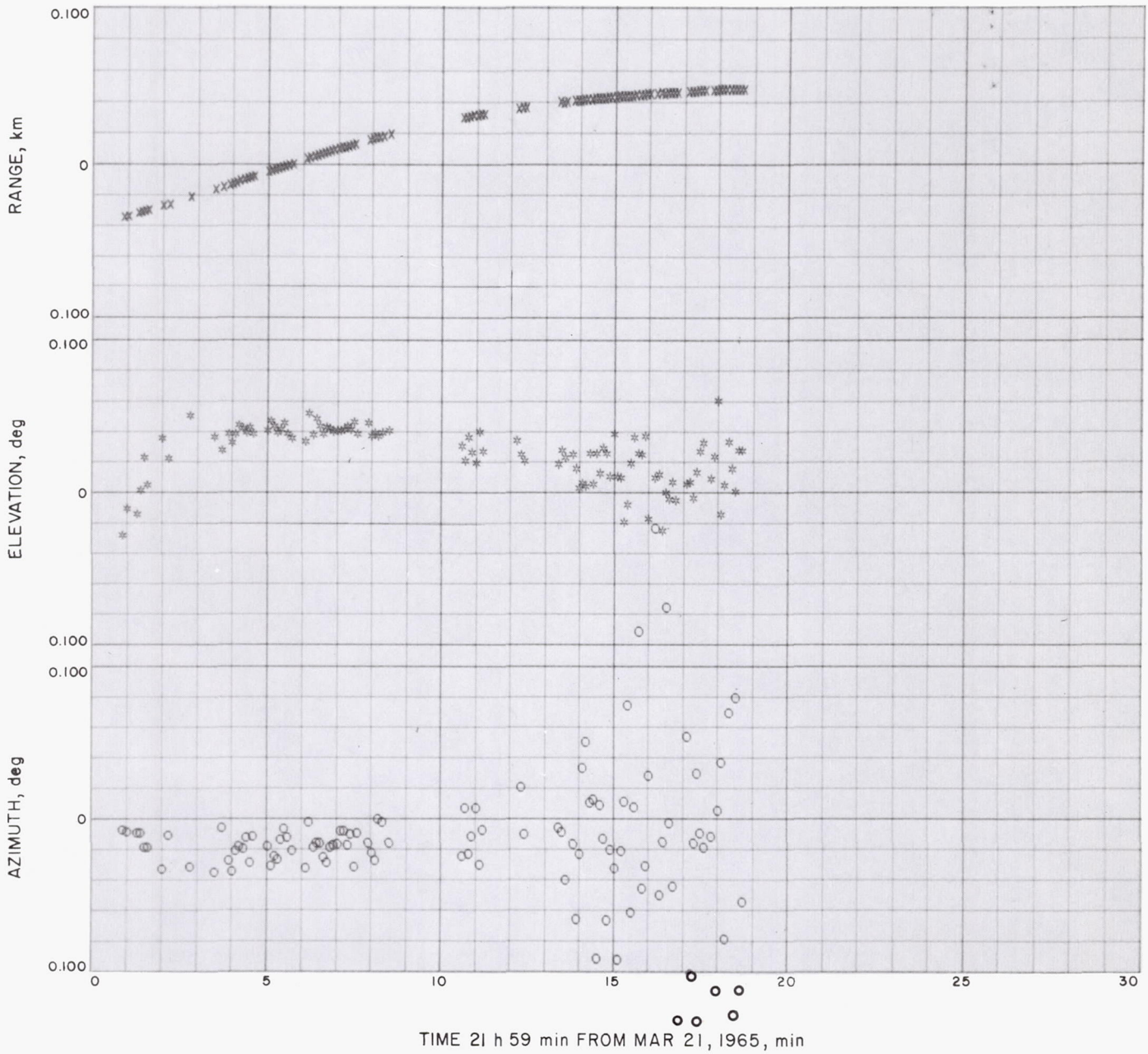


Fig. 63. Pretoria postretro orbit residuals (Carnarvon data only)

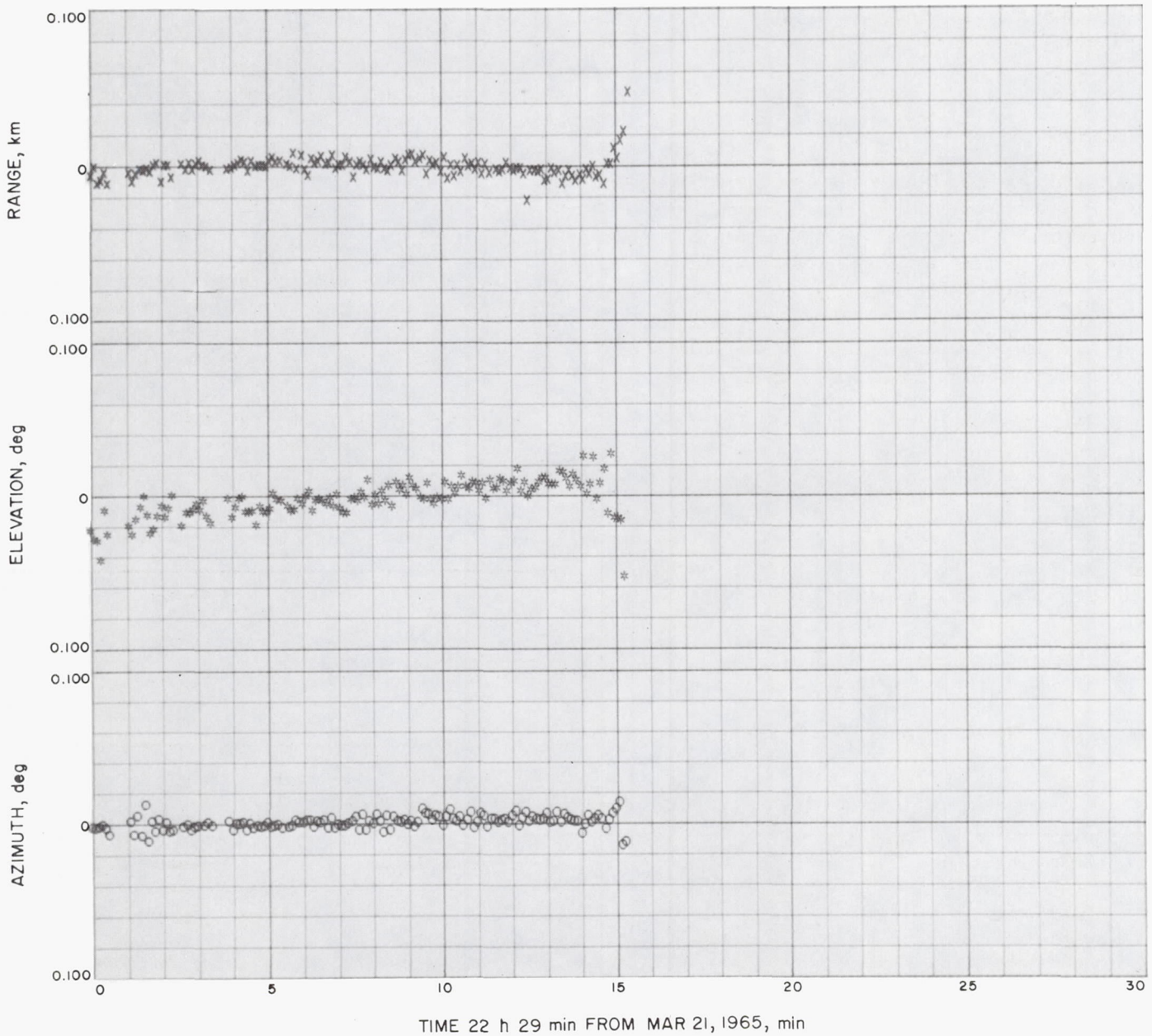


Fig. 64. Carnarvon postretro orbit residuals (Carnarvon data only)

Each of the single-station fit were mapped to the **B**-plane. All three solutions showed a **B**-plane miss of 10,000 km, indicating that a retro-maneuver on the order of 13 m/s had occurred. Figure 65 shows the **B**-plane impact points determined using data referenced to the **B**-plane from each station (Pretoria, Ascension Island, and Carnarvon). Table 42 lists the spherical conditions and orbital elements from each of the three single-station orbits.

E. Conclusions

The data received from AFETR were excellent as far as the high-frequency noise was concerned (Tables 37 and 41), with 6 m being a typical value for the random noise on range data. However, systematic errors due to timing or possible biases (Ref. 21) in the received data not accounted for caused difficulties in reducing the data, and produced sizeable residuals. The latter should not be interpreted as radar performance problems, but should suggest that more attention be given to proper handling of the data.

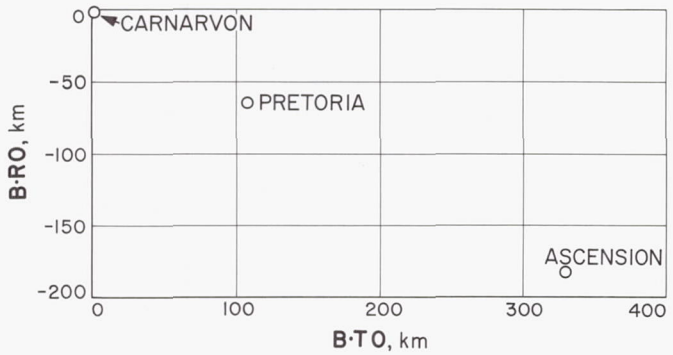


Fig. 65. Postretro impact points

VI. Deep Space Instrumentation Facility Tracking of *Ranger IX*

A. Introduction

The DSIF is primarily composed of various tracking stations located around the earth in a configuration that will supply complete tracking coverage for lunar and planetary trajectories. The tracking stations are interfaced to the main control SFOF at JPL. The Deep Space Stations names and locations employed in the *Ranger IX* mission are given in Table 43. The AFETR is also interfaced to the SFOF at JPL. The names and locations of the AFETR stations are presented in Section V of this report. The AFETR is responsible for providing orbital elements for the parking and transfer orbits, and for providing initial acquisition information to the DSSs.

Table 44 shows the nominal view periods of the spacecraft to the DSS during the course of the mission. Rise and set times (in GMT) refer to that time at which the

Table 43. DSIF station locations

Station	Location	Geodetic latitude, deg	Astronomic longitude, deg
12	Goldstone, California	35.4 N	116.8 N
41	Woomera, Australia	31.4 S	136.9 E
51	Johannesburg, S. Africa	25.9 S	27.7 E

Table 42. Postretro conditions from single-station fit

Orbital parameter	Carnarvon data only	Pretoria data only	Ascension data only
Epoch = 3/21/65, GMT	21:49:48	21:49:48	21:49:48
Radius, km	6568.6470	6567.5268	6567.9688
Latitude, deg	20.515497	20.487987	20.475994
Longitude, deg	316.76754	316.78248	316.78645
Velocity, km/s	10.538111	10.539124	10.538447
Path angle, deg	1.8093555	1.8319404	1.8391181
Azimuth, deg	111.02387	111.03391	111.03468
Semimajor axis, km	308927.22	309136.70	307847.92
Eccentricity	0.97875705	0.97877556	0.97868543
Inclination, deg	28.469205	28.456824	28.448938
Longitude of node, deg	327.04823	327.01145	326.99851
Argument of perigee, deg	129.15788	129.16895	129.17386
C_3 km/s^2	−1.2902736	−1.2893992	−1.2947972
B, km	10213.149	10331.734	10578.880

Table 44. Nominal view periods[a] vs actual tracking at DSIF stations

Date	Station	Nominal rise, GMT	Nominal set, GMT	Nominal view period	Acquisition by station,[b] GMT	Loss of signal by station, GMT	Actual view period
Mar. 21, 1965	51	22:00:42	09:01:00	11^h00^m	22:01:00	09:05:00	11^h04^m
	41	No view within 4 deg of main beam	—	00^h00^m	23:00:00	01:42:00	02^h42^m
Mar. 22, 1965	12	08:33:00	17:14:00	08^h41^m	08:24:00	17:17:00	08^h54^m
	41	14:22:00	02:22:00	12^h00^m	13:35:00	03:22:00	13^h53^m
	51	21:40:00	09:45:00	12^h05^m	21:37:00	10:04:00	12^h27^m
Mar. 23, 1965	12	08:56:00	17:43:00	08^h47^m	08:57:00	17:44:00	08^h47^m
	41	14:36:00	02:37:00	12^h01^m	14:08:00[c]	03:20:00	13^h12^m
	51	21:55:00	09:05:00	12^h00^m	21:45:00	10:16:00	12^h31^m
Mar. 24, 1965	12	09:00:00	14:08:21 (Impact)	05^h08^m	09:13:00[c]	14:08:21 (Impact)	04^h55^m
	41	No view within 8 deg of main beam	(Impact)	00^h00^m	13:43:00	13:58:00	00^h15^m

[a]A nominal view period is calculated to include land mask and antenna limits such that the spacecraft remains in the main beam (within 0.5 deg or 3 dB of the center of main beam).

[b]Actual view periods are from first good solid-receiver lock to loss of good solid-receiver lock.

[c]With squint looking feed.

spacecraft is at a 5-deg geometrical elevation angle. Since the spacecraft signal can frequently be received when the spacecraft is lower than 5 deg, it is possible that acquisition of the spacecraft will occur before nominal rise time and loss of signal after nominal set time. The modes of operation of the DSIF are identified as ground modes, which are defined in Table 45.

During *Ranger IX* mission, the DSS provided both angular and doppler data throughout the trajectory. Both data types were used during the early part of the mission; after sufficient doppler data had been compiled, the angular data were omitted from the orbit solutions. Relatively large biases were seen in the early angular data from DSS 51. These biases were mainly due to angular correction model errors that, in turn, were caused by equipment changes and RF feed realignment. New correction coefficients are being evaluated and continuous efforts are being extended in this area. For the postflight analysis, only two-way doppler data were used. Plots of the doppler residuals for the premaneuver and postmaneuver tracking are presented in Section II of this report.

Table 45. Ground station tracking modes[a]

Transmit/receive	Antenna feed
GM-0[b] No receive (transmit only)	0 Not used
GM-1 One-way doppler (receive only)	1 Horn feed and diplexer combination (85-ft diameter reflector)
GM-2 Two-way, one station (transmit/receive)	2 Tracking feed and diplexer combination (85-ft diameter reflector)
GM-3 Two-way, two station noncoherent (receive only)	3 Acquisition antenna
GM-4 Two-way, two station coherent (receive only with reference signal from transmit station)	4 Dipole (6-ft diameter reflector)
GM-5 Receive only (no doppler)	5 Horn feed, no diplexer (receive only) (85-ft diameter reflector)

[a]This ground mode (GM) description is used to define the station configuration. The code is broken into two parts: the first defines the transmit/receive mode and the second the antenna feed configuration. For example: GM-2-1 = transmitting to spacecraft and receiving two-way doppler, and horn feed and diplexer.

[b]Telemetry will be available in all receive modes except GM-0.

B. Transponder Tracking

1. Premaneuver phase. Initial acquisition of the spacecraft transponder was made by DSS 51 at 22:01:00 GMT on March 21, 1965. The acquisition was made with the ground transmitter on so that, when receiver lock was established, two-way lock was also established.

At 22:14:44 GMT, DSS 51 switched the transmitter exciter chain from a voltage-controlled oscillator (VCO)

to a rubidium standard controlled frequency synthesizer. Tests on *Ranger VIII* indicated that the two-way doppler data taken using the synthesizer had less noise than when a VCO was the frequency source. On *Ranger IX*, the data noise increased when the synthesizer was used. Upon analysis of this noise, it was decided at 22:36:06 GMT to return the station to VCO, and the noise level did decrease. The station changed synthesizers and obtained tracking data using the new unit from 22:55:15 to 23:12:10 GMT. This data also had excess noise. It was requested that DSS 51 change the rubidium standards, which would interrupt tracking momentarily. DSS 41 was requested at 23:00:00 GMT to maintain a two-way mode on the spacecraft, which was 4 deg away from the limit of the main beam.

DSS 51 reacquired two-way lock at 00:25:20 GMT on March 22, 1965, the data noise had been reduced and remained this way for the rest of the view period. There was a time bias on the doppler data from 00:25:20 to 00:40:13 GMT due to changing of the rubidium standard; the data was corrected.

DSS 41 was not expected to be in a two-way mode during the first pass, since the spacecraft trajectory was never visible within the main beam of the antenna. However, it did come within 4 deg of the main beam, and two-station noncoherent data were received using the acquisition aid with its wider beamwidth. Two-way doppler data were obtained for approximately 20 min before the spacecraft moved from the main-beam uplink lock.

Telemetry event blips B-2-1 through B-2-4 observed by DSS 51, starting at 22:37:01 GMT on March 21, 1965, indicated that solar panel extension had occurred. At 22:40:01 GMT, a B-2-1 blip was observed, indicating the start of the sun acquisition sequence.

After changing the rubidium standard and correcting the time bias that leads WWV by 80 ms, DSS 51 continued to track the spacecraft in the two-way mode until the beginning of DSS 12 view period at 08:45:00 GMT on March 22, 1965. Tracking continued without any additional incidents until the maneuver phase on March 23, 1965.

2. Maneuver phase. The nearly perfect trajectory, which the spacecraft obtained from the launch vehicle, meant that only a minute portion of the midcourse capability was needed for a midcourse maneuver at the nominal time of launch plus 16 h. A decision was made to postpone the maneuver until the second pass at DSS 12, or until launch plus 39 h. This postponement provided an opportunity to refine the orbit used for the midcourse study with a better multi-station solution.

At 10:50:00 GMT on March 23, DSS 12 started transmitting midcourse maneuver command sequence. At 11:35:00 GMT, DSS 12 transmitted the antenna change over command, which switches the spacecraft back to the low-gain omniantenna, and at 12:03:00 GMT, the maneuver execute command was transmitted. At 12:30:09 GMT, after the programmed delay, an event blip was observed, indicating midcourse motor ignition. This event was immediately followed by an increase in received doppler frequency, as predicted. The increase continued until motor cutoff, and then the observed doppler continued as predicted. A plot showing predicted doppler and observed doppler during the maneuver period is shown in Fig. 66.

3. Postmaneuver phase. Following the maneuver, the spacecraft reacquired the sun at 13:01:42 GMT on March 23. At 13:26:00 GMT, DSS 12 started transmitting the command sequence to switch the spacecraft back to the high-gain antenna. Transponder tracking then continued in a normal manner with a minimum amount of data being lost when transferring from one station to another. At 11:54:00 GMT on March 24, DSS 12 began transmitting a terminal maneuver command sequence.

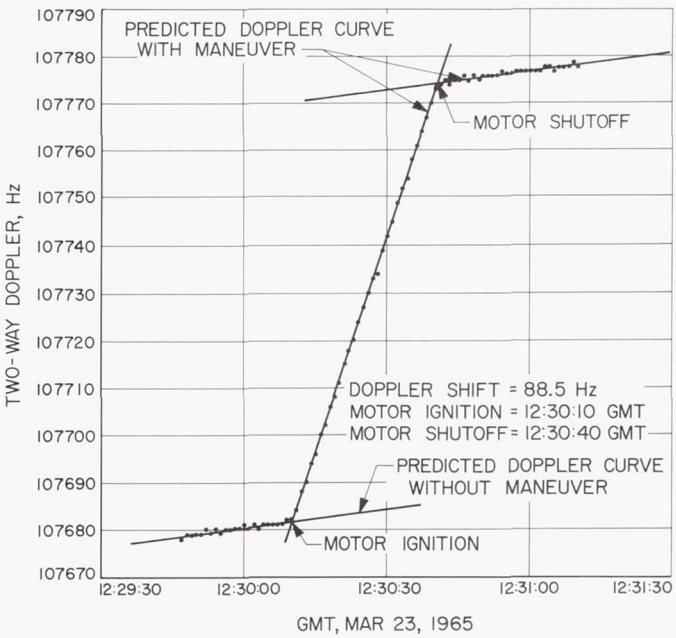


Fig. 66. *Ranger IX* two-way doppler shift midcourse maneuver

A terminal orientation maneuver sequence was conducted to minimize the image motion in the pictures and to obtain a more desirable coverage on areas of scientific interest of the crater Alphonsus. At 11:58:00 GMT, the command for the terminal maneuver for the first pitch duration began; at 13:02:34 GMT, the initiation of terminal maneuver was transmitted to the spacecraft. The maneuver override command was unloaded and the backup command that activates the TV subsystem warmup was transmitted at 13:32:34 GMT. Subsequent event blips indicated that the spacecraft responded properly. At 13:49:34 GMT, channel P video appeared occurring approximately 0.5 s before channel F video; full power was immediately obtained. DSS 12 reported excellent photographs of the lunar surface until impact. A summary of all commands transmitted to the spacecraft by the DSIF is given in Table 46.

Table 46. Ground commands from DSIF to *Ranger IX*

Command[a]	Initiated, Date/GMT	Verified, GMT	Station	Telemetry event blip recorded at station
RTC-0	22/09:26:00	09:26:38	12	—
RTC-2	22/09:28:00	09:28:38	12	—
RTC-3	22/09:30:00	09:30:38	12	B-20
RTC-0	23/10:50:00	10:50:38	12	—
RTC-0	23/10:52:00	10:52:38	12	—
SC-1	23/10:54:00	10:54:38	12	B-20
SC-2	23/10:56:00	10:56:38	12	B-20
SC-3	23/10:58:00	10:58:38	12	B-20
RTC-0	23/11:31:00	11:31:38	12	—
RTC-0	23/11:33:00	11:33:38	12	—
RTC-3	23/11:35:00	11:35:38	12	B-20
RTC-4	23/12:03:00	12:03:38	12	B-20
RTC-0	23/13:26:00	13:26:38	12	—
RTC-0	23/13:28:00	13:28:38	12	—
RTC-3	23/13:30:00	13:30:38	12	B-20
RTC-0	23/22:26:00	22:26:38	41	—
RTC-0	23/22:28:00	22:28:38	41	—
RTC-2	23/22:30:00	22:38:00	41	B-20
RTC-0	24/11:54:00	11:54:38	12	—
RTC-0	24/11:56:00	11:56:38	12	—
SC-4	24/11:58:00	11:58:38	12	B-20
SC-5	24/12:00:00	12:00:38	12	B-20
SC-6	24/12:02:00	12:02:38	12	B-20
RTC-6	24/13:02:34	13:03:12	12	B-20
RTC-5	24/13:17:00	13:17:38	12	B-20
Unload RTC-8	24/13:32:34	—	12	—
Load RTC-7	24/13:32:34	—	12	—

[a]Real-time commands:

RTC-0 = clear command.
RTC-2 = antenna angle hinge coverride.
RTC-3 = antenna switch over.
RTC-4 = begin midcourse maneuver.
RTC-5 = turn off TV subsystem, inhibit TV backup timer, and backup telemetry mode change.
RTC-6 = initiate terminal maneuver.
RTC-7 = backup turn-on TV subsystem.
RTC-8 = maneuver override.

Stored commands:

SC-1 = midcourse maneuver roll duration.
SC-2 = midcourse maneuver pitch duration.
SC-3 = midcourse maneuver velocity increment.
SC-4 = terminal maneuver first-pitch duration.
SC-5 = terminal maneuver yaw duration.
SC-6 = terminal maneuver second-pitch duration.

4. Impact phase. Due to the trajectory of *Ranger IX*, an unusual case was presented where DSS 41 might observe lunar impact. A set of predictions was generated indicating that the spacecraft would impact before it was within the main beam of the DSS 41 antenna, which was constrained by the 270-deg hour-angle limit.

A squint feed was installed at DSS 41, changing the angle of the main lobe away from the central axis of the paraboloid. This change was accomplished by moving the feed so that the angle of illumination was changed.

DSS 41 acquired the spacecraft approximately 25 min before impact, but dropped lock at 13:58:18 GMT when the DSS 12 transmitter failed. The transmitter failure at DSS 12 caused the loss of receiver lock at DSS 41 and DSS 12. Recovery was rapid at DSS 12 with only 1-min loss of tracking data. Due to the prime importance of the TV data being recorded, the receiver operator swept the receiver frequency over the beacon frequency without putting the doppler system in a one-way mode. The recovery of the last 10 min of data was not successful due to temperature variations of the doppler frequency being very unstable.

5. Determination of impact time. An experiment to measure the exact time of lunar impact was conducted at DSS 12. This experiment consisted of counting the station's 1-MHz reference, using the one per minute station time pulse as the start trigger of the counter and the decaying spin modulation output as the stop trigger of the counter. The spin modulation output (unfiltered coherent AGC voltage) was precalibrated and postcalibrated to measure the receiver delay. Receiver delay uncertainty was the limiting factor in the resolution of the impact measurement. Analysis showed the one-sigma uncertainty to be 185 μs. Impact (loss of carrier) was recorded at 14:08:21.325916 $\pm$185 μs, GMT.

A second recording of impact time was made by recording a 2-MHz spacecraft signal that was passed

through a 300-kHz filter along with the NASA 100 pulse/s time code and a 1-MHz signal. This method showed the impact time to be 14:08:21.325864 ± 7 μs, GMT.

Both times are uncorrected for wave propagation time, which is estimated to be 1.32704 s. It is interesting to note that the two methods are in agreement; the second-method time value lies within the stated uncertainty of the first-method time value. This second method is considered more accurate than the first method, but has a disadvantage since it takes two weeks of reduction time compared to the real-time readout.

The conclusion is that, neglecting signal transit time, *Ranger IX* impacted the moon at 14:08:21.325864 ± 7 μs, GMT, on March 24, 1965.

Appendix A
Definition of the Miss Parameter B

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. 4. Parameter **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**, which is the vector from the target's center-of-mass perpendicular to the incoming asymptote. Let $\mathbf{S}_I$ be a unit vector in the direction of the incoming asymptote. The orientation of **B** in the plane normal to $\mathbf{S}_I$ is described in terms of two unit vectors **R** and **T**, normal to $\mathbf{S}_I$. Vector **T** is taken parallel to a fixed *reference plane* and **R** completes a right-handed orthogonal system. Figure A-1 illustrates the situation.

The *Ranger IX* 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 the coordinate system.

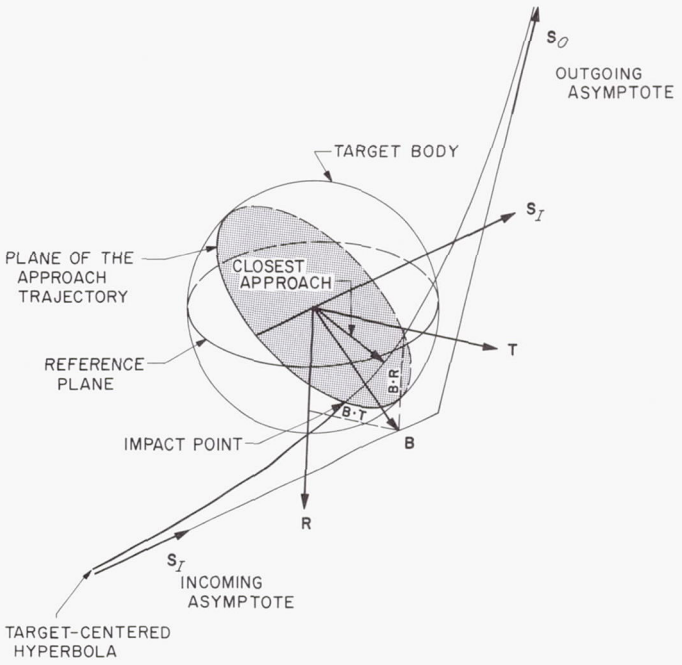


Fig. A-1. Definition of B · T, B · R system

Appendix B

Ranger IX Space Trajectory for Premaneuver Orbit

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

GME	.39860139 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63783044 04
G	.66709998-19	A	.88782497 29	B	.88800499 29	C	.88837498 29	OME	.41780741-02	AU	.14959900 09
GMM	.49027856 04	GMS	.13271544 12	GMV	.32476950 06	GMA	.42977799 05	GMC	.37918700 08	GMJ	.12671060 09
EGM	.39860320 06	MGM	.49027779 04	JA	.29200000-02	HA	.00000000 00	DA	.00000000 00	RA	.34170000 04
ARA	.35670000 01	GB	.39515566 00	MAS	.37410000 03	GB1	.00000000 00	GB2	.00000000 00	SC	.10200000 09

INJECTION CONDITIONS MOON 23571202437720200000000 J.D.= 2438841.40958333 MARCH 21,1965 21 49 48.000

GEOCENTRIC XO-.14189958 04 YO .59894569 04 ZO .23043945 04 DXO-.10386558 02 DYO-.79863629 00 DZO-.34293785 01
CARTESIAN GMC .00000000 00 SGC .00000000 00 TO .78588000 05 GHA .14664570 03 GHO .17829922 03

PROBE IS OUT OF EARTH'S SHADOW

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. 23571202437720200000000 J.D.= 2438841.40958333 MARCH 21,1965 21 49 48.000
TFL 0 DAYS 0 HRS. 12 MIN. 44.544 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	-.14189957 04	Y	.59894567 04	Z	.23043944 04	DX	-.10386558 02	DY	-.79863627 00	DZ	-.34293784 01
R	.65724708 04	DEC	.20524818 02	RA	.10332852 03	V	.10967180 02	PTH	.16316553 01	AZ	.11016285 03
R	.65724707 04	LAT	.20524819 02	LON	.31668282 03	VE	.10547151 02	PTE	.16966531 01	AZE	.11100371 03
XS	.14904462 09	YS	.25551776 07	ZS	.11084882 07	DXS	-.61624519-01	DYS	.27415670 02	DZS	.11888062 02
XM	-.21992972 06	YM	-.30359150 06	ZM	-.11818097 06	DXM	.79137395 00	DYM	-.52219293 00	DZM	-.31393385 00
XT	-.21992972 06	YT	-.30359150 06	ZT	-.11818097 06	DXT	.79137395 00	DYT	-.52219293 00	DZT	-.31393385 00
RS	.14907064 09	VS	.29882248 02	RM	.39306949 06	VM	.99875554 00	RT	.39306949 06	VT	.99875554 00
GED	.20652921 02	ALT	.19691864 03	LOS	.21433647 03	RAS	.98216497 00	RAM	.23407943 03	LOM	.87433731 02
DUT	.36000000 02	DT	.15000000 02	DR	.31227883 00	SHA	.64428335 04	DES	.42605525 00	DEM	-.17497353 02

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 23571202436620231467534O J.D.= 2438841.40918518 MARCH 21,1965 21 49 13.601

SMA	.39263550 06	ECC	.98327431 00	B	.71511018 05	SLR	.13024354 05	APO	.77870390 06	RCA	.65670966 04
VH	.92528417-01	C3	-.10151945 01	C1	.72052243 05	TFP	.34399453 02	TF	-.95554036-02	PER	.40807836 05
TA	.32910766 01	MTA	.00000000 00	EA	.30231142 00	MA	.50577717-02	C3J	-.13938627 01	TFI	.00000000 00

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	-.14189957 04	Y	.59894567 04	Z	.23043944 04	DX	-.10386558 02	DY	-.79863627 00	DZ	-.34293784 01
INC	.28462724 02	LAN	.32700536 03	APF	.12934463 03	MX	-.94129234 00	MY	-.98808777-01	MZ	-.32280887 00
WX	-.25953030 00	WY	-.39972382 00	WZ	.87912735 00	PX	-.16150560 00	PY	.91546404 00	PZ	.36856684 00
QX	-.95213441 00	QY	-.46329726-01	QZ	-.30214829 00	RX	-.64033485-01	RY	.36296174 00	RZ	-.92960124 00
BX	.95213442 00	BY	.46329727-01	BZ	.30214829 00	TX	.98479219 00	TY	.17373643 00	TZ	.00000000 00
DAP	.21627257 02	RAP	.10000513 03								
BTQ	.67628234 05	BRQ	-.23243226 05	B	.71511018 05	THA	.34103260 03				

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.14904604 09	Y	-.25491881 07	Z	-.11061837 07	DX	-.10324933 02	DY	-.28214307 02	DZ	-.15317440 02
R	.14907194 09	LAT	-.42516561 00	LON	.18097985 03	V	.33723512 02	PTH	.18892176 02	AZ	.11852497 03
XE	-.14904462 09	YE	-.25551776 07	ZE	-.11084882 07	DXE	.61624519-01	DYE	-.27415670 02	DZE	-.11888062 02
XT	-.14926455 09	YT	-.28587691 07	ZT	-.12266691 07	DXT	.85299847 00	DYT	-.27937863 02	DZT	-.12201995 02
LTE	-.42605525 00	LOE	.18098216 03	LTT	-.47076481 00	LOT	.18109721 03	RST	.14929696 09	VST	.30498204 02
EPS	.78598838 02	ESP	.27453512-18	SEP	.10139868 03	EPM	.45804447 02	EMP	.68685313 00	MEP	.13350865 03
MPS	.12440295 03	MSP	.12569964 00	SMP	.55471141 02	SEM	.12509232 03	EMS	.54784252 02	ESM	.12334256 00
RPM	.39762298 06	SPN	.25714426 01								
GCE	.25380862 03	GCT	.25399313 03	SIP	.12415283 03	CPT	.10124911 03	SIN	.10099899 03	D1	.13096073 00
REP	.65724708 04	VEP	.10967180 02	CPE	.10650661 03	CPS	.93254578 02	D2	.74498541-01	D3	.39333607-03

0 DAYS 0 HRS. 0 MIN. 33.858 SEC. 23571202440720235566415O J.D.= 2438841.40997520 MARCH 21,1965 21 50 21.858
TFL 0 DAYS 0 HRS. 13 MIN. 18.402 SEC.

PROBE IS ENTERING EARTH'S SHADOW

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

0 DAYS 0 HRS. 10 MIN. 12.000 SEC. 2357120246302020000000000 J.D.= 2438841.41666666 MARCH 21,1965 22 00 00.000
TFL 0 DAYS 0 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	-.70244588 04	Y	.41993103 04	Z	-.16539795 03	DX	-.76268724 01	DY	-.44580651 01	DZ	-.42807531 01
R	.81856328 04	DEC	-.11577896 01	RA	.14912848 03	V	.98167394 01	PTH	.26266880 02	AZ	.11845081 03
R	.81856326 04	LAT	-.11577896 01	LON	.35992580 03	VE	.93534175 01	PTE	.27676235 02	AZE	.12041778 03
XS	.14904458 09	YS	.25719560 07	ZS	.11157636 07	DXS	-.65268026-01	DYS	.27415622 02	DZS	.11888040 02
XM	-.21944513 06	YM	-.30391072 06	ZM	-.11837295 06	DXM	.79225592 00	DYM	-.52095083 00	DZM	-.31345021 00
XT	-.21944513 06	YT	-.30391072 06	ZT	-.11837295 06	DXT	.79225592 00	DYT	-.52095083 00	DZT	-.31345021 00
RS	.14907095 09	VS	.29882203 02	RM	.39310310 06	VM	.99865421 00	RT	.39310310 06	VT	.99865421 00
GED	-.11656775 01	ALT	.18074352 04	LOS	.21178593 03	RAS	.98861352 00	RAM	.23416803 03	LOM	.84965354 02
DUT	.36000000 02	DT	.59999999 02	DR	.43444265 01	SHA	.43213706 04	DES	.42885050 00	DEM	-.17525151 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.14905161 09	Y	-.25677567 07	Z	-.11159290 07	DX	-.75616044 01	DY	-.31873687 02	DZ	-.16168793 02
R	.14907790 09	LAT	-.42889404 00	LON	.18098695 03	V	.36531352 02	PTH	.13020180 02	AZ	.11690814 03
XE	-.14904458 09	YE	-.25719560 07	ZE	-.11157636 07	DXE	.65268026-01	DYE	-.27415622 02	DZE	-.11888040 02
XT	-.14926403 09	YT	-.28758667 07	ZT	-.12341366 07	DXT	.85752394 00	DYT	-.27936573 02	DZT	-.12201490 02
LTE	-.42885050 00	LOE	.18098861 03	LTT	-.47363178 00	LOT	.18110378 03	RST	.14929683 09	VST	.30496947 02
EPS	.31863454 02	ESP	.98911702-02	SEP	.14813488 03	EPM	.93888178 02	EMP	.11903981 01	MEP	.84921402 02
MPS	.12384384 03	MSP	.12491889 00	SMP	.56031064 02	SEM	.12501087 03	EMS	.54865567 02	ESM	.12373852 00
RPM	.39246319 06	SPN	-.19321194 02								
GCE	.23125528 03	GCT	.25371332 03	SIP	.12359043 03	CPT	.10159216 03	SIN	.10133875 03	D1	.13268253 00
REP	.81856328 04	VEP	.98167394 01	CPE	.11221296 03	CPS	.93253250 02	D2	.74407677-01	D3	.39535356-03

0 DAYS 0 HRS. 34 MIN. 18.687 SEC. 2357120254012025277313l1 J.D.= 2438841.43341072 MARCH 21,1965 22 24 06.687
TFL 0 DAYS 0 HRS. 47 MIN. 3.231 SEC.

PROBE IS LEAVING EARTH'S SHADOW

0 DAYS 1 HRS. 10 MIN. 12.000 SEC. 2357120264342020000000000 J.D.= 2438841.45833333 MARCH 21,1965 23 00 00.000
TFL 0 DAYS 1 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	-.19366576 05	Y	-.13641595 05	Z	-.11922920 05	DX	-.16791656 01	DY	-.44535320 01	DZ	-.25205599 01
R	.26520057 05	DEC	-.26716821 02	RA	.21516043 03	V	.53857930 01	PTH	.59704204 02	AZ	.10020295 03
R	.26520056 05	LAT	-.26716822 02	LON	.50916684 02	VE	.47699689 01	PTE	.77137093 02	AZE	.11695038 03
XS	.14904431 09	YS	.26706561 07	ZS	.11585623 07	DXS	-.86701471-01	DYS	.27415333 02	DZS	.11887911 02
XM	-.21658372 06	YM	-.30577296 06	ZM	-.11949623 06	DXM	.79739983 00	DYM	-.51362455 00	DZM	-.31059191 00
XT	-.21658372 06	YT	-.30577296 06	ZT	-.11949623 06	DXT	.79739983 00	DYT	-.51362455 00	DZT	-.31059191 00
RS	.14907274 09	VS	.29881942 02	RM	.39330008 06	VM	.99806011 00	RT	.39330008 06	VT	.99806011 00
GED	-.26873407 02	ALT	.20146215 05	LOS	.19678280 03	RAS	.10265458 01	RAM	.23468946 03	LOM	.70445720 02
DUT	.36000000 02	DT	.24000000 03	DR	.46502692 01	SHA	.17754604 05	DES	.44529589 00	DEM	-.17687766 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14906368 09	Y	-.26842977 07	Z	-.11704852 07	DX	-.15924641 01	DY	-.31868865 02	DZ	-.14408471 02
R	.14909244 09	LAT	-.44981832 00	LON	.18103165 03	V	.35010920 02	PTH	.37323286 01	AZ	.11432534 03
XE	-.14904431 09	YE	-.26706561 07	ZE	-.11585623 07	DXE	.86701471-01	DYE	-.27415333 02	DZE	-.11887911 02
XT	-.14926089 09	YT	-.29764291 07	ZT	-.12780585 07	DXT	.88410129 00	DYT	-.27928958 02	DZT	-.12198502 02
LTE	-.44529589 00	LOE	.18102654 03	LTT	-.49049040 00	LOT	.18114239 03	RST	.14929603 09	VST	.30489535 02
EPS	.42019992 02	ESP	.13988227-01	SEP	.13797318 03	EPM	.15840429 03	EMP	.14221137 01	MEP	.20173604 02
MPS	.12347821 03	MSP	.11786692 00	SMP	.56403818 02	SEM	.12453208 03	EMS	.55343573 02	ESM	.12413322 00
RPM	.36852049 06	SPN	.28104104 02								
GCE	.94280317 02	GCT	.25292486 03	SIP	.12320834 03	CPT	.10231671 03	SIN	.10204684 03	D1	.14130307 00
REP	.26520057 05	VEP	.53857930 01	CPE	.95273264 02	CPS	.93242858 02	D2	.78495172-01	D3	.44212773-03

0 DAYS 2 HRS. 10 MIN. 12.000 SEC. 23571203024020200000000000 J.D.= 2438841.50000000 MARCH 22,1965 00 00 00.000
TFL 0 DAYS 2 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.23625862 05	Y	-.28153756 05	Z	-.19777961 05	DX	-.84657228 00	DY	-.36899112 01	DZ	-.19273676 01
R	.41737071 05	DEC	-.28285825 02	RA	.22999754 03	V	.42481614 01	PTH	.66022524 02	AZ	.93318793 02
R	.41737070 05	LAT	-.28285825 02	LON	.50712687 02	VE	.39989646 01	PTE	.76082516 02	AZE	.26403588 03
XS	.14904396 09	YS	.27693525 07	ZS	.12013592 07	DXS	-.10813442 00	DYS	.27415030 02	DZS	.11887775 02
XM	-.21370393 06	YM	-.30760878 06	ZM	-.12060918 06	DXM	.80246811 00	DYM	-.50626498 00	DZM	-.30771106 00
XT	-.21370393 06	YT	-.30760878 06	ZT	-.12060918 06	DXT	.80246811 00	DYT	-.50626498 00	DZT	-.30771106 00
RS	.14907452 09	VS	.29881680 02	RM	.39349600 06	VM	.99746948 00	RT	.39349600 06	VT	.99746948 00
GED	-.28448509 02	ALT	.35363713 05	LOS	.18177962 03	RAS	.10644769 01	RAM	.23521127 03	LOM	.55926412 02
DUT	.36000000 02	DT	.48000000 03	DR	.38815676 01	SHA	.33931211 05	DES	.46173957 00	DEM	-.17848836 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14906758 09	Y	-.27975063 07	Z	-.12211372 07	DX	-.73843785 00	DY	-.31104942 02	DZ	-.13815143 02
R	.14909883 09	LAT	-.46926558 00	LON	.18107512 03	V	.34042927 02	PTH	.24159608 01	AZ	.11394406 03
XE	-.14904396 09	YE	-.27693525 07	ZE	-.12013592 07	DXE	.10813442 00	DYE	-.27415030 02	DZE	-.11887775 02
XT	-.14925766 09	YT	-.30769613 07	ZT	-.13219684 07	DXT	.91060252 00	DYT	-.27921296 02	DZT	-.12195486 02
LTE	-.46173957 00	LOE	.18106447 03	LTT	-.50734559 00	LOT	.18118099 03	RST	.14929523 09	VST	.30482090 02
EPS	.54374622 02	ESP	.13988227-01	SEP	.12561234 03	EPM	.16716802 03	EMP	.13497683 01	MEP	.11482149 02
MPS	.12378169 03	MSP	.11234211 00	SMP	.56105807 02	SEM	.12405382 03	EMS	.55821062 02	ESM	.12472294 00
RPM	.35269209 06	SPN	.45584595 02								
GCE	.88002770 02	GCT	.25253919 03	SIP	.12349971 03	CPT	.10257089 03	SIN	.10228891 03	D1	.14764474 00
REP	.41737071 05	VEP	.42481614 01	CPE	.90261084 02	CPS	.93232029 02	D2	.82672439-01	D3	.48816973-03

0 DAYS 3 HRS. 10 MIN. 12.000 SEC. 23571203204420200000000000 J.D.= 2438841.54166666 MARCH 22,1965 01 00 00.000
TFL 0 DAYS 3 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.26019019 05	Y	-.40582945 05	Z	-.26134630 05	DX	-.52188589 00	DY	-.32484878 01	DZ	-.16307531 01
R	.54835970 05	DEC	-.28463349 02	RA	.23733477 03	V	.36721102 01	PTH	.69033413 02	AZ	.89827121 02
R	.54835969 05	LAT	-.28463349 02	LON	.43008852 02	VE	.40748008 01	PTE	.57299693 02	AZE	.27010319 03
XS	.14904353 09	YS	.28680506 07	ZS	.12441569 07	DXS	-.12956809 00	DYS	.27414713 02	DZS	.11887634 02
XM	-.21080602 06	YM	-.30941804 06	ZM	-.12171173 06	DXM	.80746070 00	DYM	-.49887252 00	DZM	-.30480792 00
XT	-.21080602 06	YT	-.30941804 06	ZT	-.12171173 06	DXT	.80746070 00	DYT	-.49887252 00	DZT	-.30480792 00
RS	.14907631 09	VS	.29881418 02	RM	.39369080 06	VM	.99688235 00	RT	.39369080 06	VT	.99688235 00
GED	-.28626692 02	ALT	.48462669 05	LOS	.16677648 03	RAS	.11024087 01	RAM	.23573346 03	LOM	.41407531 02
DUT	.36000000 02	DT	.48000000 03	DR	.34289771 01	SHA	.47721335 05	DES	.47818325 00	DEM	-.18008351 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14906955 09	Y	-.29086336 07	Z	-.12702916 07	DX	-.39231781 00	DY	-.30663201 02	DZ	-.13518387 02
R	.14910333 09	LAT	-.48813910 00	LON	.18111780 03	V	.33513170 02	PTH	.18904649 01	AZ	.11378642 03
XE	-.14904353 09	YE	-.28680506 07	ZE	-.12441569 07	DXE	.12956809 00	DYE	-.27414713 02	DZE	-.11887634 02
XT	-.14925434 09	YT	-.31774687 07	ZT	-.13658687 07	DXT	.93702878 00	DYT	-.27913586 02	DZT	-.12192442 02
LTE	-.47818325 00	LOE	.18110240 03	LTT	-.52419652 00	LOT	.18121958 03	RST	.14929440 09	VST	.30474611 02
EPS	.60470069 02	ESP	.18504685-01	SEP	.11951159 03	EPM	.16774870 03	EMP	.16937061 01	MEP	.10557586 02
MPS	.12414576 03	MSP	.10767302 00	SMP	.55746266 02	SEM	.12357608 03	EMS	.56298033 02	ESM	.12589407 00
RPM	.33993165 06	SPN	.53790849 02								
GCE	.85635943 02	GCT	.25226130 03	SIP	.12385320 03	CPT	.10272168 03	SIN	.10242912 03	D1	.15318721 00
REP	.54835970 05	VEP	.36721102 01	CPE	.87798798 02	CPS	.93221220 02	D2	.86587082-01	D3	.53266288-03

0 DAYS 4 HRS. 10 MIN. 12.000 SEC. 23571203365020200000000 J.D.= 2438841.58333334 MARCH 22,1965 02 00 00.000
TFL 0 DAYS 4 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.27557179 05	Y	-.51712298 05	Z	-.31647740 05	DX	-.34785822 00	DY	-.29513372 01	DZ	-.14442398 01
R	.66596840 05	DEC	-.28373274 02	RA	.24194711 03	V	.33041224 01	PTH	.70886388 02	AZ	.87630094 02
R	.66596840 05	LAT	-.28373274 02	LON	.32580119 02	VE	.44651113 01	PTE	.44362209 02	AZE	.27080299 03
XS	.14904303 09	YS	.29667460 07	ZS	.12869535 07	DXS	-.15100152 00	DYS	.27414383 02	DZS	.11887487 02
XM	-.20789028 06	YM	-.31120063 06	ZM	-.12280378 06	DXM	.81237736 00	DYM	-.49144799 00	DZM	-.30188282 00
XT	-.20789028 06	YT	-.31120063 06	ZT	-.12280378 06	DXT	.81237736 00	DYT	-.49144799 00	DZT	-.30188282 00
RS	.14907810 09	VS	.29881156 02	RM	.39388445 06	VM	.99629880 00	RT	.39388445 06	VT	.99629880 00
GED	-.28536284 02	ALT	.60223510 05	LOS	.15177335 03	RAS	.11403398 01	RAM	.23625602 03	LOM	.26889028 02
DUT	.36000000 02	DT	.48000000 03	DR	.31219700 01	SHA	.60022023 05	DES	.49462608 00	DEM	-.18166301 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14907058 09	Y	-.30184583 07	Z	-.13186012 07	DX	-.19685670 00	DY	-.30365720 02	DZ	-.13331726 02
R	.14910697 09	LAT	-.50669160 00	LON	.18115999 03	V	.33163996 02	PTH	.16059158 01	AZ	.11369825 03
XE	-.14904303 09	YE	-.29667460 07	ZE	-.12869535 07	DXE	.15100152 00	DYE	-.27414383 02	DZE	-.11887487 02
XT	-.14925092 09	YT	-.32779466 07	ZT	-.14097572 07	DXT	.96337888 00	DYT	-.27905830 02	DZT	-.12189369 02
LTE	-.49462608 00	LOE	.18114034 03	LTT	-.54104403 00	LOT	.18125816 03	RST	.14929356 09	VST	.30467100 02
EPS	.64303012 02	ESP	.22117329-01	SEP	.11567392 03	EPM	.16623067 03	EMP	.23063261 01	MEP	.11462966 02
MPS	.12451419 03	MSP	.10350344 00	SMP	.55381802 02	SEM	.12309887 03	EMS	.56774490 02	ESM	.12628203 00
RPM	.32888241 06	SPN	.58807354 02								
GCE	.84292369 02	GCT	.25203699 03	SIP	.12421180 03	CPT	.10282585 03	SIN	.10252346 03	D1	.15833387 00
REP	.66596840 05	VEP	.33041224 01	CPE	.86262126 02	CPS	.93210454 02	D2	.90341415-01	D3	.57687073-03

0 DAYS 5 HRS. 10 MIN. 12.000 SEC. 23571203545420200000000 J.D.= 2438841.62500000 MARCH 22,1965 03 00 00.000
TFL 0 DAYS 5 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.28600146 05	Y	-.61925102 05	Z	-.36597833 05	DX	-.23907167 00	DY	-.27323319 01	DZ	-.13125242 01
R	.77408578 05	DEC	-.28215414 02	RA	.24521011 03	V	.30406435 01	PTH	.72174902 02	AZ	.86081806 02
R	.77408577 05	LAT	-.28215414 02	LON	.20802065 02	VE	.49747777 01	PTE	.35582242 02	AZE	.27090073 03
XS	.14904244 09	YS	.30654406 07	ZS	.13297496 07	DXS	-.17243510 00	DYS	.27414038 02	DZS	.11887333 02
XM	-.20495698 06	YM	-.31295644 06	ZM	-.12388525 06	DXM	.81721795 00	DYM	-.48399206 00	DZM	-.29893602 00
XT	-.20495698 06	YT	-.31295644 06	ZT	-.12388525 06	DXT	.81721795 00	DYT	-.48399206 00	DZT	-.29893602 00
RS	.14907989 09	VS	.29880895 02	RM	.39407696 06	VM	.99571894 00	RT	.39407696 06	VT	.99571894 00
GED	-.28377834 02	ALT	.71035198 05	LOS	.13677021 03	RAS	.11782691 01	RAM	.23677898 03	LOM	.12370920 02
DUT	.36000000 02	DT	.48000000 03	DR	.28946787 01	SHA	.71277535 05	DES	.51106890 00	DEM	-.18322674 02

SPACE TRAJECTORY
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HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14907104 09	Y	-.31273657 07	Z	-.13663474 07	DX	-.66636569-01	DY	-.30146370 02	DZ	-.13199858 02
R	.14911010 09	LAT	-.52502809 00	LON	.18120183 03	V	.32909638 02	PTH	.14275078 01	AZ	.11364115 03
XE	-.14904244 09	YE	-.30654406 07	ZE	-.13297496 07	DXE	.17243510 00	DYE	-.27414038 02	DZE	-.11887333 02
XT	-.14924740 09	YT	-.33783970 07	ZT	-.14536348 07	DXT	.98965304 00	DYT	-.27898030 02	DZT	-.12186269 02
LTE	-.51106890 00	LOE	.18117827 03	LTT	-.55788643 00	LOT	.18129674 03	RST	.14929271 09	VST	.30459557 02
EPS	.67015388 02	ESP	.27088086-01	SEP	.11295722 03	EPM	.16442197 03	EMP	.30238311 01	MEP	.12554188 02
MPS	.12487415 03	MSP	.10038442 00	SMP	.55025414 02	SEM	.12262218 03	EMS	.57250439 02	ESM	.12686175 00
RPM	.31896325 06	SPN	.62289204 02								
GCE	.83390877 02	GCT	.25184586 03	SIP	.12456236 03	CPT	.10290326 03	SIN	.10259146 03	D1	.16325790 00
REP	.77408578 05	VEP	.30406435 01	CPE	.85181640 02	CPS	.93199727 02	D2	.93999318-01	D3	.62150391-03

0 DAYS 6 HRS. 10 MIN. 12.000 SEC. 23571203726020200000000 J.D.= 2438841.66666666 MARCH 22,1965 04 00 00.000
TFL 0 DAYS 6 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.29319048 05	Y	-.71442183 05	Z	-.41135847 05	DX	-.16457392 00	DY	-.25613356 01	DZ	-.12127604 01
R	.87497142 05	DEC	-.28043341 02	RA	.24768731 03	V	.28387166 01	PTH	.73137737 02	AZ	.84912139 02
R	.87497141 05	LAT	-.28043342 02	LON	.82381997 01	VE	.55256001 01	PTE	.29449141 02	AZE	.27086959 03
XS	.14904179 09	YS	.31641335 07	ZS	.13725450 07	DXS	-.19386867 00	DYS	.27413680 02	DZS	.11887174 02
XM	-.20200639 06	YM	-.31468535 06	ZM	-.12495609 06	DXM	.82198229 00	DYM	-.47650540 00	DZM	-.29596784 00
XT	-.20200639 06	YT	-.31468535 06	ZT	-.12495609 06	DXT	.82198229 00	DYT	-.47650540 00	DZT	-.29596784 00
RS	.14908168 09	VS	.29880634 02	RM	.39426827 06	VM	.99514282 00	RT	.39426827 06	VT	.99514282 00
GED	-.28205115 02	ALT	.81123709 05	LOS	.12176708 03	RAS	.12161980 01	RAM	.23730232 03	LOM	.35785319 03
DUT	.36000000 02	DT	.48000000 03	DR	.27166656 01	SHA	.81743021 05	DES	.52751087 00	DEM	-.18477464 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14907110 09	Y	-.32355756 07	Z	-.14136808 07	DX	.29294755-01	DY	-.29975015 02	DZ	-.13099935 02
R	.14911291 09	LAT	-.54320665 00	LON	.18124340 03	V	.32712546 02	PTH	.13055539 01	AZ	.11360080 03
XE	-.14904179 09	YE	-.31641335 07	ZE	-.13725450 07	DXE	.19386867 00	DYE	-.27413680 02	DZE	-.11887174 02
XT	-.14924379 09	YT	-.34788188 07	ZT	-.14975011 07	DXT	.10158510 01	DYT	-.27890185 02	DZT	-.12183142 02
LTE	-.52751087 00	LOE	.18121620 03	LTT	-.57472626 00	LOT	.18133530 03	RST	.14929184 09	VST	.30451984 02
EPS	.69073729 02	ESP	.29673510-01	SEP	.11089486 03	EPM	.16272431 03	EMP	.37787817 01	MEP	.13496903 02
MPS	.12522210 03	MSP	.96660581-01	SMP	.54680753 02	SEM	.12214600 03	EMS	.57725882 02	ESM	.12820425 00
RPM	.30986124 06	SPN	.64893514 02								
GCE	.82727903 02	GCT	.25167778 03	SIP	.12490114 03	CPT	.10296323 03	SIN	.10264228 03	D1	.16805366 00
REP	.87497142 05	VEP	.28387166 01	CPE	.84365629 02	CPS	.93189033 02	D2	.97601741-01	D3	.66702405-03

0 DAYS 7 HRS. 10 MIN. 12.000 SEC. 23571204106420200000000 J.D.= 2438841.70833333 MARCH 22,1965 05 00 00.000
TFL 0 DAYS 7 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.29809194 05	Y	-.80404969 05	Z	-.45354217 05	DX	-.11037903 00	DY	-.24224210 01	DZ	-.11335753 01
R	.97007999 05	DEC	-.27874127 02	RA	.24965832 03	V	.26768078 01	PTH	.73892190 02	AZ	.83985991 02
R	.97007997 05	LAT	-.27874128 02	LON	.35516814 03	VE	.60852904 01	PTE	.24999637 02	AZE	.27080838 03
XS	.14904105 09	YS	.32628251 07	ZS	.14153398 07	DXS	-.21530233 00	DYS	.27413307 02	DZS	.11887009 02
XM	-.19903879 06	YM	-.31638725 06	ZM	-.12601620 06	DXM	.82667030 00	DYM	-.46898870 00	DZM	-.29297855 00
XT	-.19903879 06	YT	-.31638725 06	ZT	-.12601620 06	DXT	.82667030 00	DYT	-.46898870 00	DZT	-.29297855 00
RS	.14908348 09	VS	.29880374 02	RM	.39445838 06	VM	.99457056 00	RT	.39445838 06	VT	.99457056 00
GED	-.28035259 02	ALT	.90634512 05	LOS	.10676394 03	RAS	.12541264 01	RAM	.23782606 03	LOM	.34333586 03
DUT	.36000000 02	DT	.95999999 03	DR	.25717200 01	SHA	.91581257 05	DES	.54395114 00	DEM	-.18630656 02

SPACE TRAJECTORY
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HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14907086 09	Y	-.33432301 07	Z	-.14606940 07	DX	.10492330 00	DY	-.29835728 02	DZ	-.13020584 02
R	.14911550 09	LAT	-.56126225 00	LON	.18128476 03	V	.32553299 02	PTH	.12173190 01	AZ	.11357060 03
XE	-.14904105 09	YE	-.32628251 07	ZE	-.14153398 07	DXE	.21530233 00	DYE	-.27413307 02	DZE	-.11887009 02
XT	-.14924009 09	YT	-.35792124 07	ZT	-.15413560 07	DXT	.10419726 01	DYT	-.27882296 02	DZT	-.12179988 02
LTE	-.54395114 00	LOE	.18125412 03	LTT	-.59156182 00	LOT	.18137386 03	RST	.14929096 09	VST	.30444379 02
EPS	.70709561 02	ESP	.34970568-01	SEP	.10925525 03	EPM	.16120118 03	EMP	.45454015 01	MEP	.14253410 02
MPS	.12555723 03	MSP	.93835890-01	SMP	.54348670 02	SEM	.12167033 03	EMS	.58200821 02	ESM	.12839488 00
RPM	.30138455 06	SPN	.66939807 02								
GCE	.82211220 02	GCT	.25152692 03	SIP	.12522724 03	CPT	.10301096 03	SIN	.10268097 03	D1	.17278047 00
REP	.97007999 05	VEP	.26768078 01	CPE	.83719295 02	CPS	.93178368 02	D2	.10117712 00	D3	.71377305-03

0 DAYS 8 HRS. 10 MIN. 12.000 SEC. 23571204267020200000000 J.D.= 2438841.75000000 MARCH 22,1965 06 00 00.000
TFL 0 DAYS 8 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.30129302 05	Y	-.88910791 05	Z	-.49314525 05	DX	-.69222566-01	DY	-.23062617 01	DZ	-.10685829 01
R	.10604162 06	DEC	-.27713378 02	RA	.25127996 03	V	.25427356 01	PTH	.74503623 02	AZ	.83227368 02
R	.10604162 06	LAT	-.27713378 02	LON	.34174870 03	VE	.66401553 01	PTE	.21654729 02	AZE	.27074381 03
XS	.14904023 09	YS	.33615165 07	ZS	.14581345 07	DXS	-.23673625 00	DYS	.27412921 02	DZS	.11886839 02
XM	-.19605444 06	YM	-.31806205 06	ZM	-.12706551 06	DXM	.83128180 00	DYM	-.46144262 00	DZM	-.28996847 00
XT	-.19605444 06	YT	-.31806205 06	ZT	-.12706551 06	DXT	.83128180 00	DYT	-.46144262 00	DZT	-.28996847 00
RS	.14908527 09	VS	.29880114 02	RM	.39464725 06	VM	.99400222 00	RT	.39464725 06	VT	.99400222 00
GED	-.27873893 02	ALT	.99668086 05	LOS	.91760799 02	RAS	.12920549 01	RAM	.23835018 03	LOM	.32881892 03
DUT	.36000000 02	DT	.95999999 03	DR	.24503005 01	SHA	.10090388 06	DES	.56039225 00	DEM	-.18782247 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14907036 09	Y	-.34504273 07	Z	-.15074490 07	DX	.16751368 00	DY	-.29719183 02	DZ	-.12955421 02
R	.14911791 09	LAT	-.57921967 00	LON	.18132595 03	V	.32420685 02	PTH	.11508766 01	AZ	.11354702 03
XE	-.14904023 09	YE	-.33615165 07	ZE	-.14581345 07	DXE	.23673625 00	DYE	-.27412921 02	DZE	-.11886839 02
XT	-.14923629 09	YT	-.36795785 07	ZT	-.15852000 07	DXT	.10680180 01	DYT	-.27874364 02	DZT	-.12176807 02
LTE	-.56039225 00	LOE	.18129205 03	LTT	-.60839312 00	LOT	.18141240 03	RST	.14929006 09	VST	.30436745 02
EPS	.72052909 02	ESP	.41377734-01	SEP	.10790832 03	EPM	.15984262 03	EMP	.53128538 01	MEP	.14844520 02
MPS	.12587970 03	MSP	.91192092-01	SMP	.54029059 02	SEM	.12119517 03	EMS	.58675259 02	ESM	.12990992 00
RPM	.29340529 06	SPN	.68604705 02								
GCE	.81792116 02	GCT	.25138957 03	SIP	.12554074 03	CPT	.10304960 03	SIN	.10271064 03	D1	.17747945 00
REP	.10604162 06	VEP	.25427356 01	CPE	.83189648 02	CPS	.93167728 02	D2	.10474665 00	D3	.76203105-03

0 DAYS 9 HRS. 10 MIN. 12.000 SEC. 23571204447420200000000 J.D.= 2438841.79166666 MARCH 22,1965 07 00 00.000
TFL 0 DAYS 9 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.30318189 05	Y	-.97030227 05	Z	-.53060310 05	DX	-.36948464-01	DY	-.22069749 01	DZ	-.10138810 01
R	.11467107 06	DEC	-.27562604 02	RA	.25264799 03	V	.24290035 01	PTH	.75011760 02	AZ	.82589813 02
R	.11467107 06	LAT	-.27562604 02	LON	.32807568 03	VE	.71844053 01	PTE	.19062026 02	AZE	.27068363 03
XS	.14903934 09	YS	.34602063 07	ZS	.15009286 07	DXS	-.25817020 00	DYS	.27412521 02	DZS	.11886662 02
XM	-.19305363 06	YM	-.31970962 06	ZM	-.12810395 06	DXM	.83581667 00	DYM	-.45386782 00	DZM	-.28693788 00
XT	-.19305363 06	YT	-.31970962 06	ZT	-.12810395 06	DXT	.83581667 00	DYT	-.45386782 00	DZT	-.28693788 00
RS	.14908706 09	VS	.29879854 02	RM	.39483486 06	VM	.99343789 00	RT	.39483486 06	VT	.99343789 00
GED	-.27722537 02	ALT	.10829749 06	LOS	.76757660 02	RAS	.13299825 01	RAM	.23887472 03	LOM	.31430239 03
DUT	.36000000 02	DT	.95999999 03	DR	.23463662 01	SHA	.10979161 06	DES	.57683252 00	DEM	-.18932222 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC

EQUATORIAL COORDINATES

X	-.14906966 09	Y	-.35572365 07	Z	-.15539888 07	DX	.22122173 00	DY	-.29619496 02	DZ	-.12900543 02
R	.14912020 09	LAT	-.59709257 00	LON	.18136698 03	V	.32307699 02	PTH	.10993488 01	AZ	.11352803 03
XE	-.14903934 09	YE	-.34602063 07	ZE	-.15009286 07	DXE	.25817020 00	DYE	-.27412521 02	DZE	-.11886662 02
XT	-.14923239 09	YT	-.37799159 07	ZT	-.16290325 07	DXT	.10939869 01	DYT	-.27866388 02	DZT	-.12173600 02
LTE	-.57683252 00	LOE	.18132998 03	LTT	-.62522014 00	LOT	.18145094 03	RST	.14928915 09	VST	.30429080 02
EPS	.73183344 02	ESP	.43114612-01	SEP	.10677447 03	EPM	.15862546 03	EMP	.60761502 01	MEP	.15298386 02
MPS	.12619000 03	MSP	.88745359-01	SMP	.53721465 02	SEM	.12072053 03	EMS	.59149201 02	ESM	.13084791 00
RPM	.28583296 06	SPN	.69994909 02								
GCE	.81442085 02	GCT	.25126322 03	SIP	.12584206 03	CPT	.10308126 03	SIN	.10273332 03	D1	.18218144 00
REP	.11467107 06	VEP	.24290035 01	CPE	.82744420 02	CPS	.93157111 02	D2	.10832712 00	D3	.81204656-03

0 DAYS 10 HRS. 10 MIN. 12.000 SEC.

235712046300202000000000 J.D.= 2438841.83333333 MARCH 22,1965 08 00 00.000
TFL 0 DAYS 10 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC

EQUATORIAL COORDINATES

X	-.30402886 05	Y	-.10481651 06	Z	-.56623739 05	DX	-.11003341-01	DY	-.21206353 01	DZ	-.96693061 00
R	.12295155 06	DEC	-.27421766 02	RA	.25382476 03	V	.23307016 01	PTH	.75442364 02	AZ	.82043117 02
R	.12295154 06	LAT	-.27421766 02	LON	.31421138 03	VE	.77157768 01	PTE	.17000000 02	AZE	.27062972 03
XS	.14903837 09	YS	.35588940 07	ZS	.15437216 07	DXS	-.27960404 00	DYS	.27412107 02	DZS	.11886479 02
XM	-.19003663 06	YM	-.32132987 06	ZM	-.12913144 06	DXM	.84027481 00	DYM	-.44626498 00	DZM	-.28388707 00
XT	-.19003663 06	YT	-.32132987 06	ZT	-.12913144 06	DXT	.84027481 00	DYT	-.44626498 00	DZT	-.28388707 00
RS	.14908885 09	VS	.29879594 02	RM	.39502118 06	VM	.99287765 00	RT	.39502118 06	VT	.99287765 00
GED	-.27581151 02	ALT	.11657792 06	LOS	.61754524 02	RAS	.13679093 01	RAM	.23939964 03	LOM	.29978625 03
DUT	.36000000 02	DT	.95999999 03	DR	.22558751 01	SHA	.11830515 06	DES	.59327193 00	DEM	-.19080574 02

HELIOCENTRIC

EQUATORIAL COORDINATES

X	-.14906878 09	Y	-.36637105 07	Z	-.16003454 07	DX	.26860070 00	DY	-.29532743 02	DZ	-.12853409 02
R	.14912238 09	LAT	-.61489631 00	LON	.18140789 03	V	.32209706 02	PTH	.10584846 01	AZ	.11351235 03
XE	-.14903837 09	YE	-.35588940 07	ZE	-.15437216 07	DXE	.27960404 00	DYE	-.27412107 02	DZE	-.11886479 02
XT	-.14922841 09	YT	-.38802239 07	ZT	-.16728530 07	DXT	.11198788 01	DYT	-.27858372 02	DZT	-.12170366 02
LTE	-.59327193 00	LOE	.18136791 03	LTT	-.64204290 00	LOT	.18148946 03	RST	.14928822 09	VST	.30421387 02
EPS	.74152757 02	ESP	.45863470-01	SEP	.10580178 03	EPM	.15752726 03	EMP	.68329184 01	MEP	.15639816 02
MPS	.12648871 03	MSP	.85945114-01	SMP	.53425322 02	SEM	.12024637 03	EMS	.59622653 02	ESM	.13122123 00
RPM	.27860067 06	SPN	.71179257 02								
GCE	.81143155 02	GCT	.25114606 03	SIP	.12613174 03	CPT	.10310739 03	SIN	.10275042 03	D1	.18691093 00
REP	.12295155 06	VEP	.23307016 01	CPE	.82362664 02	CPS	.93146513 02	D2	.11193250 00	D3	.86405296-03

0 DAYS 11 HRS. 10 MIN. 12.000 SEC.

235712050104202000000000 J.D.= 2438841.87500000 MARCH 22,1965 09 00 00.000
TFL 0 DAYS 11 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC

EQUATORIAL COORDINATES

X	-.30402992 05	Y	-.11231103 06	Z	-.60029412 05	DX	.10269892-01	DY	-.20445054 01	DZ	-.92599773 00
R	.13092608 06	DEC	-.27290261 02	RA	.25485286 03	V	.22444553 01	PTH	.75812992 02	AZ	.81566644 02
R	.13092608 06	LAT	-.27290262 02	LON	.30019841 03	VE	.82336348 01	PTE	.15324291 02	AZE	.27058210 03
XS	.14903733 09	YS	.36575809 07	ZS	.15865144 07	DXS	-.30103806 00	DYS	.27411679 02	DZS	.11886290 02
XM	-.18700372 06	YM	-.32292270 06	ZM	-.13014791 06	DXM	.84465609 00	DYM	-.43863476 00	DZM	-.28081633 00
XT	-.18700372 06	YT	-.32292270 06	ZT	-.13014791 06	DXT	.84465609 00	DYT	-.43863476 00	DZT	-.28081633 00
RS	.14909065 09	VS	.29879335 02	RM	.39520620 06	VM	.99232160 00	RT	.39520620 06	VT	.99232160 00
GED	-.27449132 02	ALT	.12455242 06	LOS	.46751381 02	RAS	.14058356 01	RAM	.23992497 03	LOM	.28527051 03
DUT	.36000000 02	DT	.95999999 03	DR	.21760015 01	SHA	.12649163 06	DES	.60971049 00	DEM	-.19227293 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC

EQUATORIAL COORDINATES

X	-.14906521 09	Y	-.39814990 07	Z	-.17385380 07	DX	.38686461 00	DY	-.29326255 02	DZ	-.12743485 02
R	.14912851 09	LAT	-.66796944 00	LON	.18152999 03	V	.31977731 02	PTH	.97623722 00	AZ	.11347804 03
XE	-.14903501 09	YE	-.38549482 07	ZE	-.16720970 07	DXE	.34390577 00	DYE	-.27410783 02	DZE	-.11885895 02
XT	-.14921590 09	YT	-.41809740 07	ZT	-.18042445 07	DXT	.11970934 01	DYT	-.27834077 02	DZT	-.12160511 02
LTE	-.64258760 00	LOE	.18148168 03	LTT	-.69248641 00	LOT	.18160498 03	RST	.14928536 09	VST	.30398140 02
EPS	.76402559 02	ESP	.54176172-01	SEP	.10354287 03	EPM	.15477542 03	EMP	.90552820 01	MEP	.16169289 02
MPS	.12732114 03	MSP	.78196572-01	SMP	.52599962 02	SEM	.11882690 03	EMS	.61040087 02	ESM	.13288819 00
RPM	.25848416 06	SPN	.73900316 02								
GCE	.80450083 02	GCT	.25083793 03	SIP	.12693639 03	CPT	.10316196 03	SIN	.10277721 03	D1	.20145789 00
REP	.14608837 06	VEP	.20991284 01	CPE	.81474833 02	CPS	.93114824 02	D2	.12301423 00	D3	.10343277-02

0 DAYS 14 HRS. 10 MIN. 12.000 SEC.

23571205532020200000000 J.D.= 2438842.00000000 MARCH 22,1965 12 00 00.000
TFL 0 DAYS 14 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC

EQUATORIAL COORDINATES

X	-.30026492 05	Y	-.13334496 06	Z	-.69475141 05	DX	.55733614-01	DY	-.18599774 01	DZ	-.82853591 00
R	.15332731 06	DEC	-.26943815 02	RA	.25730985 03	V	.20369325 01	PTH	.76673789 02	AZ	.80430466 02
R	.15332730 06	LAT	-.26943816 02	LON	.25753219 03	VE	.97089671 01	PTE	.11779742 02	AZE	.27047052 03
XS	.14903373 09	YS	.39536303 07	ZS	.17148876 07	DXS	-.36533979 00	DYS	.27410313 02	DZS	.11885689 02
XM	-.17781230 06	YM	-.32753573 06	ZM	-.13313051 06	DXM	.85733767 00	DYM	-.41558637 00	DZM	-.27148745 00
XT	-.17781230 06	YT	-.32753573 06	ZT	-.13313051 06	DXT	.85733767 00	DYT	-.41558637 00	DZT	-.27148745 00
RS	.14909602 09	VS	.29878559 02	RM	.39575320 06	VM	.99067922 00	RT	.39575320 06	VT	.99067922 00
GED	-.27101313 02	ALT	.14695354 06	LOS	.17419586 01	RAS	.15196116 01	RAM	.24150339 03	LOM	.24172573 03
DUT	.36000000 02	DT	.19200000 04	DR	.19820851 01	SHA	.14943029 06	DES	.65902445 00	DEM	-.19657559 02

HELIOCENTRIC

EQUATORIAL COORDINATES

X	-.14906376 09	Y	-.40869753 07	Z	-.17843628 07	DX	.42107340 00	DY	-.29270290 02	DZ	-.12714224 02
R	.14913045 09	LAT	-.68556657 00	LON	.18157052 03	V	.31915179 02	PTH	.95764033 00	AZ	.11346942 03
XE	-.14903373 09	YE	-.39536303 07	ZE	-.17148876 07	DXE	.36533979 00	DYE	-.27410313 02	DZE	-.11885689 02
XT	-.14921154 09	YT	-.42811660 07	ZT	-.18480181 07	DXT	.12226775 01	DYT	-.27825899 02	DZT	-.12157176 02
LTE	-.65902445 00	LOE	.18151961 03	LTT	-.70929294 00	LOT	.18164347 03	RST	.14928438 09	VST	.30390336 02
EPS	.76997095 02	ESP	.57249289-01	SEP	.10294549 03	EPM	.15399763 03	EMP	.97792829 01	MEP	.16223084 02
MPS	.12757913 03	MSP	.76616680-01	SMP	.52344159 02	SEM	.11835472 03	EMS	.61511607 02	ESM	.13362238 00
RPM	.25219576 06	SPN	.74613059 02								
GCE	.80266132 02	GCT	.25074694 03	SIP	.12718478 03	CPT	.10317430 03	SIN	.10277995 03	D1	.20648140 00
REP	.15332731 06	VEP	.20369325 01	CPE	.81239156 02	CPS	.93104288 02	D2	.12683110 00	D3	.10966427-02

0 DAYS 15 HRS. 10 MIN. 12.000 SEC.

23571205712420200000000 J.D.= 2438842.04166666 MARCH 22,1965 13 00 00.000
TFL 0 DAYS 15 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC

EQUATORIAL COORDINATES

X	-.29805554 05	Y	-.13994826 06	Z	-.72409669 05	DX	.66741436-01	DY	-.18092518 01	DZ	-.80216701 00
R	.16036535 06	DEC	-.26841851 02	RA	.25797703 03	V	.19802319 01	PTH	.76900502 02	AZ	.80121800 02
R	.16036535 06	LAT	-.26841851 02	LON	.24315830 03	VE	.10176650 02	PTE	.10924908 02	AZE	.27044149 03
XS	.14903238 09	YS	.40523104 07	ZS	.17576773 07	DXS	-.38677372 00	DYS	.27409829 02	DZS	.11885476 02
XM	-.17471853 06	YM	-.32901793 06	ZM	-.13410220 06	DXM	.86141045 00	DYM	-.40785317 00	DZM	-.26833989 00
XT	-.17471853 06	YT	-.32901793 06	ZT	-.13410220 06	DXT	.86141045 00	DYT	-.40785317 00	DZT	-.26833989 00
RS	.14909782 09	VS	.29878301 02	RM	.39593277 06	VM	.99014063 00	RT	.39593277 06	VT	.99014063 00
GED	-.26998940 02	ALT	.15399155 06	LOS	.34673880 03	RAS	.15575363 01	RAM	.24203034 03	LOM	.22721161 03
DUT	.36000000 02	DT	.19200000 04	DR	.19287022 01	SHA	.15662140 06	DES	.67546131 00	DEM	-.19797655 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC

EQUATORIAL COORDINATES

X	-.14906773 09	Y	-.37698919 07	Z	-.16465438 07	DX	.31130795 00	DY	-.29456185 02	DZ	-.12812288 02
R	.14912449 09	LAT	-.63263944 00	LON	.18144869 03	V	.32123487 02	PTH	.10255111 01	AZ	.11349915 03
XE	-.14903733 09	YE	-.36575809 07	ZE	-.15865144 07	DXE	.30103806 00	DYE	-.27411679 02	DZE	-.11886290 02
XT	-.14922433 09	YT	-.39805036 07	ZT	-.17166623 07	DXT	.11456941 01	DYT	-.27850314 02	DZT	-.12167107 02
LTE	-.60971049 00	LOE	.18140583 03	LTT	-.65886053 00	LOT	.18152798 03	RST	.14928728 09	VST	.30413666 02
EPS	.74996688 02	ESP	.48958796-01	SEP	.10495471 03	EPM	.15652918 03	EMP	.75819963 01	MEP	.15888809 02
MPS	.12677643 03	MSP	.83637439-01	SMP	.53140052 02	SEM	.11977272 03	EMS	.60095614 02	ESM	.13214991 00
RPM	.27165726 06	SPN	.72204448 02								
GCE	.80883352 02	GCT	.25103677 03	SIP	.12641034 03	CPT	.10312905 03	SIN	.10276296 03	D1	.19168846 00
REP	.13092608 06	VEP	.22444553 01	CPE	.82030106 02	CPS	.93135934 02	D2	.11557495 00	D3	.91827936-03

0 DAYS 12 HRS. 10 MIN. 12.000 SEC.

23571205171020200000000 J.D.= 2438841.91666666 MARCH 22,1965 10 00 00.000
TFL 0 DAYS 12 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC

EQUATORIAL COORDINATES

X	-.30333182 05	Y	-.11954680 06	Z	-.63296650 05	DX	.27994361-01	DY	-.19766080 01	DZ	-.88985153 00
R	.13862902 06	DEC	-.27167296 02	RA	.25576253 03	V	.21678558 01	PTH	.76136079 02	AZ	.81145747 02
R	.13862902 06	LAT	-.27167296 02	LON	.28606701 03	VE	.87381089 01	PTE	.13937573 02	AZE	.27054017 03
XS	.14903621 09	YS	.37562649 07	ZS	.16293058 07	DXS	-.32247178 00	DYS	.27411238 02	DZS	.11886095 02
XM	-.18395519 06	YM	-.32448802 06	ZM	-.13115329 06	DXM	.84896038 00	DYM	-.43097782 00	DZM	-.27772595 00
XT	-.18395519 06	YT	-.32448802 06	ZT	-.13115329 06	DXT	.84896038 00	DYT	-.43097782 00	DZT	-.27772595 00
RS	.14909244 09	VS	.29879076 02	RM	.39538990 06	VM	.99176978 00	RT	.39538990 06	VT	.99176978 00
GED	-.27325682 02	ALT	.13225532 06	LOS	.31748241 02	RAS	.14437620 01	RAM	.24045070 03	LOM	.27075518 03
DUT	.36000000 02	DT	.19200000 04	DR	.21047009 01	SHA	.13438855 06	DES	.62614990 00	DEM	-.19372369 02

HELIOCENTRIC

EQUATORIAL COORDINATES

X	-.14906654 09	Y	-.38758116 07	Z	-.16926024 07	DX	.35046614 00	DY	-.29387846 02	DZ	-.12775947 02
R	.14912652 09	LAT	-.65032706 00	LON	.18148938 03	V	.32046733 02	PTH	.99853864 00	AZ	.11348785 03
XE	-.14903621 09	YE	-.37562649 07	ZE	-.16293058 07	DXE	.32247178 00	DYE	-.27411238 02	DZE	-.11886095 02
XT	-.14922016 09	YT	-.40807528 07	ZT	-.17604590 07	DXT	.11714321 01	DYT	-.27842215 02	DZT	-.12163821 02
LTE	-.62614990 00	LOE	.18144376 03	LTT	-.67567560 00	LOT	.18156649 03	RST	.14928633 09	VST	.30405916 02
EPS	.75740427 02	ESP	.51396029-01	SEP	.10420794 03	EPM	.15561599 03	EMP	.83228490 01	MEP	.16061152 02
MPS	.12705373 03	MSP	.80660059-01	SMP	.52865105 02	SEM	.11929957 03	EMS	.60568091 02	ESM	.13214991 00
RPM	.26496253 06	SPN	.73103449 02								
GCE	.80654335 02	GCT	.25093433 03	SIP	.12667839 03	CPT	.10314704 03	SIN	.10277170 03	D1	.19653200 00
REP	.13862902 06	VEP	.21678558 01	CPE	.81736630 02	CPS	.93125372 02	D2	.11926543 00	D3	.97495744-03

0 DAYS 13 HRS. 10 MIN. 12.000 SEC.

23571205351420200000000 J.D.= 2438841.95833333 MARCH 22,1965 11 00 00.000
TFL 0 DAYS 13 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC

EQUATORIAL COORDINATES

X	-.30204729 05	Y	-.12655071 06	Z	-.66440993 05	DX	.42958841-01	DY	-.19154722 01	DZ	-.85759026 00
R	.14608837 06	DEC	-.27052068 02	RA	.25657596 03	V	.20991284 01	PTH	.76420730 02	AZ	.80769713 02
R	.14608837 06	LAT	-.27052069 02	LON	.27183938 03	VE	.92296778 01	PTE	.12772171 02	AZE	.27050321 03
XS	.14903501 09	YS	.38549482 07	ZS	.16720970 07	DXS	-.34390577 00	DYS	.27410783 02	DZS	.11885895 02
XM	-.18089128 06	YM	-.32602572 06	ZM	-.13214751 06	DXM	.85318761 00	DYM	-.42329480 00	DZM	-.27461623 00
XT	-.18089128 06	YT	-.32602572 06	ZT	-.13214751 06	DXT	.85318761 00	DYT	-.42329480 00	DZT	-.27461623 00
RS	.14909423 09	VS	.29878818 02	RM	.39557223 06	VM	.99122230 00	RT	.39557223 06	VT	.99122230 00
GED	-.27209998 02	ALT	.13971463 06	LOS	.16745098 02	RAS	.14816862 01	RAM	.24097684 03	LOM	.25624025 03
DUT	.36000000 02	DT	.19200000 04	DR	.20404494 01	SHA	.14202638 06	DES	.64258760 00	DEM	-.19515793 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC

X	-.14906218 09	Y	-.41922586 07	Z	-.18300870 07	DX	.45351516 00	DY	-.29219081 02	DZ	-.12687643 02
R	.14913235 09	LAT	-.70312613 00	LON	.18161097 03	V	.31858070 02	PTH	.94203078 00	AZ	.11346178 03
XE	-.14903238 09	YE	-.40523104 07	ZE	-.17576773 07	DXE	.38677372 00	DYE	-.27409829 02	DZE	-.11885476 02
XT	-.14920709 09	YT	-.43813283 07	ZT	-.18917795 07	DXT	.12481842 01	DYT	-.27817682 02	DZT	-.12153816 02
LTE	-.67546131 00	LOE	.18155753 03	LTT	-.72609435 00	LOT	.18168195 03	RST	.14928339 09	VST	.30382505 02
EPS	.77534843 02	ESP	.59757735-01	SEP	.10240498 03	EPM	.15327458 03	EMP	.10494955 02	MEP	.16230457 02
MPS	.12782814 03	MSP	.74018745-01	SMP	.52097264 02	SEM	.11788302 03	EMS	.61982654 02	ESM	.13380530 00
RPM	.24607535 06	SPN	.75255493 02								
GCE	.80099080 02	GCT	.25066085 03	SIP	.12742398 03	CPT	.10318443 03	SIN	.10278028 03	D1	.21161728 00
REP	.16036535 06	VEP	.19802319 01	CPE	.81025331 02	CPS	.93093766 02	D2	.13072569 00	D3	.11621724-02

EQUATORIAL COORDINATES

0 DAYS 16 HRS. 10 MIN. 12.000 SEC.

23571206073020200000000 J.D.= 2438842.08333333 MARCH 22,1965 14 00 00.000
TFL 0 DAYS 16 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC

X	-.29547677 05	Y	-.14637647 06	Z	-.75253474 05	DX	.76302321-01	DY	-.17626054 01	DZ	-.77807527 00
R	.16721908 06	DEC	-.26745560 02	RA	.25858758 03	V	.19282118 01	PTH	.77105006 02	AZ	.79838833 02
R	.16721908 06	LAT	-.26745560 02	LON	.22872779 03	VE	.10633392 02	PTE	.10181235 02	AZE	.27041559 03
XS	.14903095 09	YS	.41509889 07	ZS	.18004664 07	DXS	-.40820771 00	DYS	.27409332 02	DZS	.11885258 02
XM	-.17161022 06	YM	-.33047225 06	ZM	-.13506253 06	DXM	.86540587 00	DYM	-.40009586 00	DZM	-.26517385 00
XT	-.17161022 06	YT	-.33047225 06	ZT	-.13506253 06	DXT	.86540587 00	DYT	-.40009586 00	DZT	-.26517385 00
RS	.14909961 09	VS	.29878043 02	RM	.39611091 06	VM	.98960657 00	RT	.39611091 06	VT	.98960657 00
GED	-.26902262 02	ALT	.16084524 06	LOS	.33173566 03	RAS	.15954600 01	RAM	.24255770 03	LOM	.21269790 03
DUT	.36000000 02	DT	.19200000 04	DR	.18795837 01	SHA	.16361763 06	DES	.69189645 00	DEM	-.19936073 02

EQUATORIAL COORDINATES

HELIOCENTRIC

X	-.14906049 09	Y	-.42973654 07	Z	-.18757199 07	DX	.48451003 00	DY	-.29171937 02	DZ	-.12663333 02
R	.14913422 09	LAT	-.72065069 00	LON	.18165136 03	V	.31805607 02	PTH	.92886559 00	AZ	.11345494 03
XE	-.14903095 09	YE	-.41509889 07	ZE	-.18004664 07	DXE	.40820771 00	DYE	-.27409332 02	DZE	-.11885258 02
XT	-.14920256 09	YT	-.44814612 07	ZT	-.19355289 07	DXT	.12736136 01	DYT	-.27809427 02	DZT	-.12150432 02
LTE	-.69189645 00	LOE	.18159546 03	LTT	-.74289149 00	LOT	.18172042 03	RST	.14928239 09	VST	.30374649 02
EPS	.78024287 02	ESP	.62557255-01	SEP	.10191285 03	EPM	.15259975 03	EMP	.11202429 02	MEP	.16197817 02
MPS	.12806856 03	MSP	.72008811-01	SMP	.51858891 02	SEM	.11741180 03	EMS	.62453233 02	ESM	.13507880 00
RPM	.24010445 06	SPN	.75838405 02								
GCE	.79946284 02	GCT	.25057922 03	SIP	.12765435 03	CPT	.10319268 03	SIN	.10277848 03	D1	.21688003 00
REP	.16721908 06	VEP	.19282118 01	CPE	.80830013 02	CPS	.93083254 02	D2	.13470758 00	D3	.12312069-02

EQUATORIAL COORDINATES

0 DAYS 17 HRS. 10 MIN. 12.000 SEC.

23571206253420200000000 J.D.= 2438842.12500000 MARCH 22,1965 15 00 00.000
TFL 0 DAYS 17 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC

X	-.29257606 05	Y	-.15264324 06	Z	-.78014151 05	DX	.84662961-01	DY	-.17194831 01	DZ	-.75593524 00
R	.17390277 06	DEC	-.26654401 02	RA	.25914953 03	V	.18802202 01	PTH	.77290580 02	AZ	.79577673 02
R	.17390277 06	LAT	-.26654402 02	LON	.21424868 03	VE	.11079831 02	PTE	.95285885 01	AZE	.27039238 03
XS	.14902944 09	YS	.42496657 07	ZS	.18432547 07	DXS	-.42964166 00	DYS	.27408821 02	DZS	.11885034 02
XM	-.16848768 06	YM	-.33189860 06	ZM	-.13601143 06	DXM	.86932384 00	DYM	-.39231507 00	DZM	-.26198962 00
XT	-.16848768 06	YT	-.33189860 06	ZT	-.13601143 06	DXT	.86932384 00	DYT	-.39231507 00	DZT	-.26198962 00
RS	.14910141 09	VS	.29877785 02	RM	.39628763 06	VM	.98907714 00	RT	.39628763 06	VT	.98907714 00
GED	-.26810735 02	ALT	.16752891 06	LOS	.31673252 03	RAS	.16333834 01	RAM	.24308546 03	LOM	.19818460 03
DUT	.36000000 02	DT	.19200000 04	DR	.18341518 01	SHA	.17043439 06	DES	.70833244 00	DEM	-.20072804 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC

X	-.14905870 09	Y	-.44023089 07	Z	-.19212688 07	DX	.51430462 00	DY	-.29128304 02	DZ	-.12640969 02
R	.14913607 09	LAT	-.73814195 00	LON	.18169168 03	V	.31757152 02	PTH	.91772299 00	AZ	.11344876 03
XE	-.14902944 09	YE	-.42496657 07	ZE	-.18432547 07	DXE	.42964166 00	DYE	-.27408821 02	DZE	-.11885034 02
XT	-.14919792 09	YT	-.45815642 07	ZT	-.19792661 07	DXT	.12989655 01	DYT	-.27801136 02	DZT	-.12147024 02
LTE	-.70833244 00	LOE	.18163338 03	LTT	-.75968522 00	LOT	.18175888 03	RST	.14928137 09	VST	.30366768 02
EPS	.78472206 02	ESP	.66719594-01	SEP	.10146231 03	EPM	.15196770 03	EMP	.11901885 02	MEP	.16130408 02
MPS	.12830075 03	MSP	.70289975-01	SMP	.51628686 02	SEM	.11694106 03	EMS	.62923345 02	ESM	.13525975 00
RPM	.23426732 06	SPN	.76370374 02								
GCE	.79805656 02	GCT	.25050170 03	SIP	.12787622 03	CPT	.10319931 03	SIN	.10277478 03	D1	.22228422 00
REP	.17390277 06	VEP	.18802202 01	CPE	.80650542 02	CPS	.93072754 02	D2	.13878652 00	D3	.13040613-02

EQUATORIAL COORDINATES

0 DAYS 18 HRS. 10 MIN. 12.000 SEC. 23571206434020200000000 J.D.= 2438842.16666666 MARCH 22,1965 16 00 00.000
TFL 0 DAYS 18 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC

X	-.28939301 05	Y	-.15876043 06	Z	-.80698232 05	DX	.92016586-01	DY	-.16794330 01	DZ	-.73548409 00
R	.18042883 06	DEC	-.26567894 02	RA	.25966937 03	V	.18357285 01	PTH	.77459887 02	AZ	.79335162 02
R	.18042883 06	LAT	-.26567894 02	LON	.19972746 03	VE	.11516564 02	PTE	.89513871 01	AZE	.27037150 03
XS	.14902785 09	YS	.43483406 07	ZS	.18860421 07	DXS	-.45107554 00	DYS	.27408296 02	DZS	.11884803 02
XM	-.16535116 06	YM	-.33329691 06	ZM	-.13694883 06	DXM	.87316430 00	DYM	-.38451146 00	DZM	-.25878746 00
XT	-.16535116 06	YT	-.33329691 06	ZT	-.13694883 06	DXT	.87316430 00	DYT	-.38451146 00	DZT	-.25878746 00
RS	.14910320 09	VS	.29877528 02	RM	.39646288 06	VM	.98855243 00	RT	.39646288 06	VT	.98855243 00
GED	-.26723876 02	ALT	.17405494 06	LOS	.30172938 03	RAS	.16713067 01	RAM	.24361363 03	LOM	.18367171 03
DUT	.36000000 02	DT	.19200000 04	DR	.17919358 01	SHA	.17708501 06	DES	.72476759 00	DEM	-.20207839 02

EQUATORIAL COORDINATES

HELIOCENTRIC

X	-.14905679 09	Y	-.45071009 07	Z	-.19667403 07	DX	.54309212 00	DY	-.29087729 02	DZ	-.12620288 02
R	.14913788 09	LAT	-.75560419 00	LON	.18173195 03	V	.31712183 02	PTH	.90827513 00	AZ	.11344315 03
XE	-.14902785 09	YE	-.43483406 07	ZE	-.18860421 07	DXE	.45107554 00	DYE	-.27408296 02	DZE	-.11884803 02
XT	-.14919320 09	YT	-.46816374 07	ZT	-.20229909 07	DXT	.13242398 01	DYT	-.27792807 02	DZT	-.12143591 02
LTE	-.72476759 00	LOE	.18167130 03	LTT	-.77647468 00	LOT	.18179733 03	RST	.14928034 09	VST	.30358863 02
EPS	.78884091 02	ESP	.68528040-01	SEP	.10104787 03	EPM	.15137392 03	EMP	.12593514 02	MEP	.16032561 02
MPS	.12852504 03	MSP	.67810450-01	SMP	.51406331 02	SEM	.11647078 03	EMS	.63392999 02	ESM	.13616089 00
RPM	.22855044 06	SPN	.76858314 02								
GCE	.79675519 02	GCT	.25042799 03	SIP	.12808989 03	CPT	.10320452 03	SIN	.10276937 03	D1	.22784468 00
REP	.18042883 06	VEP	.18357285 01	CPE	.80484769 02	CPS	.93062263 02	D2	.14297253 00	D3	.13810790-02

EQUATORIAL COORDINATES

0 DAYS 19 HRS. 10 MIN. 12.000 SEC. 23571206614420200000000 J.D.= 2438842.20833333 MARCH 22,1965 17 00 00.000
TFL 0 DAYS 19 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC

X	-.28596102 05	Y	-.16473840 06	Z	-.83311401 05	DX	.98516639-01	DY	-.16420823 01	DZ	-.71650691 00
R	.18680810 06	DEC	-.26485620 02	RA	.26015243 03	V	.17943026 01	PTH	.77615103 02	AZ	.79108706 02
R	.18680810 06	LAT	-.26485620 02	LON	.18516945 03	VE	.11944146 02	PTE	.84373897 01	AZE	.27035262 03
XS	.14902619 09	YS	.44470120 07	ZS	.19288280 07	DXS	-.47250905 00	DYS	.27407756 02	DZS	.11884567 02
XM	-.16220096 06	YM	-.33466707 06	ZM	-.13787468 06	DXM	.87692716 00	DYM	-.37668566 00	DZM	-.25556769 00
XT	-.16220096 06	YT	-.33466707 06	ZT	-.13787468 06	DXT	.87692716 00	DYT	-.37668566 00	DZT	-.25556769 00
RS	.14910500 09	VS	.29877271 02	RM	.39663664 06	VM	.98803247 00	RT	.39663664 06	VT	.98803247 00
GED	-.26641266 02	ALT	.18043419 06	LOS	.28672623 03	RAS	.17092279 01	RAM	.24414221 03	LOM	.16915922 03
DUT	.36000000 02	DT	.19200000 04	DR	.17525471 01	SHA	.18358117 06	DES	.74120102 00	DEM	-.20341172 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.14905478 09	Y	-.46117504 07	Z	-.20121394 07	DX	.57102568 00	DY	-.29049839 02	DZ	-.12601074 02
R	.14913968 09	LAT	-.77303653 00	LON	.18177216 03	V	.31670274 02	PTH	.90025820 00	AZ	.11343801 03
XE	-.14902619 09	YE	-.44470120 07	ZE	-.19288280 07	DXE	.47250905 00	DYE	-.27407756 02	DZE	-.11884567 02
XT	-.14918839 09	YT	-.47816790 07	ZT	-.20667027 07	DXT	.13494362 01	DYT	-.27784442 02	DZT	-.12140135 02
LTE	-.74120102 00	LOE	.18170922 03	LTT	-.79325902 00	LOT	.18183577 03	RST	.14927930 09	VST	.30350932 02
EPS	.79264443 02	ESP	.70289975-01	SEP	.10066503 03	EPM	.15081460 03	EMP	.13277501 02	MEP	.15907894 02
MPS	.12874172 03	MSP	.66719594-01	SMP	.51191535 02	SEM	.11600097 03	EMS	.63862195 02	ESM	.13705611 00
RPM	.22294206 06	SPN	.77307872 02								
GCE	.79554508 02	GCT	.25035784 03	SIP	.12829563 03	CPT	.10320850 03	SIN	.10276241 03	D1	.23357674 00
REP	.18680810 06	VEP	.17943026 01	CPE	.80330939 02	CPS	.93051782 02	D2	.14727604 00	D3	.14626368-02

0 DAYS 20 HRS. 10 MIN. 12.000 SEC. 23571206775020200000000 J.D.= 2438842.25000000 MARCH 22,1965 18 00 00.000
TFL 0 DAYS 20 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	-.28230848 05	Y	-.17058629 06	Z	-.85858631 05	DX	.10428652 00	DY	-.16071204 01	DZ	-.69882565 00
R	.19305017 06	DEC	-.26407202 02	RA	.26060310 03	V	.17555822 01	PTH	.77758052 02	AZ	.78896125 02
R	.19305016 06	LAT	-.26407203 02	LON	.17057906 03	VE	.12363088 02	PTE	.79768480 01	AZE	.27033549 03
XS	.14902445 09	YS	.45456829 07	ZS	.19716137 07	DXS	-.49394280 00	DYS	.27407204 02	DZS	.11884325 02
XM	-.15903736 06	YM	-.33600902 06	ZM	-.13878890 06	DXM	.88061236 00	DYM	-.36883830 00	DZM	-.25233056 00
XT	-.15903736 06	YT	-.33600902 06	ZT	-.13878890 06	DXT	.88061236 00	DYT	-.36883830 00	DZT	-.25233056 00
RS	.14910680 09	VS	.29877014 02	RM	.39680890 06	VM	.98751735 00	RT	.39680890 06	VT	.98751735 00
GED	-.26562529 02	ALT	.18667623 06	LOS	.27172309 03	RAS	.17471496 01	RAM	.24467121 03	LOM	.15464715 03
DUT	.36000000 02	DT	.19200000 04	DR	.17156619 01	SHA	.18993312 06	DES	.75763446 00	DEM	-.20472793 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.14905268 09	Y	-.47162692 07	Z	-.20574723 07	DX	.59822931 00	DY	-.29014324 02	DZ	-.12583151 02
R	.14914147 09	LAT	-.79044498 00	LON	.18181233 03	V	.31631070 02	PTH	.89346216 00	AZ	.11343328 03
XE	-.14902445 09	YE	-.45456829 07	ZE	-.19716137 07	DXE	.49394280 00	DYE	-.27407204 02	DZE	-.11884325 02
XT	-.14918349 09	YT	-.48816919 07	ZT	-.21104026 07	DXT	.13745552 01	DYT	-.27776042 02	DZT	-.12136656 02
LTE	-.75763446 00	LOE	.18174715 03	LTT	-.81003908 00	LOT	.18187420 03	RST	.14927825 09	VST	.30342978 02
EPS	.79616998 02	ESP	.72008811-01	SEP	.10031003 03	EPM	.15028653 03	EMP	.13954030 02	MEP	.15759444 02
MPS	.12895106 03	MSP	.64860743-01	SMP	.50984036 02	SEM	.11553163 03	EMS	.64330941 02	ESM	.13705611 00
RPM	.21743191 06	SPN	.77723713 02								
GCE	.79441497 02	GCT	.25029101 03	SIP	.12849366 03	CPT	.10321141 03	SIN	.10275401 03	D1	.23949639 00
REP	.19305017 06	VEP	.17555822 01	CPE	.80187593 02	CPS	.93041309 02	D2	.15170798 00	D3	.15491494-02

0 DAYS 21 HRS. 10 MIN. 12.000 SEC. 23571207155420200000000 J.D.= 2438842.29166666 MARCH 22,1965 19 00 00.000
TFL 0 DAYS 21 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	-.27845984 05	Y	-.17631222 06	Z	-.88344319 05	DX	.10942646 00	DY	-.15742861 01	DZ	-.68229171 00
R	.19916354 06	DEC	-.26332318 02	RA	.26102507 03	V	.17192652 01	PTH	.77890253 02	AZ	.78695588 02
R	.19916354 06	LAT	-.26332318 02	LON	.15595996 03	VE	.12773860 02	PTE	.75619132 01	AZE	.27031990 03
XS	.14902263 09	YS	.46443516 07	ZS	.20143985 07	DXS	-.51537642 00	DYS	.27406637 02	DZS	.11884077 02
XM	-.15586063 06	YM	-.33732268 06	ZM	-.13969143 06	DXM	.88421983 00	DYM	-.36097002 00	DZM	-.24907639 00
XT	-.15586063 06	YT	-.33732268 06	ZT	-.13969143 06	DXT	.88421983 00	DYT	-.36097002 00	DZT	-.24907639 00
RS	.14910859 09	VS	.29876758 02	RM	.39697962 06	VM	.98700714 00	RT	.39697962 06	VT	.98700714 00
GED	-.26487336 02	ALT	.19278958 06	LOS	.25671994 03	RAS	.17850708 01	RAM	.24520060 03	LOM	.14013548 03
DUT	.36000000 02	DT	.19200000 04	DR	.16810074 01	SHA	.19615000 06	DES	.77406619 00	DEM	-.20602692 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14905048 09	Y	-.48206638 07	Z	-.21027428 07	DX	.62480288 00	DY	-.28980923 02	DZ	-.12566369 02
R	.14914324 09	LAT	-.80782951 00	LON	.18185244 03	V	.31594270 02	PTH	.88771626 00	AZ	.11342891 03
XE	-.14902263 09	YE	-.46443516 07	ZE	-.20143985 07	DXE	.51537642 00	DYE	-.27406637 02	DZE	-.11884077 02
XT	-.14917849 09	YT	-.49816742 07	ZT	-.21540899 07	DXT	.13995962 01	DYT	-.27767607 02	DZT	-.12133154 02
LTE	-.77406619 00	LOE	.18178507 03	LTT	-.82681318 00	LOT	.18191263 03	RST	.14927719 09	VST	.30335001 02
EPS	.79944882 02	ESP	.75328913-01	SEP	.99979762 02	EPM	.14978693 03	EMP	.14623280 02	MEP	.15589782 02
MPS	.12915330 03	MSP	.62947024-01	SMP	.50783591 02	SEM	.11506273 03	EMS	.64799239 02	ESM	.13829968 00
RPM	.21201095 06	SPN	.78109732 02								
GCE	.79335547 02	GCT	.25022732 03	SIP	.12868421 03	CPT	.10321338 03	SIN	.10274428 03	D1	.24562054 00
REP	.19916354 06	VEP	.17192652 01	CPE	.80053522 02	CPS	.93030845 02	D2	.15627997 00	D3	.16410758-02

0 DAYS 22 HRS. 10 MIN. 12.000 SEC.

23571207336020200000000 J.D.= 2438842.33333333 MARCH 22,1965 20 00 00.000
TFL 0 DAYS 22 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.27443622 05	Y	-.18192344 06	Z	-.90772358 05	DX	.11401874 00	DY	-.15433579 01	DZ	-.66677974 00
R	.20515582 06	DEC	-.26260669 02	RA	.26142146 03	V	.16850961 01	PTH	.78012996 02	AZ	.78505545 02
R	.20515582 06	LAT	-.26260669 02	LON	.14131527 03	VE	.13176895 02	PTE	.71861930 01	AZE	.27030565 03
XS	.14902074 09	YS	.47430185 07	ZS	.20571825 07	DXS	-.53681002 00	DYS	.27406055 02	DZS	.11883823 02
XM	-.15267105 06	YM	-.33860799 06	ZM	-.14058223 06	DXM	.88774952 00	DYM	-.35308145 00	DZM	-.24580543 00
XT	-.15267105 06	YT	-.33860799 06	ZT	-.14058223 06	DXT	.88774952 00	DYT	-.35308145 00	DZT	-.24580543 00
RS	.14911039 09	VS	.29876500 02	RM	.39714881 06	VM	.98650191 00	RT	.39714881 06	VT	.98650191 00
GED	-.26415392 02	ALT	.19878184 06	LOS	.24171680 03	RAS	.18229911 01	RAM	.24573041 03	LOM	.12562422 03
DUT	.36000000 02	DT	.19200000 04	DR	.16483522 01	SHA	.20223993 06	DES	.79049876 00	DEM	-.20730864 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14904818 09	Y	-.49249419 07	Z	-.21479548 07	DX	.65082876 00	DY	-.28949413 02	DZ	-.12550603 02
R	.14914499 09	LAT	-.82519015 00	LON	.18189251 03	V	.31559622 02	PTH	.88287964 00	AZ	.11342483 03
XE	-.14902074 09	YE	-.47430185 07	ZE	-.20571825 07	DXE	.53681002 00	DYE	-.27406055 02	DZE	-.11883823 02
XT	-.14917341 09	YT	-.50816264 07	ZT	-.21977647 07	DXT	.14245595 01	DYT	-.27759136 02	DZT	-.12129629 02
LTE	-.79049876 00	LOE	.18182299 03	LTT	-.84358556 00	LOT	.18195104 03	RST	.14927612 09	VST	.30326999 02
EPS	.80250741 02	ESP	.78196572-01	SEP	.99671565 02	EPM	.14931346 03	EMP	.15285422 02	MEP	.15401117 02
MPS	.12934867 03	MSP	.61373100-01	SMP	.50589982 02	SEM	.11459430 03	EMS	.65267095 02	ESM	.13847642 00
RPM	.20667119 06	SPN	.78469211 02								
GCE	.79235874 02	GCT	.25016662 03	SIP	.12886746 03	CPT	.10321452 03	SIN	.10273331 03	D1	.25196708 00
REP	.20515582 06	VEP	.16850961 01	CPE	.79927702 02	CPS	.93020386 02	D2	.16100434 00	D3	.17389246-02

0 DAYS 23 HRS. 10 MIN. 12.000 SEC.

23571207516420200000000 J.D.= 2438842.37500000 MARCH 22,1965 21 00 00.000
TFL 0 DAYS 23 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.27025611 05	Y	-.18742646 06	Z	-.93146227 05	DX	.11813144 00	DY	-.15141464 01	DZ	-.65218320 00
R	.21103383 06	DEC	-.26191998 02	RA	.26179489 03	V	.16528573 01	PTH	.78127396 02	AZ	.78324636 02
R	.21103383 06	LAT	-.26191998 02	LON	.12664763 03	VE	.13572590 02	PTE	.68444300 01	AZE	.27029258 03
XS	.14901877 09	YS	.48416838 07	ZS	.20999656 07	DXS	-.55824361 00	DYS	.27405461 02	DZS	.11883563 02
XM	-.14946890 06	YM	-.33986486 06	ZM	-.14146122 06	DXM	.89120139 00	DYM	-.34517322 00	DZM	-.24251797 00
XT	-.14946890 06	YT	-.33986486 06	ZT	-.14146122 06	DXT	.89120139 00	DYT	-.34517322 00	DZT	-.24251797 00
RS	.14911219 09	VS	.29876244 02	RM	.39731644 06	VM	.98600174 00	RT	.39731644 06	VT	.98600174 00
GED	-.26346438 02	ALT	.20465983 06	LOS	.22671365 03	RAS	.18609115 01	RAM	.24626062 03	LOM	.11111336 03
DUT	.36000000 02	DT	.19200000 04	DR	.16174985 01	SHA	.20821021 06	DES	.80692964 00	DEM	-.20857300 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14904579 09	Y	-.50291102 07	Z	-.21931119 07	DX	.67637505 00	DY	-.28919607 02	DZ	-.12535747 02
R	.14914674 09	LAT	-.84252944 00	LON	.18193254 03	V	.31526911 02	PTH	.87883616 00	AZ	.11342103 03
XE	-.14901877 09	YE	-.48416838 07	ZE	-.20999656 07	DXE	.55824361 00	DYE	-.27405461 02	DZE	-.11883563 02
XT	-.14916824 09	YT	-.51815486 07	ZT	-.22414268 07	DXT	.14494450 01	DYT	-.27750634 02	DZT	-.12126081 02
LTE	-.80692964 00	LOE	.18186091 03	LTT	-.86035196 00	LOT	.18198944 03	RST	.14927503 09	VST	.30318977 02
EPS	.80536822 02	ESP	.79129368-01	SEP	.99383190 02	EPM	.14886405 03	EMP	.15940618 02	MEP	.15195332 02
MPS	.12953736 03	MSP	.59757735-01	SMP	.50403015 02	SEM	.11412631 03	EMS	.65734513 02	ESM	.13935676 00
RPM	.20140547 06	SPN	.78804930 02								
GCE	.79141809 02	GCT	.25010876 03	SIP	.12904357 03	CPT	.10321494 03	SIN	.10272114 03	D1	.25855521 00
REP	.21103383 06	VEP	.16528573 01	CPE	.79809256 02	CPS	.93009936 02	D2	.16589434 00	D3	.18432621-02

1 DAYS 0 HRS. 10 MIN. 12.000 SEC. 23571207677020200000000 J.D.= 2438842.41666666 MARCH 22,1965 22 00 00.000
TFL 1 DAYS 0 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.26593571 05	Y	-.19282715 06	Z	-.95469063 05	DX	.12182128 00	DY	-.14864890 01	DZ	-.63841092 00
R	.21680376 06	DEC	-.26126077 02	RA	.26214764 03	V	.16223620 01	PTH	.78234415 02	AZ	.78151675 02
R	.21680376 06	LAT	-.26126077 02	LON	.11195932 03	VE	.13961310 02	PTE	.65322656 01	AZE	.27028057 03
XS	.14901672 09	YS	.49403463 07	ZS	.21427477 07	DXS	-.57967700 00	DYS	.27404852 02	DZS	.11883298 02
XM	-.14625447 06	YM	-.34109322 06	ZM	-.14232834 06	DXM	.89457538 00	DYM	-.33724596 00	DZM	-.23921430 00
XT	-.14625447 06	YT	-.34109322 06	ZT	-.14232834 06	DXT	.89457538 00	DYT	-.33724596 00	DZT	-.23921430 00
RS	.14911399 09	VS	.29875988 02	RM	.39748247 06	VM	.98550668 00	RT	.39748247 06	VT	.98550668 00
GED	-.26280243 02	ALT	.21042974 06	LOS	.21171051 03	RAS	.18988314 01	RAM	.24679123 03	LOM	.96602909 02
DUT	.36000000 02	DT	.19200000 04	DR	.15882763 01	SHA	.21406742 06	DES	.82336051 00	DEM	-.20981992 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14904331 09	Y	-.51331734 07	Z	-.22382168 07	DX	.70149828 00	DY	-.28891341 02	DZ	-.12521708 02
R	.14914848 09	LAT	-.85984909 00	LON	.18197253 03	V	.31495950 02	PTH	.87548937 00	AZ	.11341746 03
XE	-.14901672 09	YE	-.49403463 07	ZE	-.21427477 07	DXE	.57967700 00	DYE	-.27404852 02	DZE	-.11883298 02
XT	-.14916298 09	YT	-.52814395 07	ZT	-.22850760 07	DXT	.14742524 01	DYT	-.27742098 02	DZT	-.12122512 02
LTE	-.82336051 00	LOE	.18189883 03	LTT	-.87711410 00	LOT	.18202784 03	RST	.14927394 09	VST	.30310934 02
EPS	.80805061 02	ESP	.81864005-01	SEP	.99112703 02	EPM	.14843692 03	EMP	.16589016 02	MEP	.14974061 02
MPS	.12971956 03	MSP	.57674939-01	SMP	.50222505 02	SEM	.11365876 03	EMS	.66201496 02	ESM	.13970734 00
RPM	.19620742 06	SPN	.79119274 02								
GCE	.79052780 02	GCT	.25005360 03	SIP	.12921269 03	CPT	.10321472 03	SIN	.10270785 03	D1	.26540555 00
REP	.21680376 06	VEP	.16223620 01	CPE	.79697448 02	CPS	.92999493 02	D2	.17096428 00	D3	.19547208-02

1 DAYS 1 HRS. 10 MIN. 12.000 SEC. 23571210057420200000000 J.D.= 2438842.45833333 MARCH 22,1965 23 00 00.000
TFL 1 DAYS 1 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.26148935 05	Y	-.19813087 06	Z	-.97743680 05	DX	.12513591 00	DY	-.14602445 01	DZ	-.62538426 00
R	.22247120 06	DEC	-.26062690 02	RA	.26248165 03	V	.15934486 01	PTH	.78334887 02	AZ	.77985632 02
R	.22247120 06	LAT	-.26062692 02	LON	.97252274 02	VE	.14343395 02	PTE	.62460516 01	AZE	.27026949 03
XS	.14901459 09	YS	.50390067 07	ZS	.21855289 07	DXS	-.60111027 00	DYS	.27404229 02	DZS	.11883026 02
XM	-.14302803 06	YM	-.34229301 06	ZM	-.14318354 06	DXM	.89787145 00	DYM	-.32930027 00	DZM	-.23589469 00
XT	-.14302803 06	YT	-.34229301 06	ZT	-.14318354 06	DXT	.89787145 00	DYT	-.32930027 00	DZT	-.23589469 00
RS	.14911578 09	VS	.29875733 02	RM	.39764689 06	VM	.98501680 00	RT	.39764689 06	VT	.98501680 00
GED	-.26216594 02	ALT	.21609716 06	LOS	.19670736 03	RAS	.19367513 01	RAM	.24732225 03	LOM	.82092863 02
DUT	.36000000 02	DT	.19200000 04	DR	.15605377 01	SHA	.21981753 06	DES	.83979053 00	DEM	-.21104931 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14904074 09	Y	-.52371375 07	Z	-.22832726 07	DX	.72624618 00	DY	-.28864473 02	DZ	-.12508410 02
R	.14915020 09	LAT	-.87714911 00	LON	.18201249 03	V	.31466579 02	PTH	.87275644 00	AZ	.11341409 03
XE	-.14901459 09	YE	-.50390067 07	ZE	-.21855289 07	DXE	.60111027 00	DYE	-.27404229 02	DZE	-.11883026 02
XT	-.14915762 09	YT	-.53812997 07	ZT	-.23287124 07	DXT	.14989817 01	DYT	-.27733529 02	DZT	-.12118921 02
LTE	-.83979053 00	LOE	.18193675 03	LTT	-.89387111 00	LOT	.18206622 03	RST	.14927283 09	VST	.30302868 02
EPS	.81057125 02	ESP	.84220286-01	SEP	.98858430 02	EPM	.14803050 03	EMP	.17230759 02	MEP	.14738735 02
MPS	.12989544 03	MSP	.55952909-01	SMP	.50048292 02	SEM	.11319165 03	EMS	.66668051 02	ESM	.13988231 00
RPM	.19107126 06	SPN	.79414295 02								
GCE	.78968295 02	GCT	.25000105 03	SIP	.12937494 03	CPT	.10321394 03	SIN	.10269344 03	D1	.27254046 00
REP	.22247120 06	VEP	.15934486 01	CPE	.79591626 02	CPS	.92989055 02	D2	.17622963 00	D3	.20740096-02

1 DAYS 2 HRS. 10 MIN. 12.000 SEC. 23571210240020200000000 J.D.= 2438842.50000000 MARCH 23,1965 00 00 00.000
TFL 1 DAYS 2 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.25692979 05	Y	-.20334247 06	Z	-.99972640 05	DX	.12811548 00	DY	-.14352902 01	DZ	-.61303509 00
R	.22804127 06	DEC	-.26001657 02	RA	.26279865 03	V	.15659769 01	PTH	.78429561 02	AZ	.77825555 02
R	.22804126 06	LAT	-.26001658 02	LON	.82528149 02	VE	.14719154 02	PTE	.59827155 01	AZE	.27025925 03
XS	.14901239 09	YS	.51376656 07	ZS	.22283093 07	DXS	-.62254357 00	DYS	.27403592 02	DZS	.11882748 02
XM	-.13978986 06	YM	-.34346417 06	ZM	-.14402676 06	DXM	.90108958 00	DYM	-.32133682 00	DZM	-.23255948 00
XT	-.13978986 06	YT	-.34346417 06	ZT	-.14402676 06	DXT	.90108958 00	DYT	-.32133682 00	DZT	-.23255948 00
RS	.14911758 09	VS	.29875477 02	RM	.39780969 06	VM	.98453221 00	RT	.39780969 06	VT	.98453221 00
GED	-.26155306 02	ALT	.22166721 06	LOS	.18170417 03	RAS	.19746700 01	RAM	.24785368 03	LOM	.67583174 02
DUT	.36000000 02	DT	.19200000 04	DR	.15341545 01	SHA	.22546598 06	DES	.85621970 00	DEM	-.21226109 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14903809 09	Y	-.53410080 07	Z	-.23282819 07	DX	.75065905 00	DY	-.28838882 02	DZ	-.12495783 02
R	.14915193 09	LAT	-.89443034 00	LON	.18205240 03	V	.31438658 02	PTH	.87057164 00	AZ	.11341091 03
XE	-.14901239 09	YE	-.51376656 07	ZE	-.22283093 07	DXE	.62254357 00	DYE	-.27403592 02	DZE	-.11882748 02
XT	-.14915218 09	YT	-.54811297 07	ZT	-.23723360 07	DXT	.15236331 01	DYT	-.27724929 02	DZT	-.12115307 02
LTE	-.85621970 00	LOE	.18197467 03	LTT	-.91062472 00	LOT	.18210459 03	RST	.14927171 09	VST	.30294782 02
EPS	.81294464 02	ESP	.86512414-01	SEP	.98618923 02	EPM	.14764345 03	EMP	.17865968 02	MEP	.14490583 02
MPS	.13006513 03	MSP	.55071707-01	SMP	.49880229 02	SEM	.11272497 03	EMS	.67134183 02	ESM	.14075386 00
RPM	.18599181 06	SPN	.79691770 02								
GCE	.78887930 02	GCT	.24995100 03	SIP	.12953041 03	CPT	.10321267 03	SIN	.10267796 03	D1	.27998419 00
REP	.22804127 06	VEP	.15659769 01	CPE	.79491236 02	CPS	.92978624 02	D2	.18170721 00	D3	.22019240-02

1 DAYS 3 HRS. 10 MIN. 12.000 SEC. 23571210420420200000000 J.D.= 2438842.54166666 MARCH 23,1965 01 00 00.000
TFL 1 DAYS 3 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.25226853 05	Y	-.20846639 06	Z	-.10215827 06	DX	.13079405 00	DY	-.14115191 01	DZ	-.60130406 00
R	.23351861 06	DEC	-.25942812 02	RA	.26310009 03	V	.15398245 01	PTH	.78519088 02	AZ	.77670609 02
R	.23351861 06	LAT	-.25942812 02	LON	.67788521 02	VE	.15088877 02	PTE	.57396537 01	AZE	.27024976 03
XS	.14901011 09	YS	.52363200 07	ZS	.22710877 07	DXS	-.64397622 00	DYS	.27402942 02	DZS	.11882464 02
XM	-.13654026 06	YM	-.34460663 06	ZM	-.14485795 06	DXM	.90422969 00	DYM	-.31335618 00	DZM	-.22920884 00
XT	-.13654026 06	YT	-.34460663 06	ZT	-.14485795 06	DXT	.90422969 00	DYT	-.31335618 00	DZT	-.22920884 00
RS	.14911938 09	VS	.29875222 02	RM	.39797085 06	VM	.98405290 00	RT	.39797085 06	VT	.98405290 00
GED	-.26096214 02	ALT	.22714453 06	LOS	.16670102 03	RAS	.20125878 01	RAM	.24838550 03	LOM	.53073929 02
DUT	.36000000 02	DT	.19200000 04	DR	.15090143 01	SHA	.23101772 06	DES	.87264802 00	DEM	-.21345523 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14903534 09	Y	-.54447863 07	Z	-.23732460 07	DX	.77477027 00	DY	-.28814461 02	DZ	-.12483768 02
R	.14915364 09	LAT	-.91169535 00	LON	.18209229 03	V	.31412065 02	PTH	.86887518 00	AZ	.11340789 03
XE	-.14901011 09	YE	-.52363200 07	ZE	-.22710877 07	DXE	.64397622 00	DYE	-.27402942 02	DZE	-.11882464 02
XT	-.14914665 09	YT	-.55809266 07	ZT	-.24159457 07	DXT	.15482059 01	DYT	-.27716298 02	DZT	-.12111673 02
LTE	-.87264802 00	LOE	.18201258 03	LTT	-.92737319 00	LOT	.18214295 03	RST	.14927058 09	VST	.30286676 02
EPS	.81518342 02	ESP	.88192423-01	SEP	.98392911 02	EPM	.14727454 03	EMP	.18494754 02	MEP	.14230699 02
MPS	.13022878 03	MSP	.52804401-01	SMP	.49718186 02	SEM	.11225873 03	EMS	.67599895 02	ESM	.14127420 00
RPM	.18096437 06	SPN	.79953253 02								
GCE	.78811313 02	GCT	.24990338 03	SIP	.12967921 03	CPT	.10321097 03	SIN	.10266140 03	D1	.28776325 00
REP	.23351861 06	VEP	.15398245 01	CPE	.79395790 02	CPS	.92968199 02	D2	.18741546 00	D3	.23393618-02

1 DAYS 4 HRS. 10 MIN. 12.000 SEC.

235712106010202000000000 J.D.= 2438842.58333334 MARCH 23,1965 02 00 00.000
TFL 1 DAYS 4 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.24751578 05	Y	-.21350671 06	Z	-.10430271 06	DX	.13320063 00	DY	-.13888365 01	DZ	-.59013908 00
R	.23890754 06	DEC	-.25885996 02	RA	.26338728 03	V	.15148839 01	PTH	.78604084 02	AZ	.77520002 02
R	.23890754 06	LAT	-.25885996 02	LON	.53034651 02	VE	.15452833 02	PTE	.55146392 01	AZE	.27024095 03
XS	.14900776 09	YS	.53349731 07	ZS	.23138657 07	DXS	-.66540901 00	DYS	.27402277 02	DZS	.11882175 02
XM	-.13327949 06	YM	-.34572032 06	ZM	-.14567705 06	DXM	.90729178 00	DYM	-.30535896 00	DZM	-.22584310 00
XT	-.13327949 06	YT	-.34572032 06	ZT	-.14567705 06	DXT	.90729178 00	DYT	-.30535896 00	DZT	-.22584310 00
RS	.14912118 09	VS	.29874966 02	RM	.39813033 06	VM	.98357897 00	RT	.39813033 06	VT	.98357897 00
GED	-.26039160 02	ALT	.23253345 06	LOS	.15169787 03	RAS	.20505056 01	RAM	.24891772 03	LOM	.38565084 02
DUT	.36000000 02	DT	.19200000 04	DR	.14850184 01	SHA	.23647731 06	DES	.88907547 00	DEM	-.21463159 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14903251 09	Y	-.55484798 07	Z	-.24181684 07	DX	.79860964 00	DY	-.28791114 02	DZ	-.12472314 02
R	.14915536 09	LAT	-.92894243 00	LON	.18213213 03	V	.31386694 02	PTH	.86761928 00	AZ	.11340501 03
XE	-.14900776 09	YE	-.53349731 07	ZE	-.23138657 07	DXE	.66540901 00	DYE	-.27402277 02	DZE	-.11882175 02
XT	-.14914103 09	YT	-.56806934 07	ZT	-.24595427 07	DXT	.15727008 01	DYT	-.27707636 02	DZT	-.12108018 02
LTE	-.88907547 00	LOE	.18205050 03	LTT	-.94411570 00	LOT	.18218131 03	RST	.14926944 09	VST	.30278549 02
EPS	.81729877 02	ESP	.90923484-01	SEP	.98179282 02	EPM	.14692271 03	EMP	.19117229 02	MEP	.13960051 02
MPS	.13038650 03	MSP	.52339155-01	SMP	.49562043 02	SEM	.11179291 03	EMS	.68065191 02	ESM	.14213722 00
RPM	.17598461 06	SPN	.80200098 02								
GCE	.78738117 02	GCT	.24985813 03	SIP	.12982138 03	CPT	.10320889 03	SIN	.10264376 03	D1	.29590675 00
REP	.23890754 06	VEP	.15148839 01	CPE	.79304863 02	CPS	.92957780 02	D2	.19337460 00	D3	.24873389-02

1 DAYS 5 HRS. 10 MIN. 12.000 SEC.

235712107614202000000000 J.D.= 2438842.62500000 MARCH 23,1965 03 00 00.000
TFL 1 DAYS 5 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.24268090 05	Y	-.21846722 06	Z	-.10640790 06	DX	.13535994 00	DY	-.13671597 01	DZ	-.57949442 00
R	.24421201 06	DEC	-.25831076 02	RA	.26366137 03	V	.14910606 01	PTH	.78685077 02	AZ	.77373020 02
R	.24421201 06	LAT	-.25831076 02	LON	.38267674 02	VE	.15811271 02	PTE	.53057635 01	AZE	.27023274 03
XS	.14900532 09	YS	.54336247 07	ZS	.23566430 07	DXS	-.68684181 00	DYS	.27401598 02	DZS	.11881879 02
XM	-.13000783 06	YM	-.34680521 06	ZM	-.14648400 06	DXM	.91027581 00	DYM	-.29734579 00	DZM	-.22246253 00
XT	-.13000783 06	YT	-.34680521 06	ZT	-.14648400 06	DXT	.91027581 00	DYT	-.29734579 00	DZT	-.22246253 00
RS	.14912298 09	VS	.29874711 02	RM	.39828815 06	VM	.98311044 00	RT	.39828815 06	VT	.98311044 00
GED	-.25984009 02	ALT	.23783790 06	LOS	.13669472 03	RAS	.20884234 01	RAM	.24945034 03	LOM	.24056637 02
DUT	.36000000 02	DT	.19200000 04	DR	.14620797 01	SHA	.24184894 06	DES	.90550207 00	DEM	-.21579014 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14902959 09	Y	-.56520918 07	Z	-.24630509 07	DX	.82220174 00	DY	-.28768758 02	DZ	-.12461373 02
R	.14915707 09	LAT	-.94617585 00	LON	.18217196 03	V	.31362449 02	PTH	.86676124 00	AZ	.11340225 03
XE	-.14900532 09	YE	-.54336247 07	ZE	-.23566430 07	DXE	.68684181 00	DYE	-.27401598 02	DZE	-.11881879 02
XT	-.14913533 09	YT	-.57804298 07	ZT	-.25031270 07	DXT	.15971176 01	DYT	-.27698944 02	DZT	-.12104341 02
LTE	-.90550207 00	LOE	.18208842 03	LTT	-.96085478 00	LOT	.18221965 03	RST	.14926829 09	VST	.30270404 02
EPS	.81930045 02	ESP	.93050637-01	SEP	.97977051 02	EPM	.14658702 03	EMP	.19733484 02	MEP	.13679485 02
MPS	.13053840 03	MSP	.49947962-01	SMP	.49411703 02	SEM	.11132751 03	EMS	.68530080 02	ESM	.14213722 00
RPM	.17104861 06	SPN	.80433501 02								
GCE	.78668056 02	GCT	.24981517 03	SIP	.12995696 03	CPT	.10320647 03	SIN	.10262504 03	D1	.30444668 00
REP	.24421201 06	VEP	.14910606 01	CPE	.79218072 02	CPS	.92947364 02	D2	.19960684 00	D3	.26470067-02

1 DAYS 6 HRS. 10 MIN. 12.000 SEC.

23571211142020200000000 J.D.= 2438842.66666666 MARCH 23,1965 04 00 00.000
TFL 1 DAYS 6 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.23777242 05	Y	-.22335139 06	Z	-.10847564 06	DX	.13729308 00	DY	-.13464148 01	DZ	-.56932966 00
R	.24943569 06	DEC	-.25777927 02	RA	.26392337 03	V	.14682706 01	PTH	.78762563 02	AZ	.77228971 02
R	.24943568 06	LAT	-.25777927 02	LON	.23488602 02	VE	.16164422 02	PTE	.51113737 01	AZE	.27022509 03
XS	.14900281 09	YS	.55322733 07	ZS	.23994190 07	DXS	-.70827430 00	DYS	.27400905 02	DZS	.11881577 02
XM	-.12672557 06	YM	-.34786120 06	ZM	-.14727876 06	DXM	.91318175 00	DYM	-.28931729 00	DZM	-.21906742 00
XT	-.12672557 06	YT	-.34786120 06	ZT	-.14727876 06	DXT	.91318175 00	DYT	-.28931729 00	DZT	-.21906742 00
RS	.14912478 09	VS	.29874456 02	RM	.39844425 06	VM	.98264740 00	RT	.39844425 06	VT	.98264740 00
GED	-.25930636 02	ALT	.24306156 06	LOS	.12169157 03	RAS	.21263407 01	RAM	.24998335 03	LOM	.95485801 01
DUT	.36000000 02	DT	.19200000 04	DR	.14401209 01	SHA	.24713652 06	DES	.92192868 00	DEM	-.21693080 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14902658 09	Y	-.57556246 07	Z	-.25078946 07	DX	.84556738 00	DY	-.28747320 02	DZ	-.12450907 02
R	.14915877 09	LAT	-.96339305 00	LON	.18221175 03	V	.31339248 02	PTH	.86626606 00	AZ	.11339961 03
XE	-.14900281 09	YE	-.55322733 07	ZE	-.23994190 07	DXE	.70827430 00	DYE	-.27400905 02	DZE	-.11881577 02
XT	-.14912953 09	YT	-.58801345 07	ZT	-.25466977 07	DXT	.16214560 01	DYT	-.27690222 02	DZT	-.12100645 02
LTE	-.92192868 00	LOE	.18212634 03	LTT	-.97758960 00	LOT	.18225799 03	RST	.14926714 09	VST	.30262239 02
EPS	.82119715 02	ESP	.95130239-01	SEP	.97785351 02	EPM	.14626663 03	EMP	.20343599 02	MEP	.13389768 02
MPS	.13068456 03	MSP	.47436387-01	SMP	.49267070 02	SEM	.11086252 03	EMS	.68994563 02	ESM	.14265252 00
RPM	.16615275 06	SPN	.80654519 02								
GCE	.78600875 02	GCT	.24977445 03	SIP	.13008600 03	CPT	.10320376 03	SIN	.10260519 03	D1	.31341848 00
REP	.24943569 06	VEP	.14682706 01	CPE	.79135089 02	CPS	.92936954 02	D2	.20613686 00	D3	.28196795-02

1 DAYS 7 HRS. 10 MIN. 12.000 SEC.

23571211322420200000000 J.D.= 2438842.70833333 MARCH 23,1965 05 00 00.000
TFL 1 DAYS 7 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.23279815 05	Y	-.22816245 06	Z	-.11050760 06	DX	.13901808 00	DY	-.13265368 01	DZ	-.55960895 00
R	.25458197 06	DEC	-.25726433 02	RA	.26417417 03	V	.14464398 01	PTH	.78837010 02	AZ	.77087198 02
R	.25458197 06	LAT	-.25726433 02	LON	.86983375 01	VE	.16512506 02	PTE	.49300424 01	AZE	.27021794 03
XS	.14900022 09	YS	.56309193 07	ZS	.24421939 07	DXS	-.72970662 00	DYS	.27400198 02	DZS	.11881270 02
XM	-.12343299 06	YM	-.34888828 06	ZM	-.14806127 06	DXM	.91600961 00	DYM	-.28127404 00	DZM	-.21565803 00
XT	-.12343299 06	YT	-.34888828 06	ZT	-.14806127 06	DXT	.91600961 00	DYT	-.28127404 00	DZT	-.21565803 00
RS	.14912658 09	VS	.29874201 02	RM	.39859864 06	VM	.98218994 00	RT	.39859864 06	VT	.98218994 00
GED	-.25878925 02	ALT	.24820784 06	LOS	.10668842 03	RAS	.21642572 01	RAM	.25051675 03	LOM	.35504091 03
DUT	.36000000 02	DT	.19200000 04	DR	.14190738 01	SHA	.25234360 06	DES	.93835443 00	DEM	-.21805350 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14902350 09	Y	-.58590817 07	Z	-.25527015 07	DX	.86872470 00	DY	-.28726735 02	DZ	-.12440879 02
R	.14916047 09	LAT	-.98059488 00	LON	.18225151 03	V	.31317015 02	PTH	.86610213 00	AZ	.11339708 03
XE	-.14900022 09	YE	-.56309193 07	ZE	-.24421939 07	DXE	.72970662 00	DYE	-.27400198 02	DZE	-.11881270 02
XT	-.14912365 09	YT	-.59798076 07	ZT	-.25902551 07	DXT	.16457162 01	DYT	-.27681472 02	DZT	-.12096928 02
LTE	-.93835443 00	LOE	.18216425 03	LTT	-.99432015 00	LOT	.18229631 03	RST	.14926597 09	VST	.30254056 02
EPS	.82299660 02	ESP	.96407213-01	SEP	.97603407 02	EPM	.14596079 03	EMP	.20947632 02	MEP	.13091570 02
MPS	.13082506 03	MSP	.44784179-01	SMP	.49128083 02	SEM	.11039794 03	EMS	.69458647 02	ESM	.14299503 00
RPM	.16129372 06	SPN	.80864089 02								
GCE	.78536348 02	GCT	.24973595 03	SIP	.13020846 03	CPT	.10320079 03	SIN	.10258420 03	D1	.32286139 00
REP	.25458197 06	VEP	.14464398 01	CPE	.79055613 02	CPS	.92926548 02	D2	.21299188 00	D3	.30068559-02

1 DAYS 8 HRS. 10 MIN. 12.000 SEC.

23571211503020200000000000 J.D.= 2438842.75000000 MARCH 23,1965 06 00 00.000
TFL 1 DAYS 8 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.22776526 05	Y	-.23290343 06	Z	-.11250532 06	DX	.14055035 00	DY	-.13074676 01	DZ	-.55030044 00
R	.25965404 06	DEC	-.25676489 02	RA	.26441458 03	V	.14255022 01	PTH	.78908874 02	AZ	.76947053 02
R	.25965404 06	LAT	-.25676489 02	LON	.35389768 03	VE	.16855728 02	PTE	.47605222 01	AZE	.27021125 03
XS	.14899755 09	YS	.57295638 07	ZS	.24849680 07	DXS	-.75113896 00	DYS	.27399478 02	DZS	.11880956 02
XM	-.12013037 06	YM	-.34988637 06	ZM	-.14883148 06	DXM	.91875936 00	DYM	-.27321666 00	DZM	-.21223464 00
XT	-.12013037 06	YT	-.34988637 06	ZT	-.14883148 06	DXT	.91875936 00	DYT	-.27321666 00	DZT	-.21223464 00
RS	.14912838 09	VS	.29873947 02	RM	.39875129 06	VM	.98173807 00	RT	.39875129 06	VT	.98173807 00
GED	-.25828769 02	ALT	.25327989 06	LOS	.91685272 02	RAS	.22021738 01	RAM	.25105054 03	LOM	.34053364 03
DUT	.36000000 02	DT	.19200000 04	DR	.13988773 01	SHA	.25747357 06	DES	.95477933 00	DEM	-.21915816 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14902033 09	Y	-.59624672 07	Z	-.25974733 07	DX	.89168930 00	DY	-.28706945 02	DZ	-.12431256 02
R	.14916218 09	LAT	-.99778391 00	LON	.18229124 03	V	.31295685 02	PTH	.86624727 00	AZ	.11339463 03
XE	-.14899755 09	YE	-.57295638 07	ZE	-.24849680 07	DXE	.75113896 00	DYE	-.27399478 02	DZE	-.11880956 02
XT	-.14911768 09	YT	-.60794502 07	ZT	-.26337994 07	DXT	.16698983 01	DYT	-.27672694 02	DZT	-.12093190 02
LTE	-.95477933 00	LOE	.18220217 03	LTT	-.10110447 01	LOT	.18233462 03	RST	.14926480 09	VST	.30245856 02
EPS	.82470571 02	ESP	.97917601-01	SEP	.97430526 02	EPM	.14566887 03	EMP	.21545644 02	MEP	.12785486 02
MPS	.13095997 03	MSP	.44784179-01	SMP	.48994673 02	SEM	.10993377 03	EMS	.69922336 02	ESM	.14350725 00
RPM	.15646843 06	SPN	.81063047 02								
GCE	.78474272 02	GCT	.24969962 03	SIP	.13032435 03	CPT	.10319760 03	SIN	.10256199 03	D1	.33281923 00
REP	.25965404 06	VEP	.14255022 01	CPE	.78979379 02	CPS	.92916147 02	D2	.22020241 00	D3	.32102598-02

1 DAYS 9 HRS. 10 MIN. 12.000 SEC.

23571211663420200000000000 J.D.= 2438842.79166666 MARCH 23,1965 07 00 00.000
TFL 1 DAYS 9 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.22268050 05	Y	-.23757713 06	Z	-.11447023 06	DX	.14190287 00	DY	-.12891556 01	DZ	-.54137579 00
R	.26465484 06	DEC	-.25628004 02	RA	.26464532 03	V	.14053989 01	PTH	.78978563 02	AZ	.76807906 02
R	.26465484 06	LAT	-.25628004 02	LON	.33908735 03	VE	.17194277 02	PTE	.46017204 01	AZE	.27020498 03
XS	.14899481 09	YS	.58282047 07	ZS	.25277406 07	DXS	-.77257086 00	DYS	.27398743 02	DZS	.11880636 02
XM	-.11681799 06	YM	-.35085544 06	ZM	-.14958935 06	DXM	.92143101 00	DYM	-.26514575 00	DZM	-.20879753 00
XT	-.11681799 06	YT	-.35085544 06	ZT	-.14958935 06	DXT	.92143101 00	DYT	-.26514575 00	DZT	-.20879753 00
RS	.14913018 09	VS	.29873692 02	RM	.39890218 06	VM	.98129189 00	RT	.39890218 06	VT	.98129189 00
GED	-.25780078 02	ALT	.25828068 06	LOS	.76682121 02	RAS	.22400898 01	RAM	.25158471 03	LOM	.32602674 03
DUT	.36000000 02	DT	.19200000 04	DR	.13794774 01	SHA	.26252952 06	DES	.97120337 00	DEM	-.22024471 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14901708 09	Y	-.60657818 07	Z	-.26422109 07	DX	.91447373 00	DY	-.28687898 02	DZ	-.12422012 02
R	.14916388 09	LAT	-.10149601 01	LON	.18233095 03	V	.31275200 02	PTH	.86667842 00	AZ	.11339226 03
XE	-.14899481 09	YE	-.58282047 07	ZE	-.25277406 07	DXE	.77257086 00	DYE	-.27398743 02	DZE	-.11880636 02
XT	-.14911163 09	YT	-.61790601 07	ZT	-.26773300 07	DXT	.16940019 01	DYT	-.27663888 02	DZT	-.12089434 02
LTE	-.97120337 00	LOE	.18224009 03	LTT	-.10277642 01	LOT	.18237293 03	RST	.14926361 09	VST	.30237638 02
EPS	.82633060 02	ESP	.10087055 00	SEP	.97266096 02	EPM	.14539027 03	EMP	.22137660 02	MEP	.12472065 02
MPS	.13108931 03	MSP	.43678226-01	SMP	.48866804 02	SEM	.10947000 03	EMS	.70385635 02	ESM	.14418738 00
RPM	.15167406 06	SPN	.81252137 02								
GCE	.78414468 02	GCT	.24966544 03	SIP	.13043361 03	CPT	.10319422 03	SIN	.10253852 03	D1	.34334091 00
REP	.26465484 06	VEP	.14053989 01	CPE	.78906149 02	CPS	.92905751 02	D2	.22780241 00	D3	.34318738-02

1 DAYS 10 HRS. 10 MIN. 12.000 SEC. 23571212044020200000000 J.D.= 2438842.83333333 MARCH 23,1965 08 00 00.000
TFL 1 DAYS 10 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.21755009 05	Y	-.24218620 06	Z	-.11640365 06	DX	.14308666 00	DY	-.12715547 01	DZ	-.53280959 00
R	.26958717 06	DEC	-.25580884 02	RA	.26486703 03	V	.13860776 01	PTH	.79046482 02	AZ	.76669104 02
R	.26958717 06	LAT	-.25580884 02	LON	.32426799 03	VE	.17528338 02	PTE	.44526805 01	AZE	.27019910 03
XS	.14899199 09	YS	.59268440 07	ZS	.25705125 07	DXS	-.79400281 00	DYS	.27397994 02	DZS	.11880311 02
XM	-.11349614 06	YM	-.35179542 06	ZM	-.15033481 06	DXM	.92402455 00	DYM	-.25706190 00	DZM	-.20534696 00
XT	-.11349614 06	YT	-.35179542 06	ZT	-.15033481 06	DXT	.92402455 00	DYT	-.25706190 00	DZT	-.20534696 00
RS	.14913198 09	VS	.29873438 02	RM	.39905130 06	VM	.98085144 00	RT	.39905130 06	VT	.98085144 00
GED	-.25732759 02	ALT	.26321299 06	LOS	.61678970 02	RAS	.22780051 01	RAM	.25211927 03	LOM	.31152023 03
DUT	.36000000 02	DT	.19200000 04	DR	.13608256 01	SHA	.26751439 06	DES	.98762656 00	DEM	-.22131310 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14901374 09	Y	-.61690301 07	Z	-.26869161 07	DX	.93708947 00	DY	-.28669548 02	DZ	-.12413120 02
R	.14916559 09	LAT	-.10321227 01	LON	.18237064 03	V	.31255507 02	PTH	.86737596 00	AZ	.11338996 03
XE	-.14899199 09	YE	-.59268440 07	ZE	-.25705125 07	DXE	.79400281 00	DYE	-.27397994 02	DZE	-.11880311 02
XT	-.14910549 09	YT	-.62786394 07	ZT	-.27208473 07	DXT	.17180273 01	DYT	-.27655056 02	DZT	-.12085658 02
LTE	-.98762656 00	LOE	.18227800 03	LTT	-.10444802 01	LOT	.18241123 03	RST	.14926242 09	VST	.30229403 02
EPS	.82787682 02	ESP	.10326686 00	SEP	.97109560 02	EPM	.14512448 03	EMP	.22723717 02	MEP	.12151796 02
MPS	.13121313 03	MSP	.41964682-01	SMP	.48744442 02	SEM	.10900662 03	EMS	.70848551 02	ESM	.14520161 00
RPM	.14690792 06	SPN	.81432030 02								
GCE	.78356769 02	GCT	.24963340 03	SIP	.13053615 03	CPT	.10319067 03	SIN	.10251369 03	D1	.35448146 00
REP	.26958717 06	VEP	.13860776 01	CPE	.78835709 02	CPS	.92895358 02	D2	.23583014 00	D3	.36739962-02

1 DAYS 11 HRS. 10 MIN. 12.000 SEC. 23571212224420200000000 J.D.= 2438842.87500000 MARCH 23,1965 09 00 00.000
TFL 1 DAYS 11 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.21238003 05	Y	-.24673312 06	Z	-.11830685 06	DX	.14411078 00	DY	-.12546240 01	DZ	-.52457924 00
R	.27445363 06	DEC	-.25535051 02	RA	.26508028 03	V	.13674914 01	PTH	.79113031 02	AZ	.76529986 02
R	.27445362 06	LAT	-.25535052 02	LON	.30944019 03	VE	.17858080 02	PTE	.43125566 01	AZE	.27019357 03
XS	.14898910 09	YS	.60254780 07	ZS	.26132821 07	DXS	-.81543395 00	DYS	.27397231 02	DZS	.11879979 02
XM	-.11016509 06	YM	-.35270627 06	ZM	-.15106782 06	DXM	.92653996 00	DYM	-.24896573 00	DZM	-.20188322 00
XT	-.11016509 06	YT	-.35270627 06	ZT	-.15106782 06	DXT	.92653996 00	DYT	-.24896573 00	DZT	-.20188322 00
RS	.14913378 09	VS	.29873184 02	RM	.39919863 06	VM	.98041677 00	RT	.39919863 06	VT	.98041677 00
GED	-.25686731 02	ALT	.26807944 06	LOS	.46675819 02	RAS	.23159199 01	RAM	.25265420 03	LOM	.29701410 03
DUT	.36000000 02	DT	.19200000 04	DR	.13428789 01	SHA	.27243093 06	DES	.10040480 01	DEM	-.22236325 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14901033 09	Y	-.62722111 07	Z	-.27315890 07	DX	.95954473 00	DY	-.28651855 02	DZ	-.12404558 02
R	.14916729 09	LAT	-.10492724 01	LON	.18241030 03	V	.31236558 02	PTH	.86832877 00	AZ	.11338773 03
XE	-.14898910 09	YE	-.60254780 07	ZE	-.26132821 07	DXE	.81543395 00	DYE	-.27397231 02	DZE	-.11879979 02
XT	-.14909926 09	YT	-.63781843 07	ZT	-.27643500 07	DXT	.17419739 01	DYT	-.27646197 02	DZT	-.12081862 02
LTE	-.10040480 01	LOE	.18231592 03	LTT	-.10611903 01	LOT	.18244951 03	RST	.14926122 09	VST	.30221152 02
EPS	.82934934 02	ESP	.10420996 00	SEP	.96960420 02	EPM	.14487107 03	EMP	.23303810 02	MEP	.11825107 02
MPS	.13133143 03	MSP	.38941577-01	SMP	.48627582 02	SEM	.10854363 03	EMS	.71311086 02	ESM	.14520161 00
RPM	.14216756 06	SPN	.81603324 02								
GCE	.78301032 02	GCT	.24960349 03	SIP	.13063188 03	CPT	.10318698 03	SIN	.10248742 03	D1	.36630284 00
REP	.27445363 06	VEP	.13674914 01	CPE	.78767866 02	CPS	.92884970 02	D2	.24432863 00	D3	.39392954-02

1 DAYS 12 HRS. 10 MIN. 12.000 SEC.

235712124050202000000000 J.D.= 2438842.91666666 MARCH 23,1965 10 00 00.000
TFL 1 DAYS 12 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.20717581 05	Y	-.25122025 06	Z	-.12018100 06	DX	.14498269 00	DY	-.12383271 01	DZ	-.51666445 00
R	.27925671 06	DEC	-.25490429 02	RA	.26528561 03	V	.13495985 01	PTH	.79178625 02	AZ	.76389866 02
R	.27925670 06	LAT	-.25490430 02	LON	.29460444 03	VE	.18183669 02	PTE	.41806008 01	AZE	.27018838 03
XS	.14898612 09	YS	.61241104 07	ZS	.26560510 07	DXS	-.83686511 00	DYS	.27396454 02	DZS	.11879642 02
XM	-.10682513 06	YM	-.35358797 06	ZM	-.15178835 06	DXM	.92897727 00	DYM	-.24085780 00	DZM	-.19840657 00
XT	-.10682513 06	YT	-.35358797 06	ZT	-.15178835 06	DXT	.92897727 00	DYT	-.24085780 00	DZT	-.19840657 00
RS	.14913559 09	VS	.29872929 02	RM	.39934416 06	VM	.97998796 00	RT	.39934416 06	VT	.97998796 00
GED	-.25641918 02	ALT	.27288250 06	LOS	.31672664 02	RAS	.23538343 01	RAM	.25318951 03	LOM	.28250834 03
DUT	.36000000 02	DT	.19200000 04	DR	.13255990 01	SHA	.27728174 06	DES	.10204712 01	DEM	-.22339510 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14900684 09	Y	-.63753307 07	Z	-.27762320 07	DX	.98184779 00	DY	-.28634781 02	DZ	-.12396306 02
R	.14916900 09	LAT	-.10664111 01	LON	.18244993 03	V	.31218313 02	PTH	.86952235 00	AZ	.11338555 03
XE	-.14898612 09	YE	-.61241104 07	ZE	-.26560510 07	DXE	.83686511 00	DYE	-.27396454 02	DZE	-.11879642 02
XT	-.14909294 09	YT	-.64776984 07	ZT	-.28078394 07	DXT	.17658424 01	DYT	-.27637311 02	DZT	-.12078048 02
LTE	-.10204712 01	LOE	.18235383 03	LTT	-.10778952 01	LOT	.18248779 03	RST	.14926001 09	VST	.30212885 02
EPS	.83075266 02	ESP	.10698938 00	SEP	.96818227 02	EPM	.14462966 03	EMP	.23877930 02	MEP	.11492412 02
MPS	.13144421 03	MSP	.38941577-01	SMP	.48516234 02	SEM	.10808102 03	EMS	.71773248 02	ESM	.14520161 00
RPM	.13745065 06	SPN	.81766562 02								
GCE	.78247117 02	GCT	.24957571 03	SIP	.13072065 03	CPT	.10318315 03	SIN	.10245959 03	D1	.37887527 00
REP	.27925671 06	VEP	.13495985 01	CPE	.78702439 02	CPS	.92874584 02	D2	.25334666 00	D3	.42308899-02

1 DAYS 13 HRS. 10 MIN. 12.000 SEC.

235712125654202000000000 J.D.= 2438842.95833333 MARCH 23,1965 11 00 00.000
TFL 1 DAYS 13 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.20194285 05	Y	-.25564980 06	Z	-.12202719 06	DX	.14570817 00	DY	-.12226317 01	DZ	-.50904709 00
R	.28399871 06	DEC	-.25446948 02	RA	.26548347 03	V	.13323618 01	PTH	.79243666 02	AZ	.76248001 02
R	.28399871 06	LAT	-.25446948 02	LON	.27976123 03	VE	.18505260 02	PTE	.40561488 01	AZE	.27018348 03
XS	.14898307 09	YS	.62227413 07	ZS	.26988193 07	DXS	-.85829630 00	DYS	.27395663 02	DZS	.11879298 02
XM	-.10347652 06	YM	-.35444044 06	ZM	-.15249634 06	DXM	.93133647 00	DYM	-.23273871 00	DZM	-.19491728 00
XT	-.10347652 06	YT	-.35444044 06	ZT	-.15249634 06	DXT	.93133647 00	DYT	-.23273871 00	DZT	-.19491728 00
RS	.14913739 09	VS	.29872676 02	RM	.39948786 06	VM	.97956503 00	RT	.39948786 06	VT	.97956503 00
GED	-.25598251 02	ALT	.27762449 06	LOS	.16669510 02	RAS	.23917482 01	RAM	.25372518 03	LOM	.26800294 03
DUT	.36000000 02	DT	.19200000 04	DR	.13089519 01	SHA	.28206924 06	DES	.10368919 01	DEM	-.22440859 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14900326 09	Y	-.64783911 07	Z	-.28208465 07	DX	.10040045 01	DY	-.28618295 02	DZ	-.12388345 02
R	.14917070 09	LAT	-.10835378 01	LON	.18248955 03	V	.31200736 02	PTH	.87095156 00	AZ	.11338342 03
XE	-.14898307 09	YE	-.62227413 07	ZE	-.26988193 07	DXE	.85829630 00	DYE	-.27395663 02	DZE	-.11879298 02
XT	-.14908654 09	YT	-.65771817 07	ZT	-.28513156 07	DXT	.17896328 01	DYT	-.27628402 02	DZT	-.12074215 02
LTE	-.10368919 01	LOE	.18239175 03	LTT	-.10945967 01	LOT	.18252605 03	RST	.14925879 09	VST	.30204603 02
EPS	.83209077 02	ESP	.10880289 00	SEP	.96682578 02	EPM	.14439992 03	EMP	.24446042 02	MEP	.11154040 02
MPS	.13155143 03	MSP	.38941577-01	SMP	.48410428 02	SEM	.10761880 03	EMS	.72235042 02	ESM	.14654299 00
RPM	.13275500 06	SPN	.81922229 02								
GCE	.78194907 02	GCT	.24955010 03	SIP	.13080228 03	CPT	.10317921 03	SIN	.10243006 03	D1	.39227864 00
REP	.28399871 06	VEP	.13323618 01	CPE	.78639275 02	CPS	.92864203 02	D2	.26293969 00	D3	.45524409-02

1 DAYS 14 HRS. 10 MIN. 12.000 SEC.

23571212746020200000000 J.D.= 2438843.00000000 MARCH 23,1965 12 00 00.000
TFL 1 DAYS 14 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.19668636 05	Y	-.26002389 06	Z	-.12384648 06	DX	.14629151 00	DY	-.12075093 01	DZ	-.50171101 00
R	.28868188 06	DEC	-.25404543 02	RA	.26567429 03	V	.13157484 01	PTH	.79308578 02	AZ	.76103599 02
R	.28868187 06	LAT	-.25404543 02	LON	.26491098 03	VE	.18823002 02	PTE	.39386132 01	AZE	.27017887 03
XS	.14897994 09	YS	.63213685 07	ZS	.27415860 07	DXS	-.87972701 00	DYS	.27394858 02	DZS	.11878949 02
XM	-.10011957 06	YM	-.35526368 06	ZM	-.15319174 06	DXM	.93361758 00	DYM	-.22460905 00	DZM	-.19141562 00
XT	-.10011957 06	YT	-.35526368 06	ZT	-.15319174 06	DXT	.93361758 00	DYT	-.22460905 00	DZT	-.19141562 00
RS	.14913919 09	VS	.29872422 02	RM	.39962972 06	VM	.97914807 00	RT	.39962972 06	VT	.97914807 00
GED	-.25555665 02	ALT	.28230764 06	LOS	.16663539 01	RAS	.24296618 01	RAM	.25426122 03	LOM	.25349791 03
DUT	.36000000 02	DT	.19200000 04	DR	.12929078 01	SHA	.28679577 06	DES	.10533116 01	DEM	-.22540364 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14899961 09	Y	-.65813924 07	Z	-.28654325 07	DX	.10260185 01	DY	-.28602368 02	DZ	-.12380660 02
R	.14917241 09	LAT	-.11006534 01	LON	.18252914 03	V	.31183792 02	PTH	.87260703 00	AZ	.11338134 03
XE	-.14897994 09	YE	-.63213685 07	ZE	-.27415860 07	DXE	.87972701 00	DYE	-.27394858 02	DZE	-.11878949 02
XT	-.14908006 09	YT	-.66766322 07	ZT	-.28947777 07	DXT	.18133446 01	DYT	-.27619467 02	DZT	-.12070364 02
LTE	-.10533116 01	LOE	.18242966 03	LTT	-.11112923 01	LOT	.18256431 03	RST	.14925756 09	VST	.30196306 02
EPS	.83336735 02	ESP	.11014343 00	SEP	.96553108 02	EPM	.14418159 03	EMP	.25008079 02	MEP	.10810324 02
MPS	.13165304 03	MSP	.35663121-01	SMP	.48310214 02	SEM	.10715695 03	EMS	.72696471 02	ESM	.14654299 00
RPM	.12807855 06	SPN	.82070766 02								
GCE	.78144286 02	GCT	.24952666 03	SIP	.13087653 03	CPT	.10317517 03	SIN	.10239867 03	D1	.40660426 00
REP	.28868188 06	VEP	.13157484 01	CPE	.78578225 02	CPS	.92853824 02	D2	.27317109 00	D3	.49082714-02

1 DAYS 15 HRS. 10 MIN. 12.000 SEC.

23571213126420200000000 J.D.= 2438843.04166666 MARCH 23,1965 13 00 00.000
TFL 1 DAYS 15 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.19141135 05	Y	-.26434453 06	Z	-.12563983 06	DX	.14673549 00	DY	-.11929352 01	DZ	-.49464181 00
R	.29330833 06	DEC	-.25363154 02	RA	.26585845 03	V	.12997292 01	PTH	.79373797 02	AZ	.75955781 02
R	.29330833 06	LAT	-.25363154 02	LON	.25005407 03	VE	.19137040 02	PTE	.38274672 01	AZE	.27017452 03
XS	.14897673 09	YS	.64199924 07	ZS	.27843513 07	DXS	-.90115742 00	DYS	.27394040 02	DZS	.11878593 02
XM	-.96754549 05	YM	-.35605762 06	ZM	-.15387452 06	DXM	.93582061 00	DYM	-.21646941 00	DZM	-.18790185 00
XT	-.96754549 05	YT	-.35605762 06	ZT	-.15387452 06	DXT	.93582061 00	DYT	-.21646941 00	DZT	-.18790185 00
RS	.14914099 09	VS	.29872168 02	RM	.39976973 06	VM	.97873710 00	RT	.39976973 06	VT	.97873710 00
GED	-.25514098 02	ALT	.28693409 06	LOS	.34666320 03	RAS	.24675753 01	RAM	.25479762 03	LOM	.23899324 03
DUT	.36000000 02	DT	.19200000 04	DR	.12774404 01	SHA	.29146355 06	DES	.10697314 01	DEM	-.22638020 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14899587 09	Y	-.66843370 07	Z	-.29099911 07	DX	.10478929 01	DY	-.28586974 02	DZ	-.12373235 02
R	.14917412 09	LAT	-.11177587 01	LON	.18256871 03	V	.31167453 02	PTH	.87448704 00	AZ	.11337929 03
XE	-.14897673 09	YE	-.64199924 07	ZE	-.27843513 07	DXE	.90115742 00	DYE	-.27394040 02	DZE	-.11878593 02
XT	-.14907349 09	YT	-.67760500 07	ZT	-.29382258 07	DXT	.18369780 01	DYT	-.27610509 02	DZT	-.12066495 02
LTE	-.10697314 01	LOE	.18246757 03	LTT	-.11279835 01	LOT	.18260255 03	RST	.14925633 09	VST	.30187994 02
EPS	.83458567 02	ESP	.11234211 00	SEP	.96429483 02	EPM	.14397447 03	EMP	.25563965 02	MEP	.10461560 02
MPS	.13174897 03	MSP	.34970568-01	SMP	.48215674 02	SEM	.10669546 03	EMS	.73157541 02	ESM	.14687642 00
RPM	.12341933 06	SPN	.82212571 02								
GCE	.78095154 02	GCT	.24950545 03	SIP	.13094315 03	CPT	.10317104 03	SIN	.10236522 03	D1	.42195702 00
REP	.29330833 06	VEP	.12997292 01	CPE	.78519156 02	CPS	.92843449 02	D2	.28411363 00	D3	.53035139-02

1 DAYS 16 HRS. 10 MIN. 12.000 SEC.

235712133070202000000000 J.D.= 2438843.08333333 MARCH 23,1965 14 00 00.000
TFL 1 DAYS 16 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.18612285 05	Y	-.26861366 06	Z	-.12740820 06	DX	.14704141 00	DY	-.11788878 01	DZ	-.48782675 00
R	.29788011 06	DEC	-.25322723 02	RA	.26603629 03	V	.12842790 01	PTH	.79439808 02	AZ	.75803568 02
R	.29788011 06	LAT	-.25322723 02	LON	.23519085 03	VE	.19447512 02	PTE	.37222430 01	AZE	.27017042 03
XS	.14897345 09	YS	.65186150 07	ZS	.28271159 07	DXS	-.92258788 00	DYS	.27393206 02	DZS	.11878231 02
XM	-.93381730 05	YM	-.35682225 06	ZM	-.15454462 06	DXM	.93794557 00	DYM	-.20832036 00	DZM	-.18437625 00
XT	-.93381730 05	YT	-.35682225 06	ZT	-.15454462 06	DXT	.93794557 00	DYT	-.20832036 00	DZT	-.18437625 00
RS	.14914280 09	VS	.29871915 02	RM	.39990786 06	VM	.97833218 00	RT	.39990786 06	VT	.97833218 00
GED	-.25473493 02	ALT	.29150585 06	LOS	.33166004 03	RAS	.25054892 01	RAM	.25533438 03	LOM	.22448894 03
DUT	.36000000 02	DT	.19200000 04	DR	.12625271 01	SHA	.29607468 06	DES	.10861503 01	DEM	-.22733822 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14899206 09	Y	-.67872287 07	Z	-.29545241 07	DX	.10696293 01	DY	-.28572094 02	DZ	-.12366058 02
R	.14917584 09	LAT	-.11348538 01	LON	.18260827 03	V	.31151694 02	PTH	.87659245 00	AZ	.11337728 03
XE	-.14897345 09	YE	-.65186150 07	ZE	-.28271159 07	DXE	.92258788 00	DYE	-.27393206 02	DZE	-.11878231 02
XT	-.14906683 09	YT	-.68754373 07	ZT	-.29816605 07	DXT	.18605334 01	DYT	-.27601526 02	DZT	-.12062608 02
LTE	-.10861503 01	LOE	.18250549 03	LTT	-.11446705 01	LOT	.18264079 03	RST	.14925509 09	VST	.30179667 02
EPS	.83574872 02	ESP	.11407056 00	SEP	.96311408 02	EPM	.14377841 03	EMP	.26113578 02	MEP	.10108006 02
MPS	.13183910 03	MSP	.34970568-01	SMP	.48126926 02	SEM	.10623434 03	EMS	.73618260 02	ESM	.14770671 00
RPM	.11877547 06	SPN	.82348003 02								
GCE	.78047417 02	GCT	.24948652 03	SIP	.13100177 03	CPT	.10316684 03	SIN	.10232951 03	D1	.43845807 00
REP	.29788011 06	VEP	.12842790 01	CPE	.78461946 02	CPS	.92833077 02	D2	.29585130 00	D3	.57442997-02

1 DAYS 17 HRS. 10 MIN. 12.000 SEC.

235712134674202000000000 J.D.= 2438843.12500000 MARCH 23,1965 15 00 00.000
TFL 1 DAYS 17 HRS. 22 MIN. 56.544 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.18082584 05	Y	-.27283313 06	Z	-.12915248 06	DX	.14720894 00	DY	-.11653491 01	DZ	-.48125468 00
R	.30239917 06	DEC	-.25283195 02	RA	.26620814 03	V	.12693758 01	PTH	.79507118 02	AZ	.75645866 02
R	.30239917 06	LAT	-.25283197 02	LON	.22032164 03	VE	.19754554 02	PTE	.36225222 01	AZE	.27016656 03
XS	.14897009 09	YS	.66172332 07	ZS	.28698786 07	DXS	-.94401774 00	DYS	.27392359 02	DZS	.11877864 02
XM	-.90001406 05	YM	-.35755752 06	ZM	-.15520201 06	DXM	.93999249 00	DYM	-.20016249 00	DZM	-.18083908 00
XT	-.90001406 05	YT	-.35755752 06	ZT	-.15520201 06	DXT	.93999249 00	DYT	-.20016249 00	DZT	-.18083908 00
RS	.14914460 09	VS	.29871661 02	RM	.40004412 06	VM	.97793336 00	RT	.40004412 06	VT	.97793336 00
GED	-.25433797 02	ALT	.29602490 06	LOS	.31665689 03	RAS	.25434010 01	RAM	.25587149 03	LOM	.20998498 03
DUT	.36000000 02	DT	.19200000 04	DR	.12481488 01	SHA	.30063122 06	DES	.11025667 01	DEM	-.22827763 02

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14898817 09	Y	-.68900663 07	Z	-.29990311 07	DX	.10912267 01	DY	-.28557708 02	DZ	-.12359118 02
R	.14917755 09	LAT	-.11519379 01	LON	.18264780 03	V	.31136494 02	PTH	.87892324 00	AZ	.11337529 03
XE	-.14897009 09	YE	-.66172332 07	ZE	-.28698786 07	DXE	.94401774 00	DYE	-.27392359 02	DZE	-.11877864 02
XT	-.14906009 09	YT	-.69747906 07	ZT	-.30250806 07	DXT	.18840102 01	DYT	-.27592521 02	DZT	-.12058703 02
LTE	-.11025667 01	LOE	.18254340 03	LTT	-.11613516 01	LOT	.18267901 03	RST	.14925384 09	VST	.30171328 02
EPS	.83685917 02	ESP	.11577320 00	SEP	.96198614 02	EPM	.14359334 03	EMP	.26656763 02	MEP	.97498942 01
MPS	.13192328 03	MSP	.33542591-01	SMP	.48044109 02	SEM	.10577358 03	EMS	.74078631 02	ESM	.14820265 00
RPM	.11414516 06	SPN	.82477384 02								
GCE	.78000986 02	GCT	.24946993 03	SIP	.13105198 03	CPT	.10316255 03	SIN	.10229125 03	D1	.45624819 00
REP	.30239917 06	VEP	.12693758 01	CPE	.78406482 02	CPS	.92822709 02	D2	.30848170 00	D3	.62380099-02

2 DAYS 16 HRS. 37 MIN. 6.517 SEC.

23571220605320250212357 6 J.D.= 2438844.10201986 MARCH 24,1965 14 26 54.517
TFL 2 DAYS 16 HRS. 49 MIN. 51.061 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.90894637 04	Y	-.36480537 06	Z	-.16609020 06	DX	-.41011553 00	DY	-.21492535 01	DZ	-.88433412 00
R	.40093830 06	DEC	-.24472331 02	RA	.26857271 03	V	.23599856 01	PTH	.81041479 02	AZ	.28408032 03
R	.40093830 06	LAT	-.24472331 02	LON	.22999604 03	VE	.27067459 02	PTE	.49407453 01	AZE	.27018996 03
XS	.14886919 09	YS	.89286958 07	ZS	.38721745 07	DXS	-.14464031 01	DYS	.27368449 02	DZS	.11867519 02
XM	-.92665783 04	YM	-.36633798 06	ZM	-.16688552 06	DXM	.96571983 00	DYM	-.77126914-02	DZM	-.95217233-01
XT	-.92665783 04	YT	-.36633798 06	ZT	-.16688552 06	DXT	.96571983 00	DYT	-.77126914-02	DZT	-.95217233-01
RS	.14918696 09	VS	.29865734 02	RM	.40266632 06	VM	.97043320 00	RT	.40266632 06	VT	.97043320 00
GED	-.24619376 02	ALT	.39456380 06	LOS	.32485563 03	RAS	.34323053 01	RAM	.26855099 03	LOM	.22997433 03
DUT	.36000000 02	DT	.59999999 02	DR	.23311970 01	SHA	.39938888 06	DES	.14872882 01	DEM	-.24484759 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14887828 09	Y	-.92935012 07	Z	-.40382647 07	DX	.10362876 01	DY	-.29517703 02	DZ	-.12751853 02
R	.14922271 09	LAT	-.15507261 01	LON	.18357196 03	V	.32171080 02	PTH	.20477325 01	AZ	.11331631 03
XE	-.14886919 09	YE	-.89286958 07	ZE	-.38721745 07	DXE	.14464031 01	DYE	-.27368449 02	DZE	-.11867519 02
XT	-.14887845 09	YT	-.92950338 07	ZT	-.40390600 07	DXT	.24121230 01	DYT	-.27376162 02	DZT	-.11962736 02
LTE	-.14872882 01	LOE	.18343230 03	LTT	-.15510292 01	LOT	.18357255 03	RST	.14922301 09	VST	.29972982 02
EPS	.84807891 02	ESP	.15371151 00	SEP	.95038757 02	EPM	.17457600 03	EMP	.54006529 01	MEP	.20982341-01
MPS	.99740988 02	MSP	.27453512-18	SMP	.80258352 02	SEM	.95058374 02	EMS	.84787615 02	ESM	.15418813 00
RPM	.17357500 04	SPN	.83896409 02								
GCE	.77098340 02	GCT	.26007865 03	SIP	.99740988 02	CPT	.99324443 02	SIN	.99324443 02	D1	.12288000 06
REP	.40093830 06	VEP	.23599856 01	CPE	.77404660 02	CPS	.92579642 02	D2	.35204175 03	D3	-.86410061 08

SPACE TRAJECTORY
RA-9 PRE-MIDCOURSE ORBIT

SELENOCENTRIC

EQUATORIAL COORDINATES

X	.17711458 03	Y	.15326163 04	Z	.79532743 03	DX	-.13758354 01	DY	-.21415409 01	DZ	-.78911690 00
R	.17357500 04	DEC	.27271271 02	RA	.83407937 02	V	.26649250 01	PTH	-.63885690 02	AZ	.72857486 02
R	.17357497 04	LAT	.41550106 01	LON	.35775125 03	VP	.26629750 01	PTP	-.63971391 02	AZP	.73875588 02
LTS	-.14809907 01	LNS	.27763133 03	LTE	.13634603 01	LNE	.23803200 01				
ALT	-.45776367-04	SHA	-.17107217 04	ALP	.67821663 00	DR	-.23928833 01	DP	.38719916-01	ASD	.90000000 02
HGE	.27519210 03	SVL	.29373091 01	HNG	.99753930 02	SIA	.84576004 02				

SELENOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 235712206271202312663176 J.D.= 2438844.10858315 MARCH 24,1965 14 36 21.585

SMA	-.33750833 04	ECC	.11182671 01	B	.16893004 04	SLR	.84553064 03	APO	.00000000 00	RCA	.39916147 03
VH	.12052557 01	C3	.14526413 01	C1	.20360392 04	TFP	-.56706786 03	TF	.64775994 02	LTF	.64689045 02
TA	-.11729887 03	MTA	.15341106 03	EA	-.46899060 02	MA	-.11602521 02	C3J	-.13446559 01	TFI	.64618476 02
ZAE	.14003939 03	ZAP	.13448327 03	ZAC	.10315465 03	DEF	.12682213 03	IR	.38378939 04	GP	.28920993 01
OP1	.51921090 01	OY	-.72148626 01	OP2	-.21945686 02						

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	.17711458 03	Y	.15326163 04	Z	.79532743 03	DX	-.13758354 01	DY	-.21415409 01	DZ	-.78911690 00
INC	.31857909 02	LAN	.27355488 02	APF	.17753923 03	MX	-.96476120 00	MY	-.24462942-01	MZ	.26198716 00
WX	.24253599 00	WY	-.46879032 00	WZ	.84935965 00	PX	-.90411066 00	PY	-.42669696 00	PZ	.22661741-01
QX	.35179555 00	QY	-.77341146 00	QZ	-.52732772 00	RX	.14385509 00	RY	.16080404 00	RZ	-.97644647 00
BX	-.71925754 00	BY	.50063229 00	BZ	.48170104 00	TX	-.74529247 00	TY	.66673768 00	TZ	.00000000 00
SXI	-.65103365 00	SYI	-.72773821 00	SZI	-.21575965 00	DAI	-.12460098 02	RAI	.22818422 03		
SXO	.96595144 00	SYO	.35401363-01	SZO	-.25628975 00	DAO	-.14850021 02	RAO	.20989081 01		
ETE	.15659903 03	ETS	.34973736 03	ETC	.24262078 03						
BTQ	.14694339 04	BRQ	-.83336639 03	B	.16893004 04	THA	.33044094 03				

ALL VECTORS REFERENCED TO ORBIT PLANE OF TARGET

X	.17280447 04	Y	-.12926959 03	Z	.99892608 02	DX	-.23070447 01	DY	.13327858 01	DZ	.55241822-01
INC	.10036277 02	LAN	.33671266 03	APF	.13658177 03	MX	-.94280565 00	MY	.13204656 00	MZ	-.44500003-01
WX	-.68896782-01	WY	-.16007407 00	WZ	.98469761 00	PX	-.39961486 00	PY	.90882376 00	PZ	.11977985 00
QX	-.91409035 00	QY	-.38524733 00	QZ	-.12658302 00	RX	-.38722548-01	RY	.32346461-01	RZ	-.99872627 00
BX	.63855483 00	BY	.75128089 00	BZ	.16680752 00	TX	.64109246 00	TY	.76746365 00	TZ	.00000000 00
SXI	-.76648612 00	SYI	.64027589 00	SZI	.50455220-01	DAI	.28920984 01	RAI	.14012666 03		
SXO	-.51782313-01	SYO	-.98513865 00	SZO	-.16376884 00	DAO	-.94257215 01	RAO	.26699109 03		
ETE	.17654348 03	ETS	.96818092 01	ETC	.26256522 03						
BTO	.16655719 04	BRO	-.28214741 03	B	.16893007 04	THA	.35038538 03				

ALL VECTORS REFERENCED TO TRUE LUNAR EQU. PLANE

X	.17298544 04	Y	-.67928260 02	Z	.12576387 03	DX	-.23640227 01	DY	.12209126 01	DZ	.15030938 00
INC	.16576790 02	LAN	.34362571 03	APF	.13201089 03	MX	-.97169633 00	MY	.13465127 00	MZ	-.43085566-01
WX	-.80429199-01	WY	-.27372861 00	WZ	.95843823 00	PX	-.44136782 00	PY	.87192752 00	PZ	.21198304 00
QX	-.89371448 00	QY	-.40597418 00	QZ	-.19094343 00	RX	-.83180788-01	RY	.62592576-01	RZ	-.99456678 00
BX	.60164603 00	BY	.75330123 00	BZ	.26563006 00	TX	.60127178 00	TY	.79904459 00	TZ	.00000000 00
SXI	-.79470320 00	SYI	.59800493 00	SZI	.10410031 00	DAI	.59753346 01	RAI	.14303896 03		
SXO	-.53248740-02	SYO	-.96142160 00	SZO	-.27502750 00	DAO	-.15963652 02	RAO	.26968266 03		
ETE	.31436312 01	ETS	.31499538 02	ETC	.29413441 03						
BTT	.16279359 04	BRT	-.45118056 03	B	.16893014 04	THA	.34450934 03				

613534735054 215566505275 214440226563 604514471027 600607163250 602665022132
650302121 4948000 000000000000

Appendix C

Ranger IX Space Trajectory for Postmaneuver Orbit

SPACE TRAJECTORY
RA-9 POST MIDCOURSE ORBIT

GME	.39860136 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63783006 04
G	.66709998-19	A	.88782497 29	B	.88800499 29	C	.88837498 29	OME	.41780741-02	AU	.14959900 09
GMM	.49027475 04	GMS	.13271544 12	GMV	.32476950 06	GMA	.42977799 05	GMC	.37918700 08	GMJ	.12671060 09
EGM	.39860320 06	MGM	.49027779 04	JA	.29200000-02	HA	.00000000 00	DA	.00000000 00	RA	.34170000 04
ARA	.35670000 01	GB	.39545169 00	MAS	.37410000 03	GB1	.00000000 00	GB2	.00000000 00	SC	.10200000 09

INJECTION CONDITIONS MOON 23571213037320240000000 J.D.= 2438843.02127314 MARCH 23,1965 12 30 38.000

GEOCENTRIC X0-.19399673 05 Y0-.26223645 06 Z0-.12476509 06 DX0 .13594893 00 DY0-.12091033 01 DZ0-.50967806 00
CARTESIAN GMC .00000000 00 SGC .00000000 00 T0 .45038000 05 GHA .84426084 01 GH0 .18027050 03

PROBE IS OUT OF EARTH'S SHADOW

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. 23571213037320240000000 J.D.= 2438843.02127314 MARCH 23,1965 12 30 38.000
TFL 1 DAYS 14 HRS. 53 MIN. 34.543 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	-.19399672 05	Y	-.26223645 06	Z	-.12476509 06	DX	.13594892 00	DY	-.12091032 01	DZ	-.50967804 00
R	.29105090 06	DEC	-.25383249 02	RA	.26576909 03	V	.13191605 01	PTH	.79926088 02	AZ	.76945174 02
R	.29105090 06	LAT	-.25383249 02	LON	.25732648 03	VE	.18994585 02	PTE	.39208632 01	AZE	.27015759 03
XS	.14897831 09	YS	.63717223 07	ZS	.27634203 07	DXS	-.89066856 00	DYS	.27394442 02	DZS	.11878768 02
XM	-.98402473 05	YM	-.35567248 06	ZM	-.15354183 06	DXM	.93475154 00	DYM	-.22045438 00	DZM	-.18962302 00
XT	-.98402473 05	YT	-.35567248 06	ZT	-.15354183 06	DXT	.93475154 00	DYT	-.22045438 00	DZT	-.18962302 00
RS	.14914011 09	VS	.29872292 02	RM	.39970120 06	VM	.97893690 00	RT	.39970120 06	VT	.97893690 00
GED	-.25534279 02	ALT	.28467666 06	LOS	.35400641 03	RAS	.24490185 01	RAM	.25453504 03	LOM	.24609243 03
DUT	.36000000 02	DT	.48000000 03	DR	.12988229 01	SHA	.28918613 06	DES	.10616948 01	DEM	-.22590454 02

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 23571202520720250040000 J.D.= 2438841.42776046 MARCH 21,1965 22 15 58.504

SMA	.39905441 06	ECC	.98572044 00	B	.67196775 05	SLR	.11315269 05	APO	.79241049 06	RCA	.56983192 04
VH	.84752320-01	C3	-.99886470 00	C1	.67158630 05	TFP	.13767949 06	TF	-.38244304 02	PER	.41812621 05
TA	.16717328 03	MTA	.00000000 00	EA	.74063673 02	MA	.19756641 02	C3J	-.13710045 01	TFI	.00000000 00

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	-.19399672 05	Y	-.26223645 06	Z	-.12476509 06	DX	.13594892 00	DY	-.12091032 01	DZ	-.50967804 00
INC	.28344388 02	LAN	.32735928 03	APF	.12828434 03	MX	.96435551 00	MY	-.16843506 00	MZ	.20407657 00
WX	-.25607593 00	WY	-.39978876 00	WZ	.88010979 00	PX	-.14909941 00	PY	.91590815 00	PZ	.37266828 00
QX	-.95508830 00	QY	-.35792488-01	QZ	-.29415036 00	RX	-.59877950-01	RY	.36782642 00	RZ	-.92796464 00
BX	.95508869 00	BY	.35792503-01	BZ	.29415048 00	TX	.98700760 00	TY	.16067359 00	TZ	.00000000 00
DAP	.21880271 02	RAP	.99245997 02								
BTQ	.63731485 05	BRQ	-.21300340 05	B	.67196775 05	THA	.34151933 03				

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.14899771 09	Y	-.66339587 07	Z	-.28881854 07	DX	.10266175 01	DY	-.28603545 02	DZ	-.12388446 02
R	.14917328 09	LAT	-.11093875 01	LON	.18254935 03	V	.31187983 02	PTH	.89376952 00	AZ	.11339322 03
XE	-.14897831 09	YE	-.63717223 07	ZE	-.27634203 07	DXE	.89066856 00	DYE	-.27394442 02	DZE	-.11878768 02
XT	-.14907671 09	YT	-.67273947 07	ZT	-.29169621 07	DXT	.18254201 01	DYT	-.27614896 02	DZT	-.12068391 02
LTE	-.10616948 01	LOE	.18244901 03	LTT	-.11198146 01	LOT	.18258383 03	RST	.14925694 09	VST	.30192063 02
EPS	.83399614 02	ESP	.11124820 00	SEP	.96489309 02	EPM	.14407451 03	EMP	.25292641 02	MEP	.10632843 02
MPS	.13170274 03	MSP	.35663121-01	SMP	.48261236 02	SEM	.10692129 03	EMS	.72931918 02	ESM	.14704286 00
RPM	.12569740 06	SPN	.82143952 02								
GCE	.78118984 02	GCT	.24951566 03	SIP	.13091152 03	CPT	.10317300 03	SIN	.10238179 03	D1	.41430824 00
REP	.29105090 06	VEP	.13191605 01	CPE	.78547792 02	CPS	.92848527 02	D2	.27866472 00	D3	.51048062-02

0 DAYS 0 HRS. 29 MIN. 22.000 SEC. 23571213126420200C000000 J.D.= 2438843.04166666 MARCH 23,1965 13 C0 00.000
TFL 1 DAYS 15 HRS. 22 MIN. 56.543 SEC.

SPACE TRAJECTORY
RA-9 POST MIDCOURSE ORBIT

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.19159945 05	Y	-.26436064 06	Z	-.12566011 06	DX	.13614905 00	DY	-.12020379 01	DZ	-.50625073 00
R	.29333277 06	DEC	-.25365274 02	RA	.26585464 03	V	.13113815 01	PTH	.79958270 02	AZ	.76873439 02
R	.29333276 06	LAT	-.25365275 02	LON	.25005027 03	VE	.19149019 02	PTE	.38666102 01	AZE	.27015573 03
XS	.14897673 09	YS	.64199924 07	ZS	.27843512 07	DXS	-.90115742 00	DYS	.27394040 02	DZS	.11878593 02
XM	-.96754491 05	YM	-.35605741 06	ZM	-.15387443 06	DXM	.93582005 00	DYM	-.21646927 00	DZM	-.18790173 00
XT	-.96754491 05	YT	-.35605741 06	ZT	-.15387443 06	DXT	.93582005 00	DYT	-.21646927 00	DZT	-.18790173 00
RS	.14914099 09	VS	.29872168 02	RM	.39976949 06	VM	.97873651 00	RT	.39976949 06	VT	.97873651 00
GED	-.25516228 02	ALT	.28695852 06	LOS	.34666320 03	RAS	.24675753 01	RAM	.25479763 03	LOM	.23899325 03
DUT	.36000000 02	DT	.32200000 03	DR	.12912925 01	SHA	.29148590 06	DES	.10697314 01	DEM	-.22638020 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14899589 09	Y	-.66843531 07	Z	-.29100113 07	DX	.10373065 01	DY	-.28596077 02	DZ	-.12384844 02
R	.14917414 09	LAT	-.11177656 01	LON	.18256872 03	V	.31180057 02	PTH	.89474026 00	AZ	.11339222 03
XE	-.14897673 09	YE	-.64199924 07	ZE	-.27843512 07	DXE	.90115742 00	DYE	-.27394040 02	DZE	-.11878593 02
XT	-.14907349 09	YT	-.67760498 07	ZT	-.29382256 07	DXT	.18369775 01	DYT	-.27610508 02	DZT	-.12066495 02
LTE	-.10697314 01	LOE	.18246757 03	LTT	-.11279835 01	LOT	.18260255 03	RST	.14925633 09	VST	.30187993 02
EPS	.83455192 02	ESP	.11190583 00	SEP	.96432850 02	EPM	.14397617 03	EMP	.25565144 02	MEP	.10458684 02
MPS	.13174842 03	MSP	.34970568-01	SMP	.48216235 02	SEM	.10669546 03	EMS	.73157542 02	ESM	.14687642 00
RPM	.12339068 06	SPN	.82209300 02								
GCE	.78097400 02	GCT	.24949633 03	SIP	.13094241 03	CPT	.10317774 03	SIN	.10237173 03	D1	.42205499 00
REP	.29333277 06	VEP	.13113815 01	CPE	.78521633 02	CPS	.92843452 02	D2	.28417721 00	D3	.53058726-02

0 DAYS 1 HRS. 29 MIN. 22.000 SEC.

23571213307020200000000 J.D.= 2438843.08333333 MARCH 23,1965 14 00 00.000
TFL 1 DAYS 16 HRS. 22 MIN. 56.543 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.18669205 05	Y	-.26866255 06	Z	-.12747027 06	DX	.13645581 00	DY	-.11879970 01	DZ	-.49943688 00
R	.29795431 06	DEC	-.25329176 02	RA	.26602494 03	V	.12959144 01	PTH	.80024732 02	AZ	.76723174 02
R	.29795431 06	LAT	-.25329177 02	LON	.23517949 03	VE	.19461907 02	PTE	.37601907 01	AZE	.27015210 03
XS	.14897345 09	YS	.65186140 07	ZS	.28271155 07	DXS	-.92258767 00	DYS	.27393206 02	DZS	.11878232 02
XM	-.93381678 05	YM	-.35682204 06	ZM	-.15454453 06	DXM	.93794501 00	DYM	-.20832023 00	DZM	-.18437614 00
XT	-.93381678 05	YT	-.35682204 06	ZT	-.15454453 06	DXT	.93794501 00	DYT	-.20832023 00	DZT	-.18437614 00
RS	.14914279 09	VS	.29871915 02	RM	.39990763 06	VM	.97833160 00	RT	.39990763 06	VT	.97833160 00
GED	-.25479975 02	ALT	.29158005 06	LOS	.33166004 03	RAS	.25054879 01	RAM	.25533438 03	LOM	.22448894 03
DUT	.36000000 02	DT	.48000000 03	DR	.12763236 01	SHA	.29614267 06	DES	.10861503 01	DEM	-.22733822 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14899212 09	Y	-.67872765 07	Z	-.29545858 07	DX	.10590435 01	DY	-.28581203 02	DZ	-.12377668 02
R	.14917590 09	LAT	-.11348760 01	LON	.18260828 03	V	.31164297 02	PTH	.89688835 00	AZ	.11339021 03
XE	-.14897345 09	YE	-.65186140 07	ZE	-.28271155 07	DXE	.92258767 00	DYE	-.27393206 02	DZE	-.11878232 02
XT	-.14906683 09	YT	-.68754360 07	ZT	-.29816600 07	DXT	.18605327 01	DYT	-.27601526 02	DZT	-.12062608 02
LTE	-.10861503 01	LOE	.18250548 03	LTT	-.11446705 01	LOT	.18264079 03	RST	.14925509 09	VST	.30179667 02
EPS	.83564783 02	ESP	.11407056 00	SEP	.96321471 02	EPM	.14378324 03	EMP	.26117356 02	MEP	.10099399 02
MPS	.13183740 03	MSP	.35663121-01	SMP	.48128647 02	SEM	.10623434 03	EMS	.73618261 02	ESM	.14770671 00
RPM	.11868894 06	SPN	.82338218 02								
GCE	.78054228 02	GCT	.24945737 03	SIP	.13099946 03	CPT	.10318816 03	SIN	.10235022 03	D1	.43877777 00
REP	.29795431 06	VEP	.12959144 01	CPE	.78469442 02	CPS	.92833085 02	D2	.29605951 00	D3	.57523320-02

0 DAYS 2 HRS. 29 MIN. 22.000 SEC.

23571213467420200000000 J.D.= 2438843.12500000 MARCH 23,1965 15 00 00.000
TFL 1 DAYS 17 HRS. 22 MIN. 56.543 SEC.

SPACE TRAJECTORY
RA-9 POST MIDCOURSE ORBIT

GEOCENTRIC EQUATORIAL COORDINATES

X	-.18177606 05	Y	-.27291484 06	Z	-.12925635 06	DX	.13662479 00	DY	-.11744712 01	DZ	-.49286706 00
R	.30252295 06	DEC	-.25293880 02	RA	.26618941 03	V	.12810022 01	PTH	.80092537 02	AZ	.76566960 02
R	.30252295 06	LAT	-.25293880 02	LON	.22030291 03	VE	.19771360 02	PTE	.36593652 01	AZE	.27014868 03
XS	.14897009 09	YS	.66172335 07	ZS	.28698787 07	DXS	-.94401782 00	DYS	.27392359 02	DZS	.11877864 02
XM	-.90001352 05	YM	-.35755732 06	ZM	-.15520192 06	DXM	.93999192 00	DYM	-.20016236 00	DZM	-.18083896 00
XT	-.90001352 05	YT	-.35755732 06	ZT	-.15520192 06	DXT	.93999192 00	DYT	-.20016236 00	DZT	-.18083896 00
RS	.14914460 09	VS	.29871661 02	RM	.40004389 06	VM	.97793277 00	RT	.40004389 06	VT	.97793277 00
GED	-.25444525 02	ALT	.29614869 06	LOS	.31665689 03	RAS	.25434010 01	RAM	.25587149 03	LOM	.20998498 03
DUT	.36000000 02	DT	.95999999 03	DR	.12618986 01	SHA	.30074479 06	DES	.11025667 01	DEM	-.22827762 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.14898827 09	Y	-.68901483 07	Z	-.29991351 07	DX	.10806426 01	DY	-.28566830 02	DZ	-.12370731 02
R	.14917765 09	LAT	-.11519771 01	LON	.18264783 03	V	.31149102 02	PTH	.89926185 00	AZ	.11338822 03
XE	-.14897009 09	YE	-.66172335 07	ZE	-.28698787 07	DXE	.94401782 00	DYE	-.27392359 02	DZE	-.11877864 02
XT	-.14906009 09	YT	-.69747908 07	ZT	-.30250807 07	DXT	.18840097 01	DYT	-.27592521 02	DZT	-.12058703 02
LTE	-.11025667 01	LOE	.18254340 03	LTT	-.11613516 01	LOT	.18267901 03	RST	.14925384 09	VST	.30171327 02
EPS	.83669268 02	ESP	.11556174 00	SEP	.96215221 02	EPM	.14360097 03	EMP	.26663349 02	MEP	.97356693 01
MPS	.13192039 03	MSP	.32805301-01	SMP	.48047046 02	SEM	.10577358 03	EMS	.74078632 02	ESM	.14820265 00
RPM	.11400076 06	SPN	.82461228 02								
GCE	.78012235 02	GCT	.24941907 03	SIP	.13104798 03	CPT	.10319970 03	SIN	.10232729 03	D1	.45682624 00
REP	.30252295 06	VEP	.12810022 01	CPE	.78418856 02	CPS	.92822721 02	D2	.30885947 00	D3	.62531821-02

0 DAYS 3 HRS. 29 MIN. 22.000 SEC. 235712136500202000000000 J.D.= 2438843.16666666 MARCH 23,1965 16 00 00.000
TFL 1 DAYS 18 HRS. 22 MIN. 56.543 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	-.17685654 05	Y	-.27711934 06	Z	-.13101919 06	DX	.13665370 00	DY	-.11614455 01	DZ	-.48653153 00
R	.30704062 06	DEC	-.25259340 02	RA	.26634835 03	V	.12666265 01	PTH	.80162261 02	AZ	.76403449 02
R	.30704062 06	LAT	-.25259340 02	LON	.20542078 03	VE	.20077512 02	PTE	.35637553 01	AZE	.27014546 03
XS	.14896665 09	YS	.67158485 07	ZS	.29126402 07	DXS	-.96544734 00	DYS	.27391498 02	DZS	.11877490 02
XM	-.86613803 05	YM	-.35826321 06	ZM	-.15584655 06	DXM	.94196083 00	DYM	-.19199625 00	DZM	-.17729050 00
XT	-.86613803 05	YT	-.35826321 06	ZT	-.15584655 06	DXT	.94196083 00	DYT	-.19199625 00	DZT	-.17729050 00
RS	.14914640 09	VS	.29871408 02	RM	.40017824 06	VM	.97754011 00	RT	.40017824 06	VT	.97754011 00
GED	-.25409837 02	ALT	.30066634 06	LOS	.30165374 03	RAS	.25813141 01	RAM	.25640894 03	LOM	.19548136 03
DUT	.36000000 02	DT	.19200000 04	DR	.12480015 01	SHA	.30529423 06	DES	.11189848 01	DEM	-.22919837 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.14898434 09	Y	-.69929679 07	Z	-.30436594 07	DX	.11021010 01	DY	-.28552943 02	DZ	-.12364022 02
R	.14917942 09	LAT	-.11690680 01	LON	.18268735 03	V	.31134454 02	PTH	.90186756 00	AZ	.11338625 03
XE	-.14896665 09	YE	-.67158485 07	ZE	-.29126402 07	DXE	.96544734 00	DYE	-.27391498 02	DZE	-.11877490 02
XT	-.14905327 09	YT	-.70741117 07	ZT	-.30684867 07	DXT	.19074082 01	DYT	-.27583494 02	DZT	-.12054781 02
LTE	-.11189848 01	LOE	.18258131 03	LTT	-.11780275 01	LOT	.18271723 03	RST	.14925259 09	VST	.30162975 02
EPS	.83768879 02	ESP	.11724273 00	SEP	.96113864 02	EPM	.14342934 03	EMP	.27202952 02	MEP	.93677023 01
MPS	.13199718 03	MSP	.31278626-01	SMP	.47971627 02	SEM	.10531317 03	EMS	.74538661 02	ESM	.14820265 00
RPM	.10932435 06	SPN	.82578617 02								
GCE	.77971347 02	GCT	.24938131 03	SIP	.13108745 03	CPT	.10321249 03	SIN	.10230277 03	D1	.47637204 00
REP	.30704062 06	VEP	.12666265 01	CPE	.78369779 02	CPS	.92812360 02	D2	.32269596 00	D3	.68177515-02

0 DAYS 4 HRS. 29 MIN. 22.000 SEC. 235712140304202000000000 J.D.= 2438843.20833333 MARCH 23,1965 17 00 00.000
TFL 1 DAYS 19 HRS. 22 MIN. 56.543 SEC.

SPACE TRAJECTORY
RA-9 POST MIDCOURSE ORBIT

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.17193852 05	Y	-.28127784 06	Z	-.13275964 06	DX	.13653836 00	DY	-.11489086 01	DZ	-.48042199 00
R	.31150918 06	DEC	-.25225511 02	RA	.26650199 03	V	.12527725 01	PTH	.80234536 02	AZ	.76231063 02
R	.31150917 06	LAT	-.25225511 02	LON	.19053335 03	VE	.20380497 02	PTE	.34730188 01	AZE	.27014244 03
XS	.14896314 09	YS	.68144619 07	ZS	.29554008 07	DXS	-.98687687 00	DYS	.27390622 02	DZS	.11877111 02
XM	-.83219302 05	YM	-.35893969 06	ZM	-.15647840 06	DXM	.94385173 00	DYM	-.18382246 00	DZM	-.17373099 00
XT	-.83219302 05	YT	-.35893969 06	ZT	-.15647840 06	DXT	.94385173 00	DYT	-.18382246 00	DZT	-.17373099 00
RS	.14914821 09	VS	.29871154 02	RM	.40031068 06	VM	.97715364 00	RT	.40031068 06	VT	.97715364 00
GED	-.25375862 02	ALT	.30513489 06	LOS	.28665058 03	RAS	.26192260 01	RAM	.25694673 03	LOM	.18097809 03
DUT	.36000000 02	DT	.19200000 04	DR	.12346202 01	SHA	.30979291 06	DES	.11354011 01	DEM	-.23010038 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14898033 09	Y	-.70957396 07	Z	-.30881604 07	DX	.11234152 01	DY	-.28539530 02	DZ	-.12357532 02
R	.14918118 09	LAT	-.11861477 01	LON	.18272686 03	V	.31120338 02	PTH	.90471575 00	AZ	.11338429 03
XE	-.14896314 09	YE	-.68144619 07	ZE	-.29554008 07	DXE	.98687687 00	DYE	-.27390622 02	DZE	-.11877111 02
XT	-.14904636 09	YT	-.71734015 07	ZT	-.31118792 07	DXT	.19307286 01	DYT	-.27574444 02	DZT	-.12050841 02
LTE	-.11354011 01	LOE	.18261922 03	LTT	-.11946991 01	LOT	.18275544 03	RST	.14925132 09	VST	.30154609 02
EPS	.83863824 02	ESP	.11848782 00	SEP	.96017192 02	EPM	.14326838 03	EMP	.27735937 02	MEP	.89956765 01
MPS	.13206752 03	MSP	.27088086-01	SMP	.47902649 02	SEM	.10485310 03	EMS	.74998353 02	ESM	.14820265 00
RPM	.10465803 06	SPN	.82690638 02								
GCE	.77931494 02	GCT	.24934397 03	SIP	.13111723 03	CPT	.10322672 03	SIN	.10227643 03	D1	.49761747 00
REP	.31150918 06	VEP	.12527725 01	CPE	.78322118 02	CPS	.92802002 02	D2	.33770894 00	D3	.74574628-02

0 DAYS 5 HRS. 29 MIN. 22.000 SEC. 23571214211020200000000 J.D.= 2438843.25000000 MARCH 23,1965 18 00 00.000
TFL 1 DAYS 20 HRS. 22 MIN. 56.543 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.16702739 05	Y	-.28539207 06	Z	-.13447849 06	DX	.13627241 00	DY	-.11368528 01	DZ	-.47453166 00
R	.31593049 06	DEC	-.25192351 02	RA	.26665054 03	V	.12394292 01	PTH	.80310079 02	AZ	.76047933 02
R	.31593049 06	LAT	-.25192351 02	LON	.17564084 03	VE	.20680449 02	PTE	.33868551 01	AZE	.27013960 03
XS	.14895955 09	YS	.69130691 07	ZS	.29981589 07	DXS	-.10083054 01	DYS	.27389733 02	DZS	.11876725 02
XM	-.79818140 05	YM	-.35958673 06	ZM	-.15709740 06	DXM	.94566467 00	DYM	-.17564159 00	DZM	-.17016072 00
XT	-.79818140 05	YT	-.35958673 06	ZT	-.15709740 06	DXT	.94566467 00	DYT	-.17564159 00	DZT	-.17016072 00
RS	.14915001 09	VS	.29870901 02	RM	.40044118 06	VM	.97677341 00	RT	.40044118 06	VT	.97677341 00
GED	-.25342558 02	ALT	.30955620 06	LOS	.27164742 03	RAS	.26571365 01	RAM	.25748485 03	LOM	.16647515 03
DUT	.36000000 02	DT	.19200000 04	DR	.12217464 01	SHA	.31424274 06	DES	.11518158 01	DEM	-.23098361 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14897625 09	Y	-.71984611 07	Z	-.31326373 07	DX	.11445778 01	DY	-.28526586 02	DZ	-.12351257 02
R	.14918295 09	LAT	-.12032206 01	LON	.18276635 03	V	.31106747 02	PTH	.90781922 00	AZ	.11338234 03
XE	-.14895955 09	YE	-.69130691 07	ZE	-.29981589 07	DXE	.10083054 01	DYE	-.27389733 02	DZE	-.11876725 02
XT	-.14903937 09	YT	-.72726557 07	ZT	-.31552562 07	DXT	.19539701 01	DYT	-.27565375 02	DZT	-.12046886 02
LTE	-.11518158 01	LOE	.18265713 03	LTT	-.12113639 01	LOT	.18279364 03	RST	.14925005 09	VST	.30146232 02
EPS	.83954292 02	ESP	.12053439 00	SEP	.95925015 02	EPM	.14311820 03	EMP	.28262031 02	MEP	.86197550 01
MPS	.13213111 03	MSP	.27088086-01	SMP	.47840418 02	SEM	.10439338 03	EMS	.75457714 02	ESM	.14836759 00
RPM	.10000008 06	SPN	.82797527 02								
GCE	.77892608 02	GCT	.24930691 03	SIP	.13113655 03	CPT	.10324257 03	SIN	.10224801 03	D1	.52080303 00
REP	.31593049 06	VEP	.12394292 01	CPE	.78275791 02	CPS	.92791646 02	D2	.35406487 00	D3	.81864392-02

0 DAYS 6 HRS. 29 MIN. 22.000 SEC. 23571214371420200000000 J.D.= 2438843.29166666 MARCH 23,1965 19 00 00.000
TFL 1 DAYS 21 HRS. 22 MIN. 56.543 SEC.

SPACE TRAJECTORY
RA-9 POST MIDCOURSE ORBIT

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.16212866 05	Y	-.28946375 06	Z	-.13617653 06	DX	.13584703 00	DY	-.11252747 01	DZ	-.46885537 00
R	.32030636 06	DEC	-.25159818 02	RA	.26679421 03	V	.12265900 01	PTH	.80389705 02	AZ	.75851772 02
R	.32030635 06	LAT	-.25159818 02	LON	.16074343 03	VE	.20977499 02	PTE	.33049962 01	AZE	.27013693 03
XS	.14895588 09	YS	.70116743 07	ZS	.30409160 07	DXS	-.10297339 01	DYS	.27388829 02	DZS	.11876334 02
XM	-.76410590 05	YM	-.36020430 06	ZM	-.15770354 06	DXM	.94739969 00	DYM	-.16745417 00	DZM	-.16657993 00
XT	-.76410590 05	YT	-.36020430 06	ZT	-.15770354 06	DXT	.94739969 00	DYT	-.16745417 00	DZT	-.16657993 00
RS	.14915182 09	VS	.29870648 02	RM	.40056975 06	VM	.97639947 00	RT	.40056975 06	VT	.97639947 00
GED	-.25309885 02	ALT	.31393205 06	LOS	.25664427 03	RAS	.26950474 01	RAM	.25802331 03	LOM	.15197253 03
DUT	.36000000 02	DT	.19200000 04	DR	.12093761 01	SHA	.31864554 06	DES	.11682296 01	DEM	-.23184802 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14897209 09	Y	-.73011381 07	Z	-.31770925 07	DX	.11655809 01	DY	-.28514104 02	DZ	-.12345189 02
R	.14918473 09	LAT	-.12202833 01	LON	.18280583 03	V	.31093671 02	PTH	.91119931 00	AZ	.11338039 03
XE	-.14895588 09	YE	-.70116743 07	ZE	-.30409160 07	DXE	.10297339 01	DYE	-.27388829 02	DZE	-.11876334 02
XT	-.14903229 09	YT	-.73718786 07	ZT	-.31986195 07	DXT	.19771336 01	DYT	-.27556283 02	DZT	-.12042913 02
LTE	-.11682296 01	LOE	.18269504 03	LTT	-.12280253 01	LOT	.18283182 03	RST	.14924878 09	VST	.30137843 02
EPS	.84040444 02	ESP	.12214696 00	SEP	.95837174 02	EPM	.14297904 03	EMP	.28780870 02	MEP	.82400832 01
MPS	.13218754 03	MSP	.25217635-01	SMP	.47785338 02	SEM	.10393400 03	EMS	.75916749 02	ESM	.14918958 00
RPM	.95348856 05	SPN	.82899486 02								
GCE	.77854630 02	GCT	.24926998 03	SIP	.13114445 03	CPT	.10326027 03	SIN	.10221719 03	D1	.54621662 00
REP	.32030636 06	VEP	.12265900 01	CPE	.78230721 02	CPS	.92781292 02	D2	.37196271 00	D3	.90222924-02

0 DAYS 7 HRS. 29 MIN. 22.000 SEC. 23571214552020200000000 J.D.= 2438843.33333333 MARCH 23,1965 20 00 00.000
TFL 1 DAYS 22 HRS. 22 MIN. 56.543 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.15724825 05	Y	-.29349462 06	Z	-.13785450 06	DX	.13525034 00	DY	-.11141754 01	DZ	-.46338957 00
R	.32463860 06	DEC	-.25127873 02	RA	.26693314 03	V	.12142526 01	PTH	.80474392 02	AZ	.75639850 02
R	.32463860 06	LAT	-.25127873 02	LON	.14584130 03	VE	.21271786 02	PTE	.32272114 01	AZE	.27013445 03
XS	.14895214 09	YS	.71102779 07	ZS	.30836724 07	DXS	-.10511624 01	DYS	.27387912 02	DZS	.11875936 02
XM	-.72996929 05	YM	-.36079240 06	ZM	-.15829677 06	DXM	.94905682 00	DYM	-.15926079 00	DZM	-.16298889 00
XT	-.72996929 05	YT	-.36079240 06	ZT	-.15829677 06	DXT	.94905682 00	DYT	-.15926079 00	DZT	-.16298889 00
RS	.14915363 09	VS	.29870395 02	RM	.40069636 06	VM	.97603187 00	RT	.40069636 06	VT	.97603187 00
GED	-.25277801 02	ALT	.31826428 06	LOS	.24164112 03	RAS	.27329597 01	RAM	.25856209 03	LOM	.13747025 03
DUT	.36000000 02	DT	.19200000 04	DR	.11975102 01	SHA	.32300318 06	DES	.11846434 01	DEM	-.23269352 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14896786 09	Y	-.74037725 07	Z	-.32215270 07	DX	.11864127 01	DY	-.28502088 02	DZ	-.12339325 02
R	.14918652 09	LAT	-.12373374 01	LON	.18284528 03	V	.31081112 02	PTH	.91487907 00	AZ	.11337843 03
XE	-.14895214 09	YE	-.71102779 07	ZE	-.30836724 07	DXE	.10511624 01	DYE	-.27387912 02	DZE	-.11875936 02
XT	-.14902513 09	YT	-.74710704 07	ZT	-.32419692 07	DXT	.20002192 01	DYT	-.27547173 02	DZT	-.12038925 02
LTE	-.11846434 01	LOE	.18273295 03	LTT	-.12446807 01	LOT	.18287000 03	RST	.14924750 09	VST	.30129442 02
EPS	.84122421 02	ESP	.12373852 00	SEP	.95753524 02	EPM	.14285120 03	EMP	.29292009 02	MEP	.78567811 01
MPS	.13223631 03	MSP	.24228320-01	SMP	.47737904 02	SEM	.10347494 03	EMS	.76375466 02	ESM	.14951711 00
RPM	.90702657 05	SPN	.82996690 02								
GCE	.77817498 02	GCT	.24923300 03	SIP	.13113979 03	CPT	.10328012 03	SIN	.10218360 03	D1	.57420630 00
REP	.32463860 06	VEP	.12142526 01	CPE	.78186833 02	CPS	.92770940 02	D2	.39164296 00	D3	.99872387-02

0 DAYS 8 HRS. 29 MIN. 22.000 SEC. 23571214732420200000000 J.D.= 2438843.37500000 MARCH 23,1965 21 00 00.000
TFL 1 DAYS 23 HRS. 22 MIN. 56.543 SEC.

SPACE TRAJECTORY
RA-9 POST MIDCOURSE ORBIT

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.15239265 05	Y	-.29748640 06	Z	-.13951318 06	DX	.13446675 00	DY	-.11035614 01	DZ	-.45813267 00
R	.32892904 06	DEC	-.25096473 02	RA	.26706748 03	V	.12024203 01	PTH	.80565260 02	AZ	.75408733 02
R	.32892904 06	LAT	-.25096473 02	LON	.13093458 03	VE	.21563451 02	PTE	.31532976 01	AZE	.27013214 03
XS	.14894831 09	YS	.72088768 07	ZS	.31264268 07	DXS	-.10725902 01	DYS	.27386981 02	DZS	.11875532 02
XM	-.69577446 05	YM	-.36135098 06	ZM	-.15887705 06	DXM	.95063610 00	DYM	-.15106200 00	DZM	-.15938787 00
XT	-.69577446 05	YT	-.36135098 06	ZT	-.15887705 06	DXT	.95063610 00	DYT	-.15106200 00	DZT	-.15938787 00
RS	.14915543 09	VS	.29870142 02	RM	.40082099 06	VM	.97567064 00	RT	.40082099 06	VT	.97567064 00
GED	-.25246266 02	ALT	.32255472 06	LOS	.22663796 03	RAS	.27708703 01	RAM	.25910118 03	LOM	.12296827 03
DUT	.36000000 02	DT	.19200000 04	DR	.11861551 01	SHA	.32731749 06	DES	.12010563 01	DEM	-.23352011 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14896355 09	Y	-.75063632 07	Z	-.32659400 07	DX	.12070569 01	DY	-.28490542 02	DZ	-.12333665 02
R	.14918831 09	LAT	-.12543838 01	LON	.18288473 03	V	.31069072 02	PTH	.91889266 00	AZ	.11337645 03
XE	-.14894831 09	YE	-.72088768 07	ZE	-.31264268 07	DXE	.10725902 01	DYE	-.27386981 02	DZE	-.11875532 02
XT	-.14901789 09	YT	-.75702277 07	ZT	-.32853038 07	DXT	.20232263 01	DYT	-.27538042 02	DZT	-.12034920 02
LTE	-.12010563 01	LOE	.18277087 03	LTT	-.12613327 01	LOT	.18290817 03	RST	.14924621 09	VST	.30121031 02
EPS	.84200343 02	ESP	.12589407 00	SEP	.95673948 02	EPM	.14273517 03	EMP	.29794886 02	MEP	.74699420 01
MPS	.13227682 03	MSP	.24228320-01	SMP	.47698727 02	SEM	.10301621 03	EMS	.76833867 02	ESM	.15000707 00
RPM	.86059760 05	SPN	.83089297 02								
GCE	.77781154 02	GCT	.24919579 03	SIP	.13112114 03	CPT	.10330242 03	SIN	.10214673 03	D1	.60519684 00
REP	.32892904 06	VEP	.12024203 01	CPE	.78144057 02	CPS	.92760590 02	D2	.41339898 00	D3	.11109625-01

0 DAYS 9 HRS. 29 MIN. 22.000 SEC. 235712151130202000000000 J.D.= 2438843.41666666 MARCH 23,1965 22 00 00.000
TFL 2 DAYS 0 HRS. 22 MIN. 56.543 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.14756890 05	Y	-.30144085 06	Z	-.14115331 06	DX	.13347610 00	DY	-.10934455 01	DZ	-.45308521 00
R	.33317954 06	DEC	-.25065584 02	RA	.26719734 03	V	.11911025 01	PTH	.80663678 02	AZ	.75154126 02
R	.33317954 06	LAT	-.25065584 02	LON	.11602337 03	VE	.21852641 02	PTE	.30830876 01	AZE	.27013000 03
XS	.14894441 09	YS	.73074737 07	ZS	.31691803 07	DXS	-.10940180 01	DYS	.27386035 02	DZS	.11875123 02
XM	-.66152415 05	YM	-.36188004 06	ZM	-.15944435 06	DXM	.95213757 00	DYM	-.14285837 00	DZM	-.15577712 00
XT	-.66152415 05	YT	-.36188004 06	ZT	-.15944435 06	DXT	.95213757 00	DYT	-.14285837 00	DZT	-.15577712 00
RS	.14915723 09	VS	.29869890 02	RM	.40094364 06	VM	.97531582 00	RT	.40094364 06	VT	.97531582 00
GED	-.25215242 02	ALT	.32680521 06	LOS	.21163480 03	RAS	.28087804 01	RAM	.25964059 03	LOM	.10846661 03
DUT	.36000000 02	DT	.19200000 04	DR	.11753240 01	SHA	.33159034 06	DES	.12174684 01	DEM	-.23432769 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14895917 09	Y	-.76089145 07	Z	-.33103336 07	DX	.12274940 01	DY	-.28479480 02	DZ	-.12328208 02
R	.14919010 09	LAT	-.12714218 01	LON	.18292416 03	V	.31057563 02	PTH	.92327850 00	AZ	.11337446 03
XE	-.14894441 09	YE	-.73074737 07	ZE	-.31691803 07	DXE	.10940180 01	DYE	-.27386035 02	DZE	-.11875123 02
XT	-.14901056 09	YT	-.76693537 07	ZT	-.33286247 07	DXT	.20461555 01	DYT	-.27528893 02	DZT	-.12030900 02
LTE	-.12174684 01	LOE	.18280878 03	LTT	-.12779787 01	LOT	.18294633 03	RST	.14924492 09	VST	.30112610 02
EPS	.84274303 02	ESP	.12743884 00	SEP	.95598348 02	EPM	.14263156 03	EMP	.30288781 02	MEP	.70796496 01
MPS	.13230827 03	MSP	.24228320-01	SMP	.47668606 02	SEM	.10255780 03	EMS	.77291957 02	ESM	.15033281 00
RPM	.81418411 05	SPN	.83177432 02								
GCE	.77745546 02	GCT	.24915805 03	SIP	.13108670 03	CPT	.10332760 03	SIN	.10210603 03	D1	.63971204 00
REP	.33317954 06	VEP	.11911025 01	CPE	.78102327 02	CPS	.92750244 02	D2	.43759205 00	D3	.12426070-01

0 DAYS 10 HRS. 29 MIN. 22.000 SEC. 235712152734202000000000 J.D.= 2438843.45833333 MARCH 23,1965 23 00 00.000
TFL 2 DAYS 1 HRS. 22 MIN. 56.543 SEC.

SPACE TRAJECTORY
RA-9 POST MIDCOURSE ORBIT

GEOCENTRIC EQUATORIAL COORDINATES

X	-.14278492 05	Y	-.30535983 06	Z	-.14277565 06	DX	.13225229 00	DY	-.10838489 01	DZ	-.44825030 00
R	.33739204 06	DEC	-.25035159 02	RA	.26732281 03	V	.11803166 01	PTH	.80771293 02	AZ	.74870546 02
R	.33739203 06	LAT	-.25035159 02	LON	.10110778 03	VE	.22139516 02	PTE	.30164454 01	AZE	.27012803 03
XS	.14894043 09	YS	.74060665 07	ZS	.32119321 07	DXS	-.11154451 01	DYS	.27385075 02	DZS	.11874707 02
XM	-.62722121 05	YM	-.36237956 06	ZM	-.15999863 06	DXM	.95356128 00	DYM	-.13465045 00	DZM	-.15215691 00
XT	-.62722121 05	YT	-.36237956 06	ZT	-.15999863 06	DXT	.95356128 00	DYT	-.13465045 00	DZT	-.15215691 00
RS	.14915904 09	VS	.29869637 02	RM	.40106429 06	VM	.97496746 00	RT	.40106429 06	VT	.97496746 00
GED	-.25184684 02	ALT	.33101770 06	LOS	.19663165 03	RAS	.28466900 01	RAM	.26018029 03	LOM	.93965255 02
DUT	.36000000 02	DT	.19200000 04	DR	.11650387 01	SHA	.33582367 06	DES	.12338796 01	DEM	-.23511626 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.14895471 09	Y	-.77114263 07	Z	-.33547077 07	DX	.12476974 01	DY	-.28468924 02	DZ	-.12322957 02
R	.14919191 09	LAT	-.12884528 01	LON	.18296357 03	V	.31046604 02	PTH	.92809207 00	AZ	.11337243 03
XE	-.14894043 09	YE	-.74060665 07	ZE	-.32119321 07	DXE	.11154451 01	DYE	-.27385075 02	DZE	-.11874707 02
XT	-.14900316 09	YT	-.77684461 07	ZT	-.33719307 07	DXT	.20690064 01	DYT	-.27519725 02	DZT	-.12026864 02
LTE	-.12338796 01	LOE	.18284669 03	LTT	-.12946196 01	LOT	.18298448 03	RST	.14924362 09	VST	.30104177 02
EPS	.84344376 02	ESP	.12896511 00	SEP	.95526651 02	EPM	.14254125 03	EMP	.30772791 02	MEP	.66859537 01
MPS	.13232969 03	MSP	.20982341-01	SMP	.47648519 02	SEM	.10209970 03	EMS	.77749748 02	ESM	.15082012 00
RPM	.76776722 05	SPN	.83261202 02								
GCE	.77710615 02	GCT	.24911954 03	SIP	.13103425 03	CPT	.10335616 03	SIN	.10206072 03	D1	.67840631 00
REP	.33739204 06	VEP	.11803166 01	CPE	.78061581 02	CPS	.92739896 02	D2	.46467342 00	D3	.13984609-01

0 DAYS 11 HRS. 29 MIN. 22.000 SEC. 23571215454020200000000 J.D.= 2438843.50000000 MARCH 24,1965 00 00 00.000
TFL 2 DAYS 2 HRS. 22 MIN. 56.543 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	-.13804970 05	Y	-.30924523 06	Z	-.14438097 06	DX	.13076151 00	DY	-.10748025 01	DZ	-.44363433 00
R	.34156851 06	DEC	-.25005160 02	RA	.26744395 03	V	.11700899 01	PTH	.80890156 02	AZ	.74550831 02
R	.34156851 06	LAT	-.25005160 02	LON	.86187810 02	VE	.22424247 02	PTE	.29532713 01	AZE	.27012626 03
XS	.14893638 09	YS	.75046558 07	ZS	.32546823 07	DXS	-.11368719 01	DYS	.27384101 02	DZS	.11874285 02
XM	-.59286840 05	YM	-.36284952 06	ZM	-.16053987 06	DXM	.95490734 00	DYM	-.12643891 00	DZM	-.14852748 00
XT	-.59286840 05	YT	-.36284952 06	ZT	-.16053987 06	DXT	.95490734 00	DYT	-.12643891 00	DZT	-.14852748 00
RS	.14916085 09	VS	.29869384 02	RM	.40118293 06	VM	.97462568 00	RT	.40118293 06	VT	.97462568 00
GED	-.25154554 02	ALT	.33519416 06	LOS	.18162845 03	RAS	.28846002 01	RAM	.26072030 03	LOM	.79464147 02
DUT	.36000000 02	DT	.19200000 04	DR	.11553312 01	SHA	.34001944 06	DES	.12502900 01	DEM	-.23588571 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.14895018 09	Y	-.78139009 07	Z	-.33990632 07	DX	.12676334 01	DY	-.28458903 02	DZ	-.12317920 02
R	.14919372 09	LAT	-.13054754 01	LON	.18300297 03	V	.31036224 02	PTH	.93339913 00	AZ	.11337035 03
XE	-.14893638 09	YE	-.75046558 07	ZE	-.32546823 07	DXE	.11368719 01	DYE	-.27384101 02	DZE	-.11874285 02
XT	-.14899567 09	YT	-.78675053 07	ZT	-.34152221 07	DXT	.20917792 01	DYT	-.27510540 02	DZT	-.12022813 02
LTE	-.12502900 01	LOE	.18288460 03	LTT	-.13112554 01	LOT	.18302261 03	RST	.14924232 09	VST	.30095737 02
EPS	.84410605 02	ESP	.13028593 00	SEP	.95458813 02	EPM	.14246537 03	EMP	.31245737 02	MEP	.62888803 01
MPS	.13233977 03	MSP	.18504685-01	SMP	.47639757 02	SEM	.10164191 03	EMS	.78207239 02	ESM	.15082012 00
RPM	.72132728 05	SPN	.83340678 02								
GCE	.77676311 02	GCT	.24907984 03	SIP	.13096091 03	CPT	.10338874 03	SIN	.10200988 03	D1	.72210748 00
REP	.34156851 06	VEP	.11700899 01	CPE	.78021756 02	CPS	.92729551 02	D2	.49521312 00	D3	.15849212-01

0 DAYS 12 HRS. 29 MIN. 22.000 SEC. 23571215634420200000000 J.D.= 2438843.54166666 MARCH 24,1965 01 00 00.000
TFL 2 DAYS 3 HRS. 22 MIN. 56.543 SEC.

SPACE TRAJECTORY
RA-9 POST MIDCOURSE ORBIT

GEOCENTRIC EQUATORIAL COORDINATES

X	-.13337358 05	Y	-.31309912 06	Z	-.14597009 06	DX	.12895970 00	DY	-.10663511 01	DZ	-.43924775 00
R	.34571117 06	DEC	-.24975542 02	RA	.26756079 03	V	.11604627 01	PTH	.81022805 02	AZ	.74185497 02
R	.34571116 06	LAT	-.24975542 02	LON	.71263573 02	VE	.22707030 02	PTE	.28935114 01	AZE	.27012468 03
XS	.14893225 09	YS	.76032414 07	ZS	.32974310 07	DXS	-.11582983 01	DYS	.27383113 02	DZS	.11873858 02
XM	-.55846854 05	YM	-.36328992 06	ZM	-.16106802 06	DXM	.95617568 00	DYM	-.11822410 00	DZM	-.14488911 00
XT	-.55846854 05	YT	-.36328992 06	ZT	-.16106802 06	DXT	.95617568 00	DYT	-.11822410 00	DZT	-.14488911 00
RS	.14916265 09	VS	.29869131 02	RM	.40129957 06	VM	.97429037 00	RT	.40129957 06	VT	.97429037 00
GED	-.25124807 02	ALT	.33933681 06	LOS	.16662529 03	RAS	.29225098 01	RAM	.26126059 03	LOM	.64963371 02
DUT	.36000000 02	DT	.19200000 04	DR	.11462477 01	SHA	.34417983 06	DES	.12666987 01	DEM	-.23663604 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.14894558 09	Y	-.79163406 07	Z	-.34434010 07	DX	.12872580 01	DY	-.28449463 02	DZ	-.12313105 02
R	.14919555 09	LAT	-.13224911 01	LON	.18304236 03	V	.31026465 02	PTH	.93928846 00	AZ	.11336822 03
XE	-.14893225 09	YE	-.76032414 07	ZE	-.32974310 07	DXE	.11582983 01	DYE	-.27383113 02	DZE	-.11873858 02
XT	-.14898809 09	YT	-.79665314 07	ZT	-.34584990 07	DXT	.21144740 01	DYT	-.27501336 02	DZT	-.12018747 02
LTE	-.12666987 01	LOE	.18292251 03	LTT	-.13278861 01	LOT	.18306074 03	RST	.14924101 09	VST	.30087285 02
EPS	.84473005 02	ESP	.13177923 00	SEP	.95394816 02	EPM	.14240542 03	EMP	.31706125 02	MEP	.58884400 01
MPS	.13233689 03	MSP	.18504685-01	SMP	.47643954 02	SEM	.10118442 03	EMS	.78664439 02	ESM	.15049542 00
RPM	.67484229 05	SPN	.83415900 02								
GCE	.77642574 02	GCT	.24903852 03	SIP	.13086304 03	CPT	.10342614 03	SIN	.10195228 03	D1	.77188010 00
REP	.34571117 06	VEP	.11604627 01	CPE	.77982792 02	CPS	.92719208 02	D2	.52994375 00	D3	.18106719-01

0 DAYS 13 HRS. 29 MIN. 22.000 SEC. 23571216015020200000000 J.D.= 2438843.58333334 MARCH 24,1965 02 00 00.000
TFL 2 DAYS 4 HRS. 22 MIN. 56.543 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	-.12876882 05	Y	-.31692375 06	Z	-.14754385 06	DX	.12678874 00	DY	-.10585572 01	DZ	-.43510650 00
R	.34982233 06	DEC	-.24946257 02	RA	.26767329 03	V	.11514931 01	PTH	.81172494 02	AZ	.73761615 02
R	.34982232 06	LAT	-.24946257 02	LON	.56335015 02	VE	.22988083 02	PTE	.28371581 01	AZE	.27012331 03
XS	.14892804 09	YS	.77018222 07	ZS	.33401775 07	DXS	-.11797239 01	DYS	.27382111 02	DZS	.11873424 02
XM	-.52402444 05	YM	-.36370074 06	ZM	-.16158306 06	DXM	.95736642 00	DYM	-.11000668 00	DZM	-.14124206 00
XT	-.52402444 05	YT	-.36370074 06	ZT	-.16158306 06	DXT	.95736642 00	DYT	-.11000668 00	DZT	-.14124206 00
RS	.14916446 09	VS	.29868879 02	RM	.40141416 06	VM	.97396163 00	RT	.40141416 06	VT	.97396163 00
GED	-.25095394 02	ALT	.34344796 06	LOS	.15162213 03	RAS	.29604182 01	RAM	.26180117 03	LOM	.50462881 02
DUT	.36000000 02	DT	.19200000 04	DR	.11378535 01	SHA	.34830711 06	DES	.12831074 01	DEM	-.23736721 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.14894091 09	Y	-.80187459 07	Z	-.34877213 07	DX	.13065127 01	DY	-.28440668 02	DZ	-.12308530 02
R	.14919738 09	LAT	-.13394991 01	LON	.18308174 03	V	.31017390 02	PTH	.94587789 00	AZ	.11336600 03
XE	-.14892804 09	YE	-.77018222 07	ZE	-.33401775 07	DXE	.11797239 01	DYE	-.27382111 02	DZE	-.11873424 02
XT	-.14898044 09	YT	-.80655229 07	ZT	-.35017605 07	DXT	.21370903 01	DYT	-.27492117 02	DZT	-.12014666 02
LTE	-.12831074 01	LOE	.18296041 03	LTT	-.13445108 01	LOT	.18309886 03	RST	.14923969 09	VST	.30078827 02
EPS	.84531561 02	ESP	.13325579 00	SEP	.95334677 02	EPM	.14236343 03	EMP	.32151962 02	MEP	.54845911 01
MPS	.13231889 03	MSP	.15639313-01	SMP	.47663273 02	SEM	.10072723 03	EMS	.79121353 02	ESM	.15114412 00
RPM	.62828781 05	SPN	.83486880 02								
GCE	.77609347 02	GCT	.24899497 03	SIP	.13073580 03	CPT	.10346940 03	SIN	.10188631 03	D1	.82911657 00
REP	.34982233 06	VEP	.11514931 01	CPE	.77944627 02	CPS	.92708865 02	D2	.56982236 00	D3	.20877434-01

0 DAYS 14 HRS. 29 MIN. 22.000 SEC. 23571216175420200000000 J.D.= 2438843.62500000 MARCH 24,1965 03 00 00.000
TFL 2 DAYS 5 HRS. 22 MIN. 56.543 SEC.

SPACE TRAJECTORY
RA-9 POST MIDCOURSE ORBIT

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.12424995 05	Y	-.32072162 06	Z	-.14910317 06	DX	.12417093 00	DY	-.10515088 01	DZ	-.43123406 00
R	.35390463 06	DEC	-.24917250 02	RA	.26778142 03	V	.11432638 01	PTH	.81343397 02	AZ	.73261177 02
R	.35390463 06	LAT	-.24917251 02	LON	.41402075 02	VE	.23267669 02	PTE	.27842685 01	AZE	.27012218 03
XS	.14892375 09	YS	.78004006 07	ZS	.33829230 07	DXS	-.12011494 01	DYS	.27381094 02	DZS	.11872984 02
XM	-.48953886 05	YM	-.36408197 06	ZM	-.16208495 06	DXM	.95847961 00	DYM	-.10178720 00	DZM	-.13758657 00
XT	-.48953886 05	YT	-.36408197 06	ZT	-.16208495 06	DXT	.95847961 00	DYT	-.10178720 00	DZT	-.13758657 00
RS	.14916626 09	VS	.29868626 02	RM	.40152670 06	VM	.97363948 00	RT	.40152670 06	VT	.97363948 00
GED	-.25066262 02	ALT	.34753026 06	LOS	.13661897 03	RAS	.29983271 01	RAM	.26234202 03	LOM	.35962665 02
DUT	.36000000 02	DT	.19200000 04	DR	.11302399 01	SHA	.35240385 06	DES	.12995143 01	DEM	-.23807913 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14893617 09	Y	-.81211222 07	Z	-.35320262 07	DX	.13253203 01	DY	-.28432603 02	DZ	-.12304218 02
R	.14919924 09	LAT	-.13565020 01	LON	.18312110 03	V	.31009082 02	PTH	.95331938 00	AZ	.11336369 03
XE	-.14892375 09	YE	-.78004006 07	ZE	-.33829230 07	DXE	.12011494 01	DYE	-.27381094 02	DZE	-.11872984 02
XT	-.14897271 09	YT	-.81644826 07	ZT	-.35450080 07	DXT	.21596290 01	DYT	-.27482881 02	DZT	-.12010571 02
LTE	-.12995143 01	LOE	.18299832 03	LTT	-.13611303 01	LOT	.18313697 03	RST	.14923837 09	VST	.30070360 02
EPS	.84586208 02	ESP	.13507880 00	SEP	.95278458 02	EPM	.14234215 03	EMP	.32580578 02	MEP	.50772677 01
MPS	.13228285 03	MSP	.15639313-01	SMP	.47700624 02	SEM	.10027033 03	EMS	.79577986 02	ESM	.15162881 00
RPM	.58163619 05	SPN	.83553579 02								
GCE	.77576566 02	GCT	.24894842 03	SIP	.13057275 03	CPT	.10351993 03	SIN	.10180983 03	D1	.89567506 00
REP	.35390463 06	VEP	.11432638 01	CPE	.77907203 02	CPS	.92698522 02	D2	.61612435 00	D3	.24332021-01

0 DAYS 15 HRS. 29 MIN. 22.000 SEC.

23571216356020200000000 J.D.= 2438843.66666666 MARCH 24,1965 04 00 00.000
TFL 2 DAYS 6 HRS. 22 MIN. 56.543 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.11983490 05	Y	-.32449565 06	Z	-.15064909 06	DX	.12100033 00	DY	-.10453302 01	DZ	-.42766453 00
R	.35796114 06	DEC	-.24888465 02	RA	.26788504 03	V	.11358932 01	PTH	.81541064 02	AZ	.72658237 02
R	.35796114 06	LAT	-.24888465 02	LON	.26464631 02	VE	.23546104 02	PTE	.27349887 01	AZE	.27012133 03
XS	.14891939 09	YS	.78989752 07	ZS	.34256669 07	DXS	-.12225744 01	DYS	.27380064 02	DZS	.11872538 02
XM	-.45501458 05	YM	-.36443361 06	ZM	-.16257367 06	DXM	.95951529 00	DYM	-.93566197-01	DZM	-.13392290 00
XT	-.45501458 05	YT	-.36443361 06	ZT	-.16257367 06	DXT	.95951529 00	DYT	-.93566197-01	DZT	-.13392290 00
RS	.14916807 09	VS	.29868373 02	RM	.40163719 06	VM	.97332397 00	RT	.40163719 06	VT	.97332397 00
GED	-.25037349 02	ALT	.35158676 06	LOS	.12161581 03	RAS	.30362355 01	RAM	.26288314 03	LOM	.21462717 02
DUT	.36000000 02	DT	.19200000 04	DR	.11235364 01	SHA	.35647300 06	DES	.13159213 01	DEM	-.23877181 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14893137 09	Y	-.82234708 07	Z	-.35763159 07	DX	.13435747 01	DY	-.28425394 02	DZ	-.12300203 02
R	.14920110 09	LAT	-.13734972 01	LON	.18316046 03	V	.31001664 02	PTH	.96182467 00	AZ	.11336123 03
XE	-.14891939 09	YE	-.78989752 07	ZE	-.34256669 07	DXE	.12225744 01	DYE	-.27380064 02	DZE	-.11872538 02
XT	-.14896489 09	YT	-.82634088 07	ZT	-.35882406 07	DXT	.21820897 01	DYT	-.27473630 02	DZT	-.12006461 02
LTE	-.13159213 01	LOE	.18303623 03	LTT	-.13777456 01	LOT	.18317506 03	RST	.14923705 09	VST	.30061885 02
EPS	.84636837 02	ESP	.13651968 00	SEP	.95226268 02	EPM	.14234530 03	EMP	.32988371 02	MEP	.46663371 01
MPS	.13222486 03	MSP	.13988227-01	SMP	.47759926 02	SEM	.99813710 02	EMS	.80034343 02	ESM	.15179003 00
RPM	.53485417 05	SPN	.83615912 02								
GCE	.77544166 02	GCT	.24889783 03	SIP	.13036513 03	CPT	.10357959 03	SIN	.10171986 03	D1	.97409622 00
REP	.35796114 06	VEP	.11358932 01	CPE	.77870453 02	CPS	.92688181 02	D2	.67059170 00	D3	.28719563-01

0 DAYS 16 HRS. 29 MIN. 22.000 SEC.

23571216536420200000000 J.D.= 2438843.70833333 MARCH 24,1965 05 00 00.000
TFL 2 DAYS 7 HRS. 22 MIN. 56.543 SEC.

SPACE TRAJECTORY
RA-9 POST MIDCOURSE ORBIT

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.11554606 05	Y	-.32824926 06	Z	-.15218278 06	DX	.11712911 00	DY	-.10401999 01	DZ	-.42444779 00
R	.36199542 06	DEC	-.24859828 02	RA	.26798397 03	V	.11295534 01	PTH	.81772887 02	AZ	.71914038 02
R	.36199542 06	LAT	-.24859828 02	LON	.11522494 02	VE	.23823784 02	PTE	.26895859 01	AZE	.27012081 03
XS	.14891495 09	YS	.79975463 07	ZS	.34684093 07	DXS	-.12439990 01	DYS	.27379018 02	DZS	.11872087 02
XM	-.42045441 05	YM	-.36475565 06	ZM	-.16304919 06	DXM	.96047355 00	DYM	-.85344222-01	DZM	-.13025132 00
XT	-.42045441 05	YT	-.36475565 06	ZT	-.16304919 06	DXT	.96047355 00	DYT	-.85344222-01	DZT	-.13025132 00
RS	.14916988 09	VS	.29868120 02	RM	.40174561 06	VM	.97301514 00	RT	.40174561 06	VT	.97301514 00
GED	-.25008587 02	ALT	.35562103 06	LOS	.10661265 03	RAS	.30741439 01	RAM	.26342452 03	LOM	.69630317 01
DUT	.36000000 02	DT	.19200000 04	DR	.11179288 01	SHA	.36051799 06	DES	.13323266 01	DEM	-.23944518 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14892650 09	Y	-.83257956 07	Z	-.36205921 07	DX	.13611281 01	DY	-.28419218 02	DZ	-.12296534 02
R	.14920299 09	LAT	-.13904873 01	LON	.18319981 03	V	.30995312 02	PTH	.97168575 00	AZ	.11335860 03
XE	-.14891495 09	YE	-.79975463 07	ZE	-.34684093 07	DXE	.12439990 01	DYE	-.27379018 02	DZE	-.11872087 02
XT	-.14895699 09	YT	-.83623020 07	ZT	-.36314585 07	DXT	.22044726 01	DYT	-.27464363 02	DZT	-.12002338 02
LTE	-.13323266 01	LOE	.18307414 03	LTT	-.13943549 01	LOT	.18321315 03	RST	.14923572 09	VST	.30053403 02
EPS	.84683266 02	ESP	.13847642 00	SEP	.95178289 02	EPM	.14237816 03	EMP	.33370246 02	MEP	.42515784 01
MPS	.13213938 03	MSP	.13988227-01	SMP	.47846726 02	SEM	.99357374 02	EMS	.80490434 02	ESM	.15243321 00
RPM	.48790225 05	SPN	.83673719 02								
GCE	.77512062 02	GCT	.24884179 03	SIP	.13010061 03	CPT	.10365100 03	SIN	.10161223 03	D1	.10679492 01
REP	.36199542 06	VEP	.11295534 01	CPE	.77834307 02	CPS	.92677838 02	D2	.73566697 00	D3	.34415425-01

0 DAYS 17 HRS. 29 MIN. 22.000 SEC.

23571216717020200000000 J.D.= 2438843.75000000 MARCH 24,1965 06 00 00.000
TFL 2 DAYS 8 HRS. 22 MIN. 56.543 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.11141227 05	Y	-.33198666 06	Z	-.15370563 06	DX	.11234493 00	DY	-.10363806 01	DZ	-.42165803 00
R	.36601187 06	DEC	-.24831249 02	RA	.26807791 03	V	.11245006 01	PTH	.82049149 02	AZ	.70967995 02
R	.36601186 06	LAT	-.24831249 02	LON	.35657536 03	VE	.24101232 02	PTE	.26485160 01	AZE	.27012071 03
XS	.14891043 09	YS	.80961138 07	ZS	.35111501 07	DXS	-.12654232 01	DYS	.27377960 02	DZS	.11871629 02
XM	-.38586113 05	YM	-.36504809 06	ZM	-.16351147 06	DXM	.96135446 00	DYM	-.77121820-01	DZM	-.12657207 00
XT	-.38586113 05	YT	-.36504809 06	ZT	-.16351147 06	DXT	.96135446 00	DYT	-.77121820-01	DZT	-.12657207 00
RS	.14917169 09	VS	.29867868 02	RM	.40185196 06	VM	.97271303 00	RT	.40185196 06	VT	.97271303 00
GED	-.24979882 02	ALT	.35963747 06	LOS	.91609497 02	RAS	.31120510 01	RAM	.26396615 03	LOM	.35246360 03
DUT	.36000000 02	DT	.19200000 04	DR	.11136909 01	SHA	.36454302 06	DES	.13487318 01	DEM	-.24009920 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14892157 09	Y	-.84281005 07	Z	-.36648558 07	DX	.13777681 01	DY	-.28414341 02	DZ	-.12293286 02
R	.14920489 09	LAT	-.14074714 01	LON	.18323915 03	V	.30990287 02	PTH	.98332354 00	AZ	.11335571 03
XE	-.14891043 09	YE	-.80961138 07	ZE	-.35111501 07	DXE	.12654232 01	DYE	-.27377960 02	DZE	-.11871629 02
XT	-.14894902 09	YT	-.84611619 07	ZT	-.36746616 07	DXT	.22267776 01	DYT	-.27455082 02	DZT	-.11998201 02
LTE	-.13487318 01	LOE	.18311205 03	LTT	-.14109591 01	LOT	.18325123 03	RST	.14923439 09	VST	.30044914 02
EPS	.84725215 02	ESP	.14023158 00	SEP	.95134795 02	EPM	.14244837 03	EMP	.33718877 02	MEP	.38327421 01
MPS	.13201842 03	MSP	.13988227-01	SMP	.47969006 02	SEM	.98901311 02	EMS	.80946261 02	ESM	.15211196 00
RPM	.44073058 05	SPN	.83726748 02								
GCE	.77480164 02	GCT	.24877825 03	SIP	.12976133 03	CPT	.10373789 03	SIN	.10148080 03	D1	.11824215 01
REP	.36601187 06	VEP	.11245006 01	CPE	.77798688 02	CPS	.92667495 02	D2	.81489379 00	D3	.42008116-01

0 DAYS 18 HRS. 29 MIN. 22.000 SEC.

23571217077420200000000 J.D.= 2438843.79166666 MARCH 24,1965 07 00 00.000
TFL 2 DAYS 9 HRS. 22 MIN. 56.543 SEC.

SPACE TRAJECTORY
RA-9 POST MIDCOURSE ORBIT

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.10747166 05	Y	-.33571325 06	Z	-.15521936 06	DX	.10633138 00	DY	-.10342723 01	DZ	-.41940857 00
R	.37001613 06	DEC	-.24802614 02	RA	.26816641 03	V	.11211285 01	PTH	.82384299 02	AZ	.69719904 02
R	.37001613 06	LAT	-.24802615 02	LON	.34162280 03	VE	.24379159 02	PTE	.26125328 01	AZE	.27012116 03
XS	.14890584 09	YS	.81946772 07	ZS	.35538891 07	DXS	-.12868467 01	DYS	.27376886 02	DZS	.11871164 02
XM	-.35123754 05	YM	-.36531093 06	ZM	-.16396050 06	DXM	.96215807 00	DYM	-.68899530-01	DZM	-.12288540 00
XT	-.35123754 05	YT	-.36531093 06	ZT	-.16396050 06	DXT	.96215807 00	DYT	-.68899530-01	DZT	-.12288540 00
RS	.14917349 09	VS	.29867615 02	RM	.40195621 06	VM	.97241766 00	RT	.40195621 06	VT	.97241766 00
GED	-.24951123 02	ALT	.36364172 06	LOS	.76606338 02	RAS	.31499598 01	RAM	.26450803 03	LOM	.33796440 03
DUT	.36000000 02	DT	.23841858-06	DR	.11112393 01	SHA	.36855344 06	DES	.13651354 01	DEM	-.24073384 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14891658 09	Y	-.85303903 07	Z	-.37091085 07	DX	.13931781 01	DY	-.28411159 02	DZ	-.12290573 02
R	.14920681 09	LAT	-.14244530 01	LON	.18327849 03	V	.30986982 02	PTH	.99736385 00	AZ	.11335247 03
XE	-.14890584 09	YE	-.81946772 07	ZE	-.35538891 07	DXE	.12868467 01	DYE	-.27376886 02	DZE	-.11871164 02
XT	-.14894096 09	YT	-.85599881 07	ZT	-.37178496 07	DXT	.22490048 01	DYT	-.27445786 02	DZT	-.11994050 02
LTE	-.13651354 01	LOE	.18314995 03	LTT	-.14275582 01	LOT	.18328930 03	RST	.14923306 09	VST	.30036418 02
EPS	.84762279 02	ESP	.14127420 00	SEP	.95096192 02	EPM	.14256728 03	EMP	.34023323 02	MEP	.34093998 01
MPS	.13185003 03	MSP	.27453512-18	SMP	.48138716 02	SEM	.98445515 02	EMS	.81401830 02	ESM	.15243321 00
RPM	.39327444 05	SPN	.83774618 02								
GCE	.77448355 02	GCT	.24870424 03	SIP	.12932041 03	CPT	.10384588 03	SIN	.10131626 03	D1	.13253669 01
REP	.37001613 06	VEP	.11211285 01	CPE	.77763502 02	CPS	.92657152 02	D2	.91362604 00	D3	.52465448-01

SELENOCENTRIC — EQUATORIAL COORDINATES

X	.24376588 05	Y	.29597676 05	Z	.87411339 04	DX	-.85582668 00	DY	-.96537278 00	DZ	-.29652317 00
R	.39327444 05	DEC	.12842131 02	RA	.50525194 02	V	.13237484 01	PTH	-.87966985 02	AZ	.93110943 02
R	.39327439 05	LAT	-.61437312 01	LON	.32945105 03	VP	.13243054 01	PTP	-.87374273 02	AZP	.25735914 03
LTS	-.14827794 01	LNS	.28141192 03	LTE	.94287687 00	LNE	.27849917 01				
ALT	.37591694 05	SHA	-.29289611 05	ALP	.49347606 01	DR	-.13229152 01	DP	.68416298-04	ASD	.25296177 01
HGE	.27523771 03	SVL	-.65021282 01	HNG	.13218314 03	SIA	.14003766 03				

0 DAYS 19 HRS. 29 MIN. 22.000 SEC. 235712172600202000000000 J.D.= 2438843.83333333 MARCH 24,1965 08 C0 00.C00
TFL 2 DAYS 10 HRS. 22 MIN. 56.543 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.10377671 05	Y	-.33943623 06	Z	-.15672623 06	DX	.98595089-01	DY	-.10345127 01	DZ	-.41788010 00
R	.37401571 06	DEC	-.24773772 02	RA	.26824882 03	V	.11200720 01	PTH	.82799426 02	AZ	.67991647 02
R	.37401571 06	LAT	-.24773772 02	LON	.32666414 03	VE	.24658590 02	PTE	.25829060 01	AZE	.27012237 03
XS	.14890116 09	YS	.82932361 07	ZS	.35966263 07	DXS	-.13082698 01	DYS	.27375800 02	DZS	.11870695 02
XM	-.31658641 05	YM	-.36554417 06	ZM	-.16439624 06	DXM	.96288447 00	DYM	-.60677896-01	DZM	-.11919158 00
XT	-.31658641 05	YT	-.36554417 06	ZT	-.16439624 06	DXT	.96288447 00	DYT	-.60677896-01	DZT	-.11919158 00
RS	.14917530 09	VS	.29867363 02	RM	.40205836 06	VM	.97212907 00	RT	.40205836 06	VT	.97212907 00
GED	-.24922152 02	ALT	.36764130 06	LOS	.61603180 02	RAS	.31878670 01	RAM	.26505014 03	LOM	.32346545 03
DUT	.36000000 02	DT	.48000000 03	DR	.11112385 01	SHA	.37255635 06	DES	.13815381 01	DEM	-.24134906 02

SPACE TRAJECTORY
RA-9 POST MIDCOURSE ORBIT

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14891154 09	Y	-.86326724 07	Z	-.37533525 07	DX	.14068649 01	DY	-.28410313 02	DZ	-.12288575 02
R	.14920877 09	LAT	-.14414294 01	LON	.18331782 03	V	.30986032 02	PTH	.10147808 01	AZ	.11334872 03
XE	-.14890116 09	YE	-.82932361 07	ZE	-.35966263 07	DXE	.13082698 01	DYE	-.27375800 02	DZE	-.11870695 02
XT	-.14893282 09	YT	-.86587803 07	ZT	-.37610226 07	DXT	.22711543 01	DYT	-.27436478 02	DZT	-.11989886 02
LTE	-.13815381 01	LOE	.18318786 03	LTT	-.14441521 01	LOT	.18332736 03	RST	.14923172 09	VST	.30027917 02
EPS	.84793849 02	ESP	.14265252 00	SEP	.95063088 02	EPM	.14275277 03	EMP	.34266316 02	MEP	.29808791 01
MPS	.13161536 03	MSP	.27453512-18	SMP	.48374720 02	SEM	.97989982 02	EMS	.81857149 02	ESM	.15243321 00
RPM	.34544652 05	SPN	.83816749 02								
GCE	.77416471 02	GCT	.24861511 03	SIP	.12873523 03	CPT	.10398371 03	SIN	.10110358 03	D1	.15093033 01
REP	.37401571 06	VEP	.11200720 01	CPE	.77728627 02	CPS	.92646804 02	D2	.10403735 01	D3	.67476601-01

SELENOCENTRIC — EQUATORIAL COORDINATES

X	.21280970 05	Y	.26107936 05	Z	.76700079 04	DX	-.86428938 00	DY	-.97383483 00	DZ	-.29868852 00
R	.34544652 05	DEC	.12828392 02	RA	.50816003 02	V	.13358762 01	PTH	-.87653259 02	AZ	.92504295 02
R	.34544647 05	LAT	-.62222971 01	LON	.32917644 03	VP	.13354046 01	PTP	-.88213509 02	AZP	.24914348 03
LTS	-.14825404 01	LNS	.28090438 03	LTE	.99969209 00	LNE	.27314007 01				
ALT	.32808902 05	SHA	-.25822303 05	ALP	.49707225 01	DR	-.13347558 01	DP	.90725166-04	ASD	.28801277 01
HGE	.27520615 03	SVL	-.65686039 01	HNG	.13195256 03	SIA	.13987264 03				

0 DAYS 20 HRS. 29 MIN. 22.000 SEC. 23571217440420200C000000 J.D.= 2438843.87500000 MARCH 24,1965 09 00 00.000
TFL 2 DAYS 11 HRS. 22 MIN. 56.543 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.10040281 05	Y	-.34316583 06	Z	-.15822932 06	DX	.88319375-01	DY	-.10381819 01	DZ	-.41737718 00
R	.37802131 06	DEC	-.24744496 02	RA	.26832412 03	V	.11224196 01	PTH	.83325824 02	AZ	.65434702 02
R	.37802130 06	LAT	-.24744497 02	LON	.31169837 03	VE	.24941096 02	PTE	.25618494 01	AZE	.27012471 03
XS	.14889642 09	YS	.83917914 07	ZS	.36393618 07	DXS	-.13296924 01	DYS	.27374699 02	DZS	.11870219 02
XM	-.28191053 05	YM	-.36574782 06	ZM	-.16481867 06	DXM	.96353371 00	DYM	-.52457451-01	DZM	-.11549085 00
XT	-.28191053 05	YT	-.36574782 06	ZT	-.16481867 06	DXT	.96353371 00	DYT	-.52457451-01	DZT	-.11549085 00
RS	.14917711 09	VS	.29867110 02	RM	.40215842 06	VM	.97184727 00	RT	.40215842 06	VT	.97184727 00
GED	-.24892749 02	ALT	.37164688 06	LOS	.46600017 02	RAS	.32257736 01	RAM	.26559247 03	LOM	.30896671 03
DUT	.36000000 02	DT	.48000000 03	DR	.11148131 01	SHA	.37656181 06	DES	.13979408 01	DEM	-.24194482 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14890645 09	Y	-.87349572 07	Z	-.37975911 07	DX	.14180117 01	DY	-.28412880 02	DZ	-.12287596 02
R	.14921077 09	LAT	-.14584016 01	LON	.18335716 03	V	.30988506 02	PTH	.10371881 01	AZ	.11334418 03
XE	-.14889642 09	YE	-.83917914 07	ZE	-.36393618 07	DXE	.13296924 01	DYE	-.27374699 02	DZE	-.11870219 02
XT	-.14892461 09	YT	-.87575392 07	ZT	-.38041805 07	DXT	.22932261 01	DYT	-.27427156 02	DZT	-.11985710 02
LTE	-.13979408 01	LOE	.18322577 03	LTT	-.14607418 01	LOT	.18336541 03	RST	.14923037 09	VST	.30019410 02
EPS	.84818995 02	ESP	.14435692 00	SEP	.95036405 02	EPM	.14303456 03	EMP	.34419079 02	MEP	.25463262 01
MPS	.13128285 03	MSP	.27453512-18	SMP	.48708577 02	SEM	.97534704 02	EMS	.82312220 02	ESM	.15291383 00
RPM	.29712222 05	SPN	.83852252 02								
GCE	.77384298 02	GCT	.24850325 03	SIP	.12793380 03	CPT	.10416597 03	SIN	.10081691 03	D1	.17555598 01
REP	.37802131 06	VEP	.11224196 01	CPE	.77693906 02	CPS	.92636455 02	D2	.12095898 01	D3	.90225908-01

SPACE TRAJECTORY
RA-9 POST MIDCOURSE ORBIT

SELENOCENTRIC — EQUATORIAL COORDINATES

X	.18150772 05	Y	.22581987 05	Z	.65893473 04	DX	-.87521434 00	DY	-.98572446 00	DZ	-.30188632 00
R	.29712222 05	DEC	.12813149 02	RA	.51208645 02	V	.13523269 01	PTH	-.87258910 02	AZ	.92109119 02
R	.29712217 05	LAT	-.63243982 01	LON	.32899899 03	VP	.13509845 01	PTP	-.89001638 02	AZP	.22392006 03
LTS	-.14823013 01	LNS	.28039686 03	LTE	.10564057 01	LNE	.26775933 01				
ALT	.27976472 05	SHA	-.22324662 05	ALP	.50115655 01	DR	-.13507796 01	DP	.12470998-03	ASD	.33490517 01
HGE	.27518100 03	SVL	-.66620708 01	HNG	.13162574 03	SIA	.13968551 03				

0 DAYS 21 HRS. 29 MIN. 22.000 SEC. 23571217621020200000000 J.D.= 2438843.91666666 MARCH 24,1965 10 00 00.000
TFL 2 DAYS 12 HRS. 22 MIN. 56.543 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.97464998 04	Y	-.34691757 06	Z	-.15973322 06	DX	.74040807-01	DY	-.10472712 01	DZ	-.41845649 00
R	.38204907 06	DEC	-.24714444 02	RA	.26839072 03	V	.11302057 01	PTH	.84010065 02	AZ	.61270744 02
R	.38204907 06	LAT	-.24714444 02	LON	.29672390 03	VE	.25229302 02	PTE	.25535294 01	AZE	.27012887 03
XS	.14889159 09	YS	.84903422 07	ZS	.36820954 07	DXS	-.13511143 01	DYS	.27373583 02	DZS	.11869737 02
XM	-.24721268 05	YM	-.36592187 06	ZM	-.16522777 06	DXM	.96410589 00	DYM	-.44238733-01	DZM	-.11178347 00
XT	-.24721268 05	YT	-.36592187 06	ZT	-.16522777 06	DXT	.96410589 00	DYT	-.44238733-01	DZT	-.11178347 00
RS	.14917891 09	VS	.29866858 02	RM	.40225635 06	VM	.97157232 00	RT	.40225635 06	VT	.97157232 00
GED	-.24862563 02	ALT	.37567464 06	LOS	.31596859 02	RAS	.32636808 01	RAM	.26613503 03	LOM	.29446820 03
DUT	.36000000 02	DT	.48000000 03	DR	.11240351 01	SHA	.38058501 06	DES	.14143409 01	DEM	-.24252109 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14890133 09	Y	-.88372597 07	Z	-.38418286 07	DX	.14251550 01	DY	-.28420854 02	DZ	-.12288193 02
R	.14921281 09	LAT	-.14753746 01	LON	.18339650 03	V	.30996382 02	PTH	.10674723 01	AZ	.11333834 03
XE	-.14889159 09	YE	-.84903422 07	ZE	-.36820954 07	DXE	.13511143 01	DYE	-.27373583 02	DZE	-.11869737 02
XT	-.14891631 09	YT	-.88562641 07	ZT	-.38473232 07	DXT	.23152201 01	DYT	-.27417822 02	DZT	-.11981520 02
LTE	-.14143409 01	LOE	.18326368 03	LTT	-.14773246 01	LOT	.18340345 03	RST	.14922903 09	VST	.30010898 02
EPS	.84836251 02	ESP	.14604142 00	SEP	.95017606 02	EPM	.14346640 03	EMP	.34429350 02	MEP	.21042308 01
MPS	.13079499 03	MSP	.27453512-18	SMP	.49197796 02	SEM	.97079676 02	EMS	.82767054 02	ESM	.15339293 00
RPM	.24811225 05	SPN	.83879700 02								
GCE	.77351496 02	GCT	.24835510 03	SIP	.12678340 03	CPT	.10441907 03	SIN	.10040748 03	D1	.21039023 01
REP	.38204907 06	VEP	.11302057 01	CPE	.77659091 02	CPS	.92626099 02	D2	.14481127 01	D3	.12736892 00

SELENOCENTRIC — EQUATORIAL COORDINATES

X	.14974768 05	Y	.19004295 05	Z	.54945410 04	DX	-.89006508 00	DY	-.10030325 01	DZ	-.30667301 00
R	.24811225 05	DEC	.12794438 02	RA	.51763034 02	V	.13756229 01	PTH	-.86734480 02	AZ	.91897880 02
R	.24811221 05	LAT	-.64643642 01	LON	.32897576 03	VP	.13735716 01	PTP	-.89065809 02	AZP	.15340937 03
LTS	-.14820622 01	LNS	.27988930 03	LTE	.11130143 01	LNE	.26235192 01				
ALT	.23075475 05	SHA	-.18781351 05	ALP	.50595631 01	DR	-.13733893 01	DP	.18095289-03	ASD	.40115894 01
HGE	.27516374 03	SVL	-.67987292 01	HNG	.13114609 03	SIA	.13945480 03				

0 DAYS 22 HRS. 29 MIN. 22.000 SEC. 23571220001420200000000 J.D.= 2438843.95833333 MARCH 24,1965 11 00 00.000
TFL 2 DAYS 13 HRS. 22 MIN. 56.543 SEC.

SPACE TRAJECTORY
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GEOCENTRIC — EQUATORIAL COORDINATES

X	-.95153501 04	Y	-.35071745 06	Z	-.16124542 06	DX	.52824988-01	DY	-.10659268 01	DZ	-.42226103 00
R	.38612608 06	DEC	-.24683022 02	RA	.26844588 03	V	.11477347 01	PTH	.84912135 02	AZ	.53399920 02
R	.38612607 06	LAT	-.24683023 02	LON	.28173799 03	VE	.25528098 02	PTE	.25667065 01	AZE	.27013634 03
XS	.14888669 09	YS	.85888902 07	ZS	.37248279 07	DXS	-.13725360 01	DYS	.27372453 02	DZS	.11869248 02
XM	-.21249556 05	YM	-.36606634 06	ZM	-.16562350 06	DXM	.96460106 00	DYM	-.36022265-01	DZM	-.10806969 00
XT	-.21249556 05	YT	-.36606634 06	ZT	-.16562350 06	DXT	.96460106 00	DYT	-.36022265-01	DZT	-.10806969 00
RS	.14918073 09	VS	.29866605 02	RM	.40235214 06	VM	.97130420 00	RT	.40235214 06	VT	.97130420 00
GED	-.24831003 02	ALT	.37975164 06	LOS	.16593697 02	RAS	.33015866 01	RAM	.26667779 03	LOM	.27996990 03
DUT	.36000000 02	DT	.24000000 03	DR	.11432124 01	SHA	.38465136 06	DES	.14307410 01	DEM	-.24307784 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14889620 09	Y	-.89396076 07	Z	-.38860733 07	DX	.14253610 01	DY	-.28438380 02	DZ	-.12291509 02
R	.14921494 09	LAT	-.14923476 01	LON	.18343586 03	V	.31013776 02	PTH	.11114229 01	AZ	.11333009 03
XE	-.14888669 09	YE	-.85888902 07	ZE	-.37248279 07	DXE	.13725360 01	DYE	-.27372453 02	DZE	-.11869248 02
XT	-.14890794 09	YT	-.89549566 07	ZT	-.38904514 07	DXT	.23371371 01	DYT	-.27408476 02	DZT	-.11977318 02
LTE	-.14307410 01	LOE	.18330158 03	LTT	-.14939024 01	LOT	.18344148 03	RST	.14922768 09	VST	.30002381 02
EPS	.84843113 02	ESP	.14787221 00	SEP	.95009185 02	EPM	.14415747 03	EMP	.34190417 02	MEP	.16520899 01
MPS	.13003369 03	MSP	.98911702-02	SMP	.49960485 02	SEM	.96624893 02	EMS	.83221652 02	ESM	.15339293 00
RPM	.19810286 05	SPN	.83896663 02								
GCE	.77317484 02	GCT	.24814358 03	SIP	.12500706 03	CPT	.10479675 03	SIN	.99770125 02	D1	.26387069 01
REP	.38612608 06	VEP	.11477347 01	CPE	.77623778 02	CPS	.92615735 02	D2	.18125830 01	D3	.19502163 00

SELENOCENTRIC — EQUATORIAL COORDINATES

X	.11734206 05	Y	.15348885 05	Z	.43780796 04	DX	-.91177607 00	DY	-.10299046 01	DZ	-.31419134 00
R	.19810286 05	DEC	.12767793 02	RA	.52602123 02	V	.14109412 01	PTH	-.85980862 02	AZ	.91865525 02
R	.19810283 05	LAT	-.66713539 01	LON	.32922413 03	VP	.14083539 01	PTP	-.87971202 02	AZP	.11976894 03
LTS	-.14818215 01	LNS	.27938173 03	LTE	.11695119 01	LNE	.25692230 01				
ALT	.18074536 05	SHA	-.15166774 05	ALP	.51179563 01	DR	-.14074713 01	DP	.28601893-03	ASD	.50266230 01
HGE	.27515688 03	SVL	-.70116561 01	HNG	.13039736 03	SIA	.13913085 03				

0 DAYS 23 HRS. 29 MIN. 22.000 SEC. 23571220162020200C000000 J.D.= 2438844.00000000 MARCH 24,1965 12 00 00.000
TFL 2 DAYS 14 HRS. 22 MIN. 56.543 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.93823873 04	Y	-.35461551 06	Z	-.16277996 06	DX	.17683856-01	DY	-.11045993 01	DZ	-.43160837 00
R	.39030437 06	DEC	-.24649050 02	RA	.26848442 03	V	.11860599 01	PTH	.86004619 02	AZ	.34571710 02
R	.39030437 06	LAT	-.24649050 02	LON	.26673546 03	VE	.25848309 02	PTE	.26235653 01	AZE	.27015099 03
XS	.14888171 09	YS	.86874329 07	ZS	.37675580 07	DXS	-.13939568 01	DYS	.27371310 02	DZS	.11868754 02
XM	-.17776205 05	YM	-.36618123 06	ZM	-.16600586 06	DXM	.96501933 00	DYM	-.27808596-01	DZM	-.10434976 00
XT	-.17776205 05	YT	-.36618123 06	ZT	-.16600586 06	DXT	.96501933 00	DYT	-.27808596-01	DZT	-.10434976 00
RS	.14918253 09	VS	.29866353 02	RM	.40244581 06	VM	.97104299 00	RT	.40244581 06	VT	.97104299 00
GED	-.24796880 02	ALT	.38392992 06	LOS	.15905314 01	RAS	.33394933 01	RAM	.26722076 03	LOM	.26547180 03
DUT	.36000000 02	DT	.24000000 03	DR	.11831774 01	SHA	.38880971 06	DES	.14471395 01	DEM	-.24361503 02

SPACE TRAJECTORY
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HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14889109 09	Y	-.90420483 07	Z	-.39303380 07	DX	.14116407 01	DY	-.28475909 02	DZ	-.12300363 02
R	.14921717 09	LAT	-.15093283 01	LON	.18347526 03	V	.31051071 02	PTH	.11828163 01	AZ	.11331658 03
XE	-.14888171 09	YE	-.86874329 07	ZE	-.37675580 07	DXE	.13939568 01	DYE	-.27371310 02	DZE	-.11868754 02
XT	-.14889949 09	YT	-.90536141 07	ZT	-.39335639 07	DXT	.23589762 01	DYT	-.27399119 02	DZT	-.11973104 02
LTE	-.14471395 01	LOE	.18333949 03	LTT	-.15104741 01	LOT	.18347950 03	RST	.14922633 09	VST	.29993860 02
EPS	.84834836 02	ESP	.14918958 00	SEP	.95015868 02	EPM	.14537396 03	EMP	.33440804 02	MEP	.11852293 01
MPS	.12870679 03	MSP	.27453512-18	SMP	.51288818 02	SEM	.96170348 02	EMS	.83676024 02	ESM	.15339293 00
RPM	.14650204 05	SPN	.83898520 02								
GCE	.77281126 02	GCT	.24780450 03	SIP	.12190242 03	CPT	.10543015 03	SIN	.98625781 02	D1	.35796003 01
REP	.39030437 06	VEP	.11860599 01	CPE	.77587140 02	CPS	.92605353 02	D2	.24493388 01	D3	.34232288 00

SELENOCENTRIC — EQUATORIAL COORDINATES

X	.83938182 04	Y	.11565719 05	Z	.32259006 04	DX	-.94733547 00	DY	-.10767907 01	DZ	-.32725861 00
R	.14650204 05	DEC	.12720482 02	RA	.54029737 02	V	.14710611 01	PTH	-.84761273 02	AZ	.92052050 02
R	.14650202 05	LAT	-.70165337 01	LON	.33003464 03	VP	.14681369 01	PTP	-.86204071 02	AZP	.10982384 03
LTS	-.14815816 01	LNS	.27887417 03	LTE	.12258969 01	LNE	.25147134 01				
ALT	.12914454 05	SHA	-.11431677 05	ALP	.51897469 01	DR	-.14649164 01	DP	.52529968-03	ASD	.68043641 01
HGE	.27516516 03	SVL	-.73818728 01	HNG	.12909155 03	SIA	.13856959 03				

1 DAYS 0 HRS. 29 MIN. 22.000 SEC. 23571220342420200C000000 J.D.= 2438844.04166666 MARCH 24,1965 13 00 00.000
TFL 2 DAYS 15 HRS. 22 MIN. 56.543 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.94293770 04	Y	-.35873494 06	Z	-.16437016 06	DX	-.53968362-01	DY	-.12008058 01	DZ	-.45621292 00
R	.39471157 06	DEC	-.24609470 02	RA	.26849432 03	V	.12856817 01	PTH	.86049541 02	AZ	.34535306 03
R	.39471157 06	LAT	-.24609470 02	LON	.25170429 03	VE	.26222324 02	PTE	.28036577 01	AZE	.27018747 03
XS	.14887665 09	YS	.87859727 07	ZS	.38102869 07	DXS	-.14153774 01	DYS	.27370152 02	DZS	.11868254 02
XM	-.14301483 05	YM	-.36626656 06	ZM	-.16637481 06	DXM	.96536077 00	DYM	-.19598239-01	DZM	-.10062392 00
XT	-.14301483 05	YT	-.36626656 06	ZT	-.16637481 06	DXT	.96536077 00	DYT	-.19598239-01	DZT	-.10062392 00
RS	.14918434 09	VS	.29866100 02	RM	.40253733 06	VM	.97078868 00	RT	.40253733 06	VT	.97078868 00
GED	-.24757125 02	ALT	.38833710 06	LOS	.34658737 03	RAS	.33774000 01	RAM	.26776392 03	LOM	.25097389 03
DUT	.36000000 02	DT	.12000000 03	DR	.12826269 01	SHA	.39318022 06	DES	.14635379 01	DEM	-.24413263 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14888608 09	Y	-.91447077 07	Z	-.39746571 07	DX	.13614090 01	DY	-.28570958 02	DZ	-.12324467 02
R	.14921960 09	LAT	-.15263270 01	LON	.18351473 03	V	.31145554 02	PTH	.13261871 01	AZ	.11328688 03
XE	-.14887665 09	YE	-.87859727 07	ZE	-.38102869 07	DXE	.14153774 01	DYE	-.27370152 02	DZE	-.11868254 02
XT	-.14889095 09	YT	-.91522393 07	ZT	-.39766617 07	DXT	.23807382 01	DYT	-.27389750 02	DZT	-.11968878 02
LTE	-.14635379 01	LOE	.18337740 03	LTT	-.15270416 01	LOT	.18351751 03	RST	.14922497 09	VST	.29985335 02
EPS	.84800386 02	ESP	.15114412 00	SEP	.95048642 02	EPM	.14801884 03	EMP	.31288226 02	MEP	.69298641 00
MPS	.12579703 03	MSP	.98911702-02	SMP	.54200107 02	SEM	.95716035 02	EMS	.84130173 02	ESM	.15371151 00
RPM	.91913725 04	SPN	.83874524 02								
GCE	.77239472 02	GCT	.24712936 03	SIP	.11491160 03	CPT	.10676386 03	SIN	.95878442 02	D1	.57691731 01
REP	.39471157 06	VEP	.12856817 01	CPE	.77546974 02	CPS	.92594936 02	D2	.39133897 01	D3	.80015400 00

SPACE TRAJECTORY
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SELENOCENTRIC — EQUATORIAL COORDINATES

X	.48721061 04	Y	.75316194 04	Z	.20046500 04	DX	-.10193291 01	DY	-.11812076 01	DZ	-.35558900 00
R	.91913725 04	DEC	.12597536 02	RA	.57101700 02	V	.16002271 01	PTH	-.82295788 02	AZ	.92663183 02
R	.91913711 04	LAT	-.77413559 01	LON	.33242087 03	VP	.15972459 01	PTP	-.83131278 02	AZP	.10550000 03
LTS	-.14813408 01	LNS	.27836658 03	LTE	.12821682 01	LNE	.24599677 01				
ALT	.74556226 04	SHA	-.74547996 04	ALP	.52558371 01	DR	-.15857824 01	DP	.13372719-02	ASD	.10885422 02
HGE	.27519961 03	SVL	-.81855761 01	HNG	.12622346 03	SIA	.13713342 03				

1 DAYS 1 HRS. 29 MIN. 22.000 SEC.

235712205230202000000000 J.D.= 2438844.08333333 MARCH 24,1965 14 00 00.000
TFL 2 DAYS 16 HRS. 22 MIN. 56.543 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.99629830 04	Y	-.36365763 06	Z	-.16615987 06	DX	-.31988306 00	DY	-.17527340 01	DZ	-.58595686 00
R	.39994404 06	DEC	-.24548150 02	RA	.26843067 03	V	.18755658 01	PTH	.79662216 02	AZ	.30615329 03
R	.39994404 06	LAT	-.24548150 02	LON	.23659958 03	VE	.26864219 02	PTE	.39383562 01	AZE	.27042449 03
XS	.14887152 09	YS	.88845068 07	ZS	.38530133 07	DXS	-.14367971 01	DYS	.27368980 02	DZS	.11867748 02
XM	-.10825674 05	YM	-.36632235 06	ZM	-.16673034 06	DXM	.96562546 00	DYM	-.11391741-01	DZM	-.96892434-01
XT	-.10825674 05	YT	-.36632235 06	ZT	-.16673034 06	DXT	.96562546 00	DYT	-.11391741-01	DZT	-.96892434-01
RS	.14918616 09	VS	.29865848 02	RM	.40262670 06	VM	.97054131 00	RT	.40262670 06	VT	.97054131 00
GED	-.24695533 02	ALT	.39356956 06	LOS	.33158420 03	RAS	.34153054 01	RAM	.26830726 03	LOM	.23647616 03
DUT	.36000000 02	DT	.59999999 02	DR	.18451196 01	SHA	.39833041 06	DES	.14799346 01	DEM	-.24463062 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14888148 09	Y	-.92481644 07	Z	-.40191731 07	DX	.11169140 01	DY	-.29121714 02	DZ	-.12453704 02
R	.14922258 09	LAT	-.15433948 01	LON	.18355451 03	V	.31692530 02	PTH	.18550187 01	AZ	.11310579 03
XE	-.14887152 09	YE	-.88845068 07	ZE	-.38530133 07	DXE	.14367971 01	DYE	-.27368980 02	DZE	-.11867748 02
XT	-.14888234 09	YT	-.92508292 07	ZT	-.40197437 07	DXT	.24024225 01	DYT	-.27380371 02	DZT	-.11964640 02
LTE	-.14799346 01	LOE	.18341530 03	LTT	-.15436031 01	LOT	.18355551 03	RST	.14922362 09	VST	.29976808 02
EPS	.84698498 02	ESP	.15291383 00	SEP	.95148555 02	EPM	.15973444 03	EMP	.20124661 02	MEP	.14075386 00
MPS	.11136283 03	MSP	.27453512-18	SMP	.68636144 02	SEM	.95261949 02	EMS	.84584107 02	ESM	.15387055 00
RPM	.28583851 04	SPN	.83784749 02								
GCE	.77176815 02	GCT	.24442584 03	SIP	.73972017 02	CPT	.11265522 03	SIN	.75264408 02	D1	.22929112 02
REP	.39994404 06	VEP	.18755658 01	CPE	.77490433 02	CPS	.92584395 02	D2	.15274475 02	D3	.68551464 01

SELENOCENTRIC — EQUATORIAL COORDINATES

X	.86269139 03	Y	.26647124 04	Z	.57047090 03	DX	-.12855085 01	DY	-.17413423 01	DZ	-.48906443 00
R	.28583851 04	DEC	.11512285 02	RA	.72060817 02	V	.22190063 01	PTH	-.71878587 02	AZ	.95784825 02
R	.28583845 04	LAT	-.10949992 02	LON	.34637960 03	VP	.22167353 01	PTP	-.72058788 02	AZP	.10150096 03
LTS	-.14810983 01	LNS	.27785898 03	LTE	.13383183 01	LNE	.24050321 01				
ALT	.11226351 04	SHA	-.26619734 04	ALP	.42923868 01	DR	-.21089427 01	DP	.13834544-01	ASD	.37390813 02
HGE	.27530150 03	SVL	-.11861652 02	HNG	.11185265 03	SIA	.12234363 03				

1 DAYS 1 HRS. 37 MIN. 41.941 SEC.

235712205424202770317773 J.D.= 2438844.08911968 MARCH 24,1965 14 08 19.941
TFL 2 DAYS 16 HRS. 31 MIN. 16.483 SEC.

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GEOCENTRIC — EQUATORIAL COORDINATES

X	-.10147859 05	Y	-.36463042 06	Z	-.16647237 06	DX	-.42136551 00	DY	-.22197114 01	DZ	-.67753825 00
R	.40096305 06	DEC	-.24530737 02	RA	.26840583 03	V	.23587552 01	PTH	.78395527 02	AZ	.31074888 03
R	.40096304 06	LAT	-.24530737 02	LON	.23448595 03	VE	.27059618 02	PTE	.48982829 01	AZE	.27065820 03
XS	.14887080 09	YS	.88981898 07	ZS	.38589465 07	DXS	-.14397716 01	DYS	.27368816 02	DZS	.11867677 02
XM	-.10342911 05	YM	-.36632776 06	ZM	-.16677865 06	DXM	.96565615 00	DYM	-.10252420-01	DZM	-.96373799-01
XT	-.10342911 05	YT	-.36632776 06	ZT	-.16677865 06	DXT	.96565615 00	DYT	-.10252420-01	DZT	-.96373799-01
RS	.14918640 09	VS	.29865813 02	RM	.40263894 06	VM	.97050750 00	RT	.40263894 06	VT	.97050750 00
GED	-.24678042 02	ALT	.39458856 06	LOS	.32950068 03	RAS	.34205685 01	RAM	.26838273 03	LOM	.23446285 03
DUT	.36000000 02	DT	.59999999 02	DR	.23105412 01	SHA	.39932733 06	DES	.14822116 01	DEM	-.24469824 02

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14888094 09	Y	-.92628203 07	Z	-.40254188 07	DX	.10184061 01	DY	-.29588528 02	DZ	-.12545215 02
R	.14922312 09	LAT	-.15457879 01	LON	.18356014 03	V	.32154323 02	PTH	.20656933 01	AZ	.11292830 03
XE	-.14887080 09	YE	-.88981898 07	ZE	-.38589465 07	DXE	.14397716 01	DYE	-.27368816 02	DZE	-.11867677 02
XT	-.14888114 09	YT	-.92645177 07	ZT	-.40257251 07	DXT	.24054277 01	DYT	-.27379069 02	DZT	-.11964051 02
LTE	-.14822116 01	LOE	.18342056 03	LTT	-.15459023 01	LOT	.18356078 03	RST	.14922343 09	VST	.29975623 02
EPS	.84669566 02	ESP	.15323340 00	SEP	.95177107 02	EPM	.16487733 03	EMP	.15058229 02	MEP	.63334395-01
MPS	.10022858 03	MSP	.27453512-18	SMP	.79770764 02	SEM	.95198908 02	EMS	.84647129 02	ESM	.15418813 00
RPM	.17357500 04	SPN	.83758140 02								
GCE	.77159362 02	GCT	.24271364 03	SIP	.10238470 02	CPT	.11627572 03	SIN	.26285615 02	D1	.00000000 00
REP	.40096305 06	VEP	.23587552 01	CPE	.77474875 02	CPS	.92582884 02	D2	.33517753 03	D3	.00000000 00

SELENOCENTRIC — EQUATORIAL COORDINATES

X	.19505168 03	Y	.16973434 04	Z	.30628130 03	DX	-.13870217 01	DY	-.22094590 01	DZ	-.58116445 00
R	.17357500 04	DEC	.10163326 02	RA	.83444560 02	V	.26726934 01	PTH	-.64833178 02	AZ	.97928866 02
R	.17357497 04	LAT	-.12950542 02	LON	.35763201 03	VP	.26708014 01	PTP	-.64919683 02	AZP	.99056003 02
LTS	-.14810659 01	LNS	.27778849 03	LTE	.13461056 01	LNE	.23973827 01				
ALT	.15258789-04	SHA	-.17081605 04	ALP	.24155087 01	DR	-.24189840 01	DP	.37517529-01	ASD	.89990107 02
HGE	.27533043 03	SVL	-.14211264 02	HNG	.10055513 03	SIA	.74887223 02				

SELENOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2357122056412021754357 73 J.D.= 2438844.09561320 MARCH 24,1965 14 17 40.981

SMA	-.32812950 04	ECC	.11144185 01	B	.16139453 04	SLR	.79383900 03	APO	.00000000 00	RCA	.37544082 03
VH	.12223544 01	C3	.14941502 01	C1	.19728133 04	TFP	-.56104025 03	TF	.25784161 02	LTF	.25703381 02
TA	-.11913958 03	MTA	.15380916 03	EA	-.48004354 02	MA	-.11974806 02	C3J	-.13027494 01	TFI	.25628316 02
ZAE	.14030900 03	ZAP	.13443922 03	ZAC	.10279211 03	DEF	.12761833 03	IR	.37952396 04	GP	.25141499 01
OP1	.53304338 01	OY	-.16234361 02	OP2	-.20780069 02						

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	.19505168 03	Y	.16973434 04	Z	.30628130 03	DX	-.13870217 01	DY	-.22094590 01	DZ	-.58116445 00
INC	.12864623 02	LAN	.31516066 03	APF	.24671725 03	MX	-.98118559 00	MY	.13725476 00	MZ	-.13577901 00
WX	-.15699391 00	WY	-.15787693 00	WZ	.97489885 00	PX	-.91172174 00	PY	-.35628114 00	PZ	-.20451694 00
QX	.37962659 00	QY	-.92094442 00	QZ	-.88005861-01	RX	.14837446 00	RY	.16561895 00	RZ	-.97496428 00
BX	-.74304955 00	BY	.66914107 00	BZ	-.11295858-01	TX	-.74481861 00	TY	.66726699 00	TZ	.00000000 00
SXI	-.65056149 00	SYI	-.72617155 00	SZI	-.22236145 00	DAI	-.12847770 02	RAI	.22814351 03		
SXO	.98566722 00	SYO	-.86768757-01	SZO	.14467651 00	DAO	.83185479 01	RAO	.35496919 03		
ETE	.15701849 03	ETS	.34934496 03	ETC	.24264479 03						
BTQ	.16138370 04	BRQ	.18699045 02	B	.16139453 04	THA	.66383760 00				

SPACE TRAJECTORY
RA-9 POST MIDCOURSE ORBIT

ALL VECTORS REFERENCED TO ORBIT PLANE OF TARGET

X .16761483 04	Y -.18800377 03	Z -.40988946 03	DX -.22865593 01	DY .13570524 01	DZ .27082367 00
INC .20758831 02	LAN .13372347 03	APF .34091850 03	MX -.87116271 00	MY .59880000-01	MZ .22294806 00
WX .25614468 00	WY .24497804 00	WZ .93508059 00	PX -.43228462 00	PY .89426187 00	PZ -.11586929 00
QX -.86459232 00	QY -.37454165 00	QZ .33496065 00	RX -.33787482-01	RY .27975714-01	RZ -.99903739 00
BX .58502971 00	BY .73078050 00	BZ -.35171025 00	TX .63775251 00	TY .77024135 00	TZ .00000000 00
SXI -.76949991 00	SYI .63713861 00	SZI .43866097-01	DAI .25141482 01	RAI .14037556 03	
SXO .63031576-02	SYO -.96775568 00	SZO .25181185 00	DAO .14584754 02	RAO .27037317 03	
ETE .17696735 03	ETS .92938280 01	ETC .26259365 03			
BTO .15106233 04	BRO .56818812 03	B .16139456 04	THA .20612701 02		

ALL VECTORS REFERENCED TO TRUE LUNAR EQU. PLANE

X .16901545 04	Y -.69892565 02	Z -.38899871 03	DX -.23489625 01	DY .12206163 01	DZ .36845515 00
INC .15738123 02	LAN .12294346 03	APF .35485399 03	MX -.91518644 00	MY .67994539-01	MZ .20601508 00
WX .22762720 00	WY .14750374 00	WZ .96251148 00	PX -.46916945 00	PY .88277292 00	PZ -.24328618-01
QX -.85326777 00	QY -.44604313 00	QZ .27014741 00	RX -.78058917-01	RY .58257634-01	RZ -.99524508 00
BX .55858861 00	BY .78986987 00	BZ -.25314889 00	TX .59811547 00	TY .80140993 00	TZ .00000000 00
SXI -.79759930 00	SYI .59527149 00	SZI .97401985-01	DAI .55895860 01	RAI .14326495 03	
SXO .44399589-01	SYO -.98900434 00	SZO .14106354 00	DAO .81093946 01	RAO .27257047 03	
ETE .28053900 01	ETS .31728740 02	ETC .29411673 03			
BTT .15608639 04	BRT .41052072 03	B .16139465 04	THA .14735563 02		

617477445760	623400015655	621747172037	176414527327	601465512525	600405027632
	650302312		3038000		000000000000

Appendix D
Tables Related to Trajectory Printout

Tables Related to Trajectory Printout

Table D-1. *Ranger IX* trajectory key

Group	Row	Printout column (data key and type)					
		1	2	3	4	5	6
	1	GME	J	H	D	RE	REM
	2	G	A	B	C	OME	AU
A	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	h, min, s
	6	GEOCENTRIC	XO	YO	ZO	DXO DYO	DZO
B	7	CARTESIAN			TO	GHA GHO	
		TIME PAST INJECTION			JULIAN DATE	MONTH, DAY, YEAR	h, min, s
		GEOCENTRIC				EQUATORIAL COORDINATES	
	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
C	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	SHA	DES	DEM
				GEOCENTRIC CONIC			
		EPOCH PERICENTER PASSAGE			JULIAN DATE	MONTH, DAY, YEAR	h, min, s
	17	SMA	ECC	B	SLR	APO	RCA
D	18	VH	C3	C1	TFP	TF	PER
	19	TA	MTA	EA	MA	C3J	TFI
				ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE			
	20	X	Y	Z	DX	DY	DZ
	21	INC	LAN	APF	MX	MY	MZ
	22	WX	WY	WZ	PX	PY	PZ
E	23	QX	QY	QZ	RX	RY	RZ
	24	BX	BY	BZ	TX	TY	TZ
	25	DAP	RAP				
	26	BTQ	BRQ	B	THA		
		HELIOCENTRIC				EQUATORIAL COORDINATES	
	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
F	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	GCE	GCT	SIP	CPT	SIN	D1
	37	REP	VEP	CPE	CPS	D2	D3

Table D-1 (contd)

Group	Row	Printout column (data key and type)					
		1	2	3	4	5	6
		SELENOCENTRIC				EQUATORIAL COORDINATES	
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	SHA	ALP	DR	DP	ASD
	43	HGE	SVL	HNG	SIA		
				SELENOCENTRIC CONIC			
		EPOCH OF PERICENTER PASSAGE			JULIAN DATE	MONTH, DAY, YEAR	h, min, s
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	DEF	IR	GP
	48	OP1	OY	OP2			
					ALL VECTORS REFERENCED TO PRINCIPAL PLANE		
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		
J	58	XOCTAL YOCTAL	ZOCTAL	$\dot{X}$OCTAL	$\dot{Y}$OCTAL	$\dot{Z}$OCTAL	
	59		YYMMDDDHH	TTSSSSS		SOCTAL	

Table D-2. *Ranger IX* trajectory key definitions

Group/row	Key	Definition
A/1	GME	Universal gravitational constant times mass of earth, km^3/s^2
	J	Coefficient of second harmonic in earth's potential function
	H	Coefficient of third harmonic in earth's potential function
	D	Coefficient of fourth harmonic in earth's potential function
	RE	Earth radius used in potential tunction, km
	REM	Conversion factor for converting lunar ephemerides into km
A/2	G	Universal constant of gravitation, $km^3/kg\text{-}s^2$
	A, B, C	Moments of inertia about principal axis for moon, kg/km^2
	OME	Sidereal rotation rate of earth, deg/s
	AU	Astronomical unit, km
A/3	GMM	Universal gravitational constant times mass of *moon*, km^3/s^2
	GMS	Universal gravitational constant times mass of sun, km^3/s^2
	GMV	Universal gravitational constant times mass of Venus, km^3/s^2
	GMA	Universal gravitational constant times mass of Mars, km^3/s^2
	GMB	Universal gravitational constant times mass of earth—moon, km^3/s^2
	GMJ	Universal gravitational constant times mass of Jupiter, km^3/s^2
A/4	EGM	Universal gravitational constant times mass of earth used for scaling ephemeris, km^3/s^2
	MGM	Universal gravitational constant times mass of moon used for scaling ephemeris, km^3/s^2
	JA	Coefficient of second harmonic in Mars potential function
	RA	Mars radius used in potential function
A/5	ARA	Frontal area of spacecraft, m^2
	GB	Multiple of % of reflected radiant energy
	MAS	Mass of spacecraft, kg
	SC	Solar radiation constant $(kg\text{-}km/s^2)\ 10^{-6}$

Group/row	Key	Definition
B		Injection conditions are vernal equinox Cartesian coordinates in a geocentric equatorial system: principal direction *X* is vernal equinox direction of date, principal plane *XY* is equatorial plane of date, and *Z* is along the direction of earth's spin axis of date.
B/6	XO, YO, ZO	Cartesian components of probe radius vector, km
	DXO, DYO, DZO	Cartesian components of probe space-fixed velocity vector, km/s
B/7	TO	Time of injection in seconds past midnight of day before launch, s
	GHA	HA of Greenwich at injection epoch, deg
	GHO	HA of Greenwich at midnight of day before launch, deg
C		Inertial position and velocity of probe, sun, moon, and target body in a geocentric equatorial system: principal direction *X* is vernal equinox direction of date, principal plane *XY* is equatorial plane of date, and *Z* is along the direction of earth's spin axis of date. Miscellaneous parameters are also included.
C/8	X, Y, Z	Cartesian components of probe radius vector, km
	DX, DY, DZ	Cartesian components of probe space-fixed velocity vector, km/s
C/9	R	Probe radius distance, km
	DEC	Probe declination angle, deg
	RA	Probe right-ascension angle, deg
	V	Probe space-fixed velocity, km/s
	PTH	Pitch angle of probe space-fixed velocity vector with respect to local horizontal, deg
	AZ	Azimuth angle of probe space-fixed velocity vector measured East of true North, deg

Table D-2 (contd)

Group/row	Key	Definition
C/10[a]	R	Probe radius distance, km
	LAT	Probe geocentric latitude, deg
	LON	Probe East longitude, deg
	VE	Probe earth-fixed velocity, km/s
	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
C/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/s
C/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/s
C/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/s
C/14	RS	Sun radius distance, km
	VS	Sun space-fixed velocity, km/s
	RM	Moon radius distance, km
	VM	Moon space-fixed velocity, km/s
	RT	Target radius distance, km
	VT	Target space-fixed velocity, km/s
C/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
C/16	DUT	Ephemeris time minus Universal Time, s
	DT	Adams–Moulton step size, s
	DR	Radial velocity of probe, km/s
	SHA	Sun shadow parameter, km
	DES	Declination of the sun, deg
	DEM	Declination of the moon, deg
D		General characteristics of the geocentric conic
D/17	SMA	Semimajor axis, km
	ECC	Eccentricity
	B	Magnitude of the impact parameter,[b] km
	SLR	Semilatus rectum, km
	APO	Apogee distance, km
	RCA	Magnitude of the closest approach vector, km
D/18	VH	Hyperbolic excess speed, km/s
	C3	Twice the energy (*vis viva* energy integral, km^2/s^2)
	C1	Angular momentum, km^2/s
	TFP	Time from pericenter passage, s
	TF	Time from injection to pericenter passage, h
	PER	Period, min
D/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/s^2
	TFI	Time from injection, h
E		Characteristics of the Earth conic in the geocentric equatorial system described under Group B
E/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/s
E/21	INC	Inclination of the orbit plane to the equatorial plane, deg
	LAN	Longitude of the ascending node, deg
	APF	Argument of pericenter, deg

[a]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*, and *Z* are along the direction of the earth's geometrical North direction.

[b]See Appendix A.

Table D-2 (contd)

Group/row	Key	Definition
E/21 (contd)	MX, MY, MZ	Components of a unit vector that lies in orbit plane and is normal to radius vector $\mathbf{R}$ $\mathbf{M} = \mathbf{W} \times \frac{\mathbf{R}}{\lvert\mathbf{R}\rvert}$
E/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 direction of perigee
E/23	QX, QY, QZ	Components of a unit vector perpendicular to perigee direction, vector $\mathbf{P}$, and being in orbit plane $\mathbf{Q} = \mathbf{W} \times \mathbf{P}$
	RX, RY, RZ	Components of unit vector $\mathbf{R}^b$
E/24	BX, BY, BZ	Components of impact parameter $\mathbf{B}$,[b] km
	TX, TY, TZ	Components of unit vector $\mathbf{T}^b$
E/25	DAP	Declination of asymptote, deg
	RAP	Right ascension of asymptote, deg
E/26	BTQ	Projection of impact parameters $\mathbf{B}^b$ upon the vector $\mathbf{T}$, km
	BRQ	Projection of impact parameters $\mathbf{B}^b$ upon the vector $\mathbf{R}$, km
	B	The magnitude of impact parameter $\mathbf{B}$,[b] km
	THA	Angle between parameter $\mathbf{B}^b$ and vector $\mathbf{T}$ measured clockwise from $\mathbf{T}$, deg
F		Inertial position and velocity of probe, sun, moon, and target body in a heliocentric equatorial system: principal direction *X* is vernal equinox direction of date, principal plane *XY* is equatorial plane of date, and *Z* is along the direction of earth's spin axis of date. Miscellaneous parameters are also included.
F/27	X, Y, Z	Cartesian components of probe radius vector, km
	DX, DY, DZ	Cartesian components of probe space-fixed velocity vector, km/s
F/28	R	Sun–probe radius distance, km
	LAT	Probe celestial declination, deg
	LON	Probe celestial right ascension, deg
	V	Probe space-fixed velocity, km/s
	PTH	Pitch angle of probe space-fixed velocity vector with respect to local horizontal, deg
	AZ	Azimuth angle of probe space-fixed velocity vector measured East of true North, deg
F/29	XE, YE, ZE	Cartesian components of earth radius vector, km
	DXE, DYE, DZE	Cartesian components of earth space-fixed velocity vector, km/s
F/30	XT, YT, ZT	Cartesian components of target radius vector, km
	DXT, DYT, DZT	Cartesian components of target space-fixed velocity vector, km/s
F/31	LTE	Celestial latitude of earth, deg
	LOE	Celestial longitude of earth, deg
	LTT	Celestial latitude of target, deg
	LOT	Celestial longitude of target, deg
	RST	Sun–target range, km
	VST	Sun–target velocity, km/s
F/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
F/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
F/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

[b]See Appendix A.

Table D-2 (contd)

Group/row	Key	Definition
F/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
F/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
F/37	REP	Earth–probe distance, km
	VEP	Velocity of the probe with respect to earth, km/s
	CPE	Canopus–probe–earth angle, deg
	CPS	Canopus–probe–sun angle, deg
	D2	Semiminor axis of ellipse used in construction of visible planet, cm
	D3	Distance from intersection of ellipse with circle to diameter (of circle) that is perpendicular to D1, in construction of visible planet, cm
G/38, 39		Inertial position of probe in a selenocentric equatorial system: principal direction *X* is vernal equinox direction of date, principal plane *XY* is geocentric equatorial plane of date, and *Z* is along the direction of earth's spin axis of date.
G/40, 41, 42		Selenocentric-fixed spherical coordinates of probe, sun, and earth in a selenocentric equatorial system: principal direction *X* is in direction of mean moon–earth line, principal plane *XY* is mean selenocentric equatorial plane, and *Z* is along the direction of moon's mean spin axis. Miscellaneous parameters are also included.
G/38	X, Y, Z	Cartesian components of probe radius vector, km
	DX, DY, DZ	Cartesian components of probe velocity vector, km/s
G/39	R	Probe radius distance, km
	DEC	Probe declination angle, deg
G/39 (contd)	RA	Probe right-ascension angle, deg
	V	Probe space-fixed velocity, km/s
	PTH	Pitch angle of probe space-fixed velocity vector with respect to local horizontal, deg
	AZ	Azimuth angle of probe space-fixed velocity vector measured East of true North, deg
G/40	R	Probe radius distance, km
	LAT	Probe selenocentric latitude, deg
	LON	Probe selenocentric East longitude, deg
	VP	Probe selenocentric-fixed velocity, km/s
	PTP	Pitch angle of probe selenocentric-fixed velocity vector with respect to local horizontal, deg
	AZP	Azimuth angle of probe selenocentric fiixed velocity vector measured East of moon's mean spin axis, deg
G/41	LTS	Selenocentric latitude of sun, deg
	LNS	Selenocentric longitude of sun, deg
	LTE	Selenocentric latitude of earth, deg
	LNE	Selenocentric longitude of earth, deg
G/42	ALT	Altitude of probe above moon's surface, km
	SHA	Sun shadow parameter, km
	ALP	Illuminated crescent orientation viewing angle, deg
	DR	First time derivative of probe radius distance, km/s
	DP	First time derivative of probe radius direction, deg/s
	ASD	Angular semidiameter of moon as seen from probe, deg
G/43	HGE	Right ascension of earth in probe coordinate system,[c] deg
	SVL	Declination of moon in probe coordinate system,[c] deg
	HNG	Right ascension of moon in probe coordinate system,[c] deg
	SIA	Earth–probe–moon angle minus ASD, deg
H		Characteristics of the selenocentric conic in geocentric equatorial system described under Group B, except centered at moon.

[c]Same coordinate system as defined under Group B except centered at the probe.

Table D-2 (contd)

Group/row	Key	Definition
H/44	SMA	Semimajor axis, km
	ECC	Eccentricity
	B	Magnitude of impact parameter $\mathbf{B}$,[b] km
	SLR	Semilatus rectum, km
	APO	Apogee distance, km
	RCA	Magnitude of closest approach vector, km
H/45	VH	Hyperbolic excess speed, km/s
	C3	Twice the energy (*vis viva* energy integral, km^2/s^2)
	C1	Angular momentum, km^2/s
	TFP	Time from pericenter passage, s
	TF	Time from injection to pericenter passage, h
	LTF	Linearized time-of-flight, h
H/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/s^2
	TFI	Time from injection, h
H/47	ZAE	Angle between incoming asymptote and moon–earth vector, deg
	ZAP	Angle between incoming asymptote and moon–sun vector, deg
	ZAC	Angle between incoming asymptote and moon–Canopus vector, deg
	DEF	Angle between incoming and outgoing asymptotes, deg
	IR	Maximum $\mathbf{B}$ vector magnitude for lunar impact, km
	GP	Angle between incoming asymptote and its projection on lunar orbital plane
H/48	OP1	*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
I		Characteristics of selenocentric conic in specified "principal plane" coordinate system

Group/row	Key	Definition
I/49	X, Y, Z	Cartesian components of probe radius vector, km
	DX, DY, DZ	Cartesian components of probe space-fixed velocity vector, km/s
I/50	INC	Inclination of orbit plane to equatorial plane, deg
	LAN	Longitude of ascending node, deg
	APF	Argument of pericenter, deg
	MX, MY, MZ	Components of a unit vector that lies in orbit plane and is normal to radius vector $\mathbf{R}$ $\mathbf{M} = \mathbf{W} \times \frac{\mathbf{R}}{\lvert\mathbf{R}\rvert}$
I/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
I/52	QX, QY, QZ	Components of a unit vector perpendicular to perigee direction, vector $\mathbf{P}$, and being in orbit plane $\mathbf{Q} = \mathbf{W} \times \mathbf{P}$
	RX, RY, RZ	Components of unit vector $\mathbf{R}^b$
I/53	BX, BY, BZ	Components of impact parameter $\mathbf{B}$,[b] km
	TX, TY, TZ	Components of unit vector $\mathbf{T}^b$
I/54	SXI, SYI, SZI	Components of unit vector $\mathbf{S}_I{}^b$ along the direction of incoming asymptote
	DAI	Declination of outgoing asymptote,[b] deg
	RAI	Right ascension of incoming asymptote,[b] deg

[b]See Appendix A.

Table D-2 (contd)

Group/row	Key	Definition
I/55	SXO, SYO, SZO	Components of unit vector $\mathbf{S}_o$[b] along direction of outgoing asymptote
	DAO	Declination of outgoing asymptote,[b] deg
	RAO	Right ascension of outgoing asymptote,[b] deg
I/56	ETE	Angle between vector $\mathbf{T}$ and projection of moon–earth vector on $\mathbf{R}$–$\mathbf{T}$ plane, deg
	ETS	Angle between vector $\mathbf{T}$ and projection of moon–sun vector on $\mathbf{R}$–$\mathbf{T}$ plane, deg
	ETC	Angle between vector $\mathbf{T}$ and projection of moon–Canopus vector on $\mathbf{R}$–$\mathbf{T}$ plane, deg
I/57	BT[d]	Projection of impact parameter $\mathbf{B}$[b] upon vector $\mathbf{T}$, km
	BR[d]	Projection of impact parameter $\mathbf{B}$[b] upon vector $\mathbf{R}$, km
	B	Magnitude of impact parameter $\mathbf{B}$,[b] km
	THA	Angle between parameter $\mathbf{B}$ and vector $\mathbf{T}$, measured clockwise from $\mathbf{T}$, deg
J		Cartesian coordinates and epoch of injection conditions in geocentric equatorial system described under Group B

Group/row	Key	Definition
J/58	XOCTAL, YOCTAL, ZOCTAL	Cartesian components of probe radius vector at injection in octal representation, km
	$\dot{X}$OCTAL, $\dot{Y}$OCTAL, $\dot{Z}$OCTAL	Cartesian components of probe space-fixed velocity vector at injection in octal representation, km/s
J/59		Epoch of injection
	YY	Years past 1900
	MM	Month
	DDD	Day of month
	HH	Hours
	TT	Minutes
	SSSSS	Milliseconds
	SOCTAL	Seconds in octal representation, GMT
		Time past midnight on day (DD), month (MM), and year (YY + 1900) at which injection epoch occurs is time determined by sum of HH, TT, SSSSS and SOCTAL.

[b]See Appendix A.

[d]Principal planes: Q = earth equatorial plane, C = ecliptic plane, O = lunar orbital plane, and T = true lunar equator.

Table D-3. *Ranger IX* trajectory constants and conversion factors

Constants	Conversion factors
GM_{Sun}	$1.32715445 \times 10^{11}$ km^3/s^2
GM_{Venus}	3.247695×10^5 km^3/s^2
$GM_{\oplus}$ [a]	3.986032×10^5 km^3/s^2
$GM_{\oplus-\mathbb{C}}$	4.03503×10^5 km^3/s^2
$GM_{\mathbb{C}}$ [b]	4.900759×10^3 km^3/s^2
GM_{Mars}	4.297780×10^4 km^3/s^2
$GM_{Jupiter}$	1.267106×10^8 km^3/s^2
M_{Sun}/M_{Venus}	408645
M_{Sun}/M_{Earth}	332951.3
M_{Earth}/M_{Moon}	81.335
$M_{Sun}/M_{Earth-Moon}$	328908
M_{Sun}/M_{Mars}	3,088,000
$M_{Sun}/M_{Jupiter}$	1047.39
Equatorial radius of earth	6378.3149 km
1 AU	1.495990×10^8 km
Ellipticity of earth	1/298.3
Conversion from feet to meters	0.3048
Atmospheric model	1959 ARDC
Sidereal rotation rate of earth	4.1780742×10^{-3} deg/s
Universal constant of gravitation	6.671×10^{-20} km^3/kg-s^2
Speed of light	2.997925×10^5 km/s
Mean moon radius	1738.09 km

Constants	Conversion factors
Moon moments of inertia about principal axis	$A = 0.88746 \times 10^{29}$ kg km^2 $B = 0.88764 \times 10^{29}$ kg km^2 $C = 0.88801 \times 10^{29}$ kg km^2
Lunar and solar ephemerides	The moon and sun positions are obtained from the joint JPL–STL ephemerides. For purposes of converting into kilometers, the conversion factors are: 1 AU = 1.495990×10^8 km 1 e.r. = 6378.3149 km
Geometrical earth model, used in locating, tracking and launching facilities on the earth	Clarke spheroid of 1866: a = 6378.2064 km b = 6356.5838 km $e^2 = 0.006768657997291$

Earth potential function:

$$\Phi(\mathbf{R}, \phi) = \frac{GM_{\oplus}}{\mathbf{R}}\left[1 + \frac{J\mathbf{R}_E^2}{3\mathbf{R}^2}(1 - 3\sin^2\phi) + \frac{H}{5}\frac{\mathbf{R}_E^3}{\mathbf{R}^3}(3 - 5\sin^2\phi)(\sin\phi) + \frac{D}{35}\frac{\mathbf{R}_E^4}{\mathbf{R}_4}(3 - 30\sin\phi + 35\sin^4\phi)\right]$$

where

$\mathbf{R}$ = geocentric distance
ϕ = geocentric latitude
$J = 1.62345 \times 10^{-3}$
$H = -0.575 \times 10^{-5}$
$D = 0.7875 \times 10^{-5}$

[a] 3.986005×10^5 km^3/s^2 was used for the pre-midcourse orbit.
[b] 4.9007604×10^3 km^3/s^2 was used for the pre-midcourse orbit.

Appendix E

Ranger IX Premaneuver ODP Printout

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PAGE HEADING                                                          (23
(RA9 PRE M/C WITH POST AS A PRIORI 29SEPT)
EPOCH                                                                 (01
650302121,4948000
PROBE POSITION AND VELOCITY AT EPOCH                                  (02
X=-.14189623E04,Y=.59894127E04,Z=.23044676E04
DX=-.10386613E02,DY=-.79861810E00,DZ=-.34292467E01
OTHER PARAMETER VALUES                                                (03
KE=.39860070E06,RE=.63783257E04,GBMOON=.40246991E00
KM=.49014745E04
RI(3)=.63719047E04,LA(3)=.35117255E02,LO(3)=.24319443E03
RI(4)=.63726563E04,LA(4)=-.31212092E02,LO(4)=.13688765E03
RI(5)=.63755454E04,LA(5)=-.25738887E02,LO(5)=.27685444E00
ARMOON=3.567,MSMOON=374.1
RSTOP=1735.75
DUT=36.0
ESTIMATE THESE PARAMETERS                                             (04
X,Y,Z,DX,DY,DZ,
KE,RE,G,KM,
RI(3),LA(3),LO(3)
RI(4),LA(4),LO(4),
RI(5),LA(5),LO(5)
COVARIANCE MATRIX OF ESTIMATED PARAMETERS                             (10
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	56145340054452677577434 2/8	17142220354713673164634 6/8	$
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	16570250276613241533035 4/8	$	
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	55553416563652216456441 4/8	$	
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	564450434512531021235346/8		155710216337122363126474/8	$
	555447373521522204260422/8		564546523145531565005164/8	$
	554763472043521422167776/8		553442301256520544761564/8	$
	564613765207531205206566/8		554667231526521231277532/8	$
	151551440523116152767544/8	$		
R13	573725641570540773276156/8		571515626223536675110006/8	$
	572571273333537511733326/8		157517502246124422331666/8	$
	561532363242526153277550/8		561434011057526566720410/8	$
	570654233665535212054422/8		160720543653125771610756/8	$
	155775633646122117116112/8		163661224537130740270442/8	$
	164555071227131162370746/8		555447373521522204260422/8	$
	156506334562123367173132/8		164527115024131726536054/8	$
	154736413515121531040730/8		154764711042121753655106/8	$
	164572033257131312264552/8		154642451516121570333254/8	$
	153727010426120120335570/8	$		
R14	602776721653547277216474/8		600464753163545724144350/8	$
	601561627113546700005726/8		166524274715133627112142/8	$
	570620211207535212024644/8		567727750471534735311316/8	$
	177622301564144141764634/8		567614737701534134275302/8	$
	564650665334531372417732/8		170522607000135606772264/8	$
	173672536030140123331142/8		564546523145531565005164/8	$
	164527115024131726536054/8		173734722453140522130276/8	$
	163666551723130050410622/8		162577654220127000113162/8	$
	173734452252140232447324/8		164410176230131300546500/8	$
	556661164254523000355524/8	$		
R15	573543062727540021735310/8		570656610766535227316164/8	$
	572401137316537162204450/8		156730304625123265677564/8	$
	561426116360526645420030/8		560510352656525221706102/8	$
	170430306276135323611162/8		560424436456525026445140/8	$
	555450103321522365267106/8		160761276446125630614542/8	$
	164464247330131672344640/8		554763472043521422167776/8	$
	154736413515121531040730/8		163666551723130050410622/8	$
	155562553764122362226106/8		153416400614120223563572/8	$
	164514004257131752544546/8		154560130461121717052470/8	$
	547443334070514431650202/8	$		
R16	171561127107136654020714/8		570467410146535504075550/8	$
	165665723576132525064464/8		556606703752523236244050/8	$
	157510672056124150767270/8		555421513071522626452766/8	$
	565473523313532070727506/8		155457530516122311211232/8	$
	155450352540122071423326/8		165446042011132327124106/8	$
	162544770623127151777114/8		553442301256520544761564/8	$
	154764711042121753655106/8		162577654220127000113162/8	$
	153416400614120223563572/8		154526444055121356652460/8	$
	162655570513127025365552/8		152730726367117356546616/8	$
	153774556402120266756124/8	$		
R17	603431154147550031436030/8		600546644156545762475366/8	$
	601631551174546200150614/8		166543727720133260103460/8	$
	570672552466535247203170/8		570401655264535375255132/8	$
	177613363753144451267602/8		567571516617534456150626/8	$
	564655212771531233305170/8		165502662404132171026506/8	$
	173750741715140254762300/8		564613765207531205206566/8	$
	164572033257131312264552/8		173734452252140232447324/8	$
	164514004257131752544546/8		162655570513127025365552/8	$
	174432461152141227056446/8		163677441226130557615050/8	$
	557502075341524044725610/8	$		
R18	573470660404540477642440/8		570615151540535232107532/8	$
	571707306202536435517404/8		156615342557123447767324/8	$

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      560754406275525375171000/8      560436410213525273146144/8  $
      167666203645134640016750/8      557642454703524464442204/8  $
      554733517457521443151552/8      154435514443121772461302/8  $
      164417156640131507167226/8      554667231526521231277532/8  $
      154642451516121570333254/8      164410176230131300546500/8  $
      154560130461121717052470/8      152730726367117356546616/8  $
      163677441226130557615050/8      155525443120122407417676/8  $
      547536464607514721716306/8  $
R19   173415651720140522776634/8      566771416511533113407730/8  $
      171433776662136236717616/8      557510461433524137134424/8  $
      160671057766125161276476/8      157406435003124160736376/8  $
      165702502766132415330354/8      555534165636522164564414/8  $
      154530301071121223510546/8      165474677151132163262746/8  $
      560704271573525772647522/8      151551440523116152767544/8  $
      153727010426120120335570/8      556661164254523000355524/8  $
      547443334070514431650202/8      153774556402120266756124/8  $
      557502075341524044725610/8      547536464607514721716306/8  $
      154405125541121453154340/8  $
NOMINAL VALUES CORRESPONDING TO COVARIANCE MATRIX                    (15
-.14191819E04,.59887586E04,.23040842E04
-.10387126E02,-.79887617E00,-.34295831E01
.39860328E06,.63783248E04,.39993044E00
.49026987E04,.63718876E04,.35117354E02
.24319531E03,.63726494E04,-.31212132E02
.13688807E03,.63755285E04,-.25738857E02
.27685835E02
MAP COVARIANCE MATRIX TO                                             (24
650302312,3038000
STATISTICS,PLOT AND/OR PRINT RESIDUALS FOR THESE PARAMETERS          (14
CC3(3)=.2,CC3(4)=.2,CC3(5)=.2
NHR=6.
REJECTION SIGMAS                                                     (06
CC3(3)=.025
CC3(4)=.035
CC3(5)=.130
END DATA                                                             (0
ODP       175430
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2 INPUT COVARIANCE MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 4

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.12875599-01	.42957585-02	-.49212971-02	-.43727691-05	.53006634-05	.11277728-04	-.19526612-01	.24133473-02	-.61934592-03
Y	.42957585-02	.13690921-01	-.15898818-01	.13530954-04	.14424787-04	-.29681215-04	.32525833-01	.29056077-02	-.55908515-03
Z	-.49212971-02	-.15898818-01	.22200375-01	-.15555152-04	-.16370035-04	.37588304-04	-.42340814-01	-.40275116-02	.10284039-02
DX	-.43727691-05	.13530954-04	-.15555152-04	.20898250-07	.16969826-07	-.48349882-07	.49293190-04	.14725394-05	-.47290052-06
DY	.53006634-05	.14424787-04	-.16370035-04	.16969826-07	.26706875-07	-.41786111-07	.23859493-04	.22625861-05	-.93058719-06
DZ	.11277728-04	-.29681215-04	.37588304-04	-.48349882-07	-.41786111-07	.11747584-06	-.11899184-03	-.32810519-05	.11461649-05
KE	-.19526612-01	.32525833-01	-.42340814-01	.49293190-04	.23859493-04	-.11899184-03	.35034998 00	.49353834-02	.12011301-01
RE	.24133473-02	.29056077-02	-.40275116-02	.14725394-05	.22625861-05	-.32810519-05	.49353834-02	.10773649-02	-.20393352-03
G	-.61934592-03	-.55908515-03	.10284039-02	-.47290052-06	-.93058719-06	.11461649-05	.12011301-01	-.20393352-03	.89880738-01
KM	-.14689995-01	-.17155365-01	.20243536-01	-.15774579-04	-.41119396-04	.42547194-04	.75048711-02	-.34478448-02	-.64884115-03
RI(03	-.32610225-02	-.42163885-02	.58531920-02	-.21984231-05	-.28597992-05	.46960739-05	-.67277753-02	-.14416894-02	.29186639-03
LA(03)	.21635674-04	.25138332-04	-.35032919-04	.11454878-07	.17420278-07	-.24415903-07	.38635400-04	.90453245-05	-.16731629-05
LO(03	-.16332136-04	-.91720454-05	.43752996-05	-.95948660-08	-.52867018-07	.31551407-07	.21306904-04	.33634679-06	.52083914-06
RI(04	-.33485830-02	-.39754197-02	.54889319-02	-.18675048-05	-.26671213-05	.39056981-05	-.57474165-02	-.14056347-02	.24740829-03
LA(04	-.20858761-04	-.22540855-04	.32304783-04	-.85599172-08	-.13358336-07	.17946644-07	-.36090795-04	-.86287873-05	.13610407-05
LO(04	-.19684749-04	-.18464475-04	.16872645-04	-.19291203-07	-.65176684-07	.55385408-07	.63412462-05	-.21690452-05	.19912209-06
RI(05	-.55824045-02	-.45348162-02	.41577954-02	-.77321517-06	-.23852007-05	-.11315023-05	.17293651-02	-.15094884-02	.33659633-03
LA(05)	.14742113-04	-.89230169-05	.56177674-04	-.20301619-07	-.12266130-07	.94966341-07	-.18298596-03	-.79184297-05	.49125652-06
LO(05	-.18035370-04	-.15214951-04	.12537485-04	-.15727084-07	-.59659152-07	.46340306-07	.34571521-05	-.13478824-05	-.44645933-06

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	-.14689995-01	-.32610225-02	.21635674-04	-.16332136-04	-.33485830-02	-.20858761-04	-.19684749-04	-.55824045-02	.14742113-04
Y	-.17155365-01	-.42163885-02	.25138332-04	-.91720454-05	-.39754197-02	-.22540855-04	-.18464475-04	-.45348162-02	-.89230169-05
Z	.20243536-01	.58531920-02	-.35032919-04	.43752996-05	.54889319-02	.32304783-04	.16872645-04	.41577954-02	.56177674-04
DX	-.15774579-04	-.21984231-05	.11454878-07	-.95948660-08	-.18675048-05	-.85599172-08	-.19291203-07	-.77321517-06	-.20301619-07
DY	-.41119396-04	-.28597992-05	.17420278-07	-.52867018-07	-.26671213-05	-.13358336-07	-.65176684-07	-.23852007-05	-.12266130-07
DZ	.42547194-04	.46960739-05	-.24415903-07	.31551407-07	.39056981-05	.17946644-07	.55385408-07	-.11315023-05	.94966341-07
KE	.75048711-02	-.67277753-02	.38635400-04	.21306904-04	-.57474165-02	-.36090795-04	.63412462-05	.17293651-02	-.18298596-03
RE	-.34478448-02	-.14416894-02	.90453245-05	.33634679-06	-.14056347-02	-.86287873-05	-.21690452-05	-.15094884-02	-.79184297-05
G	-.64884115-03	.29186639-03	-.16731629-05	.52083914-06	.24740829-03	.13610407-05	.19912209-06	.33659633-03	.49125652-06
KM	.89861796-01	.45101795-02	-.28513712-04	.11703209-03	.35335622-02	.18104783-04	.13536040-03	.26085209-02	.20624175-04
RI(03)	.45101795-02	.56619504-02	.28509336-04	-.15839186-05	.20169898-02	.12339206-04	.57961563-06	.22090703-02	.97582432-05
LA(03	-.28513712-04	.28509336-04	.61919494-06	.17787796-07	-.12491344-04	-.76660297-07	-.63541042-08	-.13858276-04	-.58541550-07
LO(03)	.11703209-03	-.15839186-05	.17787796-07	.24436587-06	-.22281457-05	-.18640932-07	.24380568-06	-.31506461-05	-.13813340-07
RI(04)	.35335622-02	.20169898-02	-.12491344-04	-.22281457-05	.46439396-02	-.26781482-04	.45661473-06	.22111589-02	.90901465-05
LA(04)	.18104783-04	.12339206-04	-.76660297-07	-.18640932-07	-.26781482-04	.67119327-06	.95734166-09	.13251586-04	.63854560-07
LO(04)	.13536040-03	.57961563-06	-.63541042-08	.24380568-06	.45661473-06	.95734166-09	.27232938-06	-.85713852-06	.13417711-07
RI(05)	.26085209-02	.22090703-02	-.13858276-04	-.31506461-05	.22111589-02	.13251586-04	-.85713852-06	.42231717-02	-.21219015-04
LA(05)	.20624175-04	.97582432-05	-.58541550-07	-.13813340-07	.90901465-05	.63854560-07	.13417711-07	-.21219015-04	.67524686-06
LO(05)	.12328837-03	-.59655771-06	.12759610-09	.23233346-06	-.18619302-06	-.65223114-08	.24903028-06	-.19822492-05	.83201231-08

LO(05)

X	-.18035370-04
Y	-.15214951-04
Z	.12537485-04
DX	-.15727084-07
DY	-.59659152-07
DZ	.46340306-07
KE	.34571521-05
RE	-.13478824-05
G	-.44645933-06
KM	.12328837-03
RI(03	-.59655771-06
LA(03)	.12759610-09
LO(03)	.23233346-06
RI(04	-.18619302-06
LA(04	-.65223114-08
LO(04)	.24903028-06
RI(05	-.19822492-05
LA(05)	.83201231-08
LO(05)	.24376247-06

3 INPUT J MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 4

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.77299722 05	-.29111779 06	-.10822777 06	.36109441 09	.17825717 08	.11439162 09	.51813155 04	.22484565 05	-.13236407 03
Y	-.29111779 06	.11169182 07	.41627224 06	-.13841048 10	-.74389009 08	-.44112404 09	-.19800269 05	-.98100632 05	.45538633 03
Z	-.10822777 06	.41627224 06	.15609260 06	-.51608452 09	-.28312815 08	-.16489694 09	-.73747220 04	-.38052728 05	.16281690 03
DX	.36109441 09	-.13841048 10	-.51608452 09	.17153847 13	.91910545 11	.54663606 12	.24541401 08	.12113725 09	-.56613366 06
DY	.17825717 08	-.74389009 08	-.28312815 08	.91910545 11	.67673849 10	.30145452 11	.12959145 07	.10217767 08	-.13907167 05
DZ	.11439162 09	-.44112404 09	-.16489694 09	.54663606 12	.30145452 11	.17462199 12	.78112670 07	.40395222 08	-.17241297 06
KE	.51813155 04	-.19800269 05	-.73747220 04	.24541401 08	.12959145 07	.78112670 07	.35137328 03	.16858080 04	-.82976999 01
RE	.22484565 05	-.98100632 05	-.38052728 05	.12113725 09	.10217767 08	.40395222 08	.16858080 04	.17776529 05	-.25869252 01
G	-.13236407 03	.45538633 03	.16281690 03	-.56613366 06	-.13907167 05	-.17241297 06	-.82976999 01	-.25869252 01	.11459476 02
KM	-.18802360 04	.59937690 04	.20219351 04	-.74527434 07	-.58625203 03	-.21724210 07	-.11180362 03	.40614551 03	.64852986 01
RI(03)	.78129605 04	-.27717581 05	-.10283915 05	.34509017 08	.12201598 07	.10732833 08	.50016854 03	.12216917 04	-.16797323 02
LA(03	-.61751845 06	.21869519 07	.81164163 06	-.27231992 10	-.95239254 08	-.84657805 09	-.39479933 05	-.94323431 05	.13340615 04
LO(03	-.27242643 06	.15163767 07	.52165944 06	-.18279736 10	-.21440124 09	-.62107683 09	-.24860316 05	-.38819915 06	-.39238065 03
RI(04)	.24058259 04	-.90348381 04	-.44549192 04	.11570932 08	.90059792 06	.40117630 07	.15461816 03	.26192390 04	.35560302 01
LA(04)	.15750295 06	-.59107725 06	-.29265240 06	.75742382 09	.59194718 08	.26293054 09	.10109884 05	.17324934 06	.24032500 03
LO(04)	.54606078 06	-.21955912 07	-.76484559 06	.26953015 10	.15614861 09	.85318669 09	.39172452 05	.12419757 06	-.11862971 04
RI(05)	.30990541 04	-.15733744 05	-.69482329 04	.19556000 08	.24384606 07	.70040583 07	.26521164 03	.41127536 04	.66729714 01
LA(05)	.16400829 06	-.83053964 06	-.36659572 06	.10323707 10	.12822672 09	.36950924 09	.14006941 05	.21592592 06	.34711083 03
LO(05	-.28006426 06	.62864748 06	.19988906 06	-.80245338 09	.89882516 08	-.19530853 09	-.13256293 05	.28281271 06	.16842667 04

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	-.18802360 04	.78129605 04	-.61751845 06	-.27242643 06	.24058259 04	.15750295 06	.54606078 06	.30990541 04	.16400829 06
Y	.59937690 04	-.27717581 05	.21869519 07	.15163767 07	-.90348381 04	-.59107725 06	-.21955912 07	-.15733744 05	-.83053964 06
Z	.20219351 04	-.10283915 05	.81164163 06	.52165944 06	-.44549192 04	-.29265240 06	-.76484559 06	-.69482329 04	-.36659572 06
DX	-.74527434 07	.34509017 08	-.27231992 10	-.18279736 10	.11570932 08	.75742382 09	.26953015 10	.19556000 08	.10323707 10
DY	-.58625203 03	.12201598 07	-.95239254 08	-.21440124 09	.90059792 06	.59194718 08	.15614861 09	.24384606 07	.12822672 09
DZ	-.21724210 07	.10732833 08	-.84657805 09	-.62107683 09	.40117630 07	.26293054 09	.85318669 09	.70040583 07	.36950924 09
KE	-.11180362 03	.50016854 03	-.39479933 05	-.24860316 05	.15461816 03	.10109884 05	.39172452 05	.26521164 03	.14006941 05
RE	.40614551 03	.12216917 04	-.94323431 05	-.38819915 06	.26192390 04	.17324934 06	.12419757 06	.41127536 04	.21592592 06
G	.64852986 01	-.16797323 02	.13340615 04	-.39238065 03	.35560302 01	.24032500 03	-.11862971 04	.66729714 01	.34711083 03
KM	.16145554 03	-.30876686 03	.24512676 05	-.48645398 04	.14190313 03	.95059838 04	-.31088509 05	.33263516 03	.17457403 05
RI(03-	.30876686 03	.15371988 04	-.11406104 06	.32458948 04	-.93336339 02	-.62342163 04	.15485639 05	-.75573140 02	-.40238289 04
LA(03)	.24512676 05	-.11406104 06	.10290324 08	-.39964974 06	.72727072 04	.48555725 06	-.11417962 07	.60477024 04	.32175389 06
LO(03-	.48645398 04	.32458948 04	-.39964974 06	.23763352 08	.24136603 05	.16432762 07	-.13648122 08	-.36373397 04	-.15745567 06
RI(04)	.14190313 03	-.93336339 02	.72727072 04	.24136603 05	.34467516 04	.22196343 06	-.11544310 05	-.75948818 02	-.39741853 04
LA(04)	.95059838 04	-.62342163 04	.48555725 06	.16432762 07	.22196343 06	.15958251 08	-.88879340 06	-.48367495 04	-.25321862 06
LO(04-	.31088509 05	.15485639 05	-.11417962 07	-.13648122 08	-.11544310 05	-.88879340 06	.43175308 08	-.60757839 05	-.31403251 07
RI(05)	.33263516 03	-.75573140 02	.60477024 04	-.36373397 04	-.75948818 02	-.48367495 04	-.60757839 05	.30949748 04	.15757040 06
LA(05)	.17457403 05	-.40238289 04	.32175389 06	-.15745567 06	-.39741853 04	-.25321862 06	-.31403251 07	.15757040 06	.95284247 07
LO(05)	.23184256 05	.16384179 05	-.12166524 07	-.12849326 08	-.96340661 04	-.56655549 06	-.22314770 08	.72399956 05	.36987675 07

	LO(05)
X	-.28006426 06
Y	.62864748 06
Z	.19988906 06
DX	-.80245338 09
DY	.89882516 08
DZ	-.19530853 09
KE	-.13256293 05
RE	.28281271 06
G	.16842667 04
KM	.23184256 05
RI(03)	.16384179 05
LA(03-	.12166524 07
LO(03-	.12849326 08
RI(04-	.96340661 04
LA(04-	.56655549 06
LO(04-	.22314770 08
RI(05)	.72399956 05
LA(05)	.36987675 07
LO(05)	.46720837 08

EPHEMERIS TAPE IV WITH MARS VELOCITIES. B-8 IS

GME	.39860139 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63783037 04
G	.66709998-19	A	.88782497 29	B	.88800499 29	C	.88837498 29	OME	.41780741-02	AU	.14959900 09
GMM	.49027943 04	GMS	.13271544 12	GMV	.32476952 06	GMA	.42977799 05	GMC	.37918700 08	GMJ	.12671062 09
EGM	.39860320 06	MGM	.49027779 04	JA	.29200000-02	HA	.00000000 00	DA	.00000000 00	RA	.34170000 04
ARA	.35670000 01	GB	.39523407 00	MAS	.37410000 03	GB1	.00000000 00	GB2	.00000000 00	SC	.10200000 09

INJECTION CONDITIONS MOON 23571202437720200000000 J.D.= 2438841.40958333 MARCH 21,1965 21 49 48.000

GEOCENTRIC X0-.14189953 04 YO .59894563 04 ZO .23043950 04 DXO-.10386559 02 DYO-.79863801 00 DZO-.34293750 01
CARTESIAN GMC .00000000 00 SGC .00000000 00 TO .78588000 05 GHA .14664570 03 GHO .17829921 03
DATE OF RUN 092965G 000000 EARTH IS THE CENTRAL BODY FOR INTEGRATION COWELL EQUATIONS OF MOTION

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. 23571202437720200000000 J.D.= 2438841.40958333 MARCH 21,1965 21 49 48.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.14189953 04	Y	.59894562 04	Z	.23043949 04	DX	-.10386559 02	DY	-.79863800 00	DZ	-.34293750 01
R	.65724704 04	DEC	.20524826 02	RA	.10332851 03	V	.10967180 02	PTH	.16316502 01	AZ	.11016283 03
R	.65724704 04	LAT	.20524826 02	LON	.31668282 03	VE	.10547151 02	PTE	.16966480 01	AZE	.11100368 03
XS	.14904462 09	YS	.25551776 07	ZS	.11084882 07	DXS	-.61624519-01	DYS	.27415670 02	DZS	.11888062 02
XM	-.21992970 06	YM	-.30359148 06	ZM	-.11818096 06	DXM	.79137388 00	DYM	-.52219290 00	DZM	-.31393380 00
XT	-.21992970 06	YT	-.30359148 06	ZT	-.11818096 06	DXT	.79137388 00	DYT	-.52219290 00	DZT	-.31393380 00
RS	.14907064 09	VS	.29882248 02	RM	.39306945 06	VM	.99875546 00	RT	.39306945 06	VT	.99875546 00
GEO	.20652927 02	ALT	.19691827 03	LOS	.21433647 03	RAS	.98216497 00	RAM	.23407943 03	LOM	.87433731 02
DUT	.36000000 02	DT	.37500000 01	DR	.31227778 00	SHA	.64428332 04	DES	.42605525 00	DEM	-.17497353 02
DAC	.00000000 00	CCL	.10619137 03	MCL	.18018450 03	TCL	.18018450 03				

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 23571202436620231470466O J.D.= 2438841.40918519 MARCH 21,1965 21 49 13.601

SMA	.39263502 06	ECC	.98327429 00	B	.71510979 05	SLR	.13024353 05	APO	.77870293 06	RCA	.65670964 04
VH	.92528531-01	C3	-.10151957 01	C1	.72052241 05	TFP	.34399340 02	TF	-.95553721-02	PER	.40807761 05
TA	.32910659 01	MTA	.00000000 00	EA	.30231056 00	MA	.50577643-02	C3J	-.13938637 01	TFI	.00000000 00

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	-.14189953 04	Y	.59894562 04	Z	.23043949 04	DX	-.10386559 02	DY	-.79863800 00	DZ	-.34293750 01
INC	.28462715 02	LAN	.32700540 03	APF	.12934460 03	MX	-.94129244 00	MY	-.98808844-01	MZ	-.32280851 00
WX	-.25952993 00	WY	-.39972386 00	WZ	.87912743 00	PX	-.16150572 00	PY	.91546401 00	PZ	.36856687 00
QX	-.95213449 00	QY	-.46329971-01	QZ	-.30214800 00	RX	-.64033537-01	RY	.36296176 00	RZ	-.92960123 00
BX	.95213450 00	BY	.46329972-01	BZ	.30214800 00	TX	.98479217 00	TY	.17373656 00	TZ	.00000000 00
DAP	.21627259 02	RAP	.10000514 03								
BTQ	.67628205 05	BRQ	-.23243191 05	B	.71510979 05	THA	.34103262 03				

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.14904604 09	Y	-.25491881 07	Z	-.11061837 07	DX	-.10324934 02	DY	-.28214308 02	DZ	-.15317436 02
R	.14907194 09	LAT	-.42516561 00	LON	.18097985 03	V	.33723513 02	PTH	.18892178 02	AZ	.11852496 03
XE	-.14904462 09	YE	-.25551776 07	ZE	-.11084882 07	DXE	.61624519-01	DYE	-.27415670 02	DZE	-.11888062 02
XT	-.14926455 09	YT	-.28587690 07	ZT	-.12266691 07	DXT	.85299840 00	DYT	-.27937863 02	DZT	-.12201995 02
LTE	-.42605525 00	LOE	.18098216 03	LTT	-.47076481 00	LOT	.18109721 03	RST	.14929696 09	VST	.30498204 02
EPS	.78598842 02	ESP	.27453512-18	SEP	.10139868 03	EPM	.45804443 02	EMP	.68685313 00	MEP	.13350866 03
MPS	.12440295 03	MSP	.12569964 00	SMP	.55471141 02	SEM	.12509231 03	EMS	.54784254 02	ESM	.12334256 00
RPM	.39762294 06	SPN	.25714311 01								
SAC	.61061966-10										
GCE	.25380863 03	GCT	.25399313 03	SIP	.12415251 03	CPT	.10124911 03	SIN	.10099867 03	D1	.13113051 00
REP	.65724704 04	VEP	.10967180 02	CPE	.10650660 03	CPS	.93254578 02	D2	.74595467-01	D3	.39435657-03

1 DAYS 14 HRS. 28 MIN. 44.019 SEC. 23571213010620200233500O J.D.= 2438843.01287058 MARCH 23,1965 12 18 32.019

GEOCENTRIC EQUATORIAL COORDINATES

X	-.19505803 05	Y	-.26136409 06	Z	-.12440311 06	DX	.14644381 00	DY	-.12029495 01	DZ	-.49949922 00
R	.29011687 06	DEC	-.25391647 02	RA	.26573188 03	V	.13107375 01	PTH	.79328664 02	AZ	.76058361 02
R	.29011687 06	LAT	-.25391647 02	LON	.26032247 03	VE	.18920393 02	PTE	.39036204 01	AZE	.27017749 03
XS	.14897896 09	YS	.63518331 07	ZS	.27547960 07	DXS	-.88634674 00	DYS	.27394607 02	DZS	.11878839 02
XM	-.99080975 05	YM	-.35551202 06	ZM	-.15340398 06	DXM	.93430631 00	DYM	-.22209578 00	DZM	-.19033148 00
XT	-.99080975 05	YT	-.35551202 06	ZT	-.15340398 06	DXT	.93430631 00	DYT	-.22209578 00	DZT	-.19033148 00
RS	.14913975 09	VS	.29872343 02	RM	.39967313 06	VM	.97902036 00	RT	.39967313 06	VT	.97902036 00
GED	-.25542713 02	ALT	.28374263 06	LOS	.35703196 03	RAS	.24413734 01	RAM	.25442687 03	LOM	.24901747 03
DUT	.36000000 02	DT	.48000000 03	DR	.12880690 01	SHA	.28824375 06	DES	.10583830 01	DEM	-.22570727 02
DAC	.00000000 00	CCL	.28187105 03	MCL	.35139094 03	TCL	.35139094 03				

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 23571202456020226333500O J.D.= 2438841.41483103 MARCH 21,1965 21 57 21.402

SMA	.38705369 06	ECC	.98379928 00	B	.69388457 05	SLR	.12439507 05	APO	.76783683 06	RCA	.62705469 04
VH	.91706900-01	C3	-.10298349 01	C1	.70415940 05	TFP	.13807062 06	TF	.12594461 00	PER	.39940733 05
TA	.16662671 03	MTA	.00000000 00	EA	.75251772 02	MA	.20741324 02	C3J	-.14146202 01	TFI	.38478893 02

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	-.19505803 05	Y	-.26136409 06	Z	-.12440311 06	DX	.14644381 00	DY	-.12029495 01	DZ	-.49949922 00
INC	.28743042 02	LAN	.32566411 03	APF	.13028542 03	MX	.96016102 00	MY	-.17525793 00	MZ	.21765871 00
WX	-.27123828 00	WY	-.39708620 00	WZ	.87678514 00	PX	-.15666855 00	PY	.91699985 00	PZ	.36683272 00
QX	-.94967604 00	QY	-.37865631-01	QZ	-.31093642 00	RX	-.61777877-01	RY	.36159333 00	RZ	-.93028692 00
BX	.94967611 00	BY	.37865634-01	BZ	.31093644 00	TX	.98571724 00	TY	.16840885 00	TZ	.00000000 00
DAP	.21520415 02	RAP	.99695320 02								
BTQ	.65397859 05	BRQ	-.23192198 05	B	.69388457 05	THA	.34047384 03				

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.14899846 09	Y	-.66131972 07	Z	-.28791991 07	DX	.10327905 01	DY	-.28597556 02	DZ	-.12378338 02
R	.14917294 09	LAT	-.11059391 01	LON	.18254136 03	V	.31178680 02	PTH	.87316369 00	AZ	.11338070 03
XE	-.14897896 09	YE	-.63518331 07	ZE	-.27547960 07	DXE	.88634674 00	DYE	-.27394607 02	DZE	-.11878839 02
XT	-.14907804 09	YT	-.67073451 07	ZT	-.29082000 07	DXT	.18206530 01	DYT	-.27616702 02	DZT	-.12069170 02
LTE	-.10583830 01	LOE	.18244137 03	LTT	-.11164490 01	LOT	.18257612 03	RST	.14925718 09	VST	.30193739 02
EPS	.83374986 02	ESP	.11124820 00	SEP	.96514298 02	EPM	.14411640 03	EMP	.25180467 02	MEP	.10703131 02
MPS	.13168331 03	MSP	.38308338-01	SMP	.48280383 02	SEM	.10701436 03	EMS	.72838932 02	ESM	.14687642 00
RPM	.12663763 06	SPN	.82115281 02								
SAC	.60979310-10										
GCE	.78128950 02	GCT	.24951989 03	SIP	.13089694 03	CPT	.10317389 03	SIN	.10238752 03	D1	.41176476 00
REP	.29011687 06	VEP	.13107375 01	CPE	.78559767 02	CPS	.92850619 02	D2	.27683371 00	D3	.50389300-02

5 J MATRIX ITERATION NUMBER 5

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.93649430 07	-.37860585 08	-.14366498 08	.46820318 11	.31358496 10	.15213332 11	.66649835 06	.44213376 05	-.10814315 05
Y	-.37860585 08	.15368927 09	.58384287 08	-.18985712 12	-.12746178 11	-.61712866 11	-.27044278 07	-.18664207 06	.43845535 05
Z	-.14366498 08	.58384287 08	.22191075 08	-.72096667 11	-.48407404 10	-.23436824 11	-.10272274 07	-.71725097 05	.16643893 05
DX	.46820318 11	-.18985712 12	-.72096667 11	.23464335 15	.15759768 14	.76272398 14	.33414641 10	.23050236 09	-.54165100 08
DY	.31358496 10	-.12746178 11	-.48407404 10	.15759768 14	.10679778 13	.51278857 13	.22439622 09	.17672404 08	-.36218647 07
DZ	.15213332 11	-.61712866 11	-.23436824 11	.76272398 14	.51278857 13	.24795975 14	.10861680 10	.76007176 08	-.17598805 08
KE	.66649835 06	-.27044278 07	-.10272274 07	.33414641 10	.22439622 09	.10861680 10	.47599603 05	.32525064 04	-.77261709 03
RE	.44213376 05	-.18664207 06	-.71725097 05	.23050236 09	.17672404 08	.76007176 08	.32525064 04	.17850256 05	-.29023706 02
G	-.10814315 05	.43845535 05	.16643893 05	-.54165100 08	-.36218647 07	-.17598805 08	-.77261709 03	-.29023706 02	.23941589 02
KM	-.90273359 04	.35111483 05	.13093979 05	-.43418217 08	-.24500413 07	-.13882400 08	-.62688854 03	.38247978 03	.15161008 02
RI(03)	.59072255 05	-.23372147 06	-.89981074 05	.28953581 09	.18231838 08	.93902059 08	.41426399 04	.14079425 04	-.73046967 02
LA(03	-.44754072 07	.17691020 08	.68148145 07	-.21918478 11	-.13770844 10	-.71085082 10	-.31373005 06	-.10880986 06	.55710858 04
LO(03	-.13912326 08	.56383523 08	.21471721 08	-.69661279 11	-.46739682 10	-.22642230 11	-.99046531 06	-.41860944 06	.14713482 05
RI(04	-.16033527 05	.69843797 05	.24139487 05	-.85213982 08	-.62832388 07	-.27409657 08	-.12406666 04	.25445070 04	.31371977 02
LA(04	-.98052673 06	.42960991 07	.14737952 07	-.52372406 10	-.38897986 09	-.16832864 10	-.76329198 05	.16847259 06	.19800514 04
LO(04	-.11638359 08	.47138489 08	.17955562 08	-.58239009 11	-.38993918 10	-.18942660 11	-.83085589 06	.10340809 06	.13142312 05
RI(05	-.42578179 05	.32479371 06	.13973058 06	-.33854656 09	-.23091647 08	-.11169000 09	-.53492279 04	.39067527 04	.10086901 03
LA(05	-.52141809 07	.16700273 08	.54799651 07	-.23645578 11	-.19780515 10	-.78237776 10	-.31005328 06	.20538068 06	.52717680 04
LO(05	-.14807298 08	.71293687 08	.28606878 08	-.81750841 11	-.47598529 10	-.26314634 11	-.12119685 07	.24521508 06	.21357590 05

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	-.90273359 04	.59072255 05	-.44754072 07	-.13912326 08	-.16033527 05	-.98052673 06	-.11638359 08	-.42578179 05	-.52141809 07
Y	.35111483 05	-.23372147 06	.17691020 08	.56383523 08	.69843797 05	.42960991 07	.47138489 08	.32479371 06	.16700273 08
Z	.13093979 05	-.89981074 05	.68148145 07	.21471721 08	.24139487 05	.14737952 07	.17955562 08	.13973058 06	.54799651 07
DX	-.43418217 08	.28953581 09	-.21918478 11	-.69661279 11	-.85213982 08	-.52372406 10	-.58239009 11	-.33854656 09	-.23645578 11
DY	-.24500413 07	.18231838 08	-.13770844 10	-.46739682 10	-.62832388 07	-.38897986 09	-.38993918 10	-.23091647 08	-.19780515 10
DZ	-.13882400 08	.93902059 08	-.71085082 10	-.22642230 11	-.27409657 08	-.16832864 10	-.18942660 11	-.11169000 09	-.78237776 10
KE	-.62688854 03	.41426399 04	-.31373005 06	-.99046531 06	-.12406666 04	-.76329198 05	-.83085589 06	-.53492279 04	-.31005328 06
RE	.38247978 03	.14079425 04	-.10880986 06	-.41860944 06	.25445070 04	.16847259 06	.10340809 06	.39067527 04	.20538068 06
G	.15161008 02	-.73046967 02	.55710858 04	.14713482 05	.31371977 02	.19800514 04	.13142312 05	.10086901 03	.52717680 04
KM	.16906727 03	-.36692748 03	.29028528 05	.49599399 04	.16675467 03	.11092228 05	-.23823046 05	.39900101 03	.20850223 05
RI(03	-.36692748 03	.41220578 04	-.31772207 06	-.19576434 06	-.93336339 02	-.62342163 04	.15485639 05	-.75573140 02	-.40238289 04
LA(03)	.29028528 05	-.31772207 06	.26357489 08	.14274709 08	.72727072 04	.48555725 06	-.11417962 07	.60477024 04	.32175389 06
LO(03)	.49599399 04	-.19576434 06	.14274709 08	.91545900 08	.24136603 05	.16432762 07	-.13648122 08	-.36373397 04	-.15745567 06
RI(04)	.16675467 03	-.93336339 02	.72727072 04	.24136603 05	.68850978 04	.44763019 06	.56002817 05	-.75948818 02	-.39741853 04
LA(04)	.11092228 05	-.62342163 04	.48555725 06	.16432762 07	.44763019 06	.30780125 08	.31639810 07	-.48367495 04	-.25321862 06
LO(04	-.23823046 05	.15485639 05	-.11417962 07	-.13648122 08	.56002817 05	.31639810 07	.10419193 09	-.60757839 05	-.31403251 07
RI(05)	.39900101 03	-.75573140 02	.60477024 04	-.36373397 04	-.75948818 02	-.48367495 04	-.60757839 05	.49517841 05	-.11994654 07
LA(05)	.20850223 05	-.40238289 04	.32175389 06	-.15745567 06	-.39741853 04	-.25321862 06	-.31403251 07	-.11994654 07	.11586265 09
LO(05)	.35578182 05	.16384179 05	-.12166524 07	-.12849326 08	-.96340661 04	-.56655549 06	-.22314770 08	.40791609 07	-.16297172 09

LO(05)

X	-.14807298 08
Y	.71293687 08
Z	.28606878 08
DX	-.81750841 11
DY	-.47598529 10
DZ	-.26314634 11
KE	-.12119685 07
RE	.24521508 06
G	.21357590 05
KM	.35578182 05
RI(03)	.16384179 05
LA(03)	-.12166524 07
LO(03)	-.12849326 08
RI(04)	-.96340661 04
LA(04)	-.56655549 06
LO(04)	-.22314770 08
RI(05)	.40791609 07
LA(05)	-.16297172 09
LO(05)	.52472121 09

6 CORRELATIONS BASED ON J MATRIX ITERATION NUMBER 5

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	-.10000000 01	.99795963 00	.99657316 00	-.99879804 00	-.99156581 00	-.99834625 00	-.99826271 00	-.10813814 00	.72222076 00
Y	.99795963 00	-.10000000 01	-.99973532 00	.99977202 00	.99489462 00	.99968541 00	.99988938 00	.11268485 00	-.72281493 00
Z	.99657316 00	-.99973532 00	-.10000000 01	.99912976 00	.99435510 00	.99912308 00	.99948376 00	.11396192 00	-.72208655 00
DX	-.99879804 00	.99977202 00	.99912976 00	-.10000000 01	-.99555342 00	-.99993710 00	-.99984116 00	-.11262869 00	.72266821 00
DY	-.99156581 00	.99489462 00	.99435510 00	-.99555342 00	-.10000000 01	-.99647553 00	-.99525133 00	-.12799479 00	.71626648 00
DZ	-.99834625 00	.99968541 00	.99912308 00	-.99993710 00	-.99647553 00	-.10000000 01	-.99978071 00	-.11424620 00	.72229751 00
KE	-.99826271 00	.99988938 00	.99948376 00	-.99984116 00	-.99525133 00	-.99978071 00	-.10000000 01	-.11158203 00	.72374598 00
RE	-.10813814 00	.11268485 00	.11396192 00	-.11262869 00	-.12799479 00	-.11424620 00	-.11158203 00	-.10000000 01	.44397055-01
G	.72222076 00	-.72281493 00	-.72208655 00	.72266821 00	.71626648 00	.72229751 00	.72374598 00	.44397055-01	-.10000000 01
KM	.22687010 00	-.21781993 00	-.21377293 00	.21799076 00	.18233184 00	.21440959 00	.22098302 00	-.22016916 00	-.23829878 00
RI(03)	-.30065881 00	.29364309 00	.29751233 00	-.29440225 00	-.27478454 00	-.29371592 00	-.29574573 00	-.16413669 00	.23252448 00
LA(03)	.28485771 00	-.27795794 00	-.28178174 00	.27871110 00	.25955382 00	.27805830 00	.28009311 00	.15863317 00	-.22177437 00
LO(03)	.47514672 00	-.47534724 00	-.47638517 00	.47530006 00	.47269955 00	.47523580 00	.47448027 00	.32746685 00	-.31428202 00
RI(04)	.63142452-01	-.67897065-01	-.61756660-01	.67042727-01	.73273575-01	.66337322-01	.68532784-01	-.22952308 00	-.77269898-01
LA(04)	.57752619-01	-.62462206-01	-.56391387-01	.61625891-01	.67843901-01	.60930148-01	.63059982-01	-.22728556 00	-.72939838-01
LO(04)	.37258222 00	-.37250906 00	-.37341589 00	.37247130 00	.36965682 00	.37267764 00	.37308432 00	-.75825490-01	-.26313477 00
RI(05)	.62524995-01	-.11773484 00	-.13329733 00	.99319249-01	.10041369 00	.10079590 00	.11018147 00	-.13140529 00	-.92640402-01
LA(05)	.15829303 00	-.12514977 00	-.10807292 00	.14340823 00	.17782169 00	.14596683 00	.13202705 00	-.14281230 00	-.10009401 00
LO(05)	.21123163 00	-.25105275 00	-.26510443 00	.23298277 00	.20107038 00	.23069726 00	.24250760 00	-.80123632-01	-.19055109 00

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	.22687010 00	-.30065881 00	.28485771 00	.47514672 00	.63142452-01	.57752619-01	.37258222 00	.62524995-01	.15829303 00
Y	-.21781993 00	.29364309 00	-.27795794 00	-.47534724 00	-.67897065-01	-.62462206-01	-.37250906 00	-.11773484 00	-.12514977 00
Z	-.21377293 00	.29751233 00	-.28178174 00	-.47638517 00	-.61756660-01	-.56391387-01	-.37341589 00	-.13329733 00	-.10807292 00
DX	.21799076 00	-.29440225 00	.27871110 00	.47530006 00	.67042727-01	.61625891-01	.37247130 00	.99319249-01	.14340823 00
DY	.18233184 00	-.27478454 00	.25955382 00	.47269955 00	.73273575-01	.67843901-01	.36965682 00	.10041369 00	.17782169 00
DZ	.21440959 00	-.29371592 00	.27805830 00	.47523580 00	.66337322-01	.60930148-01	.37267764 00	.10079590 00	.14596683 00
KE	.22098302 00	-.29574573 00	.28009311 00	.47448027 00	.68532784-01	.63059982-01	.37308432 00	.11018147 00	.13202705 00
RE	-.22016916 00	-.16413669 00	.15863317 00	.32746685 00	-.22952308 00	-.22728556 00	-.75825490-01	-.13140529 00	-.14281230 00
G	-.23829878 00	.23252448 00	-.22177437 00	-.31428202 00	-.77269898-01	-.72939838-01	-.26313477 00	-.92640402-01	-.10009401 00
KM	-.10000000 01	.43953496 00	-.43485375 00	-.39868251-01	-.15455860 00	-.15376370 00	.17949423 00	-.13789972 00	-.14897356 00
RI(03)	.43953496 00	-.10000000 01	.96391412 00	.31868167 00	.17520184-01	.17502079-01	-.23629528-01	.52896821-02	.58225164-02
LA(03	-.43485375 00	.96391412 00	-.10000000 01	-.29060012 00	-.17072182-01	-.17047207-01	.21788108-01	-.52936782-02	-.58223734-02
LO(03	-.39868251-01	.31868167 00	-.29060012 00	-.99999999 00	-.30401964-01	-.30956791-01	.13974503 00	.17083764-02	.15288579-02
RI(04	-.15455860 00	.17520184-01	-.17072182-01	-.30401964-01	-.10000000 01	-.97236457 00	-.66120748-01	.41132500-02	.44496034-02
LA(04	-.15376370 00	.17502079-01	-.17047207-01	-.30956791-01	-.97236457 00	-.10000000 01	-.55870380-01	.39177576-02	.42402232-02
LO(04)	.17949423 00	-.23629528-01	.21788108-01	.13974503 00	-.66120748-01	-.55870380-01	-.10000000 01	.26748807-01	.28581554-01
RI(05	-.13789972 00	.52896821-02	-.52936782-02	.17083764-02	.41132500-02	.39177576-02	.26748807-01	-.10000000 01	.50076634 00
LA(05	-.14897356 00	.58225164-02	-.58223734-02	.15288579-02	.44496034-02	.42402232-02	.28581554-01	.50076634 00	-.10000000 01
LO(05	-.11945096 00	-.11140465-01	.10345469-01	.58626851-01	.50686260-02	.44580296-02	.95435742-01	-.80024999 00	.66096156 00

	LO(05)
X	.21123163 00
Y	-.25105275 00
Z	-.26510443 00
DX	.23298277 00
DY	.20107038 00
DZ	.23069726 00
KE	.24250760 00
RE	-.80123632-01
G	-.19055109 00
KM	-.11945096 00
RI(03	-.11140465-01
LA(03)	.10345469-01
LO(03)	.58626851-01
RI(04)	.50686260-02
LA(04)	.44580296-02
LO(04)	.95435742-01
RI(05	-.80024999 00
LA(05)	.66096156 00
LO(05	-.10000000 01

7 RA9 PRE M/C WITH POST AS A PRIORI 29SEPT

ITERATION NUMBER 5 EPOCH 65/03/21 214948.000 CLOCK 184210 SOS .24434 02 QSOS .25278 02

Q	DQ	STDEVDQ	OLD Q	NEW Q	NOMINAL Q	DQ (NOM)
X	-.51294248-03	.11347062 00	-.14189953 04	-.14189958 04	-.14191819 04	.18605042 00
Y	.70816409-03	.11700843 00	.59894563 04	.59894570 04	.59887585 04	.69848633 00
Z	-.42463195-03	.14899763 00	.23043950 04	.23043945 04	.23040842 04	.31036377 00
DX	.14998432-05	.14456342-03	-.10386559 02	-.10386558 02	-.10387126 02	.56827068-03
DY	.17248300-05	.16342324-03	-.79863801 00	-.79863629 00	-.79887617 00	.23987889-03
DZ	-.35033621-05	.34275010-03	-.34293750 01	-.34293785 01	-.34295831 01	.20456314-03
KE	.87610473-03	.59190421 00	.39860139 06	.39860139 06	.39860328 06	-.18906250 01
RE	.72831725-03	.32823543-01	.63783037 04	.63783044 04	.63783247 04	-.20385742-01
G	-.78406862-04	.29980117 00	.39523407 00	.39515566 00	.39993044 00	-.47747828-02
KM	-.86971309-02	.29977404 00	.49027943 04	.49027856 04	.49026987 04	.86914063-01
STA 3						
RI	.37400704-03	.75245754-01	.63718900 04	.63718903 04	.63718875 04	.28076172-02
LA	-.87933886-06	.78688897-03	.35117335 02	.35117334 02	.35117354 02	-.19550323-04
LO	-.35998382-05	.49433471-03	.24319494 03	.24319494 03	.24319531 03	-.37193298-03
STA 4						
RI	.19163914-03	.68146326-01	.63726418 04	.63726421 04	.63726493 04	-.72631836-02
LA	.10095803-05	.81926347-03	-.31212181 02	-.31212180 02	-.31212132 02	-.47922134-04
LO	-.57379725-05	.52185414-03	.13688810 03	.13688809 03	.13688807 03	.20980835-04
STA 5						
RI	.36504744-03	.64985814-01	.63755383 04	.63755386 04	.63755284 04	.10192871-01
LA	.11237615-05	.82173346-03	-.25739085 02	-.25739083 02	-.25738857 02	-.22697449-03
LO	-.63133918-05	.49372524-03	.27685821 02	.27685815 02	.27685835 02	-.19550323-04

8 COVARIANCE MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 5

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.12875583-01	.42956351-02	-.49211351-02	-.43729213-05	.53004977-05	.11278099-04	-.19526896-01	.24133254-02	-.61934952-03
Y	.42956351-02	.13690974-01	-.15898820-01	.13531117-04	.14424925-04	-.29681582-04	.32526091-01	.29056726-02	-.55910230-03
Z	-.49211351-02	-.15898820-01	.22200294-01	-.15555279-04	-.16370128-04	.37588580-04	-.42340964-01	-.40275826-02	.10284251-02
DX	-.43729213-05	.13531117-04	-.15555279-04	.20898582-07	.16970135-07	-.48350651-07	.49293754-04	.14726415-05	-.47292283-06
DY	.53004977-05	.14424925-04	-.16370128-04	.16970135-07	.26707155-07	-.41786827-07	.23860055-04	.22626860-05	-.93062514-06
DZ	.11278099-04	-.29681582-04	.37588580-04	-.48350651-07	-.41786827-07	.11747763-06	-.11899314-03	-.32812947-05	.11462264-05
KE	-.19526896-01	.32526091-01	-.42340964-01	.49293754-04	.23860055-04	-.11899314-03	.35035059 00	.49356120-02	.12011217-01
RE	.24133254-02	.29056726-02	-.40275826-02	.14726415-05	.22626860-05	-.32812947-05	.49356120-02	.10773850-02	-.20393996-03
G	-.61934952-03	-.55910230-03	.10284251-02	-.47292283-06	-.93062514-06	.11462264-05	.12011217-01	-.20393996-03	.89880741-01
KM	-.14689797-01	-.17156230-01	.20244534-01	-.15775868-04	-.41120680-04	.42550279-04	.75019932-02	-.34480814-02	-.64875425-03
RI(03	-.32609891-02	-.42163401-02	.58531130-02	-.21983844-05	-.28597500-05	.46959730-05	-.67276716-02	-.14416941-02	.29186722-03
LA(03)	.21635481-04	.25138132-04	-.35032564-04	.11454759-07	.17420100-07	-.24415571-07	.38635064-04	.90453643-05	-.16731683-05
LO(03	-.16331976-04	-.91724159-05	.43756958-05	-.95954798-08	-.52867621-07	.31552874-07	.21305596-04	.33621456-06	.52090307-06
RI(04	-.33485528-02	-.39753865-02	.54888737-02	-.18674839-05	-.26670915-05	.39056408-05	-.57473567-02	-.14056407-02	.24741089-03
LA(04	-.20858597-04	-.22540627-04	.32304407-04	-.85597400-08	-.13358108-07	.17946180-07	-.36090348-04	-.86288115-05	.13610534-05
LO(04	-.19684492-04	-.18465093-04	.16873302-04	-.19292215-07	-.65177670-07	.55387816-07	.63390809-05	-.21692641-05	.19921434-06
RI(05	-.55823834-02	-.45347596-02	.41577123-02	-.77315477-06	-.23851294-05	-.11316559-05	.17294934-02	-.15094843-02	.33659642-03
LA(05)	.14742416-04	-.89229204-05	.56177392-04	-.20301753-07	-.12266235-07	.94966645-07	-.18298587-03	-.79185679-05	.49131086-06
LO(05	-.18035161-04	-.15215581-04	.12538179-04	-.15728077-07	-.59660140-07	.46342678-07	.34550509-05	-.13480872-05	-.44637913-06

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	-.14689797-01	-.32609891-02	.21635481-04	-.16331976-04	-.33485528-02	-.20858597-04	-.19684492-04	-.55823834-02	.14742416-04
Y	-.17156230-01	-.42163401-02	.25138132-04	-.91724159-05	-.39753865-02	-.22540627-04	-.18465093-04	-.45347596-02	-.89229204-05
Z	.20244534-01	.58531130-02	-.35032564-04	.43756958-05	.54888737-02	.32304407-04	.16873302-04	.41577123-02	.56177392-04
DX	-.15775868-04	-.21983844-05	.11454759-07	-.95954798-08	-.18674839-05	-.85597400-08	-.19292215-07	-.77315477-06	-.20301753-07
DY	-.41120680-04	-.28597500-05	.17420100-07	-.52867621-07	-.26670915-05	-.13358108-07	-.65177670-07	-.23851294-05	-.12266235-07
DZ	.42550279-04	.46959730-05	-.24415571-07	.31552874-07	.39056408-05	.17946180-07	.55387816-07	-.11316559-05	.94966645-07
KE	.75019932-02	-.67276716-02	.38635064-04	.21305596-04	-.57473567-02	-.36090348-04	.63390809-05	.17294934-02	-.18298587-03
RE	-.34480814-02	-.14416941-02	.90453643-05	.33621456-06	-.14056407-02	-.86288115-05	-.21692641-05	-.15094843-02	-.79185679-05
G	-.64875425-03	.29186722-03	-.16731683-05	.52090307-06	.24741089-03	.13610534-05	.19921434-06	.33659642-03	.49131086-06
KM	.89864475-01	.45102839-02	-.28514435-04	.11703371-03	.35336749-02	.18105301-04	.13536304-03	.26085120-02	.20626165-04
RI(03)	.45102839-02	.56619235-02	.28509473-04	-.15839119-05	.20169678-02	.12339076-04	.57963268-06	.22090485-02	.97580559-05
LA(03	-.28514435-04	.28509473-04	.61919426-06	.17787663-07	-.12491235-04	-.76659639-07	-.63543539-08	-.13858159-04	-.58540685-07
LO(03)	.11703371-03	-.15839119-05	.17787663-07	.24436680-06	-.22281250-05	-.18640896-07	.24380715-06	-.31506924-05	-.13812588-07
RI(04)	.35336749-02	.20169678-02	-.12491235-04	-.22281250-05	.46439218-02	-.26781587-04	.45665327-06	.22111403-02	.90900051-05
LA(04)	.18105301-04	.12339076-04	-.76659639-07	-.18640896-07	-.26781587-04	.67119265-06	.95743489-09	.13251479-04	.63853691-07
LO(04)	.13536304-03	.57963268-06	-.63543539-08	.24380715-06	.45665327-06	.95743489-09	.27233175-06	-.85720614-06	.13418928-07
RI(05)	.26085120-02	.22090485-02	-.13858159-04	-.31506924-05	.22111403-02	.13251479-04	-.85720614-06	.42231560-02	-.21219193-04
LA(05)	.20626165-04	.97580559-05	-.58540685-07	-.13812588-07	.90900051-05	.63853691-07	.13418928-07	-.21219193-04	.67524588-06
LO(05)	.12329080-03	-.59651766-06	.12723506-09	.23233488-06	-.18613674-06	-.65221054-08	.24903254-06	-.19822935-05	.83214364-08

	LO(05)
X	-.18035161-04
Y	-.15215581-04
Z	.12538179-04
DX	-.15728077-07
DY	-.59660140-07
DZ	.46342678-07
KE	.34550509-05
RE	-.13480872-05
G	-.44637913-06
KM	.12329080-03
RI(03	-.59651766-06
LA(03	1.12723506-09
LO(03	.23233488-06
RI(04	-.18613674-06
LA(04	-.65221054-08
LO(04	.24903254-06
RI(05	-.19822935-05
LA(05	.83214364-08
LO(05	.24376461-06

9 CORRELATION MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 5

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.10000000 01	.32353909 00	-.29107337 00	-.26658138 00	.28583762 00	.28998454 00	-.29073568 00	.64795817 00	-.18206188-01
Y	.32353909 00	.10000000 01	-.91194437 00	.79994124 00	.75436683 00	-.74010320 00	.46963805 00	.75656117 00	-.15938255-01
Z	-.29107337 00	-.91194437 00	.10000000 01	-.72217099 00	-.67229345 00	.73603584 00	-.48009806 00	-.82353038 00	.23022898-01
DX	-.26658138 00	.79994124 00	-.72217099 00	.10000000 01	.71831191 00	-.97581238 00	.57607902 00	.31035102 00	-.10911854-01
DY	.28583762 00	.75436683 00	-.67229345 00	.71831191 00	.99999999 00	-.74601572 00	.24666425 00	.42181791 00	-.18994490-01
DZ	.28998454 00	-.74010320 00	.73603584 00	-.97581238 00	-.74601572 00	.99999999 00	-.58653361 00	-.29166356 00	.11154741-01
KE	-.29073568 00	.46963805 00	-.48009806 00	.57607902 00	.24666425 00	-.58653361 00	.10000000 01	.25404118 00	.67686534-01
RE	.64795817 00	.75656117 00	-.82353038 00	.31035102 00	.42181791 00	-.29166356 00	.25404118 00	.10000000 01	-.20724475-01
G	-.18206188-01	-.15938255-01	.23022898-01	-.10911854-01	-.18994490-01	.11154741-01	.67686534-01	-.20724475-01	.10000000 01
KM	-.43185538 00	-.48911463 00	.45324643 00	-.36403307 00	-.83936808 00	.41412438 00	.42279633-01	-.35042737 00	-.72185981-02
RI(03	-.38193011 00	-.47889077 00	.52206617 00	-.20209857 00	-.23255852 00	.18208157 00	-.15105370 00	-.58372145 00	.12938085-01
LA(03)	.24230905 00	.27302497 00	-.29879897 00	.10069643 00	.13546384 00	-.90526520-01	.82950067-01	.35020886 00	-.70923936-02
LO(03	-.29116166 00	-.15857892 00	.59408236-01	-.13427253 00	-.65441742 00	.18622596 00	.72815049-01	.20720964-01	.35148151-02
RI(04	-.43304323 00	-.49856265 00	.54058181 00	-.18956406 00	-.23948684 00	.16721385 00	-.14248668 00	-.62841482 00	.12109969-01
LA(04	-.22437685 00	-.23513930 00	.26464203 00	-.72273414-01	-.99771734-01	.63910295-01	-.74424519-01	-.32087946 00	.55413841-02
LO(04	-.33242342 00	-.30240237 00	.21700592 00	-.25572580 00	-.76425075 00	.30966171 00	.20522285-01	-.12664202 00	.12733217-02
RI(05	-.75703795 00	-.59637377 00	.42939453 00	-.82298034-01	-.22458439 00	-.50806376-01	.44962341-01	-.70765989 00	.17276573-01
LA(05)	.15810814 00	-.92802326-01	.45882939 00	-.17090083 00	-.91341156-01	.33718056 00	-.37621418 00	-.29358253 00	.19943072-02
LO(05	-.32192244 00	-.26338196 00	.17043931 00	-.22035956 00	-.73940966 00	.27385344 00	.11822728-01	-.83185411-01	-.30156798-02

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	-.43185538 00	-.38193011 00	.24230905 00	-.29116166 00	-.43304323 00	-.22437685 00	-.33242342 00	-.75703795 00	.15810814 00
Y	-.48911463 00	-.47889077 00	.27302497 00	-.15857892 00	-.49856265 00	-.23513930 00	-.30240237 00	-.59637377 00	-.92802326-01
Z	.45324643 00	.52206617 00	-.29879897 00	.59408236-01	.54058181 00	.26464203 00	.21700592 00	.42939453 00	.45882939 00
DX	-.36403307 00	-.20209857 00	.10069643 00	-.13427253 00	-.18956406 00	-.72273414-01	-.25572580 00	-.82298034-01	-.17090083 00
DY	-.83936808 00	-.23255852 00	.13546384 00	-.65441742 00	-.23948684 00	-.99771734-01	-.76425075 00	-.22458439 00	-.91341156-01
DZ	.41412438 00	.18208157 00	-.90526520-01	.18622596 00	.16721385 00	.63910295-01	.30966171 00	-.50806376-01	.33718056 00
KE	.42279633-01	-.15105370 00	.82950067-01	.72815049-01	-.14248668 00	-.74424519-01	.20522285-01	.44962341-01	-.37621418 00
RE	-.35042737 00	-.58372145 00	.35020886 00	.20720964-01	-.62841482 00	-.32087946 00	-.12664202 00	-.70765989 00	-.29358253 00
G	-.72185981-02	.12938085-01	-.70923936-02	.35148151-02	.12109969-01	.55413841-02	.12733217-02	.17276573-01	.19943072-02
KM	.10000000 01	.19995297 00	-.12088079 00	.78976129 00	.17297770 00	.73720477-01	.86528052 00	.13389990 00	.83732390-01
RI(03)	.19995297 00	.10000000 01	.48149717 00	-.42582182-01	.39334580 00	.20015988 00	.14761202-01	.45175678 00	.15781574 00
LA(03	-.12088079 00	.48149717 00	.99999999 00	.45728222-01	-.23294288 00	-.11891310 00	-.15474221-01	-.27100264 00	-.90534344-01
LO(03)	.78976129 00	-.42582182-01	.45728222-01	.10000000 01	-.66141796-01	-.46027996-01	.94509659 00	-.98076810-01	-.34003449-01
RI(04)	.17297770 00	.39334580 00	-.23294288 00	-.66141796-01	.10000000 01	-.47970060 00	.12840886-01	.49929277 00	.16232698 00
LA(04)	.73720477-01	.20015988 00	-.11891310 00	-.46027996-01	-.47970060 00	.10000000 01	.22394249-02	.24889846 00	.94848710-01
LO(04)	.86528052 00	.14761202-01	-.15474221-01	.94509659 00	.12840886-01	.22394249-02	.10000000 01	-.25276536-01	.31292315-01
RI(05)	.13389990 00	.45175678 00	-.27100264 00	-.98076810-01	.49929277 00	.24889846 00	-.25276536-01	.99999999 00	-.39735558 00
LA(05)	.83732390-01	.15781574 00	-.90534344-01	-.34003449-01	.16232698 00	.94848710-01	.31292315-01	-.39735558 00	.99999999 00
LO(05)	.83301213 00	-.16056688-01	.32749752-03	.95193649 00	-.55322820-02	-.16124226-01	.96654400 00	-.61782297-01	.20510771-01

	LO(05)
X	-.32192244 00
Y	-.26338196 00
Z	.17043931 00
DX	-.22035956 00
DY	-.73940966 00
DZ	.27385344 00
KE	.11822728-01
RE	-.83185411-01
G	-.30156798-02
KM	.83301213 00
RI(03	-.16056688-01
LA(03)	.32749752-03
LO(03)	.95193649 00
RI(04	-.55322820-02
LA(04	-.16124226-01
LO(04)	.96654400 00
RI(05	-.61782297-01
LA(05)	.20510771-01
LO(05)	.99999999 00

10 STATION NUMBER 12 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/222

FREQUENCY 8369.0

TIME	TC	Q	CC3	
085132	60	12	.11223032 06 .122 00	.0127
085232	60	12	.11222599 06 .119 00	.0234
085332	60	12	.11222172 06 .116 00	.0156
085432	60	12	.11221749 06 .113 00	.0117
085532	60	12	.11221331 06 .111 00	.0068
085632	60	12	.11220918 06 .109 00	.0195
085732	60	12	.11220510 06 .107 00	.0176
085832	60	12	.11220106 06 .105 00	.0010
085932	60	12	.11219708 06 .104 00	.0176
090032	60	12	.11219315 06 .102 00	.0020
090132	60	12	.11218926 06 .101 00	.0059
090232	60	12	.11218542 06 .996-01	.0098
090332	60	12	.11218163 06 .986-01	.0166
090432	60	12	.11217789 06 .977-01	.0078
090532	60	12	.11217420 06 .967-01	.0176
090632	60	12	.11217055 06 .959-01	-.0029
090732	60	12	.11216695 06 .950-01	.0107
090832	60	12	.11216341 06 .945-01	.0107
090932	60	12	.11215990 06 .938-01	.0127
091032	60	12	.11215645 06 .930-01	.0000
091132	60	12	.11215304 06 .925-01	.0078
091232	60	12	.11214968 06 .920-01	.0166
091332	60	12	.11214637 06 .916-01	-.0039
091432	60	12	.11214310 06 .911-01	.0117
091532	60	12	.11213989 06 .908-01	.0117
091632	60	12	.11213672 06 .903-01	.0000
091732	60	12	.11213359 06 .901-01	.0078
091832	60	12	.11213051 06 .898-01	.0195
091932	60	12	.11212748 06 .894-01	-.0010
092032	60	12	.11212450 06 .891-01	.0186
092132	60	12	.11212156 06 .889-01	.0068
092232	60	12	.11211867 06 .886-01	-.0010
092332	60	12	.11211582 06 .884-01	-.0059
092432	60	12	.11211302 06 .884-01	.0117
092532	60	12	.11211027 06 .881-01	-.0010
092632	60	12	.11210756 06 .879-01	.0078
092732	60	12	.11210489 06 .876-01	.0039
092832	60	12	.11210228 06 .876-01	.0049
092932	60	12	.11209971 06 .874-01	-.0068
093032	60	12	.11209718 06 .874-01	.0029
093132	60	12	.11209470 06 .872-01	.0020
093432	60	12	.11208752 06 .869-01	.0107
093532	60	12	.11208522 06 .867-01	-.0039
093632	60	12	.11208296 06 .867-01	.0049
093732	60	12	.11208075 06 .867-01	.0020
093832	60	12	.11207858 06 .864-01	.0049
093932	60	12	.11207645 06 .864-01	-.0039
094032	60	12	.11207437 06 .864-01	.0117
094132	60	12	.11207233 06 .864-01	-.0010
094232	60	12	.11207034 06 .862-01	-.0068
094332	60	12	.11206839 06 .862-01	.0107
094632	60	12	.11206280 06 .859-01	.0020

STATION NUMBER 12 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/222

FREQUENCY 8369.0

TIME	TC	Q	CC3		
094732	60	12	.11206102	06 .859-01	-.0039
094832	60	12	.11205928	06 .859-01	-.0020
094932	60	12	.11205759	06 .859-01	.0068
095032	60	12	.11205594	06 .859-01	.0059
095132	60	12	.11205434	06 .859-01	-.0039
095232	60	12	.11205277	06 .857-01	-.0059
095332	60	12	.11205125	06 .857-01	.0000
095432	60	12	.11204977	06 .857-01	-.0029
095532	60	12	.11204833	06 .857-01	.0186
095632	60	12	.11204693	06 .857-01	-.0020
095732	60	12	.11204558	06 .857-01	.0039
095832	60	12	.11204426	06 .857-01	.0010
095932	60	12	.11204299	06 .857-01	-.0117
100032	60	12	.11204176	06 .857-01	.0039
100132	60	12	.11204057	06 .854-01	.0098
100232	60	12	.11203942	06 .854-01	-.0078
100332	60	12	.11203832	06 .854-01	.0000
100432	60	12	.11203725	06 .854-01	.0020
100532	60	12	.11203622	06 .854-01	.0107
100632	60	12	.11203523	06 .854-01	-.0020
100732	60	12	.11203429	06 .854-01	-.0049
100832	60	12	.11203338	06 .854-01	.0010
100932	60	12	.11203251	06 .854-01	.0010
101032	60	12	.11203169	06 .854-01	.0107
101132	60	12	.11203090	06 .854-01	-.0020
101232	60	12	.11203015	06 .854-01	-.0039
101332	60	12	.11202945	06 .854-01	-.0127
101432	60	12	.11202877	06 .854-01	.0078
101532	60	12	.11202814	06 .854-01	.0039
101632	60	12	.11202755	06 .854-01	-.0049
101732	60	12	.11202700	06 .854-01	-.0020
101832	60	12	.11202649	06 .852-01	.0127
101932	60	12	.11202601	06 .852-01	-.0117
102032	60	12	.11202557	06 .852-01	.0088
102132	60	12	.11202517	06 .852-01	.0068
102232	60	12	.11202481	06 .852-01	-.0137
102332	60	12	.11202449	06 .852-01	.0098
102432	60	12	.11202420	06 .852-01	-.0049
102532	60	12	.11202395	06 .852-01	-.0059
102632	60	12	.11202374	06 .852-01	.0059
102732	60	12	.11202357	06 .852-01	-.0039
102832	60	12	.11202343	06 .852-01	.0156
102932	60	12	.11202333	06 .852-01	.0000
103032	60	12	.11202327	06 .852-01	-.0029
103132	60	12	.11202324	06 .852-01	-.0107
103232	60	12	.11202325	06 .852-01	.0137
103332	60	12	.11202330	06 .852-01	.0010
103432	60	12	.11202338	06 .852-01	-.0146
103532	60	12	.11202350	06 .852-01	.0186
103632	60	12	.11202365	06 .852-01	-.0020
103732	60	12	.11202384	06 .852-01	-.0078
103832	60	12	.11202406	06 .852-01	.0010

STATION NUMBER 12 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/222

FREQUENCY 8369.0

TIME	TC	Q	CC3	
103932	60	12	.11202433 06 .852-01	.0078
104032	60	12	.11202462 06 .852-01	-.0039
104132	60	12	.11202495 06 .852-01	.0000

STATION NUMBER 12 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/223

FREQUENCY 8369.0

TIME	TC	Q	CC3	
104232	60	12	.11202531 06 .852-01	.0020
104332	60	12	.11202571 06 .852-01	.0020
104632	60	12	.11202712 06 .852-01	-.0010
104732	60	12	.11202765 06 .852-01	.0127
104832	60	12	.11202822 06 .852-01	-.0068
104932	60	12	.11202883 06 .852-01	.0059
105032	60	12	.11202946 06 .852-01	.0020
105132	60	12	.11203013 06 .852-01	-.0010
105232	60	12	.11203084 06 .852-01	-.0039
105332	60	12	.11203157 06 .852-01	-.0078
105432	60	12	.11203234 06 .852-01	.0068
105532	60	12	.11203314 06 .852-01	.0049
105632	60	12	.11203398 06 .852-01	.0039
105732	60	12	.11203485 06 .852-01	-.0127
105832	60	12	.11203574 06 .852-01	.0068
105932	60	12	.11203667 06 .852-01	.0088
110032	60	12	.11203764 06 .852-01	-.0039
110132	60	12	.11203863 06 .852-01	.0020
110232	60	12	.11203965 06 .852-01	-.0059
110332	60	12	.11204071 06 .852-01	.0039
110432	60	12	.11204180 06 .852-01	.0000
110532	60	12	.11204292 06 .852-01	-.0029
110632	60	12	.11204407 06 .852-01	-.0020
110732	60	12	.11204525 06 .852-01	.0020
110832	60	12	.11204646 06 .852-01	-.0088
110932	60	12	.11204770 06 .852-01	.0176
111032	60	12	.11204897 06 .852-01	-.0039
111132	60	12	.11205027 06 .852-01	-.0029
111232	60	12	.11205160 06 .852-01	.0000
111332	60	12	.11205296 06 .852-01	.0059
111432	60	12	.11205435 06 .852-01	.0010
111532	60	12	.11205577 06 .852-01	.0000
111632	60	12	.11205721 06 .852-01	.0020
111732	60	12	.11205869 06 .852-01	-.0078
111832	60	12	11206019 06 .852-01	.0049
111932	60	12	.11206173 06 .852-01	.0049
112032	60	12	.11206329 06 .852-01	-.0059
112132	60	12	.11206488 06 .852-01	.0039

STATION NUMBER 12 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/223

FREQUENCY 8369.0

TIME	TC	Q	CC3			
112232	60	12	.11206650	06	.852-01	.0039
112332	60	12	.11206814	06	.852-01	-.0088
112432	60	12	.11206981	06	.852-01	.0020
112532	60	12	.11207151	06	.852-01	.0020
112632	60	12	.11207324	06	.852-01	.0088
112732	60	12	.11207500	06	.852-01	.0039
112832	60	12	.11207678	06	.852-01	.0059
113132	60	12	.11208228	06	.852-01	.0029
113232	60	12	.11208417	06	.852-01	-.0010
113332	60	12	.11208608	06	.852-01	.0029
113432	60	12	.11208802	06	.852-01	.0146
113532	60	12	.11208998	06	.852-01	-.0166
113632	60	12	.11209197	06	.852-01	.0107
113732	60	12	.11209399	06	.852-01	-.0039
113832	60	12	.11209603	06	.852-01	.0068
113932	60	12	.11209809	06	.852-01	-.0088
114032	60	12	.11210018	06	.852-01	.0020
114132	60	12	.11210229	06	.852-01	.0059
114232	60	12	.11210443	06	.852-01	.0000
114332	60	12	.11210659	06	.852-01	.0049
114432	60	12	.11210878	06	.852-01	.0029
114532	60	12	.11211099	06	.852-01	-.0078
114632	60	12	.11211322	06	.852-01	.0088
114732	60	12	.11211548	06	.852-01	-.0146
114832	60	12	.11211776	06	.852-01	.0059
114932	60	12	.11212006	06	.852-01	.0029
115032	60	12	.11212239	06	.852-01	-.0059
115132	60	12	.11212474	06	.852-01	.0127
115232	60	12	.11212711	06	.852-01	-.0078
115332	60	12	.11212950	06	.852-01	-.0010
115432	60	12	.11213192	06	.852-01	.0000
115532	60	12	.11213435	06	.852-01	.0127
115632	60	12	.11213681	06	.852-01	-.0117
115732	60	12	.11213929	06	.852-01	.0078
115832	60	12	.11214179	06	.852-01	.0068
115932	60	12	.11214432	06	.852-01	.0000
120032	60	12	.11214686	06	.852-01	-.0098
120132	60	12	.11214942	06	.852-01	.0088
120232	60	12	.11215201	06	.852-01	-.0088
120332	60	12	.11215461	06	.852-01	.0020
120432	60	12	.11215724	06	.852-01	.0107
120532	60	12	.11215988	06	.852-01	-.0020
120632	60	12	.11216255	06	.852-01	.0000
120732	60	12	.11216523	06	.852-01	-.0020
120832	60	12	.11216794	06	.852-01	.0107
120932	60	12	.11217066	06	.852-01	-.0127
121032	60	12	.11217340	06	.852-01	.0117
121132	60	12	.11217616	06	.852-01	.0010
121232	60	12	.11217894	06	.852-01	.0039
121332	60	12	.11218174	06	.852-01	-.0107

STATION NUMBER 12 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/223

FREQUENCY 8369.0

TIME	TC	Q	CC3			
121432	60	12	.11218456	06	.852-01	.0059
121532	60	12	.11218739	06	.852-01	.0049
121632	60	12	.11219025	06	.852-01	.0029
121732	60	12	.11219312	06	.852-01	-.0010
121832	60	12	.11219600	06	.852-01	-.0049
121932	60	12	.11219891	06	.852-01	.0059
122032	60	12	.11220183	06	.852-01	.0010
122132	60	12	.11220477	06	.852-01	-.0049
122232	60	12	.11220773	06	.852-01	.0049
122332	60	12	.11221070	06	.852-01	.0000
122432	60	12	.11221369	06	.852-01	.0107
122532	60	12	.11221669	06	.852-01	-.0107
122632	60	12	.11221971	06	.852-01	.0186
122732	60	12	.11222275	06	.852-01	.0000
122832	60	12	.11222580	06	.852-01	-.0029
122932	60	12	.11222887	06	.852-01	-.0039
123032	60	12	.11223195	06	.852-01	.0127
123132	60	12	.11223505	06	.852-01	-.0010
123232	60	12	.11223816	06	.852-01	.0029
123332	60	12	.11224129	06	.852-01	-.0068
123432	60	12	.11224443	06	.852-01	.0010
123532	60	12	.11224759	06	.852-01	.0117
123632	60	12	.11225076	06	.852-01	-.0068
123932	60	12	.11226035	06	.852-01	.0176
124032	60	12	.11226357	06	.852-01	-.0068
124132	60	12	.11226681	06	.852-01	.0068
124232	60	12	.11227006	06	.852-01	.0068
124332	60	12	.11227332	06	.852-01	-.0059
124432	60	12	.11227660	06	.852-01	.0020
124532	60	12	.11227988	06	.852-01	-.0020
124632	60	12	.11228318	06	.852-01	.0146
124732	60	12	.11228649	06	.852-01	.0049
124832	60	12	.11228982	06	.852-01	-.0020
124932	60	12	.11229315	06	.852-01	-.0039
125032	60	12	.11229650	06	.852-01	.0010
125132	60	12	.11229986	06	.852-01	.0098
125232	60	12	.11230322	06	.852-01	.0088
125332	60	12	.11230660	06	.852-01	-.0029
125432	60	12	.11230999	06	.852-01	-.0098
125532	60	12	.11231339	06	.852-01	.0088
125632	60	12	.11231680	06	.852-01	-.0010
125732	60	12	.11232022	06	.852-01	-.0039
125832	60	12	.11232365	06	.852-01	.0000
125932	60	12	.11232709	06	.852-01	.0107
130032	60	12	.11233054	06	.852-01	.0137

STATION NUMBER 12 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/223

FREQUENCY 8369.0

TIME	TC	Q	CC3		
130332	60	12	.11234093	06 .852-01	-.0029
130432	60	12	.11234442	06 .852-01	.0127
130532	60	12	.11234791	06 .852-01	.0039
130632	60	12	.11235141	06 .852-01	.0039
130732	60	12	.11235492	06 .852-01	-.0049
130832	60	12	.11235844	06 .852-01	.0127
130932	60	12	.11236196	06 .852-01	.0049
131032	60	12	.11236549	06 .852-01	-.0098
131132	60	12	.11236903	06 .852-01	.0020
131232	60	12	.11237258	06 .852-01	.0068
131332	60	12	.11237613	06 .852-01	.0039
131432	60	12	.11237969	06 .852-01	-.0049
131532	60	12	.11238325	06 .852-01	.0137
131632	60	12	.11238682	06 .852-01	-.0088
131732	60	12	.11239040	06 .852-01	.0127
131832	60	12	.11239399	06 .852-01	.0127
131932	60	12	.11239758	06 .852-01	-.0098
132032	60	12	.11240117	06 .852-01	.0117
132132	60	12	.11240477	06 .852-01	-.0049
132232	60	12	.11240838	06 .852-01	.0059
132332	60	12	.11241199	06 .852-01	-.0049
132432	60	12	.11241560	06 .852-01	.0146
132532	60	12	.11241922	06 .852-01	-.0059
132632	60	12	.11242284	06 .852-01	.0039
132732	60	12	.11242647	06 .852-01	.0088
132832	60	12	.11243010	06 .852-01	.0107
132932	60	12	.11243374	06 .852-01	-.0088
133032	60	12	.11243738	06 .852-01	.0020
133132	60	12	.11244102	06 .852-01	.0098
133232	60	12	.11244467	06 .852-01	-.0039
133332	60	12	.11244832	06 .852-01	.0146
133432	60	12	.11245197	06 .852-01	-.0039
133532	60	12	.11245562	06 .852-01	-.0088
133632	60	12	.11245928	06 .852-01	.0186
133732	60	12	.11246294	06 .852-01	-.0078
133832	60	12	.11246660	06 .852-01	-.0020
133932	60	12	.11247026	06 .852-01	.0020
134032	60	12	.11247393	06 .852-01	.0195
134132	60	12	.11247759	06 .852-01	-.0117
134232	60	12	.11248126	06 .852-01	.0039
134332	60	12	.11248493	06 .852-01	.0020
134432	60	12	.11248860	06 .852-01	.0156
134532	60	12	.11249227	06 .852-01	-.0039
134632	60	12	.11249594	06 .852-01	.0078
134732	60	12	.11249961	06 .852-01	.0039
134832	60	12	.11250328	06 .852-01	.0000
134932	60	12	.11250695	06 .852-01	.0117
135032	60	12	.11251062	06 .852-01	-.0088
135132	60	12	.11251429	06 .852-01	.0039
135232	60	12	.11251796	06 .852-01	.0000

STATION NUMBER 12 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/223

FREQUENCY 8369.0

TIME	TC	Q	CC3	
135332	60	12	.11252163 06 .852-01	-.0020
135432	60	12	.11252530 06 .852-01	-.0029
135532	60	12	.11252897 06 .852-01	.0127
135632	60	12	.11253264 06 .852-01	-.0029
135732	60	12	.11253630 06 .852-01	.0000
135832	60	12	.11253996 06 .852-01	.0039
135932	60	12	.11254362 06 .852-01	-.0068
140032	60	12	.11254728 06 .852-01	.0020
140132	60	12	.11255094 06 .852-01	.0117
140232	60	12	.11255459 06 .852-01	-.0078
140332	60	12	.11255824 06 .852-01	.0088
140432	60	12	.11256189 06 .852-01	-.0068
140532	60	12	.11256553 06 .852-01	.0146
140632	60	12	.11256918 06 .852-01	-.0107
140732	60	12	.11257281 06 .852-01	.0010
140832	60	12	.11257645 06 .852-01	-.0010
140932	60	12	.11258008 06 .852-01	.0010
141032	60	12	.11258371 06 .852-01	.0068
141132	60	12	.11258733 06 .852-01	.0010
141232	60	12	.11259095 06 .852-01	-.0020
141332	60	12	.11259456 06 .852-01	.0010
141432	60	12	.11259817 06 .852-01	.0068
141532	60	12	.11260178 06 .852-01	.0029
141632	60	12	.11260538 06 .852-01	.0020
141732	60	12	.11260898 06 .852-01	-.0098
141832	60	12	.11261256 06 .852-01	.0186
141932	60	12	.11261615 06 .852-01	.0010

FREQUENCY 8378.0

152732	60	12	.11283729 06 .852-01	-.0098
152832	60	12	.11284008 06 .852-01	.0029
152932	60	12	.11284285 06 .852-01	.0176
153032	60	12	.11284560 06 .852-01	-.0010
153132	60	12	.11284833 06 .852-01	-.0020

STATION NUMBER 12 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/224

FREQUENCY 8378.0

TIME	TC	Q	CC3	
153232	60	12	.11285105 06 .852-01	.0146
153332	60	12	.11285375 06 .852-01	-.0010
153432	60	12	.11285643 06 .852-01	.0010

STATION NUMBER 12 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/224

FREQUENCY 8378.0

TIME	TC	Q	CC3	
153532	60	12	.11285910 06 .852-01	.0039
153632	60	12	.11286174 06 .852-01	.0098
153732	60	12	.11286437 06 .852-01	.0000
153832	60	12	.11286697 06 .852-01	-.0088
153932	60	12	.11286956 06 .852-01	.0029
154032	60	12	.11287213 06 .852-01	-.0020
154132	60	12	.11287469 06 .852-01	-.0029
154232	60	12	.11287722 06 .852-01	.0146
154332	60	12	.11287973 06 .852-01	.0010
154432	60	12	.11288223 06 .852-01	-.0098
154532	60	12	.11288470 06 .852-01	-.0010
154632	60	12	.11288715 06 .852-01	.0117
154732	60	12	.11288959 06 .852-01	-.0068
154832	60	12	.11289200 06 .854-01	-.0039
154932	60	12	.11289440 06 .854-01	.0000
155032	60	12	.11289677 06 .854-01	-.0068
155132	60	12	.11289913 06 .854-01	.0049
155232	60	12	.11290146 06 .854-01	.0039
155332	60	12	.11290378 06 .854-01	-.0088
155432	60	12	.11290607 06 .854-01	-.0010
155532	60	12	.11290834 06 .854-01	.0107
155632	60	12	.11291059 06 .854-01	-.0059
155732	60	12	.11291282 06 .854-01	-.0029
155832	60	12	.11291503 06 .854-01	.0068
155932	60	12	.11291721 06 .854-01	-.0146
160032	60	12	.11291938 06 .854-01	.0039
160132	60	12	.11292152 06 .854-01	.0117
160232	60	12	.11292364 06 .854-01	-.0107
160332	60	12	.11292574 06 .854-01	.0068
160432	60	12	.11292782 06 .857-01	-.0039
160532	60	12	.11292987 06 .857-01	.0068
160632	60	12	.11293191 06 .857-01	.0068
160732	60	12	.11293392 06 .857-01	-.0039
160832	60	12	.11293591 06 .857-01	-.0078
160932	60	12	.11293787 06 .857-01	-.0059
161032	60	12	.11293981 06 .857-01	.0020
161132	60	12	.11294173 06 .857-01	-.0010
161232	60	12	.11294363 06 .857-01	.0029
161332	60	12	.11294550 06 .859-01	.0137
161432	60	12	.11294735 06 .859-01	-.0029
161532	60	12	.11294918 06 .859-01	-.0127
161632	60	12	.11295098 06 .859-01	.0010
161732	60	12	.11295276 06 .859-01	.0059
161832	60	12	.11295452 06 .859-01	.0010
161932	60	12	.11295625 06 .862-01	.0039
162032	60	12	.11295795 06 .862-01	-.0039
162132	60	12	.11295964 06 .862-01	-.0029
162232	60	12	.11296129 06 .862-01	.0059
162332	60	12	.11296293 06 .862-01	.0039
162432	60	12	.11296454 06 .864-01	-.0049

STATION NUMBER 12 65/03/23 ITERATION NUMBER 5 PASS NUMBER 03/225

FREQUENCY 8282.0

TIME	TC	Q	CC3	
091332	60	12	.10663504 06 .123 00	.0049
091432	60	12	.10663731 06 .119 00	-.0088
091532	60	12	.10663961 06 .116 00	.0059
091632	60	12	.10664195 06 .114 00	.0166
091732	60	12	.10664432 06 .111 00	.0068
091832	60	12	.10664674 06 .109 00	.0088
091932	60	12	.10664919 06 .107 00	-.0117
092032	60	12	.10665168 06 .105 00	.0156
092132	60	12	.10665421 06 .104 00	.0039
092232	60	12	.10665677 06 .102 00	.0068
092332	60	12	.10665938 06 .101 00	-.0127
092432	60	12	.10666202 06 .994-01	.0146
092532	60	12	.10666469 06 .981-01	.0039
092632	60	12	.10666741 06 .972-01	-.0107
092732	60	12	.10667016 06 .964-01	.0049
092832	60	12	.10667295 06 .955-01	-.0010
092932	60	12	.10667578 06 .947-01	.0078
093032	60	12	.10667864 06 .940-01	.0117
093132	60	12	.10668154 06 .933-01	-.0039
093232	60	12	.10668447 06 .928-01	-.0068
093332	60	12	.10668744 06 .923-01	.0039
093432	60	12	.10669045 06 .918-01	-.0059
093532	60	12	.10669350 06 .913-01	-.0010
093632	60	12	.10669658 06 .908-01	.0000
093732	60	12	.10669970 06 .903-01	.0137
093832	60	12	.10670286 06 .901-01	-.0068
093932	60	12	.10670605 06 .898-01	.0010
094032	60	12	.10670927 06 .894-01	-.0088
094132	60	12	.10671254 06 .891-01	.0107
094232	60	12	.10671584 06 .889-01	-.0049
094332	60	12	.10671917 06 .886-01	-.0068
094432	60	12	.10672254 06 .884-01	.0059
094532	60	12	.10672595 06 .881-01	-.0020
094632	60	12	.10672939 06 .881-01	-.0107
094732	60	12	.10673287 06 .879-01	-.0049
094832	60	12	.10673638 06 .876-01	-.0010
094932	60	12	.10673993 06 .876-01	.0000
095032	60	12	.10674351 06 .874-01	.0010
095132	60	12	.10674713 06 .872-01	-.0020
095232	60	12	.10675079 06 .872-01	-.0049
095332	60	12	.10675448 06 .869-01	-.0117
095432	60	12	.10675820 06 .869-01	-.0010
095532	60	12	.10676196 06 .869-01	-.0088
095632	60	12	.10676575 06 .867-01	.0156
095732	60	12	.10676958 06 .867-01	-.0117
095832	60	12	.10677344 06 .864-01	-.0068
095932	60	12	.10677734 06 .864-01	-.0029
100032	60	12	.10678127 06 .864-01	.0000
100132	60	12	.10678523 06 .864-01	.0020
100232	60	12	.10678923 06 .862-01	-.0127
100332	60	12	.10679326 06 .862-01	.0059
100432	60	12	.10679733 06 .862-01	-.0098

STATION NUMBER 12 65/03/23 ITERATION NUMBER 5 PASS NUMBER 03/225

FREQUENCY 8282.0

TIME	TC	Q	CC3		
100532	60	12	.10680143	06 .862-01	.0059
100632	60	12	.10680556	06 .859-01	-.0098
100732	60	12	.10680972	06 .859-01	.0068
100832	60	12	.10681393	06 .859-01	-.0098
100932	60	12	.10681816	06 .859-01	-.0098
101032	60	12	.10682243	06 .859-01	.0068
101132	60	12	.10682672	06 .859-01	-.0088
101232	60	12	.10683106	06 .857-01	-.0068
101332	60	12	.10683542	06 .857-01	.0107
101432	60	12	.10683982	06 .857-01	-.0039
101532	60	12	.10684425	06 .857-01	-.0176
101632	60	12	.10684871	06 .857-01	.0029
101732	60	12	.10685321	06 .857-01	-.0088
101832	60	12	.10685773	06 .857-01	-.0029
101932	60	12	.10686229	06 .857-01	.0049
102032	60	12	.10686689	06 .857-01	-.0029
102132	60	12	.10687151	06 .854-01	-.0088
102232	60	12	.10687616	06 .854-01	.0020
102332	60	12	.10688085	06 .854-01	-.0010
102432	60	12	.10688557	06 .854-01	-.0186
102532	60	12	.10689032	06 .854-01	-.0020
102632	60	12	.10689510	06 .854-01	.0010
102732	60	12	.10689991	06 .854-01	.0059
102832	60	12	.10690475	06 .854-01	-.0029
102932	60	12	.10690963	06 .854-01	-.0107
103032	60	12	.10691453	06 .854-01	-.0156
103132	60	12	.10691947	06 .854-01	-.0010
103232	60	12	.10692443	06 .854-01	.0000
103332	60	12	.10692943	06 .854-01	-.0127
103432	60	12	.10693446	06 .854-01	-.0059
103532	60	12	.10693951	06 .854-01	.0059
103632	60	12	.10694460	06 .854-01	-.0146
103732	60	12	.10694971	06 .852-01	.0020
103832	60	12	.10695486	06 .852-01	-.0098
103932	60	12	.10696003	06 .852-01	-.0020
104032	60	12	.10696524	06 .852-01	-.0078

STATION NUMBER 12 65/03/23 ITERATION NUMBER 5 PASS NUMBER 03/226

FREQUENCY 8282.0

TIME	TC	Q	CC3			
104132	60	12	.10697047	06	.852-01	.0078
104232	60	12	.10697574	06	.852-01	-.0059
104332	60	12	.10698103	06	.852-01	-.0146
104432	60	12	.10698635	06	.852-01	.0137
104532	60	12	.10699170	06	.852-01	-.0049
104632	60	12	.10699708	06	.852-01	-.0166
104732	60	12	.10700249	06	.852-01	.0098
104832	60	12	.10700793	06	.852-01	-.0107
104932	60	12	.10701339	06	.852-01	.0078
105032	60	12	.10701888	06	.852-01	-.0176
105132	60	12	.10702440	06	.852-01	.0117
105232	60	12	.10702995	06	.852-01	-.0039
105332	60	12	.10703553	06	.852-01	.0039
105432	60	12	.10704113	06	.852-01	-.0166
105532	60	12	.10704676	06	.852-01	.0029
105632	60	12	.10705242	06	.852-01	-.0059
105732	60	12	.10705811	06	.852-01	-.0078
105832	60	12	.10706382	06	.852-01	.0127
105932	60	12	.10706956	06	.852-01	-.0107
110032	60	12	.10707533	06	.852-01	-.0107
110132	60	12	.10708112	06	.852-01	-.0029
110232	60	12	.10708694	06	.852-01	-.0068
110332	60	12	.10709278	06	.852-01	-.0010

FREQUENCY 8296.0

110932	60	12	.10712841	06	.852-01	-.0068
111032	60	12	.10713443	06	.852-01	.0010
111132	60	12	.10714048	06	.852-01	.0000
111232	60	12	.10714656	06	.852-01	-.0088
111332	60	12	.10715266	06	.852-01	.0068
111432	60	12	.10715878	06	.852-01	-.0020
111532	60	12	.10716493	06	.852-01	-.0020
111632	60	12	.10717111	06	.852-01	.0078
111732	60	12	.10717731	06	.852-01	-.0068
111832	60	12	.10718353	06	.852-01	.0039
111932	60	12	.10718978	06	.852-01	.0068
112032	60	12	.10719605	06	.852-01	-.0137
112132	60	12	.10720234	06	.852-01	.0098
112232	60	12	.10720866	06	.852-01	-.0078
112332	60	12	.10721500	06	.852-01	.0020
112432	60	12	.10722136	06	.852-01	-.0127
112532	60	12	.10722775	06	.852-01	.0020
112632	60	12	.10723416	06	.852-01	.0078
112732	60	12	.10724059	06	.852-01	-.0068
112832	60	12	.10724704	06	.852-01	.0049
112932	60	12	.10725352	06	.852-01	-.0059
113032	60	12	.10726002	06	.852-01	-.0049
113132	60	12	.10726654	06	.852-01	.0068
113232	60	12	.10727309	06	.852-01	-.0029
113332	60	12	.10727965	06	.852-01	-.0020
113432	60	12	.10728624	06	.852-01	-.0059

STATION NUMBER 12 65/03/23 ITERATION NUMBER 5 PASS NUMBER 03/226

FREQUENCY 8296.0

TIME	TC	Q	CC3	
113532	60	12	.10729285 06 .852-01	.0029
113632	60	12	.10729948 06 .852-01	-.0098
113732	60	12	.10730613 06 .852-01	.0068
113832	60	12	.10731280 06 .852-01	.0029
113932	60	12	.10731949 06 .852-01	-.0068
114032	60	12	.10732620 06 .852-01	-.0020
114132	60	12	.10733293 06 .852-01	-.0020
114232	60	12	.10733969 06 .852-01	-.0059
114332	60	12	.10734646 06 .852-01	.0049
114432	60	12	.10735325 06 .852-01	.0117
114532	60	12	.10736007 06 .852-01	-.0020
114632	60	12	.10736690 06 .852-01	-.0010
114732	60	12	.10737375 06 .852-01	-.0029
114832	60	12	.10738062 06 .852-01	-.0088
114932	60	12	.10738751 06 .852-01	.0010
115032	60	12	.10739442 06 .852-01	.0078
115132	60	12	.10740135 06 .852-01	-.0039
115232	60	12	.10740830 06 .852-01	.0000
115332	60	12	.10741526 06 .852-01	.0010
115432	60	12	.10742225 06 .852-01	.0010
115532	60	12	.10742925 06 .852-01	-.0010
115632	60	12	.10743627 06 .852-01	-.0049
115732	60	12	.10744331 06 .852-01	.0078
115832	60	12	.10745036 06 .852-01	.0020
115932	60	12	.10745744 06 .852-01	-.0039
120032	60	12	.10746453 06 .852-01	.0068
120132	60	12	.10747163 06 .852-01	.0000
120232	60	12	.10747876 06 .852-01	-.0068

DATA STATISTICS STATION 3 ITERATION 5

PASS	DATA TYPE	BEGINNING TIME	END TIME	NUMBER OF POINTS	STD DEV	RMS	FIRST MOMENT	SECOND MOMENT
03/222	CC3	3/22-085132	3/22-104132	107	.842-02	.920-02	.371-02	.847-04
03/223	CC3	3/22-104232	3/22-153132	215	.753-02	.774-02	.178-02	.599-04
03/224	CC3	3/22-153232	3/22-162432	53	.695-02	.697-02	.479-03	.485-04
03/225	CC3	3/23-091332	3/23-104032	88	.810-02	.827-02	-.169-02	.684-04
03/226	CC3	3/23-104132	3/23-120232	77	.735-02	.747-02	-.131-02	.558-04

STATION NUMBER 41 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/227

FREQUENCY 8628.0

TIME	TC	Q	CC3	
000757	10	41	.12505123 06 .216 00	-.0342
000827	10	41	.12503212 06 .216 00	-.0195
000907	10	41	.12500668 06 .216 00	.0215
000917	10	41	.12500032 06 .216 00	-.0264
001437	10	41	.12479879 06 .216 00	.0078
001507	10	41	.12478008 06 .216 00	.0225
001537	10	41	.12476139 06 .216 00	.0059
001547	10	41	.12475517 06 .216 00	.0264
001617	10	41	.12473653 06 .216 00	-.0332
001627	10	41	.12473032 06 .216 00	-.0264
001737	10	41	.12468698 06 .217 00	.0186
001747	10	41	.12468080 06 .217 00	-.0049
001757	10	41	.12467463 06 .217 00	-.0313
001827	10	41	.12465613 06 .217 00	-.0313
001837	10	41	.12464997 06 .217 00	.0293
001847	10	41	.12464381 06 .217 00	-.0146
001917	10	41	.12462537 06 .217 00	.0303
001927	10	41	.12461923 06 .217 00	-.0293
001937	10	41	.12461309 06 .217 00	.0088

STATION NUMBER 41 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/228

FREQUENCY 8330.0

TIME	TC	Q	CC3	
142832	60	41	.10969349 06 .857-01	.0088
142932	60	41	.10968907 06 .857-01	.0127
143032	60	41	.10968470 06 .857-01	.0205
143132	60	41	.10968037 06 .857-01	.0156
143232	60	41	.10967608 06 .857-01	.0146
143532	60	41	.10966351 06 .854-01	.0176
143632	60	41	.10965942 06 .854-01	.0137
143732	60	41	.10965537 06 .854-01	.0146
143832	60	41	.10965136 06 .854-01	.0029
143932	60	41	.10964741 06 .854-01	.0107

STATION NUMBER 41 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/229

FREQUENCY 8330.0

TIME	TC	Q	CC3	
144032	60	41	.10964349 06 .854-01	.0234
144132	60	41	.10963963 06 .854-01	.0059
144232	60	41	.10963581 06 .854-01	.0254
144332	60	41	.10963203 06 .854-01	-.0010
144432	60	41	.10962831 06 .854-01	.0254
144532	60	41	.10962463 06 .854-01	.0068
144632	60	41	.10962099 06 .854-01	.0078
144732	60	41	.10961740 06 .854-01	.0127
144832	60	41	.10961386 06 .854-01	.0225
144932	60	41	.10961036 06 .854-01	.0010
145032	60	41	.10960691 06 .852-01	.0176
145132	60	41	.10960351 06 .852-01	.0059
145232	60	41	.10960015 06 .852-01	.0127
145332	60	41	.10959684 06 .852-01	.0088
145432	60	41	.10959357 06 .852-01	.0234
145532	60	41	.10959036 06 .852-01	.0098
145632	60	41	.10958718 06 .852-01	.0000
145732	60	41	.10958405 06 .852-01	.0107
145832	60	41	.10958097 06 .852-01	.0264
145932	60	41	.10957794 06 .852-01	.0107
150032	60	41	.10957495 06 .852-01	.0010
150132	60	41	.10957200 06 .852-01	.0117
150232	60	41	.10956911 06 .852-01	.0088
150332	60	41	.10956625 06 .852-01	.0107
150432	60	41	.10956345 06 .852-01	.0166
150532	60	41	.10956069 06 .852-01	.0098
150632	60	41	.10955797 06 .852-01	.0078
150732	60	41	.10955531 06 .852-01	.0098
150832	60	41	.10955268 06 .852-01	.0156
150932	60	41	.10955011 06 .852-01	.0098
151032	60	41	.10954757 06 .852-01	.0078
151132	60	41	.10954509 06 .852-01	.0098
151532	60	41	.10953560 06 .852-01	-.0029
151632	60	41	.10953334 06 .852-01	.0215
151732	60	41	.10953113 06 .852-01	.0010
151832	60	41	.10952896 06 .852-01	.0176
151932	60	41	.10952684 06 .852-01	.0059

FREQUENCY 8326.0

163232	60	41	.10949095 06 .852-01	-.0029
163332	60	41	.10949203 06 .852-01	.0215
164932	60	41	.10951464 06 .852-01	.0088
165032	60	41	.10951639 06 .852-01	.0127
165132	60	41	.10951817 06 .852-01	-.0059
165232	60	41	.10951999 06 .852-01	.0059
165332	60	41	.10952186 06 .852-01	.0107
165432	60	41	.10952375 06 .852-01	-.0049
165532	60	41	.10952569 06 .852-01	.0068
165632	60	41	.10952767 06 .852-01	.0146
165732	60	41	.10952968 06 .852-01	.0020
165832	60	41	.10953173 06 .852-01	.0010

STATION NUMBER 41 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/229

FREQUENCY 8326.0

TIME	TC	Q	CC3			
165932	60	41	.10953382	06	.852-01	-.0039
170032	60	41	.10953594	06	.852-01	.0039
170132	60	41	.10953811	06	.852-01	.0068
170232	60	41	.10954031	06	.852-01	.0068
170332	60	41	.10954255	06	.852-01	.0029
170432	60	41	.10954482	06	.852-01	-.0049
170532	60	41	.10954713	06	.852-01	.0166
170632	60	41	.10954948	06	.852-01	.0010
170732	60	41	.10955186	06	.852-01	.0000
171032	60	41	.10955924	06	.852-01	-.0068
171132	60	41	.10956177	06	.852-01	-.0029
171232	60	41	.10956433	06	.852-01	.0146
171332	60	41	.10956694	06	.852-01	-.0049
171432	60	41	.10956957	06	.852-01	.0078
171932	60	41	.10958329	06	.852-01	.0049
172032	60	41	.10958614	06	.852-01	-.0117
172632	60	41	.10960397	06	.852-01	.0137
172932	60	41	.10961334	06	.852-01	-.0088
173332	60	41	.10962631	06	.852-01	.0059
173432	60	41	.10962963	06	.852-01	-.0020
173532	60	41	.10963299	06	.852-01	.0068
173632	60	41	.10963638	06	.852-01	-.0010
173732	60	41	.10963981	06	.852-01	.0088
173832	60	41	.10964326	06	.852-01	-.0137
173932	60	41	.10964675	06	.852-01	.0146
174032	60	41	.10965027	06	.852-01	-.0059
174132	60	41	.10965382	06	.852-01	.0088
174232	60	41	.10965741	06	.852-01	.0068
174332	60	41	.10966102	06	.852-01	-.0088
174432	60	41	.10966467	06	.852-01	.0098
174532	60	41	.10966835	06	.852-01	-.0029
174632	60	41	.10967206	06	.852-01	.0029
174732	60	41	.10967580	06	.852-01	.0117
174832	60	41	.10967958	06	.852-01	.0049
175432	60	41	.10970286	06	.852-01	-.0088
175532	60	41	.10970684	06	.852-01	.0049
175632	60	41	.10971086	06	.852-01	.0059
175732	60	41	.10971490	06	.852-01	.0107
175832	60	41	.10971898	06	.852-01	-.0146
175932	60	41	.10972308	06	.852-01	.0146
180032	60	41	.10972722	06	.852-01	-.0020
180332	60	41	.10973979	06	.852-01	-.0088
180432	60	41	.10974404	06	.852-01	.0098
180532	60	41	.10974832	06	.852-01	-.0010
180632	60	41	.10975262	06	.852-01	.0098
180732	60	41	.10975696	06	.852-01	-.0068
180832	60	41	.10976132	06	.852-01	-.0020
180932	60	41	.10976571	06	.852-01	.0088
181232	60	41	.10977904	06	.852-01	-.0059
181632	60	41	.10979719	06	.852-01	.0049
181732	60	41	.10980180	06	.852-01	.0010
181832	60	41	.10980643	06	.852-01	.0020

STATION NUMBER 41 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/229

FREQUENCY 8326.0

TIME	TC	Q	CC3		
181932	60	41	.10981109	06 .852-01	.0107
182032	60	41	.10981577	06 .852-01	-.0059
182132	60	41	.10982048	06 .852-01	.0000
182632	60	41	.10984441	06 .852-01	.0059
182732	60	41	.10984927	06 .852-01	.0127
182832	60	41	.10985415	06 .852-01	-.0059
183132	60	41	.10986896	06 .852-01	.0088
183432	60	41	.10988397	06 .852-01	-.0078
184132	60	41	.10991982	06 .852-01	.0098
184232	60	41	.10992503	06 .852-01	-.0010
184332	60	41	.10993027	06 .852-01	-.0010
184432	60	41	.10993552	06 .852-01	.0107
184532	60	41	.10994080	06 .852-01	.0000
184632	60	41	.10994610	06 .852-01	.0020
184732	60	41	.10995142	06 .852-01	-.0010
184832	60	41	.10995676	06 .852-01	.0088
184932	60	41	.10996212	06 .852-01	-.0029
185032	60	41	.10996750	06 .852-01	-.0010
185132	60	41	.10997290	06 .852-01	-.0049
185232	60	41	.10997833	06 .852-01	.0059
185332	60	41	.10998377	06 .852-01	-.0039
185432	60	41	.10998923	06 .852-01	-.0010
185532	60	41	.10999472	06 .852-01	.0156
185632	60	41	.11000022	06 .852-01	-.0039
185732	60	41	.11000574	06 .852-01	-.0088
185832	60	41	.11001128	06 .852-01	.0166
185932	60	41	.11001684	06 .852-01	-.0107
190032	60	41	.11002242	06 .852-01	-.0068
190132	60	41	.11002802	06 .852-01	.0117
190232	60	41	.11003364	06 .852-01	-.0049
190332	60	41	.11003927	06 .852-01	.0107
190432	60	41	.11004492	06 .852-01	-.0098
190532	60	41	.11005060	06 .852-01	.0029
190632	60	41	.11005628	06 .852-01	-.0020
190732	60	41	.11006199	06 .852-01	.0078
190832	60	41	.11006771	06 .852-01	.0000
190932	60	41	.11007346	06 .852-01	.0088
191232	60	41	.11009078	06 .852-01	.0010
191332	60	41	.11009659	06 .852-01	.0098
191432	60	41	.11010241	06 .852-01	.0020
191532	60	41	.11010825	06 .852-01	-.0049
191632	60	41	.11011411	06 .852-01	.0049
191732	60	41	.11011998	06 .852-01	-.0010
191832	60	41	.11012587	06 .852-01	-.0049
191932	60	41	.11013177	06 .852-01	.0098
192232	60	41	.11014957	06 .852-01	.0107
192332	60	41	.11015553	06 .852-01	-.0020
192632	60	41	.11017351	06 .852-01	-.0078
192732	60	41	.11017953	06 .852-01	.0068
192832	60	41	.11018556	06 .852-01	.0078
192932	60	41	.11019160	06 .852-01	-.0049
193032	60	41	.11019766	06 .852-01	.0020

STATION NUMBER 41 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/229

FREQUENCY 8326.0

TIME	TC	Q	CC3	
193332	60	41	.11021592 06 .852-01	-.0020
193432	60	41	.11022203 06 .852-01	-.0117
193532	60	41	.11022815 06 .852-01	.0156
193632	60	41	.11023428 06 .852-01	-.0020
193732	60	41	.11024043 06 .852-01	.0020
193832	60	41	.11024659 06 .852-01	-.0059
193932	60	41	.11025276 06 .852-01	.0078
194032	60	41	.11025894 06 .852-01	.0098
194132	60	41	.11026513 06 .852-01	.0020
194232	60	41	.11027133 06 .852-01	-.0176
194332	60	41	.11027755 06 .852-01	.0029
194432	60	41	.11028377 06 .852-01	.0127
194532	60	41	.11029000 06 .852-01	-.0049
194632	60	41	.11029625 06 .852-01	.0010
194732	60	41	.11030250 06 .852-01	-.0039
194832	60	41	.11030877 06 .852-01	.0156
194932	60	41	.11031504 06 .852-01	-.0078
195032	60	41	.11032132 06 .852-01	.0088
195132	60	41	.11032761 06 .852-01	.0000
195232	60	41	.11033392 06 .852-01	-.0010
195332	60	41	.11034023 06 .852-01	.0059
195432	60	41	.11034654 06 .852-01	.0049
195532	60	41	.11035287 06 .852-01	-.0049
195632	60	41	.11035921 06 .852-01	.0098
195932	60	41	.11037826 06 .852-01	-.0078
200032	60	41	.11038462 06 .852-01	.0098
200132	60	41	.11039100 06 .852-01	.0039
200232	60	41	.11039737 06 .852-01	-.0088
200332	60	41	.11040376 06 .852-01	.0049
200432	60	41	.11041015 06 .852-01	.0117
200532	60	41	.11041655 06 .852-01	-.0039
200632	60	41	.11042296 06 .852-01	.0068
200732	60	41	.11042937 06 .852-01	-.0049
200832	60	41	.11043579 06 .852-01	-.0049
200932	60	41	.11044221 06 .852-01	.0049
201032	60	41	.11044864 06 .852-01	.0098
201132	60	41	.11045507 06 .852-01	-.0068
201232	60	41	.11046151 06 .852-01	.0059
201732	60	41	.11049377 06 .852-01	-.0049
201832	60	41	.11050024 06 .852-01	.0137
201932	60	41	.11050670 06 .852-01	-.0049
202032	60	41	.11051317 06 .852-01	.0068
202132	60	41	.11051965 06 .852-01	.0000
202232	60	41	.11052613 06 .852-01	.0059
202332	60	41	.11053261 06 .852-01	-.0078
202432	60	41	.11053909 06 .852-01	.0088
202532	60	41	.11054558 06 .852-01	.0068
202632	60	41	.11055206 06 .852-01	-.0146
202732	60	41	.11055855 06 .852-01	.0127
202832	60	41	.11056504 06 .852-01	-.0117
202932	60	41	.11057154 06 .852-01	.0107
203232	60	41	.11059103 06 .852-01	.0068

STATION NUMBER 41 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/229

FREQUENCY 8326.0

TIME	TC	Q	CC3	
203332	60	41	.11059752 06 .852-01	-.0068
203432	60	41	.11060402 06 .852-01	.0107
203532	60	41	.11061052 06 .852-01	-.0049
203632	60	41	.11061702 06 .852-01	.0127
203732	60	41	.11062352 06 .852-01	-.0029
203832	60	41	.11063002 06 .852-01	-.0020
203932	60	41	.11063652 06 .852-01	.0156
204532	60	41	.11067549 06 .852-01	-.0098
204632	60	41	.11068198 06 .852-01	.0000
204732	60	41	.11068847 06 .852-01	.0107
204832	60	41	.11069496 06 .852-01	-.0088
204932	60	41	.11070144 06 .852-01	.0059
205032	60	41	.11070792 06 .852-01	-.0088
205132	60	41	.11071440 06 .852-01	.0117
205232	60	41	.11072088 06 .852-01	.0020
205332	60	41	.11072735 06 .852-01	-.0049
205432	60	41	.11073382 06 .852-01	.0078
205532	60	41	.11074029 06 .852-01	-.0088
205632	60	41	.11074675 06 .852-01	-.0049
205732	60	41	.11075321 06 .852-01	.0020
205832	60	41	.11075967 06 .852-01	-.0029
205932	60	41	.11076612 06 .852-01	.0127
210032	60	41	.11077257 06 .852-01	.0000
210132	60	41	.11077901 06 .852-01	-.0078
210232	60	41	.11078544 06 .852-01	.0039
210332	60	41	.11079188 06 .852-01	.0059
210432	60	41	.11079830 06 .852-01	-.0039
210532	60	41	.11080472 06 .852-01	.0068
210632	60	41	.11081114 06 .852-01	-.0088
210732	60	41	.11081755 06 .852-01	-.0010
210832	60	41	.11082395 06 .852-01	-.0059
210932	60	41	.11083035 06 .852-01	.0137
211032	60	41	.11083674 06 .852-01	-.0117
211132	60	41	.11084313 06 .852-01	.0039
211232	60	41	.11084951 06 .852-01	.0088
211332	60	41	.11085588 06 .852-01	.0039
211432	60	41	.11086224 06 .852-01	-.0107
211532	60	41	.11086860 06 .852-01	.0000
211632	60	41	.11087495 06 .852-01	.0000
211732	60	41	.11088129 06 .852-01	.0098
211832	60	41	.11088762 06 .852-01	-.0078
211932	60	41	.11089395 06 .852-01	.0000
212032	60	41	.11090027 06 .852-01	.0000
212132	60	41	.11090657 06 .852-01	.0078
212232	60	41	.11091288 06 .852-01	.0068
212332	60	41	.11091917 06 .852-01	-.0010
212432	60	41	.11092545 06 .852-01	.0000
212532	60	41	.11093172 06 .852-01	.0098
212632	60	41	.11093799 06 .852-01	-.0039
212732	60	41	.11094424 06 .852-01	-.0078
212832	60	41	.11095048 06 .852-01	-.0020
212932	60	41	.11095672 06 .852-01	.0137

STATION NUMBER 41 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/229

FREQUENCY 8326.0

TIME	TC	Q	CC3		
213032	60	41	.11096294	06 .852-01	.0059
213132	60	41	.11096916	06 .852-01	-.0078
213232	60	41	.11097536	06 .852-01	.0059
213332	60	41	.11098155	06 .852-01	-.0039
213432	60	41	.11098773	06 .852-01	-.0029
213532	60	41	.11099391	06 .852-01	.0098
213632	60	41	.11100006	06 .852-01	.0010
213732	60	41	.11100621	06 .852-01	.0029
214032	60	41	.11102459	06 .852-01	.0127
214132	60	41	.11103069	06 .852-01	-.0049
214232	60	41	.11103677	06 .852-01	.0078
214332	60	41	.11104285	06 .852-01	-.0010
214432	60	41	.11104891	06 .852-01	.0029
214532	60	41	.11105496	06 .852-01	.0029
214632	60	41	.11106100	06 .852-01	.0000
214732	60	41	.11106702	06 .852-01	-.0068
214832	60	41	.11107303	06 .852-01	-.0010
214932	60	41	.11107903	06 .852-01	.0029
215032	60	41	.11108501	06 .852-01	.0039
215332	60	41	.11110287	06 .852-01	.0068
215432	60	41	.11110880	06 .852-01	-.0020
215532	60	41	.11111471	06 .852-01	.0029
215632	60	41	.11112061	06 .852-01	.0078
215732	60	41	.11112649	06 .852-01	-.0068
215832	60	41	.11113236	06 .852-01	.0107
215932	60	41	.11113821	06 .852-01	.0098
220032	60	41	.11114404	06 .852-01	-.0078
220132	60	41	.11114986	06 .852-01	.0059
220232	60	41	.11115566	06 .852-01	.0029
220332	60	41	.11116145	06 .852-01	.0000
220432	60	41	.11116722	06 .852-01	-.0049
220532	60	41	.11117297	06 .852-01	.0078
220632	60	41	.11117871	06 .852-01	.0029
220732	60	41	.11118443	06 .852-01	-.0010
220832	60	41	.11119014	06 .852-01	.0117
220932	60	41	.11119582	06 .852-01	-.0078
221032	60	41	.11120149	06 .852-01	.0068
221132	60	41	.11120715	06 .852-01	.0039
221232	60	41	.11121278	06 .852-01	.0039
221332	60	41	.11121840	06 .852-01	-.0137
221432	60	41	.11122399	06 .852-01	.0049
221532	60	41	.11122957	06 .852-01	.0078
221632	60	41	.11123514	06 .852-01	-.0039
221732	60	41	.11124068	06 .852-01	.0020
221832	60	41	.11124620	06 .852-01	.0107
221932	60	41	.11125171	06 .852-01	.0039
222032	60	41	.11125720	06 .852-01	.0010
222132	60	41	.11126267	06 .852-01	.0000
222232	60	41	.11126812	06 .852-01	.0010
222332	60	41	.11127354	06 .852-01	.0059
222432	60	41	.11127895	06 .852-01	-.0039
222532	60	41	.11128434	06 .852-01	.0068

STATION NUMBER 41 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/229

FREQUENCY 8326.0

TIME	TC	Q	CC3		
222632	60	41	.11128971	06 .852-01	.0029
222732	60	41	.11129506	06 .852-01	.0039
222832	60	41	.11130039	06 .852-01	-.0088
222932	60	41	.11130570	06 .852-01	-.0010
223032	60	41	.11131099	06 .852-01	.0117
223132	60	41	.11131625	06 .852-01	-.0059
223232	60	41	.11132150	06 .852-01	.0146
223332	60	41	.11132673	06 .852-01	.0049
223432	60	41	.11133193	06 .852-01	.0010
223732	60	41	.11134741	06 .852-01	.0020
223832	60	41	.11135253	06 .852-01	.0020
223932	60	41	.11135763	06 .852-01	.0059
224232	60	41	.11137278	06 .852-01	.0039
224332	60	41	.11137778	06 .852-01	.0156
224632	60	41	.11139266	06 .852-01	.0029
224732	60	41	.11139757	06 .852-01	.0068
224832	60	41	.11140247	06 .852-01	.0156
224932	60	41	.11140733	06 .852-01	.0000
225032	60	41	.11141217	06 .852-01	.0068
225332	60	41	.11142656	06 .852-01	.0068
225432	60	41	.11143130	06 .852-01	.0117
225932	60	41	.11145467	06 .852-01	.0166
230032	60	41	.11145926	06 .852-01	.0039
230132	60	41	.11146383	06 .852-01	-.0010
230232	60	41	.11146838	06 .852-01	.0020
230332	60	41	.11147290	06 .852-01	.0146
230432	60	41	.11147740	06 .852-01	.0029
230532	60	41	.11148186	06 .852-01	.0010
230632	60	41	.11148631	06 .852-01	-.0078
230732	60	41	.11149072	06 .852-01	.0078
230832	60	41	.11149511	06 .852-01	.0010
231132	60	41	.11150813	06 .852-01	-.0098
231232	60	41	.11151241	06 .852-01	.0059
231332	60	41	.11151666	06 .852-01	.0000
231432	60	41	.11152090	06 .852-01	.0205
231532	60	41	.11152510	06 .852-01	.0020
231632	60	41	.11152927	06 .852-01	-.0059
231732	60	41	.11153342	06 .852-01	.0127
231832	60	41	.11153754	06 .852-01	-.0059
231932	60	41	.11154163	06 .852-01	.0186
232032	60	41	.11154569	06 .852-01	.0049
232132	60	41	.11154973	06 .852-01	.0029
232232	60	41	.11155374	06 .852-01	-.0049
232332	60	41	.11155771	06 .852-01	.0166
232432	60	41	.11156167	06 .852-01	-.0010
232532	60	41	.11156559	06 .852-01	.0107
232632	60	41	.11156948	06 .852-01	.0000
232732	60	41	.11157335	06 .852-01	-.0137
232832	60	41	.11157718	06 .852-01	.0176
232932	60	41	.11158099	06 .852-01	-.0049
233032	60	41	.11158476	06 .852-01	.0020
233132	60	41	.11158851	06 .852-01	.0039

STATION NUMBER 41 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/229

FREQUENCY 8326.0

TIME	TC	Q	CC3	
233232	60	41	.11159223 06 .852-01	.0020
233332	60	41	.11159592 06 .852-01	.0137
233432	60	41	.11159958 06 .852-01	.0059
233532	60	41	.11160320 06 .852-01	-.0068
233632	60	41	.11160680 06 .852-01	.0117
234432	60	41	.11163450 06 .852-01	-.0029
234532	60	41	.11163783 06 .852-01	.0059
235032	60	41	.11165398 06 .852-01	.0049
235132	60	41	.11165711 06 .852-01	.0039
235232	60	41	.11166022 06 .852-01	.0000
235332	60	41	.11166329 06 .852-01	.0117
235432	60	41	.11166633 06 .852-01	.0059
235532	60	41	.11166933 06 .852-01	-.0020
235632	60	41	.11167231 06 .852-01	.0068
235732	60	41	.11167525 06 .852-01	.0146
235832	60	41	.11167816 06 .852-01	.0029
235932	60	41	.11168104 06 .852-01	-.0068

FREQUENCY 8362.0 65/03/23

000632	60	41	.11170028 06 .852-01	.0039
000732	60	41	.11170289 06 .852-01	.0059
000832	60	41	.11170547 06 .852-01	-.0078
000932	60	41	.11170802 06 .852-01	.0127
001032	60	41	.11171053 06 .852-01	.0000
001132	60	41	.11171301 06 .852-01	.0039
001232	60	41	.11171546 06 .852-01	.0088
001332	60	41	.11171787 06 .852-01	-.0029
001432	60	41	.11172025 06 .852-01	.0039
001532	60	41	.11172259 06 .852-01	.0107
001632	60	41	.11172490 06 .852-01	.0010
001732	60	41	.11172717 06 .852-01	.0098
001832	60	41	.11172941 06 .852-01	.0029
001932	60	41	.11173162 06 .852-01	-.0020
002032	60	41	.11173379 06 .852-01	.0107
002132	60	41	.11173593 06 .852-01	.0068
002232	60	41	.11173803 06 .852-01	.0059
002332	60	41	.11174009 06 .852-01	.0049
002432	60	41	.11174213 06 .852-01	-.0098
002532	60	41	.11174412 06 .852-01	.0098
002632	60	41	.11174608 06 .852-01	.0146
002732	60	41	.11174801 06 .852-01	.0049
002832	60	41	.11174990 06 .852-01	-.0029
002932	60	41	.11175176 06 .852-01	.0078
003032	60	41	.11175358 06 .852-01	.0039
003132	60	41	.11175536 06 .852-01	.0020
003232	60	41	.11175711 06 .852-01	.0195
003332	60	41	.11175883 06 .852-01	-.0107
003432	60	41	.11176050 06 .852-01	.0117
003532	60	41	.11176215 06 .852-01	.0020
003632	60	41	.11176375 06 .852-01	.0137
003732	60	41	.11176532 06 .852-01	.0098

STATION NUMBER 41 65/03/23 ITERATION NUMBER 5 PASS NUMBER 03/229

FREQUENCY 8362.0

TIME	TC	Q	CC3		
003832	60	41	.11176686	06 .852-01	-.0078
003932	60	41	.11176835	06 .852-01	.0107
004032	60	41	.11176982	06 .852-01	.0000
004132	60	41	.11177124	06 .852-01	.0078
004232	60	41	.11177263	06 .852-01	.0020
004332	60	41	.11177398	06 .852-01	.0166
004432	60	41	.11177530	06 .852-01	.0000
004532	60	41	.11177658	06 .852-01	.0039
004632	60	41	.11177782	06 .852-01	.0107
004732	60	41	.11177903	06 .852-01	.0049
004832	60	41	.11178020	06 .852-01	.0020
004932	60	41	.11178133	06 .852-01	.0029
005032	60	41	.11178243	06 .852-01	.0068
005132	60	41	.11178348	06 .852-01	-.0020
005232	60	41	.11178451	06 .852-01	.0107
005332	60	41	.11178549	06 .852-01	-.0078
005432	60	41	.11178644	06 .852-01	.0117
005532	60	41	.11178735	06 .852-01	.0020
005632	60	41	.11178822	06 .852-01	.0117
005732	60	41	.11178906	06 .852-01	-.0059
005832	60	41	.11178985	06 .852-01	.0127
005932	60	41	.11179061	06 .852-01	.0020
010032	60	41	.11179134	06 .852-01	.0127
010132	60	41	.11179202	06 .852-01	-.0059
010232	60	41	.11179267	06 .852-01	.0127
010332	60	41	.11179328	06 .852-01	.0029
010432	60	41	.11179385	06 .852-01	-.0020
010532	60	41	.11179439	06 .852-01	.0137
010632	60	41	.11179488	06 .852-01	.0000
010732	60	41	.11179534	06 .852-01	.0078
010832	60	41	.11179576	06 .852-01	.0049
010932	60	41	.11179614	06 .852-01	-.0117
011032	60	41	.11179649	06 .852-01	.0107
011132	60	41	.11179679	06 .852-01	.0049
011232	60	41	.11179706	06 .852-01	.0029
011332	60	41	.11179729	06 .852-01	.0059
011432	60	41	.11179748	06 .852-01	-.0029
011532	60	41	.11179764	06 .852-01	-.0049
011632	60	41	.11179775	06 .852-01	.0137
011732	60	41	.11179783	06 .852-01	-.0137
011832	60	41	.11179787	06 .852-01	.0146
011932	60	41	.11179787	06 .852-01	-.0176
012032	60	41	.11179783	06 .852-01	.0049
012432	60	41	.11179729	06 .852-01	-.0029
012532	60	41	.11179705	06 .852-01	.0137
012632	60	41	.11179678	06 .852-01	.0010
012732	60	41	.11179647	06 .852-01	-.0059
012832	60	41	.11179612	06 .852-01	.0098

DATA STATISTICS STATION 4 ITERATION 5

PASS	DATA TYPE	BEGINNING TIME	END TIME	NUMBER OF POINTS	STD DEV	RMS	FIRST MOMENT	SECOND MOMENT
03/227	CC3	3/22-000757	3/22-001937	19	.237-01	.241-01	-.421-02	.581-03
03/228	CC3	3/22-142832	3/22-143932	10	.463-02	.140-01	.132-01	.195-03
03/229	CC3	3/22-144032	3/23-012832	458	.791-02	.860-02	.336-02	.739-04

STATION NUMBER 51 65/03/21 ITERATION NUMBER 5 PASS NUMBER 03/231

FREQUENCY 7880.0

TIME	TC	Q	CC3	
220117	10	51	.84159878 05 .176 01	.1221
220127	10	51	.85067197 05 .148 01	-.0977
220137	10	51	.85982507 05 .127 01	.0928
220147	10	51	.86905067 05 .109 01	.0322
220157	10	51	.87834106 05 .951 00	.0928
220207	10	51	.88768816 05 .834 00	.0830
220217	10	51	.89708357 05 .736 00	.0420

STATION NUMBER 51 65/03/21 ITERATION NUMBER 5 PASS NUMBER 03/232

FREQUENCY 7880.0

TIME	TC	Q	CC3		
220227	10	51	.90651856 05	.656 00	.0430
220237	10	51	.91598421 05	.590 00	-.0225
220247	10	51	.92547135 05	.531 00	.0635
220257	10	51	.93497066 05	.483 00	.0332
220307	10	51	.94447267 05	.442 00	-.0684
220317	10	51	.95396784 05	.408 00	.0156
220327	10	51	.96344656 05	.379 00	-.0566
220337	10	51	.97289928 05	.354 00	-.0293
220347	10	51	.98231640 05	.333 00	-.0410
220357	10	51	.99168858 05	.314 00	-.0586
220407	10	51	.10010065 06	.300 00	-.0498
220417	10	51	.10102611 06	.287 00	-.0078
220427	10	51	.10194434 06	.275 00	-.0410
220437	10	51	.10285449 06	.267 00	.0049
220447	10	51	.10375574 06	.259 00	-.1445
220457	10	51	.10464729 06	.252 00	.0117
220507	10	51	.10552838 06	.246 00	.0195
220517	10	51	.10639829 06	.241 00	-.0967
220527	10	51	.10725637 06	.237 00	.0303
220537	10	51	.10810197 06	.234 00	-.0684
220547	10	51	.10893451 06	.231 00	-.0127
220557	10	51	.10975347 06	.229 00	-.0703
220607	10	51	.11055835 06	.227 00	.0469
220617	10	51	.11134872 06	.225 00	.0791
220627	10	51	.11212419 06	.224 00	.0117
220637	10	51	.11288441 06	.222 00	-.0117
220647	10	51	.11362910 06	.221 00	.0020
220657	10	51	.11435800 06	.220 00	-.0059
220707	10	51	.11507092 06	.220 00	.0752
220717	10	51	.11576771 06	.219 00	-.0068
220727	10	51	.11644823 06	.219 00	.0732
220737	10	51	.11711242 06	.218 00	.0791
220747	10	51	.11776025 06	.218 00	-.0469
220757	10	51	.11839170 06	.217 00	.0947
220807	10	51	.11900684 06	.217 00	-.0371
220817	10	51	.11960570 06	.217 00	.0977
220857	10	51	.12184087 06	.216 00	-.0684
220907	10	51	.12236039 06	.216 00	.1123
220917	10	51	.12286460 06	.216 00	.0029
220927	10	51	.12335372 06	.216 00	-.0244
220937	10	51	.12382801 06	.216 00	-.0146
220947	10	51	.12428772 06	.216 00	.0742
220957	10	51	.12473312 06	.216 00	-.0234
221007	10	51	.12516449 06	.216 00	-.0928

FREQUENCY 8500.0

223947	10	51	.13351643 06	.216 00	.0703
223957	10	51	.13348723 06	.216 00	.0723
224007	10	51	.13345803 06	.216 00	-.0273
224017	10	51	.13342883 06	.216 00	-.0332
224027	10	51	.13339964 06	.216 00	.0586

STATION NUMBER 51 65/03/21 ITERATION NUMBER 5 PASS NUMBER 03/232

FREQUENCY 8500.0

TIME	TC	Q	CC3				
224037	10	51	.13337046	06	.216	00	.0410
224047	10	51	.13334129	06	.216	00	-.0879
224057	10	51	.13331213	06	.216	00	.0723
224107	10	51	.13328298	06	.216	00	-.0801
224117	10	51	.13325384	06	.216	00	-.0469
224127	10	51	.13322473	06	.216	00	.0723
224137	10	51	.13319562	06	.216	00	-.0254
224147	10	51	.13316654	06	.216	00	-.1445
224157	10	51	.13313748	06	.216	00	.0215
224207	10	51	.13310844	06	.216	00	-.0391
224217	10	51	.13307942	06	.216	00	-.0195
224227	10	51	.13305042	06	.216	00	-.1230
224257	10	51	.13296359	06	.216	00	-.0918
224307	10	51	.13293470	06	.216	00	-.0020
224317	10	51	.13290584	06	.216	00	-.1406
224327	10	51	.13287701	06	.216	00	-.0098
224337	10	51	.13284821	06	.216	00	-.1133
224347	10	51	.13281945	06	.216	00	-.0488
224357	10	51	.13279071	06	.216	00	-.1152
224407	10	51	.13276202	06	.216	00	-.0176
224417	10	51	.13273335	06	.216	00	-.0566
224427	10	51	.13270473	06	.216	00	-.1270
224807	10	51	.13208547	06	.216	00	.0293
224817	10	51	.13205785	06	.216	00	.0430
224827	10	51	.13203029	06	.216	00	-.0918
224837	10	51	.13200277	06	.216	00	.0234
224847	10	51	.13197531	06	.216	00	-.0117
224857	10	51	.13194790	06	.216	00	.0020
224907	10	51	.13192054	06	.216	00	.0625
224917	10	51	.13189323	06	.216	00	-.1270
224927	10	51	.13186597	06	.216	00	.0313
224937	10	51	.13183876	06	.216	00	.0371
224947	10	51	.13181161	06	.216	00	-.0098
224957	10	51	.13178451	06	.216	00	-.0098
225007	10	51	.13175746	06	.216	00	-.0645
225017	10	51	.13173047	06	.216	00	.0313
225027	10	51	.13170353	06	.216	00	.0703
225037	10	51	.13167664	06	.216	00	-.0449
225047	10	51	.13164981	06	.216	00	-.0137
225057	10	51	.13162303	06	.217	00	-.0332
225107	10	51	.13159631	06	.217	00	-.0117
225117	10	51	.13156964	06	.217	00	.0566
225127	10	51	.13154303	06	.217	00	-.0293
225137	10	51	.13151647	06	.217	00	-.0723
225147	10	51	.13148996	06	.217	00	.0352
225157	10	51	.13146352	06	.217	00	-.0176
225207	10	51	.13143712	06	.217	00	.0742
225217	10	51	.13141079	06	.217	00	-.0898
225227	10	51	.13138450	06	.217	00	-.0059
225237	10	51	.13135828	06	.217	00	.0195
225247	10	51	.13133211	06	.217	00	-.0117
225257	10	51	.13130599	06	.217	00	.0039

STATION NUMBER 51 65/03/21 ITERATION NUMBER 5 PASS NUMBER 03/232

FREQUENCY 8500.0

TIME	TC	Q	CC3	
225307	10	51	.13127994 06 .217 00	.0605
225317	10	51	.13125394 06 .217 00	-.0391
225327	10	51	.13122799 06 .217 00	.0078
225337	10	51	.13120210 06 .217 00	-.0039
225347	10	51	.13117627 06 .217 00	-.0723
225357	10	51	.13115050 06 .217 00	.0039
225407	10	51	.13112478 06 .217 00	.0215
225417	10	51	.13109911 06 .217 00	-.0137
225427	10	51	.13107351 06 .217 00	-.0078
225437	10	51	.13104796 06 .217 00	.0400
225447	10	51	.13102247 06 .217 00	.0313
225457	10	51	.13099703 06 .217 00	-.0322
231217	10	51	.12865134 06 .217 00	-.0439
				65/03/22
004812	60	51	.12195904 06 .884-01	-.0039
004912	60	51	.12191918 06 .884-01	.0039
005012	60	51	.12187968 06 .884-01	-.0195
005112	60	51	.12184056 06 .884-01	.0088
005212	60	51	.12180179 06 .884-01	-.0039
005312	60	51	.12176337 06 .884-01	-.0049
005412	60	51	.12172531 06 .884-01	.0098
005912	60	51	.12154009 06 .886-01	.0068
010012	60	51	.12150404 06 .886-01	-.0117
010112	60	51	.12146832 06 .886-01	-.0029
010212	60	51	.12143291 06 .886-01	.0039
010312	60	51	.12139782 06 .886-01	-.0039
010412	60	51	.12136304 06 .886-01	-.0078
010512	60	51	.12132857 06 .886-01	-.0029
010612	60	51	.12129440 06 .889-01	-.0020
010712	60	51	.12126054 06 .889-01	-.0029
010812	60	51	.12122697 06 .889-01	-.0020
010912	60	51	.12119369 06 .889-01	-.0117
011012	60	51	.12116071 06 .889-01	.0039
011112	60	51	.12112802 06 .889-01	-.0020
011212	60	51	.12109561 06 .889-01	.0078
011312	60	51	.12106348 06 .889-01	-.0156
011412	60	51	.12103163 06 .891-01	.0000
011512	60	51	.12100006 06 .891-01	.0068
011612	60	51	.12096876 06 .891-01	-.0078
011712	60	51	.12093773 06 .891-01	.0049
011812	60	51	.12090696 06 .891-01	.0029
011912	60	51	.12087646 06 .891-01	-.0127
012012	60	51	.12084622 06 .891-01	.0088
012112	60	51	.12081624 06 .891-01	-.0107
012212	60	51	.12078652 06 .894-01	-.0010
012312	60	51	.12075704 06 .894-01	-.0107
012412	60	51	.12072782 06 .894-01	.0107
012512	60	51	.12069885 06 .894-01	.0020
012612	60	51	.12067012 06 .894-01	-.0020
012712	60	51	.12064163 06 .894-01	.0010

STATION NUMBER 51 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/232

FREQUENCY 8500.0

TIME	TC	Q	CC3	
012812	60	51	.12061338 06 .894-01	-.0010
012912	60	51	.12058537 06 .894-01	.0088
013012	60	51	.12055760 06 .894-01	-.0156
013112	60	51	.12053006 06 .896-01	.0098
013212	60	51	.12050274 06 .896-01	.0049
013312	60	51	.12047566 06 .896-01	-.0117
013412	60	51	.12044880 06 .896-01	-.0029
013512	60	51	.12042217 06 .896-01	-.0010
013612	60	51	.12039575 06 .896-01	-.0029
013712	60	51	.12036956 06 .896-01	-.0078
013812	60	51	.12034358 06 .896-01	.0049
013912	60	51	.12031781 06 .898-01	.0029
014012	60	51	.12029226 06 .898-01	-.0117
014112	60	51	.12026692 06 .898-01	.0127
014212	60	51	.12024179 06 .898-01	-.0186
014312	60	51	.12021686 06 .898-01	.0098
014412	60	51	.12019213 06 .898-01	.0000
014512	60	51	.12016761 06 .898-01	-.0117
014612	60	51	.12014329 06 .898-01	.0117
014712	60	51	.12011916 06 .901-01	-.0146
014812	60	51	.12009524 06 .901-01	-.0039
014912	60	51	.12007150 06 .901-01	-.0020
015012	60	51	.12004796 06 .901-01	.0049
015112	60	51	.12002461 06 .901-01	.0068
015212	60	51	.12000145 06 .901-01	-.0137
015312	60	51	.11997847 06 .901-01	-.0049
015412	60	51	.11995568 06 .903-01	.0029
015512	60	51	.11993307 06 .903-01	.0117
015612	60	51	.11991065 06 .903-01	-.0127
015712	60	51	.11988840 06 .903-01	.0010
015812	60	51	.11986633 06 .903-01	-.0127
015912	60	51	.11984444 06 .903-01	.0117
020012	60	51	.11982272 06 .903-01	-.0039
020112	60	51	.11980117 06 .903-01	-.0088
020212	60	51	.11977980 06 .906-01	-.0010
020312	60	51	.11975860 06 .906-01	.0020
020412	60	51	.11973756 06 .906-01	.0049
020512	60	51	.11971669 06 .906-01	.0068
020612	60	51	.11969599 06 .906-01	-.0215
020712	60	51	.11967545 06 .906-01	.0029
020812	60	51	.11965507 06 .906-01	-.0020
020912	60	51	.11963485 06 .906-01	.0010
021012	60	51	.11961479 06 .908-01	-.0068
021112	60	51	.11959489 06 .908-01	-.0039
021212	60	51	.11957514 06 .908-01	-.0078
021312	60	51	.11955555 06 .908-01	.0176
021412	60	51	.11953611 06 .908-01	-.0098
021512	60	51	.11951682 06 .908-01	-.0059
021612	60	51	.11949769 06 .908-01	-.0029
021712	60	51	.11947870 06 .911-01	.0020
021812	60	51	.11945986 06 .911-01	-.0068
021912	60	51	.11944116 06 .911-01	.0039

STATION NUMBER 51 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/232

FREQUENCY 8500.0

TIME	TC	Q	CC3		
022012	60	51	.11942261	06 .911-01	.0039
022112	60	51	.11940421	06 .911-01	-.0078
022212	60	51	.11938594	06 .911-01	.0078
022312	60	51	.11936782	06 .911-01	-.0029
022412	60	51	.11934983	06 .911-01	-.0020
022512	60	51	.11933199	06 .913-01	.0098
022612	60	51	.11931428	06 .913-01	.0010
022712	60	51	.11929671	06 .913-01	.0068
022812	60	51	.11927927	06 .913-01	.0117
022912	60	51	.11926197	06 .913-01	.0000
023012	60	51	.11924479	06 .913-01	.0059
023112	60	51	.11922775	06 .913-01	-.0029
023212	60	51	.11921084	06 .916-01	.0088
023312	60	51	.11919406	06 .916-01	-.0078
023412	60	51	.11917740	06 .916-01	-.0020
023512	60	51	.11916087	06 .916-01	.0107
023612	60	51	.11914447	06 .916-01	.0156
023712	60	51	.11912819	06 .916-01	-.0039
023812	60	51	.11911203	06 .916-01	.0049
023912	60	51	.11909599	06 .918-01	-.0098
024212	60	51	.11904860	06 .850-01	-.0039
024312	60	51	.11903304	06 .850-01	.0068
024412	60	51	.11901760	06 .850-01	.0000
024512	60	51	.11900227	06 .850-01	-.0049
024612	60	51	.11898706	06 .850-01	-.0078
024712	60	51	.11897196	06 .850-01	.0098
024812	60	51	.11895697	06 .850-01	-.0020
024912	60	51	.11894209	06 .850-01	.0098
025012	60	51	.11892732	06 .850-01	-.0068
025112	60	51	.11891266	06 .850-01	.0020
025212	60	51	.11889811	06 .850-01	.0020
025312	60	51	.11888367	06 .850-01	-.0059
025412	60	51	.11886933	06 .850-01	.0146
025512	60	51	.11885510	06 .850-01	-.0049
025612	60	51	.11884098	06 .850-01	.0049
025712	60	51	.11882695	06 .850-01	-.0059
025812	60	51	.11881303	06 .850-01	-.0010
025912	60	51	.11879921	06 .850-01	.0010
030012	60	51	.11878550	06 .850-01	.0039
030112	60	51	.11877188	06 .850-01	.0059
030212	60	51	.11875836	06 .850-01	-.0078
030312	60	51	.11874494	06 .850-01	-.0029
030412	60	51	.11873161	06 .850-01	.0059
030512	60	51	.11871838	06 .850-01	-.0156
030612	60	51	.11870525	06 .850-01	.0186
030712	60	51	.11869221	06 .850-01	-.0098
030812	60	51	.11867926	06 .850-01	.0029
030912	60	51	.11866641	06 .850-01	.0049
031012	60	51	.11865365	06 .850-01	-.0010
031112	60	51	.11864098	06 .850-01	.0020
031212	60	51	.11862840	06 .850-01	-.0020
031312	60	51	.11861591	06 .850-01	.0059

STATION NUMBER 51 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/232

FREQUENCY 8500.0

TIME	TC	Q	CC3	
031412	60	51	.11860351 06 .850-01	-.0088
031512	60	51	.11859119 06 .850-01	.0039
031612	60	51	.11857897 06 .850-01	-.0029
031712	60	51	.11856683 06 .850-01	.0059
031812	60	51	.11855477 06 .850-01	-.0059
031912	60	51	.11854280 06 .850-01	-.0020
032012	60	51	.11853091 06 .850-01	.0010
032112	60	51	.11851911 06 .850-01	.0049
032212	60	51	.11850739 06 .850-01	.0107
032312	60	51	.11849575 06 .850-01	.0010
032412	60	51	.11848419 06 .850-01	-.0068
032512	60	51	.11847271 06 .850-01	.0049
032612	60	51	.11846131 06 .850-01	-.0098
032712	60	51	.11844999 06 .850-01	.0117
032812	60	51	.11843874 06 .850-01	-.0127
032912	60	51	.11842758 06 .850-01	.0215
033012	60	51	.11841649 06 .850-01	-.0059
033112	60	51	.11840547 06 .850-01	.0088
033212	60	51	.11839453 06 .850-01	-.0166
033312	60	51	.11838367 06 .850-01	.0146
033412	60	51	.11837288 06 .850-01	-.0098
033512	60	51	.11836216 06 .850-01	.0088
033612	60	51	.11835151 06 .850-01	-.0098
033712	60	51	.11834093 06 .850-01	.0146
033812	60	51	.11833043 06 .850-01	.0039
033912	60	51	.11831999 06 .850-01	-.0127
034012	60	51	.11830963 06 .850-01	.0039
034112	60	51	.11829933 06 .850-01	.0000
034212	60	51	.11828910 06 .850-01	-.0039
034312	60	51	.11827894 06 .850-01	.0059
034412	60	51	.11826885 06 .850-01	.0010
034512	60	51	.11825882 06 .850-01	.0127
034612	60	51	.11824886 06 .850-01	-.0078
034912	60	51	.11821935 06 .850-01	-.0059
035012	60	51	.11820965 06 .850-01	.0010
035112	60	51	.11820000 06 .850-01	-.0039
035212	60	51	.11819042 06 .850-01	.0117
035312	60	51	.11818090 06 .850-01	.0000
035412	60	51	.11817144 06 .850-01	-.0049
035512	60	51	.11816204 06 .850-01	-.0029
035612	60	51	.11815269 06 .850-01	.0059
035712	60	51	.11814341 06 .850-01	.0059
035812	60	51	.11813418 06 .850-01	-.0020
035912	60	51	.11812502 06 .850-01	.0000
040012	60	51	.11811590 06 .850-01	-.0059
040112	60	51	.11810685 06 .850-01	.0146
040212	60	51	.11809785 06 .850-01	-.0029
040312	60	51	.11808891 06 .850-01	-.0098
040412	60	51	.11808002 06 .850-01	.0137
040512	60	51	.11807118 06 .850-01	-.0020
040612	60	51	.11806240 06 .850-01	-.0039
040712	60	51	.11805367 06 .850-01	.0078

STATION NUMBER 51 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/232

FREQUENCY 8500.0

TIME	TC	Q	CC3		
040812	60	51	.11804500	06 .850-01	.0010
040912	60	51	.11803637	06 .850-01	-.0088
041012	60	51	.11802780	06 .850-01	-.0029
041112	60	51	.11801928	06 .850-01	.0039
041212	60	51	.11801081	06 .850-01	.0088
041312	60	51	.11800238	06 .850-01	-.0029
041412	60	51	.11799401	06 .850-01	.0039
041712	60	51	.11796918	06 .850-01	-.0010
041812	60	51	.11796100	06 .850-01	-.0020
041912	60	51	.11795287	06 .850-01	-.0010
042012	60	51	.11794478	06 .850-01	.0059
042112	60	51	.11793673	06 .850-01	-.0010
042212	60	51	.11792873	06 .850-01	-.0029
042312	60	51	.11792078	06 .850-01	.0020
042412	60	51	.11791287	06 .850-01	-.0049
042512	60	51	.11790500	06 .850-01	.0117
042612	60	51	.11789718	06 .850-01	.0010
042712	60	51	.11788940	06 .850-01	-.0010
042812	60	51	.11788166	06 .850-01	-.0117
042912	60	51	.11787396	06 .850-01	.0020
043012	60	51	.11786631	06 .850-01	-.0078
043112	60	51	.11785869	06 .850-01	.0068
043212	60	51	.11785112	06 .850-01	.0000
043312	60	51	.11784358	06 .850-01	.0029
043412	60	51	.11783608	06 .850-01	.0000
043512	60	51	.11782862	06 .850-01	-.0088
043612	60	51	.11782120	06 .850-01	-.0059
043712	60	51	.11781382	06 .850-01	.0098
043812	60	51	.11780648	06 .850-01	.0039
043912	60	51	.11779917	06 .850-01	-.0029
044012	60	51	.11779190	06 .850-01	.0020
044512	60	51	.11775607	06 .850-01	-.0039
044612	60	51	.11774901	06 .850-01	.0088
044712	60	51	.11774198	06 .850-01	.0039
044812	60	51	.11773498	06 .850-01	-.0156
044912	60	51	.11772802	06 .850-01	.0156
045012	60	51	.11772109	06 .850-01	-.0029
045112	60	51	.11771418	06 .852-01	-.0020
045212	60	51	.11770732	06 .852-01	.0010
045312	60	51	.11770048	06 .852-01	-.0107
045412	60	51	.11769367	06 .852-01	.0146
045512	60	51	.11768689	06 .852-01	-.0068
045612	60	51	.11768014	06 .852-01	.0088
045712	60	51	.11767342	06 .852-01	-.0049
045812	60	51	.11766673	06 .852-01	.0029
045912	60	51	.11766006	06 .852-01	.0000
050012	60	51	.11765343	06 .852-01	.0020
050512	60	51	.11762066	06 .852-01	.0068
050612	60	51	.11761418	06 .852-01	.0000
050712	60	51	.11760773	06 .852-01	.0010
050812	60	51	.11760130	06 .852-01	.0117
050912	60	51	.11759490	06 .852-01	-.0029

STATION NUMBER 51 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/232

FREQUENCY 8500.0

TIME	TC	Q	CC3	
051012	60	51	.11758852 06 .852-01	-.0068
051112	60	51	.11758217 06 .852-01	-.0029
051212	60	51	.11757584 06 .852-01	.0127
051312	60	51	.11756953 06 .852-01	-.0107
051412	60	51	.11756324 06 .852-01	.0088
051512	60	51	.11755698 06 .852-01	.0049
051612	60	51	.11755073 06 .852-01	-.0020
051712	60	51	.11754451 06 .852-01	.0039
051812	60	51	.11753831 06 .852-01	-.0127
051912	60	51	.11753213 06 .852-01	.0000
052012	60	51	.11752597 06 .852-01	.0098
052112	60	51	.11751983 06 .852-01	.0000
052212	60	51	.11751371 06 .852-01	.0029
052312	60	51	.11750761 06 .852-01	-.0117
052412	60	51	.11750153 06 .852-01	.0205
052512	60	51	.11749546 06 .852-01	-.0156
052612	60	51	.11748942 06 .852-01	.0127
052712	60	51	.11748339 06 .852-01	-.0088
052812	60	51	.11747738 06 .852-01	.0020
052912	60	51	.11747139 06 .852-01	-.0049
053012	60	51	.11746541 06 .852-01	.0049
053112	60	51	.11745945 06 .852-01	-.0020
053212	60	51	.11745351 06 .852-01	-.0059
053312	60	51	.11744758 06 .852-01	.0049
053412	60	51	.11744166 06 .852-01	.0010
053512	60	51	.11743577 06 .852-01	.0000
053612	60	51	.11742988 06 .852-01	-.0010
053712	60	51	.11742401 06 .852-01	.0029
053812	60	51	.11741816 06 .852-01	.0068
053912	60	51	.11741232 06 .852-01	-.0010
054012	60	51	.11740649 06 .852-01	.0098
054112	60	51	.11740067 06 .852-01	-.0098
054212	60	51	.11739487 06 .852-01	.0088
054312	60	51	.11738908 06 .852-01	-.0020
054412	60	51	.11738331 06 .852-01	-.0078
054512	60	51	.11737754 06 .852-01	.0078
054612	60	51	.11737179 06 .852-01	-.0049
054712	60	51	.11736605 06 .852-01	.0039
054812	60	51	.11736031 06 .852-01	.0020
054912	60	51	.11735459 06 .852-01	.0068
055012	60	51	.11734888 06 .852-01	.0000
055112	60	51	.11734318 06 .852-01	.0010
055212	60	51	.11733749 06 .852-01	.0098
055312	60	51	.11733181 06 .852-01	.0078
055412	60	51	.11732613 06 .852-01	-.0029
055512	60	51	.11732047 06 .852-01	-.0068
055612	60	51	.11731482 06 .852-01	.0146
055712	60	51	.11730917 06 .852-01	-.0049
055812	60	51	.11730353 06 .852-01	.0010
055912	60	51	.11729790 06 .852-01	-.0010
060012	60	51	.11729228 06 .852-01	.0068
060112	60	51	.11728666 06 .852-01	.0068

STATION NUMBER 51 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/232

FREQUENCY 8500.0

TIME	TC	Q	CC3	
060212	60	51	.11728105 06 .852-01	.0000
060312	60	51	.11727545 06 .852-01	.0039
060412	60	51	.11726985 06 .852-01	.0010
060632	60	51	.11725681 06 .852-01	.0059
060732	60	51	.11725123 06 .852-01	.0010
060832	60	51	.11724566 06 .852-01	.0078
060932	60	51	.11724009 06 .852-01	-.0068
061032	60	51	.11723453 06 .852-01	.0078
061132	60	51	.11722896 06 .852-01	.0010
061232	60	51	.11722341 06 .852-01	.0078
061332	60	51	.11721786 06 .852-01	-.0059
061832	60	51	.11719014 06 .852-01	.0107
061932	60	51	.11718460 06 .852-01	-.0029
062032	60	51	.11717907 06 .852-01	.0146
062132	60	51	.11717354 06 .852-01	-.0029
062232	60	51	.11716800 06 .852-01	-.0059
062332	60	51	.11716247 06 .852-01	.0068
062432	60	51	.11715695 06 .852-01	.0029
062532	60	51	.11715142 06 .852-01	-.0020
062632	60	51	.11714589 06 .852-01	-.0068
062732	60	51	.11714036 06 .852-01	.0215
062832	60	51	.11713483 06 .852-01	-.0166
062932	60	51	.11712930 06 .852-01	.0127
063032	60	51	.11712378 06 .852-01	-.0088
063132	60	51	.11711824 06 .852-01	.0059
063432	60	51	.11710165 06 .852-01	.0020
063532	60	51	.11709611 06 .852-01	-.0117
063832	60	51	.11707949 06 .852-01	.0098
063932	60	51	.11707394 06 .852-01	.0039
064032	60	51	.11706840 06 .852-01	.0020
064132	60	51	.11706284 06 .852-01	.0039
064232	60	51	.11705729 06 .852-01	-.0078
064332	60	51	.11705173 06 .852-01	.0010
064432	60	51	.11704617 06 .852-01	-.0039
064532	60	51	.11704060 06 .852-01	.0127
064632	60	51	.11703503 06 .852-01	.0010
064732	60	51	.11702946 06 .852-01	.0088
064832	60	51	.11702388 06 .852-01	.0059
064932	60	51	.11701829 06 .852-01	.0068
065032	60	51	.11701270 06 .852-01	-.0039
065132	60	51	.11700711 06 .852-01	.0088
065632	60	51	.11697904 06 .852-01	.0068

FREQUENCY 8432.0

070132	60	51	.11695078 06 .852-01	-.0098
070232	60	51	.11694511 06 .852-01	.0078
070332	60	51	.11693943 06 .852-01	-.0010
070432	60	51	.11693375 06 .852-01	.0000
070732	60	51	.11691665 06 .852-01	.0166
070832	60	51	.11691093 06 .852-01	.0000
070932	60	51	.11690520 06 .852-01	-.0068

STATION NUMBER 51 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/232

FREQUENCY 8432.0

TIME	TC	Q	CC3		
071032	60	51	.11689947	06 .852-01	.0117
071132	60	51	.11689373	06 .852-01	.0068
071232	60	51	.11688797	06 .852-01	-.0059
071332	60	51	.11688221	06 .852-01	.0078
071432	60	51	.11687643	06 .852-01	-.0020
071532	60	51	.11687065	06 .852-01	.0146
071632	60	51	.11686486	06 .852-01	-.0078
071732	60	51	.11685905	06 .852-01	-.0029
071832	60	51	.11685324	06 .852-01	.0117
072132	60	51	.11683573	06 .852-01	.0039
072432	60	51	.11681812	06 .852-01	-.0010
072532	60	51	.11681222	06 .852-01	.0088
072632	60	51	.11680632	06 .852-01	-.0020
072732	60	51	.11680040	06 .852-01	-.0010
072832	60	51	.11679447	06 .852-01	.0117
072932	60	51	.11678853	06 .852-01	.0049
073032	60	51	.11678257	06 .852-01	.0098
073132	60	51	.11677660	06 .852-01	-.0059
073232	60	51	.11677062	06 .852-01	.0078
073332	60	51	.11676463	06 .852-01	.0020
073632	60	51	.11674657	06 .852-01	-.0029
073732	60	51	.11674052	06 .852-01	.0107
073832	60	51	.11673446	06 .852-01	.0049
073932	60	51	.11672838	06 .852-01	-.0020
074032	60	51	.11672229	06 .852-01	.0215
074132	60	51	.11671619	06 .852-01	-.0088
074232	60	51	.11671007	06 .852-01	.0107
074332	60	51	.11670394	06 .852-01	-.0068
074432	60	51	.11669779	06 .852-01	.0078
074532	60	51	.11669163	06 .852-01	.0039
074632	60	51	.11668545	06 .852-01	.0137
074732	60	51	.11667926	06 .852-01	.0078
074832	60	51	.11667305	06 .852-01	.0156
074932	60	51	.11666683	06 .852-01	-.0107
075232	60	51	.11664806	06 .852-01	.0215
075332	60	51	.11664177	06 .852-01	-.0088
075432	60	51	.11663547	06 .852-01	.0098
075532	60	51	.11662915	06 .852-01	-.0039
075832	60	51	.11661009	06 .852-01	.0039
075932	60	51	.11660371	06 .852-01	.0225
080032	60	51	.11659731	06 .852-01	-.0068
080132	60	51	.11659089	06 .852-01	.0117
080232	60	51	.11658445	06 .852-01	-.0020
080332	60	51	.11657800	06 .852-01	.0195
080432	60	51	.11657152	06 .852-01	.0088
080532	60	51	.11656503	06 .852-01	-.0020
080632	60	51	.11655853	06 .852-01	.0049
080732	60	51	.11655200	06 .852-01	.0127
080832	60	51	.11654546	06 .852-01	.0049
080932	60	51	.11653890	06 .852-01	.0156
081032	60	51	.11653232	06 .852-01	-.0049
081332	60	51	.11651247	06 .852-01	.0078

STATION NUMBER 51 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/232

FREQUENCY 8432.0

TIME	TC	Q	CC3			
081432	60	51	.11650582	06	.852-01	-.0059
081532	60	51	.11649915	06	.854-01	.0156
081632	60	51	.11649246	06	.854-01	.0049
081732	60	51	.11648575	06	.854-01	.0146
081832	60	51	.11647902	06	.854-01	-.0068
081932	60	51	.11647228	06	.854-01	.0068
082032	60	51	.11646551	06	.854-01	.0068
082132	60	51	.11645872	06	.854-01	.0088
082232	60	51	.11645192	06	.854-01	.0146
082332	60	51	.11644509	06	.854-01	.0098
082432	60	51	.11643825	06	.854-01	.0020
082532	60	51	.11643138	06	.854-01	.0156
083032	60	51	.11639676	06	.854-01	.0059

STATION NUMBER 51 65/03/22 ITERATION NUMBER 5 PASS NUMBER 03/233

FREQUENCY 8432.0

TIME	TC	Q	CC3			
083132	60	51	.11638978	06	.857-01	.0078
083232	60	51	.11638277	06	.857-01	.0127
083332	60	51	.11637574	06	.857-01	.0059
083432	60	51	.11636870	06	.857-01	-.0146
083532	60	51	.11636163	06	.857-01	.0205
083632	60	51	.11635454	06	.857-01	-.0068
083932	60	51	.11633315	06	.859-01	.0010
084032	60	51	.11632597	06	.859-01	-.0098
084132	60	51	.11631878	06	.859-01	.0010
084232	60	51	.11631157	06	.859-01	.0166
084332	60	51	.11630433	06	.859-01	.0039

STATION NUMBER 51 65/03/23 ITERATION NUMBER 5 PASS NUMBER 03/235

FREQUENCY 8307.0

TIME	TC	Q	CC3			
013232	60	51	.10829231	06	.852-01	.0049
013332	60	51	.10829850	06	.852-01	.0039
013432	60	51	.10830471	06	.852-01	.0068
013532	60	51	.10831095	06	.852-01	.0010
013632	60	51	.10831721	06	.852-01	.0010
013732	60	51	.10832351	06	.852-01	-.0078
013832	60	51	.10832983	06	.852-01	.0215
013932	60	51	.10833617	06	.852-01	-.0088
014032	60	51	.10834255	06	.852-01	.0020
014132	60	51	.10834895	06	.852-01	.0029
014232	60	51	.10835537	06	.852-01	-.0049
014332	60	51	.10836182	06	.852-01	.0117
014432	60	51	.10836830	06	.852-01	.0020
014532	60	51	.10837480	06	.852-01	.0000
014632	60	51	.10838133	06	.852-01	.0068
014732	60	51	.10838788	06	.852-01	.0049
014832	60	51	.10839445	06	.852-01	-.0059
014932	60	51	.10840106	06	.852-01	.0088
015032	60	51	.10840768	06	.852-01	-.0010
015132	60	51	.10841433	06	.852-01	-.0010
015232	60	51	.10842101	06	.852-01	.0078
015332	60	51	.10842771	06	.852-01	.0088
015432	60	51	.10843443	06	.852-01	.0029
015532	60	51	.10844118	06	.852-01	-.0107
015632	60	51	.10844795	06	.852-01	.0029
015732	60	51	.10845474	06	.852-01	.0107
015832	60	51	.10846155	06	.852-01	-.0059
015932	60	51	.10846839	06	.852-01	.0049
020032	60	51	.10847525	06	.852-01	.0107
020132	60	51	.10848214	06	.852-01	-.0068
020232	60	51	.10848905	06	.852-01	.0029
020332	60	51	.10849597	06	.852-01	.0068
020432	60	51	.10850293	06	.852-01	.0059
020532	60	51	.10850990	06	.852-01	.0000
020632	60	51	.10851689	06	.852-01	.0059
020732	60	51	.10852391	06	.852-01	.0068
020832	60	51	.10853095	06	.852-01	-.0137
020932	60	51	.10853800	06	.852-01	.0127
021032	60	51	.10854508	06	.852-01	.0000
021132	60	51	.10855218	06	.852-01	.0010
021232	60	51	.10855930	06	.852-01	.0146
021332	60	51	.10856644	06	.852-01	-.0098
021432	60	51	.10857360	06	.852-01	.0137
021532	60	51	.10858078	06	.852-01	.0000
021632	60	51	.10858798	06	.852-01	-.0010
021732	60	51	.10859520	06	.852-01	-.0039
021832	60	51	.10860244	06	.852-01	.0068
021932	60	51	.10860970	06	.852-01	-.0020
022032	60	51	.10861698	06	.852-01	.0049
022132	60	51	.10862427	06	.852-01	.0098
022232	60	51	.10863159	06	.852-01	-.0049
022332	60	51	.10863892	06	.852-01	.0117

STATION NUMBER 51 65/03/23 ITERATION NUMBER 5 PASS NUMBER 03/235

FREQUENCY 8307.0

TIME	TC	Q	CC3		
022632	60	51	.10866103	06 .852-01	.0049
022732	60	51	.10866843	06 .852-01	.0000
022832	60	51	.10867585	06 .852-01	-.0049
022932	60	51	.10868329	06 .852-01	.0059
023032	60	51	.10869075	06 .852-01	.0166
023132	60	51	.10869822	06 .852-01	-.0068
023632	60	51	.10873583	06 .852-01	.0000
023732	60	51	.10874340	06 .852-01	.0127
023832	60	51	.10875099	06 .852-01	-.0059
024132	60	51	.10877383	06 .852-01	-.0020
024232	60	51	.10878148	06 .852-01	.0205
024332	60	51	.10878914	06 .852-01	-.0068
024432	60	51	.10879681	06 .852-01	.0029
024532	60	51	.10880450	06 .852-01	-.0010
024632	60	51	.10881220	06 .852-01	.0127
024732	60	51	.10881992	06 .852-01	-.0020
024832	60	51	.10882765	06 .852-01	.0029
024932	60	51	.10883539	06 .852-01	-.0059
025032	60	51	.10884314	06 .852-01	.0059
025132	60	51	.10885091	06 .852-01	.0039
025232	60	51	.10885869	06 .852-01	.0068
025332	60	51	.10886648	06 .852-01	-.0029
025432	60	51	.10887429	06 .852-01	.0098
025732	60	51	.10889778	06 .852-01	.0059
025832	60	51	.10890563	06 .852-01	.0039
031132	60	51	.10900865	06 .852-01	-.0029
031232	60	51	.10901664	06 .852-01	.0068
031332	60	51	.10902464	06 .852-01	.0088
031432	60	51	.10903265	06 .852-01	.0020
031532	60	51	.10904066	06 .852-01	.0039
032032	60	51	.10908085	06 .852-01	.0020
032532	60	51	.10912120	06 .852-01	-.0010
032632	60	51	.10912929	06 .852-01	.0107
032932	60	51	.10915358	06 .852-01	-.0020
033032	60	51	.10916169	06 .852-01	.0059
033132	60	51	.10916981	06 .852-01	.0098
033432	60	51	.10919417	06 .852-01	-.0059
033532	60	51	.10920230	06 .852-01	.0146
033632	60	51	.10921043	06 .852-01	-.0029
033732	60	51	.10921857	06 .852-01	.0107
034032	60	51	.10924300	06 .852-01	.0010
034132	60	51	.10925115	06 .852-01	.0020
034932	60	51	.10931640	06 .852-01	.0039
035032	60	51	.10932456	06 .852-01	.0098
035132	60	51	.10933272	06 .852-01	-.0020
035432	60	51	.10935720	06 .852-01	.0137
035532	60	51	.10936536	06 .852-01	.0029
035632	60	51	.10937352	06 .852-01	.0088
035732	60	51	.10938168	06 .852-01	-.0010
035832	60	51	.10938984	06 .852-01	-.0088
035932	60	51	.10939800	06 .852-01	.0000
040032	60	51	.10940615	06 .852-01	.0107

STATION NUMBER 51 65/03/23 ITERATION NUMBER 5 PASS NUMBER 03/235

FREQUENCY 8307.0

TIME	TC	Q	CC3		
040132	60	51	.10941431	06 .852-01	.0068
040232	60	51	.10942246	06 .852-01	.0039
040332	60	51	.10943061	06 .852-01	.0039
040432	60	51	.10943876	06 .852-01	.0068
040532	60	51	.10944690	06 .852-01	-.0059
040632	60	51	.10945505	06 .852-01	.0010
040732	60	51	.10946319	06 .852-01	.0107
040832	60	51	.10947132	06 .852-01	-.0088
040932	60	51	.10947946	06 .852-01	.0068
041032	60	51	.10948759	06 .852-01	-.0059
041132	60	51	.10949571	06 .852-01	.0010
041232	60	51	.10950384	06 .852-01	.0127
041332	60	51	.10951195	06 .852-01	-.0059
041432	60	51	.10952007	06 .852-01	-.0029
041532	60	51	.10952818	06 .852-01	.0049
041632	60	51	.10953628	06 .852-01	.0010
041732	60	51	.10954438	06 .852-01	.0010
041832	60	51	.10955248	06 .852-01	.0059
042232	60	51	.10958480	06 .852-01	.0020
042332	60	51	.10959286	06 .852-01	.0029
042432	60	51	.10960092	06 .852-01	-.0059
042532	60	51	.10960897	06 .852-01	.0078
042632	60	51	.10961702	06 .852-01	-.0029
042732	60	51	.10962506	06 .852-01	.0078
042832	60	51	.10963309	06 .852-01	-.0068
042932	60	51	.10964111	06 .852-01	.0029
043032	60	51	.10964913	06 .852-01	.0029
043132	60	51	.10965714	06 .852-01	-.0049
043232	60	51	.10966514	06 .852-01	.0107
043332	60	51	.10967313	06 .852-01	.0029
043432	60	51	.10968111	06 .852-01	.0029
043532	60	51	.10968909	06 .852-01	-.0059
043632	60	51	.10969705	06 .852-01	-.0049
043732	60	51	.10970501	06 .852-01	.0049
043832	60	51	.10971296	06 .852-01	.0068
043932	60	51	.10972090	06 .852-01	.0020
044032	60	51	.10972883	06 .852-01	-.0098
044132	60	51	.10973675	06 .852-01	.0215
044232	60	51	.10974465	06 .852-01	-.0039
044332	60	51	.10975255	06 .852-01	-.0029
044432	60	51	.10976044	06 .852-01	.0088
044532	60	51	.10976832	06 .852-01	-.0010
044632	60	51	.10977618	06 .852-01	-.0020
044732	60	51	.10978404	06 .852-01	.0098
044832	60	51	.10979188	06 .852-01	-.0010
044932	60	51	.10979972	06 .852-01	-.0010
045032	60	51	.10980754	06 .852-01	.0117
045132	60	51	.10981535	06 .852-01	-.0146
045232	60	51	.10982314	06 .852-01	.0215
045332	60	51	.10983093	06 .852-01	-.0127
045432	60	51	.10983870	06 .852-01	.0146
045532	60	51	.10984646	06 .852-01	-.0117

STATION NUMBER 51 65/03/23 ITERATION NUMBER 5 PASS NUMBER 03/235

FREQUENCY 8307.0

TIME	TC	Q	CC3		
045832	60	51	.10986966	06 .852-01	.0029
045932	60	51	.10987737	06 .852-01	-.0039
050032	60	51	.10988506	06 .852-01	.0029
050132	60	51	.10989274	06 .852-01	.0059
050232	60	51	.10990041	06 .852-01	.0059
050332	60	51	.10990806	06 .852-01	.0049
050432	60	51	.10991570	06 .852-01	.0000
050532	60	51	.10992332	06 .852-01	-.0059
050632	60	51	.10993093	06 .852-01	.0029
050732	60	51	.10993852	06 .852-01	.0107
050832	60	51	.10994610	06 .852-01	-.0010
050932	60	51	.10995366	06 .852-01	.0029
051032	60	51	.10996121	06 .852-01	-.0107
051132	60	51	.10996874	06 .852-01	.0088
051632	60	51	.11000615	06 .852-01	.0127
051732	60	51	.11001358	06 .852-01	-.0029
051832	60	51	.11002100	06 .852-01	-.0020
051932	60	51	.11002840	06 .852-01	.0156
052032	60	51	.11003578	06 .852-01	-.0146
052132	60	51	.11004314	06 .852-01	.0049
052232	60	51	.11005049	06 .852-01	.0107
052332	60	51	.11005782	06 .852-01	-.0010
052432	60	51	.11006513	06 .852-01	.0059
054532	60	51	.11021410	06 .852-01	.0010
054632	60	51	.11022096	06 .852-01	.0039
054732	60	51	.11022780	06 .852-01	-.0029
054832	60	51	.11023462	06 .852-01	.0117
054932	60	51	.11024142	06 .852-01	-.0010
055032	60	51	.11024819	06 .852-01	.0098
055132	60	51	.11025494	06 .852-01	.0088
055232	60	51	.11026167	06 .852-01	-.0010
055332	60	51	.11026837	06 .852-01	-.0039
055432	60	51	.11027505	06 .852-01	.0000
055532	60	51	.11028171	06 .852-01	.0088
055632	60	51	.11028834	06 .852-01	-.0059
055732	60	51	.11029495	06 .852-01	.0020
055832	60	51	.11030153	06 .852-01	.0186
055932	60	51	.11030809	06 .852-01	.0078
060032	60	51	.11031463	06 .852-01	-.0107
060132	60	51	.11032114	06 .852-01	.0117
060232	60	51	.11032762	06 .852-01	-.0068
060332	60	51	.11033408	06 .852-01	-.0010
060432	60	51	.11034052	06 .852-01	.0137
060532	60	51	.11034693	06 .852-01	.0029
060632	60	51	.11035331	06 .852-01	.0020
060732	60	51	.11035967	06 .852-01	.0098
060832	60	51	.11036600	06 .852-01	.0059
060932	60	51	.11037231	06 .852-01	.0029
061032	60	51	.11037859	06 .852-01	.0049
061132	60	51	.11038485	06 .852-01	.0010
061232	60	51	.11039108	06 .852-01	.0059
061332	60	51	.11039728	06 .852-01	.0049

STATION NUMBER 51 65/03/23 ITERATION NUMBER 5 PASS NUMBER 03/235

FREQUENCY 8307.0

TIME	TC	Q	CC3		
061432	60	51	.11040345	06 .852-01	-.0039
061532	60	51	.11040960	06 .852-01	-.0010
061632	60	51	.11041572	06 .852-01	.0107
061732	60	51	.11042181	06 .852-01	.0010
061832	60	51	.11042788	06 .852-01	.0020
061932	60	51	.11043392	06 .852-01	-.0029
062032	60	51	.11043993	06 .852-01	.0029
062132	60	51	.11044591	06 .852-01	.0039
062232	60	51	.11045187	06 .852-01	-.0010
062332	60	51	.11045779	06 .852-01	.0059
062432	60	51	.11046369	06 .852-01	.0078
062532	60	51	.11046956	06 .852-01	.0049
062632	60	51	.11047540	06 .852-01	-.0029
062732	60	51	.11048121	06 .852-01	.0020
063532	60	51	.11052666	06 .852-01	-.0068
063632	60	51	.11053220	06 .852-01	.0137
063732	60	51	.11053772	06 .852-01	-.0029
063832	60	51	.11054320	06 .852-01	-.0049
063932	60	51	.11054866	06 .852-01	.0068
064032	60	51	.11055408	06 .852-01	.0000
064132	60	51	.11055948	06 .852-01	.0059
064232	60	51	.11056484	06 .852-01	-.0059
064332	60	51	.11057017	06 .852-01	-.0039
064432	60	51	.11057547	06 .852-01	.0127
064532	60	51	.11058074	06 .852-01	-.0068
064632	60	51	.11058597	06 .852-01	.0068
064732	60	51	.11059118	06 .852-01	.0010
064832	60	51	.11059635	06 .852-01	-.0059
064932	60	51	.11060150	06 .852-01	.0039
065332	60	51	.11062174	06 .852-01	.0088
065432	60	51	.11062672	06 .852-01	-.0059
065532	60	51	.11063167	06 .852-01	-.0029
065632	60	51	.11063658	06 .852-01	.0000
065732	60	51	.11064146	06 .852-01	.0010
065832	60	51	.11064631	06 .852-01	.0039
065932	60	51	.11065113	06 .852-01	.0049
070032	60	51	.11065591	06 .852-01	-.0098
070132	60	51	.11066066	06 .852-01	.0088
070232	60	51	.11066537	06 .852-01	-.0059
070332	60	51	.11067005	06 .852-01	.0137
070432	60	51	.11067470	06 .852-01	-.0010
070532	60	51	.11067931	06 .852-01	.0039
070632	60	51	.11068389	06 .852-01	-.0088
070932	60	51	.11069742	06 .852-01	.0107
071032	60	51	.11070186	06 .852-01	.0029
071132	60	51	.11070627	06 .852-01	-.0186
071432	60	51	.11071928	06 .852-01	.0049
071532	60	51	.11072354	06 .852-01	.0049
071632	60	51	.11072778	06 .852-01	-.0088
071732	60	51	.11073197	06 .852-01	-.0049
071832	60	51	.11073613	06 .852-01	.0186
071932	60	51	.11074025	06 .852-01	-.0049

STATION NUMBER 51 65/03/23 ITERATION NUMBER 5 PASS NUMBER 03/235

FREQUENCY 8307.0

TIME	TC	Q	CC3		
072032	60	51	.11074434	06 .852-01	.0059
072132	60	51	.11074840	06 .852-01	.0039
072232	60	51	.11075241	06 .852-01	-.0127
072332	60	51	.11075639	06 .852-01	.0059
072432	60	51	.11076034	06 .852-01	-.0049
072532	60	51	.11076424	06 .852-01	.0049
072632	60	51	.11076812	06 .852-01	-.0010
072732	60	51	.11077195	06 .852-01	-.0029
072832	60	51	.11077575	06 .852-01	.0000
072932	60	51	.11077951	06 .852-01	.0049
073032	60	51	.11078324	06 .852-01	-.0039
073332	60	51	.11079419	06 .852-01	.0098
073932	60	51	.11081508	06 .852-01	-.0020
074032	60	51	.11081844	06 .852-01	-.0039
074132	60	51	.11082175	06 .852-01	.0010
074232	60	51	.11082502	06 .852-01	.0098
074332	60	51	.11082826	06 .852-01	-.0107
074432	60	51	.11083146	06 .852-01	.0068
074532	60	51	.11083462	06 .852-01	-.0029
074632	60	51	.11083774	06 .852-01	-.0078
074732	60	51	.11084082	06 .852-01	.0088
074832	60	51	.11084387	06 .852-01	-.0020
074932	60	51	.11084687	06 .852-01	-.0078
075032	60	51	.11084984	06 .852-01	-.0088
075132	60	51	.11085277	06 .852-01	.0137
075232	60	51	.11085566	06 .852-01	-.0098
075332	60	51	.11085851	06 .852-01	-.0098
075432	60	51	.11086132	06 .852-01	-.0049
075532	60	51	.11086409	06 .852-01	.0068
075632	60	51	.11086683	06 .852-01	-.0098
075732	60	51	.11086952	06 .852-01	-.0029
075832	60	51	.11087217	06 .852-01	-.0078
075932	60	51	.11087479	06 .852-01	-.0049
080032	60	51	.11087736	06 .852-01	.0039
080332	60	51	.11088485	06 .852-01	-.0156
080432	60	51	.11088726	06 .852-01	.0020
080532	60	51	.11088964	06 .852-01	-.0068
080632	60	51	.11089198	06 .852-01	-.0098
080732	60	51	.11089427	06 .852-01	-.0049
080832	60	51	.11089653	06 .852-01	-.0098
080932	60	51	.11089874	06 .852-01	.0088
081032	60	51	.11090091	06 .852-01	-.0166
081132	60	51	.11090305	06 .852-01	.0000
081232	60	51	.11090514	06 .852-01	-.0107
081332	60	51	.11090720	06 .852-01	-.0146
081432	60	51	.11090921	06 .852-01	-.0098
081532	60	51	.11091118	06 .852-01	.0020
081632	60	51	.11091311	06 .852-01	-.0117
081932	60	51	.11091866	06 .852-01	.0068
082232	60	51	.11092384	06 .852-01	-.0049
082332	60	51	.11092548	06 .852-01	-.0156
082432	60	51	.11092708	06 .852-01	.0000

STATION NUMBER 51 65/03/23 ITERATION NUMBER 5 PASS NUMBER 03/235

FREQUENCY 8307.0

TIME	TC	Q	CC3			
082732	60	51	.11093164	06	.852-01	-.0098
083232	60	51	.11093841	06	.852-01	-.0107
083532	60	51	.11094197	06	.852-01	-.0039
083632	60	51	.11094307	06	.852-01	-.0059
083732	60	51	.11094413	06	.852-01	.0000
083832	60	51	.11094515	06	.852-01	-.0020
083932	60	51	.11094613	06	.852-01	-.0117
084132	60	51	.11094795	06	.852-01	-.0049
084232	60	51	.11094880	06	.852-01	-.0049
084332	60	51	.11094961	06	.852-01	.0039
084432	60	51	.11095038	06	.852-01	-.0117
084532	60	51	.11095110	06	.852-01	-.0010
084632	60	51	.11095178	06	.852-01	-.0146
084732	60	51	.11095242	06	.852-01	-.0039
085032	60	51	.11095408	06	.852-01	-.0137
085132	60	51	.11095455	06	.852-01	-.0146
085232	60	51	.11095497	06	.852-01	-.0078
085332	60	51	.11095535	06	.852-01	-.0059
085432	60	51	.11095570	06	.852-01	-.0137
085532	60	51	.11095599	06	.852-01	-.0107
085632	60	51	.11095625	06	.854-01	-.0156
085732	60	51	.11095646	06	.854-01	-.0107
085832	60	51	.11095663	06	.854-01	-.0127
			FREQUENCY 8349.0			
090632	60	51	.11095645	06	.854-01	-.0186
090732	60	51	.11095623	06	.854-01	-.0010

DATA STATISTICS STATION 5 ITERATION 5

PASS	DATA TYPE	BEGINNING TIME	END TIME	NUMBER OF POINTS	STD DEV	RMS	FIRST MOMENT	SECOND MOMENT
03/231	CC3	3/21-220117	3/21-220217	7	.677-01	.856-01	.525-01	.733-02
03/232	CC3	3/21-220227	3/22-083032	524	.284-01	.285-01	-.145-02	.810-03
03/233	CC3	3/22-083132	3/22-084332	11	.104-01	.110-01	.346-02	.121-03
03/235	CC3	3/23-013232	3/23-090732	337	.779-02	.783-02	.788-03	.613-04

ITERATION 5 GENERATED 14 PLOTS.

EPHEMERIS TAPE IV WITH MARS VELOCITIES. B-8 IS

GME	.39860139 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63783044 04
G	.66709998-19	A	.88782497 29	B	.88800499 29	C	.88837498 29	OME	.41780741-02	AU	.14959900 09
GMM	.49027856 04	GMS	.13271544 12	GMV	.32476952 06	GMA	.42977799 05	GMC	.37918700 08	GMJ	.12671062 09
EGM	.39860320 06	MGM	.49027779 04	JA	.29200000-02	HA	.00000000 00	DA	.00000000 00	RA	.34170000 04
ARA	.35670000 01	GB	.39515566 00	MAS	.37410000 03	GB1	.00000000 00	GB2	.00000000 00	SC	.10200000 09

INJECTION CONDITIONS MOON 235712024377202000000000 J.D.= 2438841.40958333 MARCH 21,1965 21 49 48.000

GEOCENTRIC X0-.14189958 04 Y0 .59894570 04 Z0 .23043945 04 DX0-.10386558 02 DY0-.79863629 00 DZ0-.34293785 01
CARTESIAN GMC .00000000 00 SGC .00000000 00 T0 .78588000 05 GHA .14664570 03 GHO .17829921 03
DATE OF RUN 092965G 000000 EARTH IS THE CENTRAL BODY FOR INTEGRATION COWELL EQUATIONS OF MOTION

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. 235712024377202000000000 J.D.= 2438841.40958333 MARCH 21,1965 21 49 48.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.14189958 04	Y	.59894568 04	Z	.23043945 04	DX	-.10386557 02	DY	-.79863629 00	DZ	-.34293784 01
R	.65724711 04	DEC	.20524819 02	RA	.10332852 03	V	.10967180 02	PTH	.16316545 01	AZ	.11016285 03
R	.65724710 04	LAT	.20524820 02	LON	.31668282 03	VE	.10547151 02	PTE	.16966523 01	AZE	.11100371 03
XS	.14904462 09	YS	.25551776 07	ZS	.11084882 07	DXS	-.61624519-01	DYS	.27415670 02	DZS	.11888062 02
XM	-.21992972 06	YM	-.30359150 06	ZM	-.11818097 06	DXM	.79137395 00	DYM	-.52219293 00	DZM	-.31393385 00
XT	-.21992972 06	YT	-.30359150 06	ZT	-.11818097 06	DXT	.79137395 00	DYT	-.52219293 00	DZT	-.31393385 00
RS	.14907064 09	VS	.29882248 02	RM	.39306949 06	VM	.99875554 00	RT	.39306949 06	VT	.99875554 00
GED	.20652921 02	ALT	.19691894 03	LOS	.21433647 03	RAS	.98216497 00	RAM	.23407943 03	LOM	.87433731 02
DUT	.36000000 02	DT	.37500000 01	DR	.31227872 00	SHA	.64428338 04	DES	.42605525 00	DEM	-.17497353 02
DAC	.00000000 00	CCL	.10619137 03	MCL	.18018450 03	TCL	.18018450 03				

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 235712024366202314675760 J.D.= 2438841.40918518 MARCH 21,1965 21 49 13.601

SMA	.39263644 06	ECC	.98327436 00	B	.71511091 05	SLR	.13024355 05	APO	.77870577 06	RCA	.65670970 04
VH	.92528196-01	C3	-.10151920 01	C1	.72052246 05	TFP	.34399445 02	TF	-.95554013-02	PER	.40807981 05
TA	.32910761 01	MTA	.00000000 00	EA	.30231142 00	MA	.50577524-02	C3J	-.13938589 01	TFI	.00000000 00

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	-.14189958 04	Y	.59894568 04	Z	.23043945 04	DX	-.10386557 02	DY	-.79863629 00	DZ	-.34293784 01
INC	.28462727 02	LAN	.32700536 03	APF	.12934463 03	MX	-.94129230 00	MY	-.98808768-01	MZ	-.32280886 00
WX	-.25953029 00	WY	-.39972382 00	WZ	.87912732 00	PX	-.16150562 00	PY	.91546404 00	PZ	.36856684 00
QX	-.95213439 00	QY	-.46329737-01	QZ	-.30214829 00	RX	-.64033491-01	RY	.36296174 00	RZ	-.92960124 00
BX	.95213443 00	BY	.46329739-01	BZ	.30214830 00	TX	.98479219 00	TY	.17373645 00	TZ	.00000000 00
DAP	.21627257 02	RAP	.10000514 03								
BTQ	.67628303 05	BRQ	-.23243250 05	B	.71511091 05	THA	.34103260 03				

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.14904604 09	Y	-.25491881 07	Z	-.11061837 07	DX	-.10324933 02	DY	-.28214307 02	DZ	-.15317440 02
R	.14907194 09	LAT	-.42516561 00	LON	.18097985 03	V	.33723512 02	PTH	.18892176 02	AZ	.11852497 03
XE	-.14904462 09	YE	-.25551776 07	ZE	-.11084882 07	DXE	.61624519-01	DYE	-.27415670 02	DZE	-.11888062 02
XT	-.14926455 09	YT	-.28587691 07	ZT	-.12266691 07	DXT	.85299847 00	DYT	-.27937863 02	DZT	-.12201995 02
LTE	-.42605525 00	LOE	.18098216 03	LTT	-.47076481 00	LOT	.18109721 03	RST	.14929696 09	VST	.30498204 02
EPS	.78598838 02	ESP	.27453512-18	SEP	.10139868 03	EPM	.45804447 02	EMP	.68685313 00	MEP	.13350865 03
MPS	.12440295 03	MSP	.12569964 00	SMP	.55471141 02	SEM	.12509232 03	EMS	.54784252 02	ESM	.12334256 00
RPM	.39762298 06	SPN	.25714521 01								
SAC	.61058536-10										
GCE	.25380862 03	GCT	.25399313 03	SIP	.12415251 03	CPT	.10124911 03	SIN	.10099867 03	D1	.13113050 00
REP	.65724711 04	VEP	.10967180 02	CPE	.10650660 03	CPS	.93254578 02	D2	.74595460-01	D3	.39435649-03

2 DAYS 9 HRS. 15 MIN. 37.921 SEC. 23571217111520236573776 7 J.D.= 2438843.79543890 MARCH 24,1965 07 05 25.921

GEOCENTRIC EQUATORIAL COORDINATES

X	-.99965081 04	Y	-.33540898 06	Z	-.15457689 06	DX	.11721765 00	DY	-.10229477 01	DZ	-.40752844 00
R	.36944976 06	DEC	-.24733463 02	RA	.26829286 03	V	.11073578 01	PTH	.81798161 02	AZ	.69158878 02
R	.36944975 06	LAT	-.24733464 02	LON	.34038752 03	VE	.24346375 02	PTE	.25802268 01	AZE	.27013240 03
XS	.14890542 09	YS	.82035993 07	ZS	.35577580 07	DXS	-.12887861 01	DYS	.27376789 02	DZS	.11871123 02
XM	-.34810176 05	YM	-.36533348 06	ZM	-.16400059 06	DXM	.96222758 00	DYM	-.68155187-01	DZM	-.12255135 00
XT	-.34810176 05	YT	-.36533348 06	ZT	-.16400059 06	DXT	.96222758 00	DYT	-.68155187-01	DZT	-.12255135 00
RS	.14917365 09	VS	.29867593 02	RM	.40196579 06	VM	.97239182 00	RT	.40196579 06	VT	.97239182 00
GED	-.24881667 02	ALT	.36307533 06	LOS	.75248046 02	RAS	.31533911 01	RAM	.26455710 03	LOM	.33665175 03
DUT	.36000000 02	DT	.48000000 03	DR	.10960314 01	SHA	.36805169 06	DES	.13666201 01	DEM	-.24079033 02
DAC	.00000000 00	CCL	.28262286 03	MCL	.35240772 03	TCL	.35240772 03				

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 23571202725020226053776 7 J.D.= 2438841.47668263 MARCH 21,1965 23 26 25.380

SMA	.42788143 06	ECC	.98996338 00	B	.60469951 05	SLR	.85458589 04	APO	.85146838 06	RCA	.42944805 04
VH	.68545463-01	C3	-.93156970 00	C1	.58364297 05	TFP	.20034054 06	TF	.16103835 01	PER	.46424194 05
TA	.17067055 03	MTA	.00000000 00	EA	.82071073 02	MA	.25892603 02	C3J	-.14092131 01	TFI	.57260533 02

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	-.99965081 04	Y	-.33540898 06	Z	-.15457689 06	DX	.11721765 00	DY	-.10229477 01	DZ	-.40752844 00
INC	.31914633 02	LAN	.31599485 03	APF	.13700933 03	MX	.92972112 00	MY	-.17663198 00	MZ	.32314007 00
WX	-.36726861 00	WY	-.38024962 00	WZ	.84883668 00	PX	-.12401804 00	PY	.92448615 00	PZ	.36047873 00
QX	-.92180964 00	QY	.27121538-01	QZ	-.38669253 00	RX	-.47928200-01	RY	.35727832 00	RZ	-.93276744 00
BX	.92180978 00	BY	-.27121542-01	BZ	.38669258 00	TX	.99112179 00	TY	.13295708 00	TZ	.00000000 00
DAP	.21129599 02	RAP	.97640505 02								
BTQ	.55028851 05	BRQ	-.25068718 05	B	.60469951 05	THA	.33550808 03				

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.14891541 09	Y	-.85390082 07	Z	-.37123348 07	DX	.14060038 01	DY	-.28399737 02	DZ	-.12278651 02
R	.14920622 09	LAT	-.14256969 01	LON	.18328182 03	V	.30972361 02	PTH	.97594523 00	AZ	.11334054 03
XE	-.14890542 09	YE	-.82035993 07	ZE	-.35577580 07	DXE	.12887861 01	DYE	-.27376789 02	DZE	-.11871123 02
XT	-.14894023 09	YT	-.85689327 07	ZT	-.37217585 07	DXT	.22510137 01	DYT	-.27444945 02	DZT	-.11993674 02
LTE	-.13666201 01	LOE	.18315339 03	LTT	-.14290608 01	LOT	.18329275 03	RST	.14923293 09	VST	.30035650 02
EPS	.84872544 02	ESP	.14162004 00	SEP	.94986120 02	EPM	.14261168 03	EMP	.33924136 02	MEP	.34641607 01
MPS	.13189814 03	MSP	.98911702-02	SMP	.48090424 02	SEM	.98404264 02	EMS	.81443062 02	ESM	.15259359 00
RPM	.40000001 05	SPN	.83883369 02								
SAC	.60948685-10										
GCE	.77377138 02	GCT	.24978485 03	SIP	.12940785 03	CPT	.10306039 03	SIN	.10057010 03	D1	.13047322 01
REP	.36944976 06	VEP	.11073578 01	CPE	.77685203 02	CPS	.92656123 02	D2	.89977657 00	D3	.50930779-01

2 DAYS 9 HRS. 15 MIN. 37.921 SEC. 23571217111520236573776 7 J.D.= 2438843.79543890 MARCH 24,1965 07 05 25.921
CHANGE OF PHASE OCCURS AT THIS POINT EARTH IS THE CENTRAL BODY FOR INTEGRATION COWELL EQUATIONS OF MOTION

2 DAYS 16 HRS. 37 MIN. 6.464 SEC. 23571220605320247331263 2 J.D.= 2438844.10201925 MARCH 24,1965 14 26 54.464

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.90894972 04	Y	-.36480537 06	Z	-.16609019 06	DX	-.41012108 00	DY	-.21492504 01	DZ	-.88433025 00
R	.40093830 06	DEC	-.24472331 02	RA	.26857271 03	V	.23599823 01	PTH	.81041320 02	AZ	.28408046 03
R	.40093830 06	LAT	-.24472331 02	LON	.22999626 03	VE	.27067464 02	PTE	.49407359 01	AZE	.27018996 03
XS	.14886919 09	YS	.89286949 07	ZS	.38721741 07	DXS	-.14464029 01	DYS	.27368450 02	DZS	.11867519 02
XM	-.92666273 04	YM	-.36633798 06	ZM	-.16688552 06	DXM	.96571984 00	DYM	-.77128068-02	DZM	-.95217286-01
XT	-.92666273 04	YT	-.36633798 06	ZT	-.16688552 06	DXT	.96571984 00	DYT	-.77128068-02	DZT	-.95217286-01
RS	.14918697 09	VS	.29865735 02	RM	.40266632 06	VM	.97043321 00	RT	.40266632 06	VT	.97043321 00
GED	-.24619376 02	ALT	.39456380 06	LOS	.32485586 03	RAS	.34323045 01	RAM	.26855099 03	LOM	.22997454 03
DUT	.36000000 02	DT	.30000000 02	DR	.23311926 01	SHA	.39938888 06	DES	.14872882 01	DEM	-.24484758 02
DAC	.00000000 00	CCL	.28290166 03	MCL	.29802100 01	TCL	.29802100 01				

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14887828 09	Y	-.92935002 07	Z	-.40382643 07	DX	.10362819 01	DY	-.29517700 02	DZ	-.12751849 02
R	.14922271 09	LAT	-.15507261 01	LON	.18357196 03	V	.32171076 02	PTH	.20477419 01	AZ	.11331630 03
XE	-.14886919 09	YE	-.89286949 07	ZE	-.38721741 07	DXE	.14464029 01	DYE	-.27368450 02	DZE	-.11867519 02
XT	-.14887846 09	YT	-.92950328 07	ZT	-.40390597 07	DXT	.24121228 01	DYT	-.27376162 02	DZT	-.11962736 02
LTE	-.14872882 01	LOE	.18343230 03	LTT	-.15510284 01	LOT	.18357255 03	RST	.14922301 09	VST	.29972982 02
EPS	.84807885 02	ESP	.15339293 00	SEP	.95038762 02	EPM	.17457563 03	EMP	.54010203 01	MEP	.23196850-01
MPS	.99741501 02	MSP	.98911702-02	SMP	.80257840 02	SEM	.95058382 02	EMS	.84787609 02	ESM	.15387055 00
RPM	.17357509 04	SPN	.83896404 02								
SAC	.60935213-10										
GCE	.77098339 02	GCT	.26007854 03	SIP	.99741501 02	CPT	.99324510 02	SIN	.99324510 02	D1	.58988024 03
REP	.40093830 06	VEP	.23599823 01	CPE	.77404660 02	CPS	.92579642 02	D2	.38672646 03	D3	-.19913743 04

SELENOCENTRIC — EQUATORIAL COORDINATES

X	.17713013 03	Y	.15326172 04	Z	.79532421 03	DX	-.13758409 01	DY	-.21415376 01	DZ	-.78911296 00
R	.17357509 04	DEC	.27271137 02	RA	.83407366 02	V	.26649241 01	PTH	-.63886052 02	AZ	.72857160 02
R	.17357503 04	LAT	.41548322 01	LON	.35775075 03	VP	.26629741 01	PTP	-.63971767 02	AZP	.73875592 02
LTS	-.14809907 01	LNS	.27763134 03	LTE	.13634594 01	LNE	.23803200 01				
ALT	-.22491302 01	SHA	-.17107200 04	ALP	.67825268 00	DR	-.23928899 01	DP	.38719382-01	ASD	.90000000 02
HGE	.27519211 03	SVL	.29371990 01	HNG	.99754442 02	SIA	.84575628 02				
SAC	.60935213-10										

SELENOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2357122062712023037172 32 J.D.= 2438844.10858252 MARCH 24,1965 14 36 21.530

SMA	-.33750877 04	ECC	.11182642 01	B	.16892800 04	SLR	.84550913 03	APO	.00000000 00	RCA	.39915188 03
VH	.12052549 01	C3	.14526394 01	C1	.20360132 04	TFP	-.56706647 03	TF	.64775980 02	LTF	.64689031 02
TA	-.11729968 03	MTA	.15341137 03	EA	-.46899265 02	MA	-.11602470 02	C3J	-.13446578 01	TFI	.64618462 02
ZAE	.14003938 03	ZAP	.13448328 03	ZAC	.10315467 03	DEF	.12682274 03	IR	.38408916 04	GP	.28921241 01
OP1	.00000000 00	OY	.00000000 00	OP2	.38000000 02						

ALL VECTORS REFERENCED TO ORBIT PLANE OF TARGET

X	.17280446 04	Y	-.12928516 03	Z	.99890587 02	DX	-.23070404 01	DY	.13327914 01	DZ	.55243625-01
INC	.10036318 02	LAN	.33671269 03	APF	.13658204 03	MX	.64131768-01	MY	.98429066 00	MZ	.16449616 00
WX	-.68897150-01	WY	-.16007514 00	WZ	.98469748 00	PX	-.39961964 00	PY	.90882169 00	PZ	.11978004 00
QX	-.91408821 00	QY	-.38525190 00	QZ	-.12658438 00	RX	-.38722884-01	RY	.32346750-01	RZ	-.99872629 00
BX	.63855485 00	BY	.75128065 00	BZ	.16680855 00	TX	.64109255 00	TY	.76746357 00	TZ	.00000000 00
SXI	-.76648605 00	SYI	.64027599 00	SZI	.50455663-01	DAI	.28921241 01	RAI	.14012666 03		
SXO	-.51771782-01	SYO	-.98513919 00	SZO	-.16376930 00	DAO	-.94257489 01	RAO	.26699171 03		
ETE	.17654345 03	ETS	.96818370 01	ETC	.26256522 03						

BTO	.16655514 04	BRO	-.28214576 03	B	.16892803 04	THA	.35038532 03				

ALL VECTORS REFERENCED TO TRUE LUNAR EQU. PLANE

X	.17298548 04	Y	-.67943471 02	Z	.12575851 03	DX	-.23640186 01	DY	.12209181 01	DZ	.15031184 00
INC	.16576749 02	LAN	.34362578 03	APF	.13201114 03	MX	.17684583-01	MY	.96101028 00	MZ	.27594645 00
WX	-.80428606-01	WY	-.27372791 00	WZ	.95843843 00	PX	-.44137275 00	PY	.87192535 00	PZ	.21198160 00
QX	-.89371211 00	QY	-.40597921 00	QZ	-.19094378 00	RX	-.83180857-01	RY	.62592664-01	RZ	-.99456675 00
BX	.60164636 00	BY	.75330129 00	BZ	.26562913 00	TX	.60127198 00	TY	.79904443 00	TZ	.00000000 00
SXI	-.79470304 00	SYI	.59800513 00	SZI	.10410042 00	DAI	.59753405 01	RAI	.14303895 03		
SXO	-.53135864-02	SYO	-.96142206 00	SZO	-.27502593 00	DAO	-.15963558 02	RAO	.26968333 03		
ETE	.31436372 01	ETS	.31499524 02	ETC	.29413441 03						
BTT	.16279163 04	BRT	-.45117344 03	B	.16892806 04	THA	.34450940 03				

U MATRIX FOR MAPPING FORWARD ITERATION NUMBER 5

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.10389405 03	.82890310 02	.80754642 02	.60139790-03	.10215090-02	.69092757-03	.00000000 00	.00000000 00	.00000000 00
Y	-.27961224 03	-.40461524 03	-.24639744 03	-.18300145-02	-.44108464-02	-.24267989-02	.00000000 00	.00000000 00	.00000000 00
Z	-.84163964 02	-.14049763 03	-.13111508 03	-.59756962-03	-.16183908-02	-.10958345-02	.00000000 00	.00000000 00	.00000000 00
DX	.34921494 06	.49132654 06	.32332960 06	.22955954 01	.54044557 01	.30937348 01	.00000000 00	.00000000 00	.00000000 00
DY	-.20081116 05	.47016871 05	.11933948 05	-.35212705-01	.41151349 00	.17020524 00	.00000000 00	.00000000 00	.00000000 00
DZ	.91703167 05	.16291890 06	.10848399 06	.65797653 00	.17767515 01	.10017059 01	.00000000 00	.00000000 00	.00000000 00
KE	.49508705 01	.69411764 01	.46040325 01	.32929711-04	.77706601-04	.44514184-04	.10000000 01	.00000000 00	.00000000 00
RE	.24623966 00	.23959160 00	.56974410-01	.75692077-05	.67055225-05	.15745754-05	.00000000 00	.10000000 01	.00000000 00
G	-.39818382 00	-.79511165-01	-.43650388-01	-.55405106-05	-.10519943-05	-.53400435-06	.00000000 00	.00000000 00	.10000000 01
KM	-.65761565-01	-.78742027-01	-.22999763-01	-.17026104-05	-.20080333-05	-.60714956-06	.00000000 00	.00000000 00	.00000000 00
RI(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
Y	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
Z	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DX	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DY	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DZ	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
KE	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RE	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
G	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
KM	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(03)	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(03)	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(03)	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00
LO(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00
RI(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00
LA(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01
LO(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00

LO(05)

X	.00000000 00
Y	.00000000 00
Z	.00000000 00
DX	.00000000 00
DY	.00000000 00
DZ	.00000000 00
KE	.00000000 00
RE	.00000000 00
G	.00000000 00
KM	.00000000 00
RI(03)	.00000000 00
LA(03)	.00000000 00
LO(03)	.00000000 00
RI(04)	.00000000 00
LA(04)	.00000000 00
LO(04)	.00000000 00
RI(05)	.00000000 00
LA(05)	.00000000 00
LO(05)	.10000000 01

CONDITIONS AFTER FORWARD MAPPING 65/03/21 214948.000 TO 65/03/23 123038.000

X= -.19399532 05 Y= -.26223640 06 Z= -.12476527 06 DX= .14653538 00 DY= -.12000017 01 DZ= -.49806944 00

STANDARD DEVIATIONS

X= .29064506 01 Y= .25515337 01 Z= .56441052 01 DX= .13579802-04 DY= .12533971-04 DZ= .30081594-04

12 COVARIANCE MATRIX AFTER MAPPING ITERATION NUMBER 5

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.84474549 01	.14561339 01	-.50623761 01	.39176971-04	.16369347-04	-.34102875-04	-.64273190-02	-.29819288-01	-.12252985-01
Y	.14561339 01	.65103240 01	-.14283697 02	.70037795-05	.29815503-04	-.72893805-04	-.44393167 00	-.79620121-01	.17246938-01
Z	-.50623761 01	-.14283697 02	.31855924 02	-.23979837-04	-.67553312-04	.16448867-03	.88693952 00	.17707050 00	-.35384780-01
DX	.39176971-04	.70037795-05	-.23979837-04	.18441102-09	.79962306-10	-.16820798-09	-.44635361-06	-.13971031-06	-.36544378-06
DY	.16369347-04	.29815503-04	-.67553312-04	.79962306-10	.15710043-09	-.37450237-09	-.28569141-05	-.37524036-06	.10548571-06
DZ	-.34102875-04	-.72893805-04	.16448867-03	-.16820798-09	-.37450237-09	.90490233-09	.69318823-05	.90730846-06	-.18464824-06
KE	-.64273190-02	-.44393167 00	.88693952 00	-.44635361-06	-.28569141-05	.69318823-05	.35035059 00	.49356120-02	.12011217-01
RE	-.29819288-01	-.79620121-01	.17707050 00	-.13971031-06	-.37524036-06	.90730846-06	.49356120-02	.10773850-02	-.20393996-03
G	-.12252985-01	.17246938-01	-.35384780-01	-.36544378-06	.10548571-06	-.18464824-06	.12011217-01	-.20393996-03	.89880741-01
KM	.81626583 00	.17171922 00	-.55659059 00	.37657923-05	.17038100-05	-.36076636-05	.75019932-02	-.34480814-02	-.64875425-03
RI(03)	.33799979-01	.11640244 00	-.25854200 00	.15935824-06	.53773908-06	-.13235608-05	-.67276716-02	-.14416941-02	.29186722-03
LA(03)	-.22523347-03	-.71388099-03	.15884677-02	-.10414788-08	-.32664065-08	.80312657-08	.38635064-04	.90453643-05	-.16731683-05
LO(03)	.12015635-02	-.17815320-03	.15241317-03	.54461619-08	.56308831-09	-.19560844-10	.21305596-04	.33621456-06	.52090307-06
RI(04)	.32139745-01	.11259750 00	-.24913568 00	.15068055-06	.51678566-06	-.12605200-05	-.57473567-02	-.14056407-02	.24741089-03
LA(04)	.15892639-03	.68859019-03	-.15133583-02	.73794088-09	.30628620-08	-.75207233-08	-.36090348-04	-.86288115-05	.13610534-05
LO(04)	.13706580-02	-.17753786-04	-.23314690-03	.62827984-08	.15622000-08	-.23796396-08	.63390809-05	-.21692641-05	.19921434-06
RI(05)	.20076015-01	.12298862 00	-.27200142 00	.60672873-07	.51888405-06	-.12668745-05	.17294934-02	-.15094843-02	.33659642-03
LA(05)	.25443991-03	.58621544-03	-.12282018-02	.18149179-08	.31504054-08	-.76591369-08	-.18298587-03	-.79185679-05	.49131086-06
LO(05)	.12896303-02	-.68639160-04	-.10816827-03	.58900050-08	.11979495-08	-.15897782-08	.34550509-05	-.13480872-05	-.44637913-06

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	.81626583 00	.33799979-01	-.22523347-03	.12015635-02	.32139745-01	.15892639-03	.13706580-02	.20076015-01	.25443991-03
Y	.17171922 00	.11640244 00	-.71388099-03	-.17815320-03	.11259750 00	.68859019-03	-.17753786-04	.12298862 00	.58621544-03
Z	-.55659059 00	-.25854200 00	.15884677-02	.15241317-03	-.24913568 00	-.15133583-02	-.23314690-03	-.27200142 00	-.12282018-02
DX	.37657923-05	.15935824-06	-.10414788-08	.54461619-08	.15068055-06	.73794088-09	.62827984-08	.60672873-07	.18149179-08
DY	.17038100-05	.53773908-06	-.32664065-08	.56308831-09	.51678566-06	.30628620-08	.15622000-08	.51888405-06	.31504054-08
DZ	-.36076636-05	-.13235608-05	.80312657-08	-.19560844-10	-.12605200-05	-.75207233-08	-.23796396-08	-.12668745-05	-.76591369-08
KE	.75019932-02	-.67276716-02	.38635064-04	.21305596-04	-.57473567-02	-.36090348-04	.63390809-05	.17294934-02	-.18298587-03
RE	-.34480814-02	-.14416941-02	.90453643-05	.33621456-06	-.14056407-02	-.86288115-05	-.21692641-05	-.15094843-02	-.79185679-05
G	-.64875425-03	.29186722-03	-.16731683-05	.52090307-06	.24741089-03	.13610534-05	.19921434-06	.33659642-03	.49131086-06
KM	.89864475-01	.45102839-02	-.28514435-04	.11703371-03	.35336749-02	.18105301-04	.13536304-03	.26085120-02	.20626165-04
RI(03)	.45102839-02	.56619235-02	.28509473-04	-.15839119-05	.20169678-02	.12339076-04	.57963268-06	.22090485-02	.97580559-05
LA(03-	.28514435-04	.28509473-04	.61919426-06	.17787663-07	-.12491235-04	-.76659639-07	-.63543539-08	-.13858159-04	-.58540685-07
LO(03)	.11703371-03	-.15839119-05	.17787663-07	.24436680-06	-.22281250-05	-.18640896-07	.24380715-06	-.31506924-05	-.13812588-07
RI(04)	.35336749-02	.20169678-02	-.12491235-04	-.22281250-05	.46439218-02	-.26781587-04	.45665327-06	.22111403-02	.90900051-05
LA(04)	.18105301-04	.12339076-04	-.76659639-07	-.18640896-07	-.26781587-04	.67119265-06	.95743489-09	.13251479-04	.63853691-07
LO(04)	.13536304-03	.57963268-06	-.63543539-08	.24380715-06	.45665327-06	.95743489-09	.27233175-06	-.85720614-06	.13418928-07
RI(05)	.26085120-02	.22090485-02	-.13858159-04	-.31506924-05	.22111403-02	.13251479-04	-.85720614-06	.42231560-02	-.21219193-04
LA(05)	.20626165-04	.97580559-05	-.58540685-07	-.13812588-07	.90900051-05	.63853691-07	.13418928-07	-.21219193-04	.67524588-06
LO(05)	.12329080-03	-.59651766-06	.12723506-09	.23233488-06	-.18613674-06	-.65221054-08	.24903254-06	-.19822935-05	.83214364-08

	LO(05)
X	.12896303-02
Y	-.68639160-04
Z	-.10816827-03
DX	.58900050-08
DY	.11979495-08
DZ	-.15897782-08
KE	.34550509-05
RE	-.13480872-05
G	-.44637913-06
KM	.12329080-03
RI(03	-.59651766-06
LA(03)	.12723506-09
LO(03)	.23233488-06
RI(04	-.18613674-06
LA(04	-.65221054-08
LO(04)	.24903254-06
RI(05	-.19822935-05
LA(05)	.83214364-08
LO(05)	.24376461-06

U MATRIX FOR MAPPING FORWARD ITERATION NUMBER 5

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.27732974 03	.45558991 03	.22736001 03	.47150930-01	.32485130 00	.14124947 00	.00000000 00	.00000000 00	.00000000 00
Y	-.96450251 03	-.18367792 04	-.82589854 03	-.23233627 00	-.12362583 01	-.57685813 00	.00000000 00	.00000000 00	.00000000 00
Z	-.33744974 03	-.66959327 03	-.33980184 03	-.93812456-01	-.46165122 00	-.19830016 00	.00000000 00	.00000000 00	.00000000 00
DX	.11969021 07	.22634516 07	.10380296 07	.28573307 03	.15331944 04	.70633440 03	.00000000 00	.00000000 00	.00000000 00
DY	.29893201 05	.14062016 06	.53040266 05	.31623126 02	.79574613 02	.42041779 02	.00000000 00	.00000000 00	.00000000 00
DZ	.36396607 06	.72726165 06	.33473858 06	.98964917 02	.48782646 03	.22431451 03	.00000000 00	.00000000 00	.00000000 00
KE	.17074709 02	.32322746 02	.14842132 02	.40880730-02	.21897789-01	.10080088-01	.10000000 01	.00000000 00	.00000000 00
RE	.65625000 02	.68250000 02	-.53375000 02	.63781738-02	.52612304-01	.61828613-01	.00000000 00	.10000000 01	.00000000 00
G	-.11699448 01	-.98478699 00	-.40216827 00	.94166025-04	-.81184506-03	-.39180368-03	.00000000 00	.00000000 00	.10000000 01
KM	-.16718750 01	-.25839844 01	-.53857422 00	-.23508072-03	-.17604828-02	-.10881424-02	.00000000 00	.00000000 00	.00000000 00
RI(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
Y	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
Z	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DX	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DY	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DZ	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
KE	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RE	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
G	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
KM	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(03)	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(03)	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(03)	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00
LO(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00
RI(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00
LA(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01
LO(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00

LO(05)

X	.00000000 00
Y	.00000000 00
Z	.00000000 00
DX	.00000000 00
DY	.00000000 00
DZ	.00000000 00
KE	.00000000 00
RE	.00000000 00
G	.00000000 00
KM	.00000000 00
RI(03)	.00000000 00
LA(03)	.00000000 00
LO(03)	.00000000 00
RI(04)	.00000000 00
LA(04)	.00000000 00
LO(04)	.00000000 00
RI(05)	.00000000 00
LA(05)	.00000000 00
LO(05)	.10000000 01

COVARIANCE MATRIX AT IMPACT ITERATION NUMBER 5

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.11429991 02	.48467741 01	.33802558 01	-.19493665-02	.65555075-02	.24442776-02	.18408785 00	.22812750-01	-.68590840-01
Y	.48467741 01	.45550799 01	-.30035481 01	-.14367311-02	.67738318-03	.25276605-02	-.26825998 00	-.33503094-01	-.24064950-01
Z	.33802558 01	-.30035481 01	.94147826 01	.60575521-03	.59450144-02	-.20347391-02	.61461407 00	.85454551-01	-.31736986-01
DX	-.19493665-02	-.14367311-02	.60575521-03	.58777891-06	-.39602223-06	-.72727783-06	.20753126-04	.11977609-04	.95131740-05
DY	.65555075-02	.67738318-03	.59450144-02	-.39602223-06	.59522827-05	.22417650-06	.32894842-03	.59342729-04	-.44290320-04
DZ	.24442776-02	.25276605-02	-.20347391-02	-.72727783-06	.22417650-06	.14970973-05	-.17192054-03	-.17150383-04	-.10993415-04
KE	.18408785 00	-.26825998 00	.61461407 00	.20753126-04	.32894842-03	-.17192054-03	.35035059 00	.49356120-02	.12011217-01
RE	.22812750-01	-.33503094-01	.85454551-01	.11977609-04	.59342729-04	-.17150383-04	.49356120-02	.10773850-02	-.20393996-03
G	-.68590840-01	-.24064950-01	-.31736986-01	.95131740-05	-.44290320-04	-.10993415-04	.12011217-01	-.20393996-03	.89880741-01
KM	.76958627 00	.49453846 00	-.11609714 00	-.21538963-03	.21432275-03	.24500966-03	.75019932-02	-.34480814-02	-.64875425-03
RI(03)	-.37759658-01	.48938427-01	-.13524364 00	-.14825005-04	-.87591373-04	.29319497-04	-.67276716-02	-.14416941-02	.29186722-03
LA(03)	.22354405-03	-.29685383-03	.80979897-03	.95902153-07	.53540218-06	-.17128605-06	.38635064-04	.90453643-05	-.16731683-05
LO(03)	.14494170-02	.67979638-03	.40787150-03	-.27865551-06	.76541281-06	.30209613-06	.21305596-04	.33621456-06	.52090307-06
RI(04)	-.36581559-01	.48364082-01	-.12806817 00	-.13876313-04	-.83526330-04	.27917902-04	-.57473567-02	-.14056407-02	.24741089-03
LA(04)	-.27237876-03	.26338738-03	-.77513225-03	-.75940529-07	-.53262375-06	.15092426-06	-.36090348-04	-.86288115-05	.13610534-05
LO(04)	.15160023-02	.80601013-03	.23564337-03	-.33277580-06	.68416552-06	.36509023-06	.63390809-05	-.21692641-05	.19921434-06
RI(05)	-.60251102-01	.39500723-01	-.13993418 00	-.11144962-04	-.10037811-03	.23835285-04	.17294934-02	-.15094843-02	.33659642-03
LA(05)	-.42755371-04	.36977902-03	-.60789616-03	-.95683473-07	-.34991833-06	.17976237-06	-.18298587-03	-.79185679-05	.49131086-06
LO(05)	.14664560-02	.75116467-03	.28465161-03	-.30935242-06	.69697218-06	.33877987-06	.34550509-05	-.13480872-05	-.44637913-06

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	.76958627 00	-.37759658-01	.22354405-03	.14494170-02	-.36581559-01	-.27237876-03	.15160023-02	-.60251102-01	-.42755371-04
Y	.49453846 00	.48938427-01	-.29685383-03	.67979638-03	.48364082-01	.26338738-03	.80601013-03	.39500723-01	.36977902-03
Z	-.11609714 00	-.13524364 00	.80979897-03	.40787150-03	-.12806817 00	-.77513225-03	.23564337-03	-.13993418 00	-.60789616-03
DX	-.21538963-03	-.14825005-04	.95902153-07	-.27865551-06	-.13876313-04	-.75940529-07	-.33277580-06	-.11144962-04	-.95683473-07
DY	.21432275-03	-.87591373-04	.53540218-06	.76541281-06	-.83526330-04	-.53262375-06	.68416552-06	-.10037811-03	-.34991833-06
DZ	.24500966-03	.29319497-04	-.17128605-06	.30209613-06	.27917902-04	.15092426-06	.36509023-06	.23835285-04	.17976237-06
KE	.75019932-02	-.67276716-02	.38635064-04	.21305596-04	-.57473567-02	-.36090348-04	.63390809-05	.17294934-02	-.18298587-03
RE	-.34480814-02	-.14416941-02	.90453643-05	.33621456-06	-.14056407-02	-.86288115-05	-.21692641-05	-.15094843-02	-.79185679-05
G	-.64875425-03	.29186722-03	-.16731683-05	.52090307-06	.24741089-03	.13610534-05	.19921434-06	.33659642-03	.49131086-06
KM	.89864475-01	.45102839-02	-.28514435-04	.11703371-03	.35336749-02	.18105301-04	.13536304-03	.26085120-02	.20626165-04
RI(03)	.45102839-02	.56619235-02	.28509473-04	-.15839119-05	.20169678-02	.12339076-04	.57963268-06	.22090485-02	.97580559-05
LA(03	-.28514435-04	.28509473-04	.61919426-06	.17787663-07	-.12491235-04	-.76659639-07	-.63543539-08	-.13858159-04	-.58540685-07
LO(03)	.11703371-03	-.15839119-05	.17787663-07	.24436680-06	-.22281250-05	-.18640896-07	.24380715-06	-.31506924-05	-.13812588-07
RI(04)	.35336749-02	.20169678-02	-.12491235-04	-.22281250-05	.46439218-02	-.26781587-04	.45665327-06	.22111403-02	.90900051-05
LA(04)	.18105301-04	.12339076-04	-.76659639-07	-.18640896-07	-.26781587-04	.67119265-06	.95743489-09	.13251479-04	.63853691-07
LO(04)	.13536304-03	.57963268-06	-.63543539-08	.24380715-06	.45665327-06	.95743489-09	.27233175-06	-.85720614-06	.13418928-07
RI(05)	.26085120-02	.22090485-02	-.13858159-04	-.31506924-05	.22111403-02	.13251479-04	-.85720614-06	.42231560-02	-.21219193-04
LA(05)	.20626165-04	.97580559-05	-.58540685-07	-.13812588-07	.90900051-05	.63853691-07	.13418928-07	-.21219193-04	.67524588-06
LO(05)	.12329080-03	-.59651766-06	.12723506-09	.23233488-06	-.18613674-06	-.65221054-08	.24903254-06	-.19822935-05	.83214364-08

	LO(05)
X	.14664560-02
Y	.75116467-03
Z	.28465161-03
DX	-.30935242-06
DY	.69697218-06
DZ	.33877987-06
KE	.34550509-05
RE	-.13480872-05
G	-.44637913-06
KM	.12329080-03
RI(03	-.59651766-06
LA(03)	.12723506-09
LO(03)	.23233488-06
RI(04	-.18613674-06
LA(04	-.65221054-08
LO(04)	.24903254-06
RI(05	-.19822935-05
LA(05)	.83214364-08
LO(05)	.24376461-06

13 IMPACT PARAMETERS 65/03/24 142654

N MATRIX (TARGET ORBITAL PLANE)

	B.RO	B.TO	TL	C3	S.TS	S.RS
B.RO	.36414235 02	-.14417330 02	.62785692-03	.35737056-01	-.89267956-03	-.43849153-03
B.TO	-.14417329 02	.17970397 02	-.17471754-02	-.19274293-01	.22886256-02	.43056107-03
TL	.62785682-03	-.17471752-02	.21539734-06	.85995159-06	-.27463103-06	-.39174824-07
C3	.35737054-01	-.19274297-01	.85995181-06	.45555692-04	-.13636731-05	-.55200440-06
S.TS	-.89267956-03	.22886254-02	-.27463103-06	-.13636727-05	.35617107-06	.52541269-07
S.RS	-.43849185-03	.43056124-03	-.39174840-07	-.55200464-06	.52541294-07	.10899164-07

14 NORMALIZED N MATRIX

	B.RO	B.TO	TL	C3	S.TS	S.RS
B.RO	.10000000 01	-.56359926 00	.22418416 00	.87742873 00	-.24787383 00	-.69603170 00
B.TO	-.56359920 00	.10000000 01	-.88805013 00	-.67364068 00	.90462081 00	.97288011 00
TL	.22418412 00	-.88805006 00	.10000000 01	.27452538 00	-.99151688 00	-.80851908 00
C3	.87742867 00	-.67364081 00	.27452545 00	.10000000 01	-.33853971 00	-.78338384 00
S.TS	-.24787383 00	.90462077 00	-.99151687 00	-.33853962 00	.99999999 00	.84328549 00
S.RS	-.69603220 00	.97288050 00	-.80851942 00	-.78338420 00	.84328590 00	.99999998 00

15 DM/DQO MATRIX

	B.RO	B.TO	TL	C3	S.TS	S.RS
X	-.87134148 02	.49993625 02	.20793108 03	-.36659328-02	-.12652476 00	-.13220017-01
Y	.18728418 03	-.36910243 03	-.78042687 03	.14495476-01	.49347654 00	.51715772-01
Z	.12407151 03	-.17136962 03	-.28008470 03	.54091121-02	.18278761 00	.18986858-01
DX	-.26283842 06	.45267221 06	.96516695 06	-.17935380 02	-.61045315 03	-.63898181 02
DY	.88210706 04	.83353524 05	.43494358 05	-.10736528 01	-.34503551 02	-.35942429 01
DZ	-.82581510 05	.17399420 06	.30261315 06	-.57787061 01	-.19517170 03	-.20411161 02

B	.16892723 04
B.RO	-.28214198 03
B.TO	.16655440 04
B.RT	-.45117344 03
B.TT	.16279163 04
TL	.64689033 02
SMAA	.66563302 01
SMIA	.31745709 01
THETA	.61302327 02
DEL T	.16707931 01
DEL B	.73745936 01
DEL S	.20137695 01
TF	.64618462 02

16 N MATRIX (TARGET EQUATORIAL PLANE)

	B.RT	B.TT	TL
B.RT	.39157391 02	-.12236835 02	.80342670-03
B.TT	-.12236834 02	.15227239 02	-.16737179-02
TL	.80342659-03	-.16737177-02	.21539734-06

Appendix F

Ranger IX Postmaneuver ODP Printout

```
|  PAGE HEADING                                                          (23
   (RA9 POST M/C WITH PRE DATA AS APRIORI 22 SEPT)
   EPOCH                                                                 (01
   650302312,3038000
   PROBE POSITION AND VELOCITY AT EPOCH                                  (02
   X=-.19400734E05
   Y=-.26223542E06
   Z=-.12476777E06
   DX=.13594845E00
   DY=-.12091184E01
   DZ=-.50964415E00
   OTHER PARAMETER VALUES                                                (03
   ARMOON=3.567,MSMOON=374.1
   RSTOP=1735.75
   DUT=36.0
   KE=.39860070E06
   RE=.63783257E04
   GBMOON=.40246991E00
   KM=.49014745E04
   RI(3)=.63719047E04
   LA(3)=.35117255E02
   LO(3)=.24319443E03
   RI(4)=.63725563E04
   LA(4)=-.31212092E02
   LO(4)=.13688765E03
   RI(5)=.63755454E04
   LA(5)=-.25738887E02
   LO(5)=.27685444E02
   ESTIMATE THESE PARAMETERS                                             (04
   X,Y,Z,DX,DY,DZ
   KE,RE,G,KM
   RI(3),LA(3),LO(3)
   RI(4),LA(4),LO(4)
   RI(5),LA(5),LO(5)
   COVARIANCE MATRIX OF ESTIMATED PARAMETERS                             (10
    R01 21047444102215554355477 6/8      60370434672255037751052 0/8 $      12
        60452217670355140754273 6/8      16656376101213304225202 6/8 $      12
        16375127220213034232700 0/8      56342325513453011036772 0/8 $      12
        17641127224514353536344 0/8      57073211735453576013166 2/8 $      12
        57175046667053663014435 7/8      20453431601615151337344 6/8 $      12
        17546565242314240625215 3/8      56576152020253205533100 6/8 $      12
        17442547271614140060070 6/8      17543505465114222516342 0/8 $      12
        16561475131213246553637 2/8      17442667376414163132475 5/8 $      12
        17541165323714263206005 5/8      16640061202313352363513 7/8 $      12
        17442643371114172554175 2/8      00000000000000000000000 0/8 $      12
```

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R02 603704346722550377503577/8      204666202045151566424136/8 $      12
    605711616662552061773511/8      562406252602527752347664/8 $      12
    162702704110127401042601/8      564472135473531536572751/8 $      12
    577754105520544427613424/8      565417121435532400552514/8 $      12
    173726354104140175144132/8      201632747473146757640541/8 $      12
    176755302155143455077676/8      567616157350534135544726/8 $      12
    570535421076535131371574/8      176703174144143050522207/8 $      12
    167532613145134475612522/8      570450162033535064024664/8 $      12
    176751273762143221502154/8      167461165213134576034521/8 $      12
    570476330532535060614260/8      000000000000000000000000/8 $      12
R03 604522176703551407542663/8      605711616662552061775026/8 $      12
    207400310244154156356010/8      562626370623527777352646/8 $      12
    564435575516531127303150/8      165543037302132045243304/8 $      12
    200764661115145562451660/8      167454767757134366201036/8 $      12
    574761752636541146250001/8      603521230175550003441776/8 $      12
    600423334067545475220527/8      170674424102135513741443/8 $      12
    165575737707132642040172/8      577766177624544531363657/8 $      12
    570600110204535330174634/8      566446370735533665001424/8 $      12
    600417265713545544026552/8      570513075723535443017563/8 $      12
    564630615444531761776765/8      000000000000000000000000/8 $      12
R04 166563761012133042252034/8      562406252602527752353326/8 $      12
    562626370623527777352176/8      .01                        $      12
    142443462615107432111470/8      541526733754506672523471/8 $      12
    554513304240521307656566/8      546600664371513005611302/8 $      12
    553551455431520424706143/8      162614222353127163123726/8 $      12
    153547331371120310742303/8      544435366624511256343517/8 $      12
    152505162550117300012534/8      153517745007120470640551/8 $      12
    143717204466110430410510/8      152506775224117645073544/8 $      12
    153402626567120070705044/8      144626531163111662117777/8 $      12
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    .01                             542640527417507431547740/8 $      12
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    556527530233523677530026/8      546773450164513531443446/8 $      12
    544436660004511147262021/8      000000000000000000000000/8 $      12
R07 176411272245143535363440/8      577754105520544427613424/8 $      12
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    200514552240145237117772/8      557433065770524346372506/8 $      12
    172426427003137177463522/8      200443732070145733755652/8 $      12
    570700014215535604015412/8      161446202664126040067540/8 $      12
    164426105567131204561467/8      571500642706536633124124/8 $      12
    561756135246526300412632/8      163632203631130547310116/8 $      12
    171763150747136051500265/8      564725245243531403204075/8 $      12
    162547766742127070146133/8      000000000000000000000000/8 $      12
R08 570732117354535760131662/8      565417121435532400552514/8 $      12
    167454767757134366201036/8      546600664371513005611302/8 $      12
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    550751525264515751356664/8      554667143755521414746626/8 $      12
    560456670467525245037022/8      547703515116514472300474/8 $      12
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R09 571750466670536630144357/8      173726354104140175144132/8 $      12
    574761752636541146250001/8      553551455431520424706143/8 $      12
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R15	165614751312132465536372/8	167532613145134475612522/8	$	12
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      152575102667117505141351/8      000000000000000000000000/8 $      12
   R18 166400612023133523635137/8      167461165213134576034521/8 $      12
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  NOMINAL VALUES CORRESPONDING TO COVARIANCE MATRIX                      (15
  -.19400576E05,-.26223528E06,-.12476760E06
  .14653272E00,-.11999960E01,-.49808334E00
  .39860070E06,..63783257E04,..40246991E00
  .49014745E04,..63719047E04,..35117255E02
  .24319443E03,..63726563E04,-.31212092E02
  .13688765E03,..63755454E04,-.25738887E02
  .27685444E02
  STATISTICS,PLOT AND/OR PRINT RESIDUALS FOR THESE PARAMETERS            (14
  NHR=6.
  CC3(3)=.2 CC3(4)=.2 CC3(5)=.2
  REJECTION SIGMAS                                                       (06
  CC3(3)=.03
  CC3(4)=.03
  CC3(5)=.03
  OFFLINE CONTROL                                                        (27
  KEY(14)
  KEY(16)
  END DATA                                                               (0
0DP       024750
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2 INPUT COVARIANCE MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 2

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.84505887 01	.14558778 01	-.50625427 01	-.76387576-04	.22258141-04	-.29197904-04	-.62856768-02	-.29891518-01	-.13852678-01
Y	.14558778 01	.64992615 01	-.14259431 02	-.24791598-04	.41184796-04	-.91086285-04	-.44423926 00	-.79673446-01	.18218506-01
Z	-.50625427 01	-.14259431 02	.31802885 02	.70867012-04	-.93643745-04	.20297489-03	.88762370 00	.17720097 00	-.37435977-01
DX	-.76387576-04	-.24791598-04	.70867012-04	.73857966-09	-.27597533-09	.43877027-09	.12019106-05	.39646278-06	.25500838-06
DY	.22258141-04	.41184796-04	-.93643745-04	-.27597533-09	.38934940-09	-.82352381-09	-.20979803-05	-.61019331-06	.82935036-07
DZ	-.29197904-04	-.91086285-04	.20297489-03	.43877027-09	-.82352381-09	.17932556-08	.46237509-05	.13109918-05	-.20272306-06
KE	-.62856768-02	-.44423926 00	.88762370 00	.12019106-05	-.20979803-05	.46237509-05	.35027992 00	.49187710-02	.12063527-01
RE	-.29891518-01	-.79673446-01	.17720097 00	.39646278-06	-.61019331-06	.13109918-05	.49187710-02	.10787852-02	-.18704319-03
G	-.13852678-01	.18218506-01	-.37435977-01	.25500838-06	.82935036-07	-.20272306-06	.12063527-01	-.18704319-03	.89853598-01
KM	.81670976 00	.17161364 00	-.55649126 00	-.69732025-05	.22883760-05	-.30806450-05	.77231927-02	-.34371934-02	-.12949229-02
RI(03)	.33791411-01	.11619021 00	-.25807547 00	-.48271527-06	.75044486-06	-.16424028-05	-.67380369-02	-.14430409-02	.32043406-03
LA(03-	.22525477-03	-.71258866-03	.15856401-02	.31918576-08	-.49004616-08	.10682358-07	.38671326-04	.90534399-05	-.17955188-05
LO(03)	.12021577-02	-.17738960-03	.15061682-03	-.98063324-08	.25000794-09	.28564725-08	.21311477-04	.32564358-06	.50861871-07
RI(04)	.32140015-01	.11239339 00	-.24868864 00	-.49529744-06	.75116718-06	-.16458471-05	-.57533471-02	-.14068138-02	.26597808-03
LA(04)	.15893327-03	.68727868-03	-.15104808-02	-.26962312-08	.46260974-08	-.10208151-07	-.36133105-04	-.86370972-05	.14748053-05
LO(04)	.13713925-02	-.17018723-04	-.23492121-03	-.11624365-07	.19877357-08	-.62737095-09	.64029396-05	-.21773206-05	-.40113461-06
RI(05)	.20080024-01	.12274373 00	-.27146158 00	-.40091073-06	.79390933-06	-.17673305-05	.17161387-02	-.15112270-02	.35958308-03
LA(05)	.25441871-03	.58513274-03	-.12258697-02	-.35505255-08	.44122063-08	-.94629660-08	-.18301686-03	-.79257464-05	.57281534-06
LO(05)	.12903497-02	-.67824600-04	-.11011083-03	-.10999343-07	.15574554-08	.10196574-09	.35390384-05	-.13550314-05	-.10298657-05

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	.81670976 00	.33791411-01	-.22525477-03	.12021577-02	.32140015-01	.15893327-03	.13713925-02	.20080024-01	.25441871-03
Y	.17161364 00	.11619021 00	-.71258866-03	-.17738960-03	.11239339 00	.68727868-03	-.17018723-04	.12274373 00	.58513274-03
Z	-.55649126 00	-.25807547 00	.15856401-02	.15061682-03	-.24868864 00	-.15104808-02	-.23492121-03	-.27146158 00	-.12258697-02
DX	-.69732025-05	-.48271527-06	.31918576-08	-.98063324-08	-.49529744-06	-.26962312-08	-.11624365-07	-.40091073-06	-.35505255-08
DY	.22883760-05	.75044486-06	-.49004616-08	.25000794-09	.75116718-06	.46260974-08	.19877357-08	.79390933-06	.44122063-08
DZ	-.30806450-05	-.16424028-05	.10682358-07	.28564725-08	-.16458471-05	-.10208151-07	-.62737095-09	-.17673305-05	-.94629660-08
KE	.77231927-02	-.67380369-02	.38671326-04	.21311477-04	-.57533471-02	-.36133105-04	.64029396-05	.17161387-02	-.18301686-03
RE	-.34371934-02	-.14430409-02	.90534399-05	.32564358-06	-.14068138-02	-.86370972-05	-.21773206-05	-.15112270-02	-.79257464-05
G	-.12949229-02	.32043406-03	-.17955188-05	.50861871-07	.26597808-03	.14748053-05	-.40113461-06	.35958308-03	.57281534-06
KM	.89777606-01	.45120544-02	-.28524845-04	.11713361-03	.35346669-02	.18125701-04	.13541466-03	.26171189-02	.20622480-04
RI(03)	.45120544-02	.56577569-02	.28534580-04	-.15704253-05	.20130080-02	.12313373-04	.59403586-06	.22041056-02	.97375567-05
LA(03-	.28524845-04	.28534580-04	.61904385-06	.17689365-07	-.12467430-04	-.76506605-07	-.64537133-08	-.13829092-04	-.58416357-07
LO(03)	.11713361-03	-.15704253-05	.17689365-07	.24440291-06	-.22133592-05	-.18545174-07	.24387855-06	-.31329527-05	-.13742234-07
RI(04)	.35346669-02	.20130080-02	-.12467430-04	-.22133592-05	.46401560-02	-.26805705-04	.47160085-06	.22065493-02	.90704259-05
LA(04)	.18125701-04	.12313373-04	-.76506605-07	-.18545174-07	-.26805705-04	.67103672-06	.10562530-08	.13221682-04	.63728838-07
LO(04)	.13541466-03	.59403586-06	-.64537133-08	.24387855-06	.47160085-06	.10562530-08	.27242166-06	-.83687431-06	.13487139-07
RI(05)	.26171189-02	.22041056-02	-.13829092-04	-.31329527-05	.22065493-02	.13221682-04	-.83687431-06	.42173897-02	-.21243016-04
LA(05)	.20622480-04	.97375567-05	-.58416357-07	-.13742234-07	.90704259-05	.63728838-07	.13487139-07	-.21243016-04	.67513590-06
LO(05)	.12333648-03	-.58041041-06	.17855656-10	.23240072-06	-.16966726-06	-.64113211-08	.24911280-06	-.19598498-05	.83992179-08

```
          LO(05)

 X     .12903497-02
 Y    -.67824600-04
 Z    -.11011083-03
DX    -.10999343-07
DY     .15574554-08
DZ     .10196574-09
KE     .35390384-05
RE    -.13550314-05
 G    -.10298657-05
KM     .12333648-03
RI(03-.58041041-06
LA(03).17855656-10
LO(03).23240072-06
RI(04-.16966726-06
LA(04-.64113211-08
LO(04).24911280-06
RI(05-.19598498-05
LA(05).83992179-08
LO(05).24383477-06
```

3 INPUT J MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 2

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.19191083 02	.89482909 02	.42695550 02	-.54583037-03	-.26678513-03	.28446279-03	.43920961 01	.10694885 01	.17588034 01
Y	.89482909 02	.44498125 03	.20892905 03	-.25306157-03	-.11619238-02	.37275715-03	.25847906 02	.12488102 02	.68661638 01
Z	.42695550 02	.20892905 03	.99509206 02	-.93152115-04	-.25463717-03	-.47147812-03	.10976132 02	.45151417 01	.36271292 01
DX	-.54583037-03	-.25306157-03	-.93152115-04	.10000003 03	-.15662259-07	.30693798-07	.50880372-04	-.44673781-03	.32625149-03
DY	-.26678513-03	-.11619238-02	-.25463717-03	-.15662259-07	.10000000 03	.90256181-07	.21713749-03	.86794367-04	-.97887918-04
DZ	.28446279-03	.37275715-03	-.47147812-03	.30693798-07	.90256181-07	.10000002 03	-.69783629-03	-.10404269-02	.15269107-03
KE	.43920961 01	.25847906 02	.10976132 02	.50880372-04	.21713749-03	-.69783629-03	.58601683 01	.58690205 01	-.38508728 00
RE	.10694885 01	.12488102 02	.45151417 01	-.44673781-03	.86794367-04	-.10404269-02	.58690205 01	.41736903 03	-.10312869 01
G	.17588034 01	.68661638 01	.36271292 01	.32625149-03	-.97887918-04	.15269107-03	-.38508728 00	-.10312869 01	.11431707 02
KM	-.49225777 00	-.45435567 01	-.16939822 01	.78088523-04	-.39726555-04	.33414194-03	-.18536432 01	-.51854105 01	.30307802 00
RI(03)	.68365370 02	.34525057 03	.19341530 03	.53394955-03	.17710516-02	-.33752379-02	.13543404 02	.56922353 02	.83273241 01
LA(03-	.51432587 04	-.26076142 05	-.14668960 05	-.45726677-01	-.14959183 00	.28564300 00	-.99234160 03	-.45892778 04	-.63040125 03
LO(03-	.18378942 05	-.87605000 05	-.45466633 05	.13563353 00	.34645622 00	-.68780483 00	-.62787201 04	-.41394943 04	-.17507593 04
RI(04-	.17539595 02	-.13874302 03	-.30399502 02	.79953953-03	.23141325-02	-.45000932-02	-.41718171 02	-.53939859 02	.75327381 01
LA(04-	.10295462 04	-.85996744 04	-.17634556 04	.54691004-01	.15910729 00	-.30915720 00	-.27284882 04	-.36505598 04	.51203905 03
LO(04-	.18783138 05	-.84752363 05	-.39046771 05	-.99656077-01	-.33970589 00	.64499193 00	-.38300161 04	.10117374 05	-.19496522 04
RI(05-	.60667923 02	-.48129862 03	-.18234475 03	.15544179-02	.53831019-02	-.10540231-01	-.72593021 02	-.93565779 02	.82045804 01
LA(05-	.88131085 04	-.51542478 05	-.22276470 05	.15300405-01	.33200861 00	-.54542791 00	-.41961993 04	-.44417499 04	-.20416833 03
LO(05-	.20098170 05	-.84647790 05	-.39351342 05	.30488275 00	.55709601 00	-.12126743 01	-.72444183 03	-.50965524 04	-.20896716 04

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	-.49225777 00	.68365370 02	-.51432587 04	-.18378942 05	-.17539595 02	-.10295462 04	-.18783138 05	-.60667923 02	-.88131085 04
Y	-.45435567 01	.34525057 03	-.26076142 05	-.87605000 05	-.13874302 03	-.85996744 04	-.84752363 05	-.48129862 03	-.51542478 05
Z	-.16939822 01	.19341530 03	-.14668960 05	-.45466633 05	-.30399502 02	-.17634556 04	-.39046771 05	-.18234475 03	-.22276470 05
DX	.78088523-04	.53394955-03	-.45726677-01	.13563353 00	.79953953-03	.54691004-01	-.99656077-01	.15544179-02	.15300405-01
DY	-.39726555-04	.17710516-02	-.14959183 00	.34645622 00	.23141325-02	.15910729 00	-.33970589 00	.53831019-02	.33200861 00
DZ	.33414194-03	-.33752379-02	.28564300 00	-.68780483 00	-.45000932-02	-.30915720 00	.64499193 00	-.10540231-01	-.54542791 00
KE	-.18536432 01	.13543404 02	-.99234160 03	-.62787201 04	-.41718171 02	-.27284882 04	-.38300161 04	-.72593021 02	-.41961993 04
RE	-.51854105 01	.56922353 02	-.45892778 04	-.41394943 04	-.53939859 02	-.36505598 04	.10117374 05	-.93565779 02	-.44417499 04
G	.30307802 00	.83273241 01	-.63040125 03	-.17507593 04	.75327381 01	.51203905 03	-.19496522 04	.82045804 01	-.20416833 03
KM	.15929736 01	-.16072501 02	.12958576 04	.12333661 04	.17887939 02	.12059030 04	-.27367559 04	.28721920 02	.14018195 04
RI(03	-.16072501 02	.25442300 04	-.19227748 06	-.20931891 06	-.84685105 02	-.58632859 04	.15049535 05	-.14417946 03	-.30466649 05
LA(03)	.12958576 04	-.19227748 06	.16381185 08	.15574431 08	.71861447 04	.49710804 06	-.12491778 07	.12828110 05	.23890845 07
LO(03)	.12333661 04	-.20931891 06	.15574431 08	.64343059 08	-.18218303 05	-.12397631 07	.18510265 07	-.58961302 05	.31456270 07
RI(04)	.17887939 02	-.84685105 02	.71861447 04	-.18218303 05	.33520567 04	.21296926 06	.83645184 05	-.27848078 03	-.10483992 05
LA(04)	.12059030 04	-.58632859 04	.49710804 06	-.12397631 07	.21296926 06	.15193046 08	.51692854 07	-.19259597 05	-.78713229 06
LO(04	-.27367559 04	.15049535 05	-.12491778 07	.18510265 07	.83645184 05	.51692854 07	.58070813 08	.27960302 05	.65276910 07
RI(05)	.28721920 02	-.14417946 03	.12828110 05	-.58961302 05	-.27848078 03	-.19259597 05	.27960302 05	.41393618 04	.22055070 06
LA(05)	.14018195 04	-.30466649 05	.23890845 07	.31456270 07	-.10483992 05	-.78713229 06	.65276910 07	.22055070 06	.15252332 08
LO(05)	.17561176 04	.49284267 04	-.14584086 06	-.12344696 08	-.36066485 05	-.23961789 07	-.18411233 07	.13770430 06	.12770627 08

	LO(05)
X	-.20098170 05
Y	-.84647790 05
Z	-.39351342 05
DX	.30488275 00
DY	.55709601 00
DZ	-.12126743 01
KE	-.72444183 03
RE	-.50965524 04
G	-.20896716 04
KM	.17561176 04
RI(03)	.49284267 04
LA(03	-.14584086 06
LO(03	-.12344696 08
RI(04	-.36066485 05
LA(04	-.23961789 07
LO(04	-.18411233 07
RI(05)	.13770430 06
LA(05)	.12770627 08
LO(05)	.76950070 08

EPHEMERIS TAPE IV WITH MARS VELOCITIES. B-8 IS

GME	.39860137 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63783007 04
G	.66709998-19	A	.88782497 29	B	.88800499 29	C	.88837498 29	OME	.41780741-02	AU	.14959900 09
GMM	.49027486 04	GMS	.13271544 12	GMV	.32476952 06	GMA	.42977799 05	GMC	.37918700 08	GMJ	.12671062 09
EGM	.39860320 06	MGM	.49027779 04	JA	.29200000-02	HA	.00000000 00	DA	.00000000 00	RA	.34170000 04
ARA	.35670000 01	GB	.39544794 00	MAS	.37410000 03	GB1	.00000000 00	GB2	.00000000 00	SC	.10200000 09

INJECTION CONDITIONS MOON 23571213037320240000000O J.D.= 2438843.02127314 MARCH 23,1965 12 30 38.000

GEOCENTRIC X0-.19399678 05 Y0-.26223645 06 Z0-.12476510 06 DX0 .13594903 00 DY0-.12091033 01 DZ0-.50967801 00
CARTESIAN GMC .00000000 00 SGC .00000000 00 TO .45038000 05 GHA .84426084 01 GH0 .18027050 03
DATE OF RUN 020166B 000000 EARTH IS THE CENTRAL BODY FOR INTEGRATION COWELL EQUATIONS OF MOTION

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. 23571213037320240000000O J.D.= 2438843.02127314 MARCH 23,1965 12 30 38.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.19399680 05	Y	-.26223645 06	Z	-.12476510 06	DX	.13594902 00	DY	-.12091033 01	DZ	-.50967801 00
R	.29105091 06	DEC	-.25383252 02	RA	.26576909 03	V	.13191605 01	PTH	.79926088 02	AZ	.76945156 02
R	.29105091 06	LAT	-.25383252 02	LON	.25732648 03	VE	.18994586 02	PTE	.39208632 01	AZE	.27015759 03
XS	.14897831 09	YS	.63717223 07	ZS	.27634203 07	DXS	-.89066856 00	DYS	.27394442 02	DZS	.11878768 02
XM	-.98402474 05	YM	-.35567249 06	ZM	-.15354183 06	DXM	.93475155 00	DYM	-.22045435 00	DZM	-.18962300 00
XT	-.98402474 05	YT	-.35567249 06	ZT	-.15354183 06	DXT	.93475155 00	DYT	-.22045435 00	DZT	-.18962300 00
RS	.14914011 09	VS	.29872292 02	RM	.39970120 06	VM	.97893690 00	RT	.39970120 06	VT	.97893690 00
GED	-.25534282 02	ALT	.28467667 06	LOS	.35400641 03	RAS	.24490185 01	RAM	.25453504 03	LOM	.24609243 03
DUT	.36000000 02	DT	.12000000 03	DR	.12988230 01	SHA	.28918613 06	DES	.10616948 01	DEM	-.22590454 02
DAC	.00000000 00	CCL	.28188101 03	MCL	.35139666 03	TCL	.35139666 03				

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 23571202520720247720000O J.D.= 2438841.42776035 MARCH 21,1965 22 15 58.494

SMA	.39905447 06	ECC	.98572044 00	B	.67196830 05	SLR	.11315269 05	APO	.79241061 06	RCA	.56983192 04
VH	.84752307-01	C3	-.99886456 00	C1	.67158630 05	TFP	.13767950 06	TF	-.38244307 02	PER	.41812630 05
TA	.16717328 03	MTA	.00000000 00	EA	.74063673 02	MA	.19756638 02	C3J	-.13710046 01	TFI	.00000000 00

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	-.19399680 05	Y	-.26223645 06	Z	-.12476510 06	DX	.13594902 00	DY	-.12091033 01	DZ	-.50967801 00
INC	.28344325 02	LAN	.32735925 03	APF	.12828438 03	MX	.96435609 00	MY	-.16843534 00	MZ	.20407699 00
WX	-.25607643 00	WY	-.39978901 00	WZ	.88011032 00	PX	-.14909952 00	PY	.91590817 00	PZ	.37266822 00
QX	-.95508886 00	QY	-.35792371-01	QZ	-.29415080 00	RX	-.59877980-01	RY	.36782636 00	RZ	-.92796467 00
BX	.95508862 00	BY	.35792362-01	BZ	.29415073 00	TX	.98700758 00	TY	.16067370 00	TZ	.00000000 00
DAP	.21880267 02	RAP	.99246003 02								
BTQ	.63731529 05	BRQ	-.21300380 05	B	.67196830 05	THA	.34151931 03				

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.14899771 09	Y	-.66339587 07	Z	-.28881854 07	DX	.10266176 01	DY	-.28603545 02	DZ	-.12388446 02
R	.14917328 09	LAT	-.11093875 01	LON	.18254935 03	V	.31187983 02	PTH	.89376952 00	AZ	.11339322 03
XE	-.14897831 09	YE	-.63717223 07	ZE	-.27634203 07	DXE	.89066856 00	DYE	-.27394442 02	DZE	-.11878768 02
XT	-.14907671 09	YT	-.67273947 07	ZT	-.29169621 07	DXT	.18254201 01	DYT	-.27614896 02	DZT	-.12068391 02
LTE	-.10616948 01	LOE	.18244901 03	LTT	-.11198146 01	LOT	.18258383 03	RST	.14925694 09	VST	.30192063 02
EPS	.83399613 02	ESP	.11124820 00	SEP	.96489312 02	EPM	.14407451 03	EMP	.25292644 02	MEP	.10632841 02
MPS	.13170273 03	MSP	.35663121-01	SMP	.48261237 02	SEM	.10692129 03	EMS	.72931918 02	ESM	.14704286 00
RPM	.12569739 06	SPN	.82143951 02								
SAC	.60988376-10										
GCE	.78118986 02	GCT	.24951565 03	SIP	.13091049 03	CPT	.10317301 03	SIN	.10238076 03	D1	.41484541 00
REP	.29105091 06	VEP	.13191605 01	CPE	.78547795 02	CPS	.92848527 02	D2	.27902972 00	D3	.51180521-02

0 DAYS 18 HRS. 20 MIN. 53.336 SEC. 23571217057420265302000l J.D.= 2438843.78577935 MARCH 24,1965 06 51 31.336

GEOCENTRIC EQUATORIAL COORDINATES

X	-.10801499 05	Y	-.33518711 06	Z	-.15500597 06	DX	.10727174 00	DY	-.10344460 01	DZ	-.41968776 00
R	.36945084 06	DEC	-.24806671 02	RA	.26815426 03	V	.11214827 01	PTH	.82332668 02	AZ	.69920035 02
R	.36945083 06	LAT	-.24806671 02	LON	.34373588 03	VE	.24339826 02	PTE	.26172678 01	AZE	.27012105 03
XS	.14890649 09	YS	.81807503 07	ZS	.35478502 07	DXS	-.12838197 01	DYS	.27377040 02	DZS	.11871231 02
XM	-.35613145 05	YM	-.36527559 06	ZM	-.16389786 06	DXM	.96204922 00	DYM	-.70061278-01	DZM	-.12340677 00
XT	-.35613145 05	YT	-.36527559 06	ZT	-.16389786 06	DXT	.96204922 00	DYT	-.70061278-01	DZT	-.12340677 00
RS	.14917324 09	VS	.29867652 02	RM	.40194161 06	VM	.97245900 00	RT	.40194161 06	VT	.97245900 00
GED	-.24955196 02	ALT	.36307643 06	LOS	.78726215 02	RAS	.31446033 01	RAM	.26443145 03	LOM	.34001306 03
DUT	.36000000 02	DT	.48000000 03	DR	.11114560 01	SHA	.36798744 06	DES	.13628174 01	DEM	-.24064535 02
DAC	.00000000 00	CCL	.28254714 03	MCL	.35126261 03	TCL	.35126261 03				

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 23571202761320237722000l J.D.= 2438841.48719900 MARCH 21,1965 23 41 33.994

SMA	.44285045 06	ECC	.99130612 00	B	.58268382 05	SLR	.76667022 04	APO	.88185081 06	RCA	.38500872 04
VH	.62687154-01	C3	-.90008120 00	C1	.55280720 05	TFP	.19859734 06	TF	-.36817779 02	PER	.48881537 05
TA	.17105442 03	MTA	.00000000 00	EA	.80375127 02	MA	.24376975 02	C3J	-.13658607 01	TFI	.18348149 02

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	-.10801499 05	Y	-.33518711 06	Z	-.15500597 06	DX	.10727174 00	DY	-.10344460 01	DZ	-.41968776 00
INC	.31509698 02	LAN	.31708932 03	APF	.13555088 03	MX	.93408743 00	MY	-.17422326 00	MZ	.31165154 00
WX	-.35584498 00	WY	-.38279199 00	WZ	.85265170 00	PX	-.11636590 00	PY	.92331330 00	PZ	.36599389 00
QX	-.92727184 00	QY	.31029084-01	QZ	-.37310037 00	RX	-.45764472-01	RY	.36312138 00	RZ	-.93061725 00
BX	.92727195 00	BY	-.31029088-01	BZ	.37310041 00	TX	.99215150 00	TY	.12504163 00	TZ	.00000000 00
DAP	.21468760 02	RAP	.97183160 02								
BTQ	.53380500 05	BRQ	-.23360792 05	B	.58268382 05	THA	.33636447 03				

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.14891730 09	Y	-.85159373 07	Z	-.37028562 07	DX	.13910914 01	DY	-.28411486 02	DZ	-.12290918 02
R	.14920654 09	LAT	-.14220531 01	LON	.18327293 03	V	.30987325 02	PTH	.99520295 00	AZ	.11335296 03
XE	-.14890649 09	YE	-.81807503 07	ZE	-.35478502 07	DXE	.12838197 01	DYE	-.27377040 02	DZE	-.11871231 02
XT	-.14894211 09	YT	-.85460258 07	ZT	-.37117480 07	DXT	.22458689 01	DYT	-.27447101 02	DZT	-.11994637 02
LTE	-.13628174 01	LOE	.18314460 03	LTT	-.14252137 01	LOT	.18328392 03	RST	.14923325 09	VST	.30037620 02
EPS	.84757359 02	ESP	.14127420 00	SEP	.95101330 02	EPM	.14254694 03	EMP	.33983550 02	MEP	.34695046 01
MPS	.13187731 03	MSP	.13988227-01	SMP	.48111248 02	SEM	.98509901 02	EMS	.81337476 02	ESM	.15259359 00
RPM	.39999995 05	SPN	.83768187 02								
SAC	.60961189-10										
GCE	.77452851 02	GCT	.24871546 03	SIP	.12938703 03	CPT	.10382907 03	SIN	.10133879 03	D1	.13047323 01
REP	.36945084 06	VEP	.11214827 01	CPE	.77768452 02	CPS	.92658614 02	D2	.89942207 00	D3	.50893567-01

0 DAYS 18 HRS. 20 MIN. 53.336 SEC. 23571217057420265302000l J.D.= 2438843.78577935 MARCH 24,1965 06 51 31.336
CHANGE OF PHASE OCCURS AT THIS POINT EARTH IS THE CENTRAL BODY FOR INTEGRATION COWELL EQUATIONS OF MOTION

1 DAYS 1 HRS. 30 MIN. 21.019 SEC. 23571220524620260233510O J.D.= 2438844.08401641 MARCH 24,1965 14 00 59.019

GEOCENTRIC EQUATORIAL COORDINATES

X	-.99821758 04	Y	-.36376207 06	Z	-.16619467 06	DX	-.33079692 00	DY	-.17872125 01	DZ	-.59325501 00
R	.40005393 06	DEC	-.24546441 02	RA	.26842810 03	V	.19119379 01	PTH	.79478510 02	AZ	.30622372 03
R	.40005393 06	LAT	-.24546441 02	LON	.23635043 03	VE	.26884173 02	PTE	.40094986 01	AZE	.27044078 03
XS	.14887143 09	YS	.88861222 07	ZS	.38537136 07	DXS	-.14371482 01	DYS	.27368961 02	DZS	.11867740 02
XM	-.10768685 05	YM	-.36632302 06	ZM	-.16673606 06	DXM	.96562918 00	DYM	-.11257239-01	DZM	-.96831229-01
XT	-.10768685 05	YT	-.36632302 06	ZT	-.16673606 06	DXT	.96562918 00	DYT	-.11257239-01	DZT	-.96831229-01
RS	.14918618 09	VS	.29865844 02	RM	.40262815 06	VM	.97053733 00	RT	.40262815 06	VT	.97053733 00
GED	-.24693816 02	ALT	.39367945 06	LOS	.33133824 03	RAS	.34159265 01	RAM	.26831617 03	LOM	.23623849 03
DUT	.36000000 02	DT	.30000000 02	DR	.18797915 01	SHA	.39843796 06	DES	.14802036 01	DEM	-.24463862 02
DAC	.00000000 00	CCL	.28282490 03	MCL	.34711332 03	TCL	.34711332 03				

HELIOCENTRIC EQUATORIAL COORDINATES

X	-.14888141 09	Y	-.92498842 07	Z	-.40199083 07	DX	.11063513 01	DY	-.29156173 02	DZ	-.12460995 02
R	.14922263 09	LAT	-.15436765 01	LON	.18355517 03	V	.31726689 02	PTH	.18769949 01	AZ	.11309339 03
XE	-.14887143 09	YE	-.88861222 07	ZE	-.38537136 07	DXE	.14371482 01	DYE	-.27368961 02	DZE	-.11867740 02
XT	-.14888220 09	YT	-.92524452 07	ZT	-.40204497 07	DXT	.24027774 01	DYT	-.27380218 02	DZT	-.11964571 02
LTE	-.14802036 01	LOE	.18341592 03	LTT	-.15438746 01	LOT	.18355613 03	RST	.14922359 09	VST	.29976668 02
EPS	.84695422 02	ESP	.15291383 00	SEP	.95151590 02	EPM	.16029833 03	EMP	.19570549 02	MEP	.13084791 00
MPS	.11051941 03	MSP	.27453512-18	SMP	.69479609 02	SEM	.95254508 02	EMS	.84591547 02	ESM	.15387055 00
RPM	.27331635 04	SPN	.83781926 02								
SAC	.60948043-10										
GCE	.77175098 02	GCT	.24428841 03	SIP	.71033146 02	CPT	.11296059 03	SIN	.73474331 02	D1	.24718011 02
REP	.40005393 06	VEP	.19119379 01	CPE	.77488913 02	CPS	.92584219 02	D2	.16533802 02	D3	.76227989 01

SELENOCENTRIC EQUATORIAL COORDINATES

X	.78650891 03	Y	.25609531 04	Z	.54139257 03	DX	-.12964261 01	DY	-.17759553 01	DZ	-.49642377 00
R	.27331635 04	DEC	.11424867 02	RA	.72927455 02	V	.22541460 01	PTH	-.71324203 02	AZ	.95957052 02
R	.27331645 04	LAT	-.11117349 02	LON	.34722363 03	VP	.22519093 01	PTP	-.71493257 02	AZP	.10132532 03
LTS	-.14810949 01	LNS	.27785065 03	LTE	.13392370 01	LNE	.24041151 01				
ALT	.99516354 03	SHA	-.25597374 04	ALP	.41810560 01	DR	-.21354554 01	DP	.15131350-01	ASD	.39486259 02
HGE	.27530457 03	SVL	-.12056343 02	HNG	.11100385 03	SIA	.12081207 03				
SAC	.60948043-10										

SELENOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 235712205641202202245500 J.D.= 2438844.09561363 MARCH 24,1965 14 17 41.018

SMA	-.32825607 04	ECC	.11143768 01	B	.16142576 04	SLR	.79384000 03	APO	.00000000 00	RCA	.37544870 03
VH	.12221188 01	C3	.14935743 01	C1	.19728147 04	TFP	-.10019991 04	TF	.25784171 02	LTF	.25703372 02
TA	-.12954812 03	MTA	.15381352 03	EA	-.61984773 02	MA	-.21374238 02	C3J	-.13241904 01	TFI	.25505838 02
ZAE	.14036775 03	ZAP	.13443667 03	ZAC	.10278940 03	DEF	.12762704 03	LR	.37987925 04	GP	.25117038 01
OP1	.00000000 00	OY	.00000000 00	OP2	.38000000 02						

ALL VECTORS REFERENCED TO ORBIT PLANE OF TARGET

X	.25752679 04	Y	-.76410517 03	Z	-.50430246 03	DX	-.18560695 01	DY	.12670293 01	DZ	.17554701 00
INC	.20761529 02	LAN	.13378968 03	APF	.34091502 03	MX	.21615232 00	MY	.92826046 00	MZ	-.30267249 00
WX	.25589309 00	WY	.24530425 00	WZ	.93506390 00	PX	-.43326930 00	PY	.89378068 00	PZ	-.11590392 00
QX	-.86417386 00	QY	-.37547547 00	QZ	.33499513 00	RX	-.33783290-01	RY	.27913895-01	RZ	-.99903926 00
BX	.58427822 00	BY	.73135764 00	BZ	-.35175981 00	TX	.63696228 00	TY	.77089497 00	TZ	.00000000 00
SXI	-.77015435 00	SYI	.63635033 00	SZI	.43823466-01	DAI	.25117030 01	RAI	.14043432 03		
SXO	.74450038-02	SYO	-.96774042 00	SZO	.25183916 00	DAO	.14586370 02	RAO	.27044078 03		
ETE	.17696398 03	ETS	.92910123 01	ETC	.26259334 03						

BTO	.15108857 04	BRO	.56837702 03	B	.16142577 04	THA	.20615697 02

ALL VECTORS REFERENCED TO TRUE LUNAR EQU. PLANE

X	.26154733 04	Y	-.59308668 03	Z	-.52700632 03	DX	-.19133199 01	DY	.11598674 01	DZ	.27402010 00
INC	.15740387 02	LAN	.12302014 03	APF	.35484637 03	MX	.18035489 00	MY	.96491399 00	MZ	-.19082168 00
WX	.22746146 00	WY	.14782896 00	WZ	.96250077 00	PX	-.47023787 00	PY	.88220318 00	PZ	-.24367952-01
QX	-.85272361 00	QY	-.44706149 00	QZ	.27018200 00	RX	-.78093486-01	RY	.58145869-01	RZ	-.99524891 00
BX	.55768886 00	BY	.79048754 00	BZ	-.25320464 00	TX	.59720764 00	TY	.80208668 00	TZ	.00000000 00
SXI	-.79827589 00	SYI	.59437025 00	SZI	.97362902-01	DAI	.55873355 01	RAI	.14332983 03		
SXO	.45671686-01	SYO	-.98894167 00	SZO	.14109667 00	DAO	.81113122 01	RAO	.27264417 03		
ETE	.28038199 01	ETS	.31703520 02	ETC	.29410884 03						
BTT	.15611432 04	BRT	.41068916 03	B	.16142594 04	THA	.14738824 02				

5 J MATRIX ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.27073229 04	.33892681 04	.72411481 03	.22948912 09	.29745035 09	.62154771 08	.14130754 03	.19367339 06	-.46389559 03
Y	.33892681 04	.45562188 04	.10593064 04	.28231193 09	.36663121 09	.75376952 08	.19297444 03	.24163630 06	-.56652498 03
Z	.72411481 03	.10593064 04	.27602677 03	.58281384 08	.75916685 08	.15644573 08	.45615542 02	.49984629 05	-.11479031 03
DX	.22948912 09	.28231193 09	.58281384 08	.19606827 14	.25373109 14	.52772974 13	.11625755 08	.16579080 11	-.39776891 08
DY	.29745035 09	.36663121 09	.75916685 08	.25373109 14	.37593205 14	.91307966 13	.17048589 08	.21247512 11	-.51659451 08
DZ	.62154771 08	.75376952 08	.15644573 08	.52772974 13	.91307966 13	.25691537 13	.41250207 07	.42825441 10	-.10777574 08
KE	.14130754 03	.19297444 03	.45615542 02	.11625755 08	.17048589 08	.41250207 07	.13906294 02	.96616809 04	-.24126509 02
RE	.19367339 06	.24163630 06	.49984629 05	.16579080 11	.21247512 11	.42825441 10	.96616809 04	.14224028 08	-.33655291 05
G	-.46389559 03	-.56652498 03	-.11479031 03	-.39776891 08	-.51659451 08	-.10777574 08	-.24126509 02	-.33655291 05	.92175865 02
KM	-.64598523 04	-.78660785 04	-.16253151 04	-.54993070 09	-.72752129 09	-.15758789 09	-.34225316 03	-.45967389 06	.11174103 04
RI(03)	.33066668 03	.55853619 03	.25289324 03	.18604134 08	.32483223 08	.11733717 08	.41629994 02	.10812475 05	-.31610758 02
LA(03	-.24407478 05	-.41256069 05	-.19036087 05	-.13459246 10	-.23709189 10	-.87257335 09	-.31285596 04	-.75815342 06	.22778103 04
LO(03	-.23352880 06	-.32237855 06	-.92394193 05	-.18037679 11	-.29345369 11	-.86514644 10	-.19245622 05	-.13388310 08	.34169260 05
RI(04	-.29708618 02	-.18413837 03	-.15354257 02	-.99020460 06	-.52539237 07	-.10216456 07	-.52743882 02	-.67137842 03	.13512770 02
LA(04	-.18114771 04	-.11575496 05	-.75569809 03	-.63126177 08	-.31085594 09	-.50585008 08	-.34474042 04	-.44206222 05	.90308785 03
LO(04	-.27485716 05	-.95668513 05	-.42030632 05	-.81271686 09	-.11642449 11	-.53290907 10	-.76962646 04	-.11021615 06	-.20140648 03
RI(05	-.16416959 03	-.60769464 03	-.19102259 03	-.75006075 07	-.35898051 08	-.13281849 08	-.98519745 02	-.42742591 04	.28374666 02
LA(05	-.14211761 05	-.58136064 05	-.22716643 05	-.39135837 09	-.18591297 10	-.68571319 09	-.55436106 04	-.22305956 06	.84771490 03
LO(05	-.40498734 05	-.10878599 06	-.45462272 05	-.14217484 10	-.11866722 11	-.51858715 10	-.76102704 04	-.59643471 06	.19130401 04

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	-.64598523 04	.33066668 03	-.24407478 05	-.23352880 06	-.29708618 02	-.18114771 04	-.27485716 05	-.16416959 03	-.14211761 05
Y	-.78660785 04	.55853619 03	-.41256069 05	-.32237855 06	-.18413837 03	-.11575496 05	-.95668513 05	-.60769464 03	-.58136064 05
Z	-.16253151 04	.25289324 03	-.19036087 05	-.92394193 05	-.15354257 02	-.75569809 03	-.42030632 05	-.19102259 03	-.22716643 05
DX	-.54993070 09	.18604134 08	-.13459246 10	-.18037679 11	-.99020460 06	-.63126177 08	-.81271686 09	-.75006075 07	-.39135837 09
DY	-.72752129 09	.32483223 08	-.23709189 10	-.29345369 11	-.52539237 07	-.31085594 09	-.11642449 11	-.35898051 08	-.18591297 10
DZ	-.15758789 09	.11733717 08	-.87257335 09	-.86514644 10	-.10216456 07	-.50585008 08	-.53290907 10	-.13281849 08	-.68571319 09
KE	-.34225316 03	.41629994 02	-.31285596 04	-.19245622 05	-.52743882 02	-.34474042 04	-.76962646 04	-.98519745 02	-.55436106 04
RE	-.45967389 06	.10812475 05	-.75815342 06	-.13388310 08	-.67137842 03	-.44206222 05	-.11021615 06	-.42742591 04	-.22305956 06
G	.11174103 04	-.31610758 02	.22778103 04	.34169260 05	.13512770 02	.90308785 03	-.20140648 03	.28374666 02	.84771490 03
KM	.15740945 05	-.10197427 04	.76895668 05	.57027729 06	.13637557 03	.89794274 04	.23384414 05	.58040099 03	.30210537 05
RI(03	-.10197427 04	.43165340 04	-.33226980 06	-.30282433 06	-.84685105 02	-.58632859 04	.15049535 05	-.14417946 03	-.30466649 05
LA(03)	.76895668 05	-.33226980 06	.27441598 08	.22556563 08	.71861447 04	.49710804 06	-.12491778 07	.12828110 05	.23890845 07
LO(03)	.57027729 06	-.30282433 06	.22556563 08	.13478536 09	-.18218303 05	-.12397631 07	.18510265 07	-.58961302 05	.31456270 07
RI(04)	.13637557 03	-.84685105 02	.71861447 04	-.18218303 05	.68154657 04	.44270815 06	.82439429 05	-.27848078 03	-.10483992 05
LA(04)	.89794274 04	-.58632859 04	.49710804 06	-.12397631 07	.44270815 06	.30432979 08	.48889301 07	-.19259597 05	-.78713229 06
LO(04)	.23384414 05	.15049535 05	-.12491778 07	.18510265 07	.82439429 05	.48889301 07	.12505364 09	.27960302 05	.65276910 07
RI(05)	.58040099 03	-.14417946 03	.12828110 05	-.58961302 05	-.27848078 03	-.19259597 05	.27960302 05	.74249230 04	.39335187 06
LA(05)	.30210537 05	-.30466649 05	.23890845 07	.31456270 07	-.10483992 05	-.78713229 06	.65276910 07	.39335187 06	.24341090 08
LO(05)	.95699437 05	.49284267 04	-.14584086 06	-.12344696 08	-.36066485 05	-.23961789 07	-.18411233 07	.26690299 06	.19404128 08

LO(05)

X	-.40498734 05
Y	-.10878599 06
Z	-.45462272 05
DX	-.14217484 10
DY	-.11866722 11
DZ	-.51858715 10
KE	-.76102704 04
RE	-.59643471 06
G	.19130401 04
KM	.95699437 05
RI(03)	.49284267 04
LA(03	-.14584086 06
LO(03	-.12344696 08
RI(04	-.36066485 05
LA(04	-.23961789 07
LO(04	-.18411233 07
RI(05)	.26690299 06
LA(05)	.19404128 08
LO(05)	.14490223 09

6 CORRELATIONS BASED ON J MATRIX ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	-.10000000 01	-.96501401 00	-.83764847 00	-.99606668 00	-.93237320 00	-.74526273 00	-.72826529 00	-.98693521 00	.92862765 00
Y	-.96501401 00	-.10000000 01	-.94459078 00	-.94454636 00	-.88587508 00	-.69669267 00	-.76664055 00	-.94918003 00	.87419470 00
Z	-.83764847 00	-.94459078 00	-.10000000 01	-.79222875 00	-.74525854 00	-.58747997 00	-.73626055 00	-.79771832 00	.71964947 00
DX	-.99606668 00	-.94454636 00	-.79222875 00	-.10000000 01	-.93457758 00	-.74355461 00	-.70406346 00	-.99276272 00	.93566108 00
DY	-.93237320 00	-.88587508 00	-.74525854 00	-.93457758 00	-.10000000 01	-.92909249 00	-.74563806 00	-.91884468 00	.87757958 00
DZ	-.74526273 00	-.69669267 00	-.58747997 00	-.74355461 00	-.92909249 00	-.10000000 01	-.69012120 00	-.70842765 00	.70035359 00
KE	-.72826529 00	-.76664055 00	-.73626055 00	-.70406346 00	-.74563806 00	-.69012120 00	-.10000000 01	-.68696669 00	.67387628 00
RE	-.98693521 00	-.94918003 00	-.79771832 00	-.99276272 00	-.91884468 00	-.70842765 00	-.68696669 00	-.10000000 01	.92946587 00
G	.92862765 00	.87419470 00	.71964947 00	.93566108 00	.87757958 00	.70035359 00	.67387628 00	.92946587 00	-.10000000 01
KM	.98954868 00	.92883931 00	.77973419 00	.98989449 00	.94574845 00	.78363241 00	.73152025 00	.97145599 00	-.92765963 00
RI(03	-.96728139-01	-.12594515 00	-.23168293 00	-.63949655-01	-.80637465-01	-.11142252 00	-.16991553 00	-.43636129-01	.50113960-01
LA(03)	.89546411-01	.11667582 00	.21872447 00	.58024628-01	.73817159-01	.10392073 00	.16015261 00	.38374356-01	-.45290200-01
LO(03)	.38658862 00	.41137936 00	.47901345 00	.35087759 00	.41225275 00	.46491463 00	.44453389 00	.30576875 00	-.30655302 00
RI(04)	.69161539-02	.33044124-01	.11194519-01	.27087786-02	.10379617-01	.77207137-02	.17132416 00	.21562957-02	-.17048572-01
LA(04)	.63108896-02	.31086017-01	.82451864-02	.25842444-02	.91903546-02	.57207706-02	.16757694 00	.21247110-02	-.17050972-01
LO(04)	.47237712-01	.12674142 00	.22622581 00	.16412980-01	.16980149 00	.29731026 00	.18455513 00	.26132791-02	.18759301-02
RI(05)	.36616490-01	.10448096 00	.13343297 00	.19658338-01	.67946988-01	.96165102-01	.30659961 00	.13152356-01	-.34298583-01
LA(05)	.55361502-01	.17457150 00	.27713957 00	.17914346-01	.61458931-01	.86711648-01	.30131240 00	.11987801-01	-.17896627-01
LO(05)	.64659731-01	.13388538 00	.22732019 00	.26673596-01	.16078242 00	.26877519 00	.16953402 00	.13137541-01	-.16553046-01

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	.98954868 00	-.96728139-01	.89546411-01	.38658862 00	.69161539-02	.63108896-02	.47237712-01	.36616490-01	.55361502-01
Y	.92883931 00	-.12594515 00	.11667582 00	.41137936 00	.33044124-01	.31086017-01	.12674142 00	.10448096 00	.17457150 00
Z	.77973419 00	-.23168293 00	.21872447 00	.47901345 00	.11194519-01	.82451864-02	.22622581 00	.13343297 00	.27713957 00
DX	.98989449 00	-.63949655-01	.58024628-01	.35087759 00	.27087786-02	.25842444-02	.16412980-01	.19658338-01	.17914346-01
DY	.94574845 00	-.80637465-01	.73817159-01	.41225275 00	.10379617-01	.91903546-02	.16980149 00	.67946988-01	.61458931-01
DZ	.78363241 00	-.11142252 00	.10392073 00	.46491463 00	.77207137-02	.57207706-02	.29731026 00	.96165102-01	.86711648-01
KE	.73152025 00	-.16991553 00	.16015261 00	.44453389 00	.17132416 00	.16757694 00	.18455513 00	.30659961 00	.30131240 00
RE	.97145599 00	-.43636129-01	.38374356-01	.30576875 00	.21562957-02	.21247110-02	.26132791-02	.13152356-01	.11987801-01
G	-.92765963 00	.50113960-01	-.45290200-01	-.30655302 00	-.17048572-01	-.17050972-01	.18759301-02	-.34298583-01	-.17896627-01
KM	-.10000000 01	.12371080 00	-.11699890 00	-.39151581 00	-.13166593-01	-.12973615-01	-.16667210-01	-.53686706-01	-.48805980-01
RI(03	.12371080 00	-.10000000 01	.96542511 00	.39701035 00	.15613191-01	.16177122-01	-.20483650-01	.25467707-01	.93991177-01
LA(03	-.11699890 00	.96542511 00	-.10000000 01	-.37089149 00	-.16616651-01	-.17201798-01	.21324132-01	-.28419209-01	-.92439331-01
LO(03	-.39151581 00	.39701035 00	-.37089149 00	-.10000000 01	.19008104-01	.19357315-01	-.14257491-01	.58938587-01	-.54918143-01
RI(04	-.13166593-01	.15613191-01	-.16616651-01	.19008104-01	-.10000000 01	-.97206993 00	-.89297444-01	.39147270-01	.25740021-01
LA(04	-.12973615-01	.16177122-01	-.17201798-01	.19357315-01	-.97206993 00	-.10000000 01	-.79248932-01	.40516226-01	.28920479-01
LO(04	-.16667210-01	-.20483650-01	.21324132-01	-.14257491-01	-.89297444-01	-.79248932-01	-.10000000 01	-.29016679-01	-.11831543 00
RI(05	-.53686706-01	.25467707-01	-.28419209-01	.58938587-01	.39147270-01	.40516226-01	-.29016679-01	-.10000000 01	-.92526308 00
LA(05	-.48805980-01	.93991177-01	-.92439331-01	-.54918143-01	.25740021-01	.28920479-01	-.11831543 00	-.92526308 00	-.10000000 01
LO(05	-.63366022-01	-.62316519-02	.23127941-02	.88332701-01	.36292636-01	.36083568-01	.13677199-01	-.25731787 00	-.32672818 00

	LO(05)
X	.64659731-01
Y	.13388538 00
Z	.22732019 00
DX	.26673596-01
DY	.16078242 00
DZ	.26877519 00
KE	.16953402 00
RE	.13137541-01
G	-.16553046-01
KM	-.63366022-01
RI(03	-.62316519-02
LA(03	.23127941-02
LO(03	.88332701-01
RI(04	.36292636-01
LA(04	.36083568-01
LO(04	.13677199-01
RI(05	-.25731787 00
LA(05	-.32672818 00
LO(05	-.10000000 01

7 RA9 POST M/C WITH PRE DATA AS APRIORI 22 SEPT

ITERATION NUMBER 3 EPOCH 65/03/23 123038.000 CLOCK 030750 SOS .10799 02 QSOS .12720 02

Q	DQ	STDEVDQ	OLD Q	NEW Q	NOMINAL Q	DQ (NOM)
X	.20404460-02	.29069987 01	-.19399678 05	-.19399676 05	-.19400576 05	.89990234 00
Y	.50510748-03	.25493142 01	-.26223645 06	-.26223645 06	-.26223528 06	-.11796875 01
Z	-.43880733-03	.56392994 01	-.12476510 06	-.12476510 06	-.12476760 06	.24951172 01
DX	-.74666080-07	.27176654-04	.13594903 00	.13594896 00	.14653272 00	-.10583762-01
DY	-.41894589-07	.19731667-04	-.12091033 01	-.12091034 01	-.11999960 01	-.91073661-02
DZ	.12100864-06	.42346178-04	-.50967801 00	-.50967789 00	-.49808334 00	-.11594556-01
KE	.24693627-02	.59184339 00	.39860137 06	.39860137 06	.39860070 06	.67187500 00
RE	.69984328-04	.32845725-01	.63783007 04	.63783007 04	.63783257 04	-.24902344-01
G	.34368949-05	.29975590 00	.39544794 00	.39545138 00	.40246991 00	-.70185288-02
KM	-.35483738-03	.29962887 00	.49027486 04	.49027482 04	.49014745 04	.12737427 01
STA 3						
RI	.47257254-04	.75217562-01	.63718890 04	.63718890 04	.63719046 04	-.15686035-01
LA	.59960920-07	.78679147-03	.35117341 02	.35117341 02	.35117254 02	.86784363-04
LO	.27883127-05	.49437042-03	.24319488 03	.24319488 03	.24319443 03	.45013428-03
STA 4						
RI	.85486795-04	.68118136-01	.63726405 04	.63726406 04	.63726562 04	-.15625000-01
LA	.29651894-06	.81916657-03	-.31212191 02	-.31212190 02	-.31212092 02	-.98466872-04
LO	.17783307-05	.52194101-03	.13688803 03	.13688803 03	.13688765 03	.38337708-03
STA 5						
RI	.12194355-03	.64940755-01	.63755352 04	.63755353 04	.63755453 04	-.10009766-01
LA	.18784744-06	.82166509-03	-.25739093 02	-.25739092 02	-.25738887 02	-.20575523-03
LO	.76896255-06	.49379665-03	.27685766 02	.27685767 02	.27685444 02	.32281875-03

8 COVARIANCE MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.84506413 01	.14559055 01	-.50626125 01	-.76387622-04	.22258448-04	-.29198484-04	-.62861274-02	-.29893162-01	-.13852636-01
Y	.14559055 01	.64990032 01	-.14258876 02	-.24790036-04	.41183111-04	-.91082443-04	-.44422043 00	-.79673886-01	.18217767-01
Z	-.50626125 01	-.14258876 02	.31801698 02	.70863639-04	-.93640151-04	.20296667-03	.88758302 00	.17720222 00	-.37434385-01
DX	-.76387622-04	-.24790036-04	.70863639-04	.73857051-09	-.27596479-09	.43874632-09	.12018025-05	.39646068-06	.25501266-06
DY	.22258448-04	.41183111-04	-.93640151-04	-.27596479-09	.38933869-09	-.82349911-09	-.20978541-05	-.61020006-06	.82930186-07
DZ	-.29198484-04	-.91082443-04	.20296667-03	.43874632-09	-.82349911-09	.17931989-08	.46234662-05	.13110041-05	-.20271210-06
KE	-.62861274-02	-.44422043 00	.88758302 00	.12018025-05	-.20978541-05	.46234662-05	.35027859 00	.49187498-02	.12063581-01
RE	-.29893162-01	-.79673886-01	.17720222 00	.39646068-06	-.61020006-06	.13110041-05	.49187498-02	.10788417-02	-.18704324-03
G	-.13852636-01	.18217767-01	-.37434385-01	.25501266-06	.82930186-07	-.20271210-06	.12063581-01	-.18704324-03	.89853597-01
KM	.81671182 00	.17160527 00	-.55647350 00	-.69731531-05	.22883240-05	-.30805223-05	.77238274-02	-.34372212-02	-.12949485-02
RI(03)	.33792002-01	.11618579 00	-.25806602 00	-.48268828-06	.75041634-06	-.16423375-05	-.67377109-02	-.14430520-02	.32042135-03
LA(03	-.22525845-03	-.71256073-03	.15855803-02	.31916873-08	-.49002808-08	.10681944-07	.38669272-04	.90535073-05	-.17954385-05
LO(03)	.12021658-02	-.17736158-03	.15055466-03	-.98064774-08	.25021637-09	.28560206-08	.21309770-04	.32534852-06	.50934153-07
RI(04)	.32140563-01	.11238898 00	-.24867919 00	-.49527058-06	.75113855-06	-.16457816-05	-.57530236-02	-.14068235-02	.26596541-03
LA(04)	.15893660-03	.68725154-03	-.15104226-02	-.26960662-08	.46259210-08	-.10207748-07	-.36131109-04	-.86371557-05	.14747272-05
LO(04)	.13714018-02	-.16998129-04	-.23496752-03	-.11624465-07	.19878967-08	-.62771339-09	.64017793-05	-.21776380-05	-.40108400-06
RI(05)	.20080609-01	.12273896 00	-.27145137 00	-.40088162-06	.79387838-06	-.17672598-05	.17164891-02	-.15112378-02	.35956941-03
LA(05)	.25442115-03	.58510787-03	-.12258163-02	-.35503755-08	.44120433-08	-.94625941-08	-.18301506-03	-.79257793-05	.57274475-06
LO(05)	.12903584-02	-.67803187-04	-.11015878-03	-.10999450-07	.15576201-08	.10161326-09	.35377955-05	-.13553276-05	-.10298124-05

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	.81671182 00	.33792002-01	-.22525845-03	.12021658-02	.32140563-01	.15893660-03	.13714018-02	.20080609-01	.25442115-03
Y	.17160527 00	.11618579 00	-.71256073-03	-.17736158-03	.11238898 00	.68725154-03	-.16998129-04	.12273896 00	.58510787-03
Z	-.55647350 00	-.25806602 00	.15855803-02	.15055466-03	-.24867919 00	-.15104226-02	-.23496752-03	-.27145137 00	-.12258163-02
DX	-.69731531-05	-.48268828-06	.31916873-08	-.98064774-08	-.49527058-06	-.26960662-08	-.11624465-07	-.40088162-06	-.35503755-08
DY	.22883240-05	.75041634-06	-.49002808-08	.25021637-09	.75113855-06	.46259210-08	.19878967-08	.79387838-06	.44120433-08
DZ	-.30805223-05	-.16423375-05	.10681944-07	.28560206-08	-.16457816-05	-.10207748-07	-.62771339-09	-.17672598-05	-.94625941-08
KE	.77238274-02	-.67377109-02	.38669272-04	.21309770-04	-.57530236-02	-.36131109-04	.64017793-05	.17164891-02	-.18301506-03
RE	-.34372212-02	-.14430520-02	.90535073-05	.32534852-06	-.14068235-02	-.86371557-05	-.21776380-05	-.15112378-02	-.79257793-05
G	-.12949485-02	.32042135-03	-.17954385-05	.50934153-07	.26596541-03	.14747272-05	-.40108400-06	.35956941-03	.57274475-06
KM	.89777457-01	.45119144-02	-.28523957-04	.11713475-03	.35345251-02	.18124828-04	.13541558-03	.26169645-02	.20621674-04
RI(03)	.45119144-02	.56576817-02	.28535056-04	-.15699225-05	.20129327-02	.12312910-04	.59441227-06	.22040243-02	.97371307-05
LA(03-	.28523957-04	.28535056-04	.61904083-06	.17686198-07	-.12466953-04	-.76503674-07	-.64560822-08	-.13828577-04	-.58413664-07
LO(03)	.11713475-03	-.15699225-05	.17686198-07	.24440212-06	-.22128658-05	-.18542146-07	.24387863-06	-.31324201-05	-.13739586-07
RI(04)	.35345251-02	.20129327-02	-.12466953-04	-.22128658-05	.46400805-02	-.26806169-04	.47196788-06	.22064679-02	.90700007-05
LA(04)	.18124828-04	.12312910-04	-.76503674-07	-.18542146-07	-.26806169-04	.67103387-06	.10585025-08	.13221182-04	.63726220-07
LO(04)	.13541558-03	.59441227-06	-.64560822-08	.24387863-06	.47196788-06	.10585025-08	.27242243-06	-.83647858-06	.13489072-07
RI(05)	.26169645-02	.22040243-02	-.13828577-04	-.31324201-05	.22064679-02	.13221182-04	-.83647858-06	.42173018-02	-.21243476-04
LA(05)	.20621674-04	.97371307-05	-.58413664-07	-.13739586-07	.90700007-05	.63726220-07	.13489072-07	-.21243476-04	.67513351-06
LO(05)	.12333740-03	-.58002169-06	.15406667-10	.23240058-06	-.16928699-06	-.64089906-08	.24911336-06	-.19594400-05	.84012365-08

	LO(05)
X	.12903584-02
Y	-.67803187-04
Z	-.11015878-03
DX	-.10999460-07
DY	.15576201-08
DZ	.10161326-09
KE	.35377955-05
RE	-.13553276-05
G	-.10298124-05
KM	.12333740-03
RI(03-	.58002169-06
LA(03)	.15406667-10
LO(03)	.23240058-06
RI(04-	.16928699-06
LA(04-	.64089906-08
LO(04)	.24911336-06
RI(05-	.19594400-05
LA(05)	.84012365-08
LO(05)	.24383513-06

9 CORRELATION MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.10000000 01	.19645586 00	-.30881949 00	-.96690136 00	.38804873 00	-.23719266 00	-.36536887-02	-.31307484 00	-.15897171-01
Y	.19645586 00	.99999999 00	-.99182895 00	-.35781438 00	.81871358 00	-.84371752 00	-.29442070 00	-.95151089 00	.23839878-01
Z	-.30881949 00	-.99182895 00	.10000000 01	.46238348 00	-.84153692 00	.84993429 00	.26593594 00	.95667662 00	-.22145109-01
DX	-.96690136 00	-.35781438 00	.46238348 00	.99999998 00	-.51462858 00	.38124422 00	.74718870-01	.44414552 00	.31303869-01
DY	.38804873 00	.81871358 00	-.84153692 00	-.51462858 00	.10000000 01	-.98556467 00	-.17964068 00	-.94152013 00	.14021069-01
DZ	-.23719266 00	-.84371752 00	.84993429 00	.38124422 00	-.98556467 00	.10000000 01	.18447888 00	.94256428 00	-.15969735-01
KE	-.36536887-02	-.29442070 00	.26593594 00	.74718870-01	-.17964068 00	.18447888 00	.99999999 00	.25302828 00	.67998870-01
RE	-.31307484 00	-.95151089 00	.95667662 00	.44414552 00	-.94152013 00	.94256428 00	.25302828 00	.99999999 00	-.18997455-01
G	-.15897171-01	.23839878-01	-.22145109-01	.31303869-01	.14021069-01	-.15969735-01	.67998870-01	-.18997455-01	.99999999 00
KM	.93764912 00	.22465888 00	-.32933332 00	-.85634655 00	.38705268 00	-.24278758 00	.43555410-01	-.34925688 00	-.14417870-01
RI(03)	.15454317 00	.60591318 00	-.60839608 00	-.23613019 00	.50561418 00	-.51561903 00	-.15135136 00	-.58409551 00	.14211321-01
LA(03	-.98486479-01	-.35525390 00	.35735794 00	.14926731 00	-.31564400 00	.32060951 00	.83042332-01	.35033082 00	-.76127774-02
LO(03)	.83650214 00	-.14072903 00	.54002835-01	-.72990201 00	.25650714-01	.13642520 00	.72831537-01	.20036298-01	.34370738-03
RI(04)	.16231023 00	.64719861 00	-.64736844 00	-.26753696 00	.55884776 00	-.57055199 00	-.14270086 00	-.62877898 00	.13025508-01
LA(04)	.66743175-01	.32909412 00	-.32696487 00	-.12110507 00	.28619510 00	-.29426830 00	-.74525049-01	-.32101082 00	.60058119-02
LO(04)	.90385437 00	-.12774865-01	-.79829101-01	-.81951244 00	.19302279 00	-.28400483-01	.20723946-01	-.12702389 00	-.25635758-02
RI(05)	.10636891 00	.74138144 00	-.74122410 00	-.22714481 00	.61954499 00	-.64264157 00	.44659813-01	-.70849471 00	.18471308-01
LA(05)	.10651568 00	.27933009 00	-.26454857 00	-.15899500 00	.27213296 00	-.27195757 00	-.37634417 00	-.29367588 00	.23254046-02
LO(05)	.89891239 00	-.53861517-01	-.39559048-01	-.81964696 00	.15986362 00	.48594602-02	.12105362-01	-.83563627-01	-.69573241-02

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	.93764912 00	.15454317 00	-.98486479-01	.83650214 00	.16231023 00	.66743175-01	.90385437 00	.10636891 00	.10651568 00
Y	.22465888 00	.60591318 00	-.35525390 00	-.14072903 00	.64719861 00	.32909412 00	-.12774865-01	.74138144 00	.27933009 00
Z	-.32933332 00	-.60839608 00	.35735794 00	.54002835-01	-.64736844 00	-.32696487 00	-.79829101-01	-.74122410 00	-.26454857 00
DX	-.85634655 00	-.23613019 00	.14926731 00	-.72990201 00	-.26753696 00	-.12110507 00	-.81951244 00	-.22714481 00	-.15899500 00
DY	.38705268 00	.50561418 00	-.31564400 00	.25650714-01	.55884776 00	.28619510 00	.19302279 00	.61954499 00	.27213296 00
DZ	-.24278758 00	-.51561903 00	.32060951 00	.13642520 00	-.57055199 00	-.29426830 00	-.28400483-01	-.64264157 00	-.27195757 00
KE	.43555410-01	-.15135136 00	.83042332-01	.72831537-01	-.14270086 00	-.74525049-01	.20723946-01	.44659813-01	-.37634417 00
RE	-.34925688 00	-.58409551 00	.35033082 00	.20036298-01	-.62877898 00	-.32101082 00	-.12702389 00	-.70849471 00	-.29367588 00
G	-.14417870-01	.14211321-01	-.76127774-02	.34370738-03	.13025508-01	.60058119-02	-.25635758-02	.18471308-01	.23254046-02
KM	.99999999 00	.20019717 00	-.12099473 00	.79076900 00	.17317479 00	.73844476-01	.86589161 00	.13449212 00	.83761688-01
RI(03)	.20019717 00	.10000000 01	.48216959 00	-.42218857-01	.39286854 00	.19983393 00	.15140739-01	.45121110 00	.15754945 00
LA(03	-.12099473 00	.48216959 00	.10000000 01	.45469727-01	-.23261511 00	-.11869992 00	-.15721282-01	-.27064530 00	-.90356616-01
LO(03)	.79076900 00	-.42218857-01	.45469727-01	.10000000 01	-.65711267-01	-.45786272-01	.94514805 00	-.97568622-01	-.33824106-01
RI(04)	.17317479 00	.39286854 00	-.23261511 00	-.65711267-01	.10000000 01	-.48039643 00	.13274808-01	.49878974 00	.16205026 00
LA(04)	.73844476-01	.19983393 00	-.11869992 00	-.45786272-01	-.48039643 00	.10000000 01	.24757013-02	.24853109 00	.94678438-01
LO(04)	.86589161 00	.15140739-01	-.15721282-01	.94514805 00	.13274808-01	.24757013-02	.99999997 00	-.24678346-01	.31453270-01
RI(05)	.13449212 00	.45121110 00	-.27064530 00	-.97568622-01	.49878974 00	.24853109 00	-.24678346-01	.99999999 00	-.39811945 00
LA(05)	.83761688-01	.15754945 00	-.90356616-01	-.33824106-01	.16205026 00	.94678438-01	.31453270-01	-.39811945 00	.99999998 00
LO(05)	.83361018 00	-.15616253-01	.39655268-04	.95199922 00	-.50328348-02	-.15844162-01	.96655696 00	-.61103556-01	.20706191-01

	LO(05)
X	.89891239 00
Y	-.53861517-01
Z	-.39559048-01
DX	-.81964696 00
DY	.15986362 00
DZ	.48594602-02
KE	.12105362-01
RE	-.83563627-01
G	-.69573241-02
KM	.83361018 00
RI(03	-.15616253-01
LA(03)	.39655268-04
LO(03)	.95199922 00
RI(04	-.50328348-02
LA(04	-.15844162-01
LO(04)	.96655696 00
RI(05	-.61103556-01
LA(05)	.20706191-01
LO(05)	.10000000 01

10 STATION NUMBER 12 65/03/23 ITERATION NUMBER 3 PASS NUMBER 03/231

FREQUENCY 8296.0

TIME	TC	Q	CC3		
123317	60	12	.10779454	06 .852-01	.0127
123417	60	12	.10780211	06 .852-01	.0059
123517	60	12	.10780969	06 .852-01	.0205
123617	60	12	.10781729	06 .852-01	-.0078
123717	60	12	.10782490	06 .852-01	-.0137
124217	60	12	.10786308	06 .852-01	.0010
124317	60	12	.10787075	06 .852-01	.0000
124417	60	12	.10787843	06 .852-01	.0068
124732	60	12	.10790344	06 .852-01	-.0049
124832	60	12	.10791115	06 .852-01	-.0029
124932	60	12	.10791887	06 .852-01	.0068
125032	60	12	.10792661	06 .852-01	.0088
125132	60	12	.10793435	06 .852-01	.0029
125232	60	12	.10794209	06 .852-01	.0049
125332	60	12	.10794985	06 .852-01	-.0010
125432	60	12	.10795761	06 .852-01	.0029
125532	60	12	.10796538	06 .852-01	-.0010
125632	60	12	.10797316	06 .852-01	.0039
125732	60	12	.10798095	06 .852-01	.0020
125832	60	12	.10798874	06 .852-01	.0117
125932	60	12	.10799654	06 .852-01	-.0039
130032	60	12	.10800434	06 .852-01	.0068
130132	60	12	.10801215	06 .852-01	.0127
130232	60	12	.10801997	06 .852-01	-.0049
130332	60	12	.10802779	06 .852-01	.0059
130432	60	12	.10803562	06 .852-01	.0098
130532	60	12	.10804346	06 .852-01	.0078
130632	60	12	.10805130	06 .852-01	.0020
130732	60	12	.10805914	06 .852-01	.0059
130832	60	12	.10806699	06 .852-01	.0059
131132	60	12	.10809057	06 .852-01	.0098
131232	60	12	.10809844	06 .852-01	-.0088
131332	60	12	.10810631	06 .852-01	.0029
131432	60	12	.10811419	06 .852-01	.0088
131532	60	12	.10812207	06 .852-01	-.0039
131632	60	12	.10812995	06 .852-01	.0117
131732	60	12	.10813784	06 .852-01	.0088
131832	60	12	.10814573	06 .852-01	.0010
131932	60	12	.10815362	06 .852-01	.0088
132032	60	12	.10816152	06 .852-01	.0127
132132	60	12	.10816942	06 .852-01	-.0029
132232	60	12	.10817732	06 .852-01	.0137
132332	60	12	.10818522	06 .852-01	-.0068
132432	60	12	.10819313	06 .852-01	.0049
132532	60	12	.10820103	06 .852-01	-.0010
132632	60	12	.10820894	06 .852-01	.0059
132732	60	12	.10821685	06 .852-01	.0137
132832	60	12	.10822476	06 .852-01	.0020
132932	60	12	.10823268	06 .852-01	.0059
133032	60	12	.10824059	06 .852-01	-.0068
133132	60	12	.10824850	06 .852-01	.0127
133232	60	12	.10825642	06 .852-01	.0146

STATION NUMBER 12 65/03/23 ITERATION NUMBER 3 PASS NUMBER 03/231

FREQUENCY 8296.0

TIME	TC	Q	CC3	
133332	60	12	.10826433 06 .852-01	.0000
133432	60	12	.10827225 06 .852-01	.0020
133532	60	12	.10828016 06 .852-01	.0029
133632	60	12	.10828808 06 .852-01	.0049
133732	60	12	.10829599 06 .852-01	.0078
133832	60	12	.10830390 06 .852-01	-.0059
133932	60	12	.10831182 06 .852-01	-.0020
134032	60	12	.10831973 06 .852-01	.0195
134132	60	12	.10832764 06 .852-01	-.0088
134232	60	12	.10833555 06 .852-01	-.0010
134332	60	12	.10834346 06 .852-01	.0068
134432	60	12	.10835136 06 .852-01	.0020
134532	60	12	.10835927 06 .852-01	-.0020
134632	60	12	.10836717 06 .852-01	.0117
134732	60	12	.10837507 06 .852-01	-.0039
134832	60	12	.10838297 06 .852-01	-.0020
134932	60	12	.10839086 06 .852-01	.0039
135032	60	12	.10839875 06 .852-01	.0127
135132	60	12	.10840664 06 .852-01	-.0098
135232	60	12	.10841453 06 .852-01	.0049
135332	60	12	.10842241 06 .852-01	-.0117
135432	60	12	.10843029 06 .852-01	.0107
135532	60	12	.10843816 06 .852-01	.0020
135632	60	12	.10844603 06 .852-01	-.0020
135732	60	12	.10845390 06 .852-01	-.0029
135832	60	12	.10846176 06 .852-01	.0020
135932	60	12	.10846962 06 .852-01	-.0059
140032	60	12	.10847747 06 .852-01	.0068
140132	60	12	.10848532 06 .852-01	.0098
140232	60	12	.10849317 06 .852-01	.0000
140332	60	12	.10850100 06 .852-01	-.0039
140432	60	12	.10850884 06 .852-01	-.0039
140532	60	12	.10851666 06 .852-01	.0020
140632	60	12	.10852448 06 .852-01	-.0020
140732	60	12	.10853230 06 .852-01	.0000
140832	60	12	.10854011 06 .852-01	.0078
140932	60	12	.10854791 06 .852-01	.0049
141032	60	12	.10855571 06 .852-01	-.0078
141132	60	12	.10856349 06 .852-01	.0039
141232	60	12	.10857128 06 .852-01	.0049
141332	60	12	.10857905 06 .852-01	.0127
141432	60	12	.10858682 06 .852-01	-.0049
141532	60	12	.10859458 06 .852-01	.0010
141632	60	12	.10860233 06 .852-01	-.0020
141732	60	12	.10861008 06 .852-01	.0029
141832	60	12	.10861782 06 .852-01	.0000
141932	60	12	.10862554 06 .852-01	.0049
142032	60	12	.10863326 06 .852-01	.0010
142132	60	12	.10864098 06 .852-01	.0049
142232	60	12	.10864868 06 .852-01	.0020
142332	60	12	.10865637 06 .852-01	-.0088
142432	60	12	.10866406 06 .852-01	.0068

STATION NUMBER 12 65/03/23 ITERATION NUMBER 3 PASS NUMBER 03/231

FREQUENCY 8296.0

TIME	TC	Q	CC3			
142532	60	12	.10867174	06	.852-01	-.0029
142632	60	12	.10867940	06	.852-01	.0146
142732	60	12	.10868706	06	.852-01	-.0088
142832	60	12	.10869470	06	.852-01	.0107
142932	60	12	.10870234	06	.852-01	.0078
143032	60	12	.10870997	06	.852-01	-.0029
143132	60	12	.10871758	06	.852-01	-.0020
143232	60	12	.10872519	06	.852-01	.0088
143332	60	12	.10873278	06	.852-01	-.0020
143432	60	12	.10874037	06	.852-01	-.0029
143532	60	12	.10874794	06	.852-01	.0068
143632	60	12	.10875550	06	.852-01	.0127
143732	60	12	.10876305	06	.852-01	-.0039
143832	60	12	.10877059	06	.852-01	.0068
143932	60	12	.10877812	06	.852-01	-.0029
144032	60	12	.10878563	06	.852-01	-.0020
144132	60	12	.10879314	06	.852-01	.0117
144232	60	12	.10880063	06	.852-01	.0049
144332	60	12	.10880810	06	.852-01	-.0059
144432	60	12	.10881557	06	.852-01	.0117
144532	60	12	.10882302	06	.852-01	-.0068
144632	60	12	.10883046	06	.852-01	.0029
144732	60	12	.10883789	06	.852-01	.0107
144832	60	12	.10884530	06	.852-01	-.0020
144932	60	12	.10885270	06	.852-01	-.0020
145032	60	12	.10886009	06	.852-01	.0137
145132	60	12	.10886746	06	.852-01	-.0088
145232	60	12	.10887481	06	.852-01	.0010
145332	60	12	.10888216	06	.852-01	.0078
145432	60	12	.10888949	06	.852-01	.0127

FREQUENCY 8322.0

160232	60	12	.10934496	06	.852-01	.0010
160332	60	12	.10935090	06	.852-01	.0107
160432	60	12	.10935682	06	.852-01	-.0039
160532	60	12	.10936271	06	.852-01	.0068

STATION NUMBER 12 65/03/23 ITERATION NUMBER 3 PASS NUMBER 03/232

FREQUENCY 8322.0

TIME	TC	Q	CC3	
160632	60	12	.10936857 06 .852-01	-.0059
160732	60	12	.10937441 06 .852-01	.0068
160832	60	12	.10938022 06 .852-01	.0117
160932	60	12	.10938600 06 .852-01	-.0059
161032	60	12	.10939177 06 .852-01	.0010
161332	60	12	.10940888 06 .852-01	.0000
161432	60	12	.10941453 06 .852-01	-.0020
161532	60	12	.10942016 06 .852-01	.0059
161632	60	12	.10942576 06 .852-01	.0068
161732	60	12	.10943133 06 .852-01	.0029
161832	60	12	.10943687 06 .852-01	-.0078
161932	60	12	.10944239 06 .852-01	.0088
162032	60	12	.10944788 06 .854-01	-.0127
162132	60	12	.10945334 06 .854-01	.0098
162232	60	12	.10945877 06 .854-01	-.0059
162332	60	12	.10946418 06 .854-01	.0049
162432	60	12	.10946955 06 .854-01	-.0049
162532	60	12	.10947490 06 .854-01	-.0039
162632	60	12	.10948022 06 .854-01	-.0068
162732	60	12	.10948551 06 .854-01	.0020
162832	60	12	.10949078 06 .854-01	.0059
162932	60	12	.10949601 06 .854-01	-.0117
163032	60	12	.10950122 06 .854-01	-.0010
163132	60	12	.10950639 06 .854-01	-.0107
163232	60	12	.10951154 06 .854-01	-.0068
163332	60	12	.10951666 06 .854-01	.0088
163432	60	12	.10952175 06 .854-01	-.0137
163532	60	12	.10952680 06 .854-01	-.0049
163632	60	12	.10953183 06 .857-01	-.0010
163732	60	12	.10953683 06 .857-01	.0000
163832	60	12	.10954180 06 .857-01	-.0029
163932	60	12	.10954674 06 .857-01	-.0098
164032	60	12	.10955165 06 .857-01	-.0029
164132	60	12	.10955653 06 .857-01	-.0146
164232	60	12	.10956138 06 .857-01	-.0137
164332	60	12	.10956620 06 .857-01	.0010
164432	60	12	.10957099 06 .857-01	-.0205
164532	60	12	.10957574 06 .859-01	-.0107
164632	60	12	.10958047 06 .859-01	-.0029
164732	60	12	.10958516 06 .859-01	-.0146
164832	60	12	.10958983 06 .859-01	-.0117
164932	60	12	.10959446 06 .859-01	-.0127
165032	60	12	.10959906 06 .859-01	-.0137
165132	60	12	.10960363 06 .862-01	-.0176
165232	60	12	.10960817 06 .862-01	-.0234
165332	60	12	.10961268 06 .862-01	.0029
165432	60	12	.10961715 06 .862-01	-.0225
165832	60	12	.10963474 06 .864-01	-.0225

STATION NUMBER 12 65/03/24 ITERATION NUMBER 3 PASS NUMBER 03/233

FREQUENCY 8259.0

TIME	TC	Q	CC3	
091532	60	12	.10515521 06 .130 00	.0176
091632	60	12	.10516002 06 .126 00	.0156
091732	60	12	.10516487 06 .122 00	-.0020
091832	60	12	.10516977 06 .119 00	.0146
091932	60	12	.10517472 06 .116 00	.0156
092032	60	12	.10517972 06 .113 00	.0000
092332	60	12	.10519501 06 .107 00	.0078
092432	60	12	.10520020 06 .105 00	.0107
092532	60	12	.10520545 06 .103 00	-.0020
092832	60	12	.10522149 06 .991-01	.0127
092932	60	12	.10522693 06 .981-01	.0000
093032	60	12	.10523243 06 .972-01	.0049
093132	60	12	.10523797 06 .962-01	.0107
093232	60	12	.10524357 06 .952-01	.0000
093332	60	12	.10524921 06 .945-01	.0049
093432	60	12	.10525490 06 .938-01	-.0068
093532	60	12	.10526065 06 .933-01	-.0020
093632	60	12	.10526645 06 .925-01	.0029
093732	60	12	.10527229 06 .920-01	.0088
093832	60	12	.10527819 06 .916-01	-.0039
093932	60	12	.10528413 06 .911-01	.0000
094032	60	12	.10529013 06 .908-01	-.0117
094132	60	12	.10529617 06 .903-01	.0078
094232	60	12	.10530227 06 .901-01	-.0049
094332	60	12	.10530842 06 .896-01	-.0029
094432	60	12	.10531462 06 .894-01	-.0010
094532	60	12	.10532086 06 .891-01	.0010
094632	60	12	.10532716 06 .889-01	.0010
094732	60	12	.10533351 06 .886-01	.0029
094832	60	12	.10533991 06 .884-01	.0010
094932	60	12	.10534637 06 .881-01	-.0166
095032	60	12	.10535287 06 .879-01	.0146
095132	60	12	.10535942 06 .879-01	-.0049
095232	60	12	.10536602 06 .876-01	-.0088
095332	60	12	.10537268 06 .874-01	.0029
095432	60	12	.10537938 06 .874-01	-.0029
095532	60	12	.10538614 06 .872-01	.0059
095632	60	12	.10539295 06 .872-01	-.0029
095732	60	12	.10539981 06 .869-01	.0039
095832	60	12	.10540672 06 .869-01	-.0068
095932	60	12	.10541368 06 .867-01	-.0029
100032	60	12	.10542070 06 .867-01	-.0010
100132	60	12	.10542776 06 .867-01	.0010
100232	60	12	.10543488 06 .864-01	.0000
100332	60	12	.10544205 06 .864-01	-.0020
100432	60	12	.10544927 06 .864-01	-.0059
100532	60	12	.10545654 06 .862-01	.0049
100632	60	12	.10546387 06 .862-01	-.0039
100732	60	12	.10547125 06 .862-01	.0029
100832	60	12	.10547868 06 .862-01	.0068
100932	60	12	.10548616 06 .862-01	-.0068
101032	60	12	.10549369 06 .859-01	.0098

STATION NUMBER 12 65/03/24 ITERATION NUMBER 3 PASS NUMBER 03/233

FREQUENCY 8259.0

TIME	TC	Q	CC3	
101132	60	12	.10550127 06 .859-01	-.0088
101232	60	12	.10550891 06 .859-01	.0020
101332	60	12	.10551660 06 .859-01	.0117
101432	60	12	.10552435 06 .859-01	-.0156
101532	60	12	.10553214 06 .857-01	.0049
101632	60	12	.10553999 06 .857-01	.0059
101732	60	12	.10554790 06 .857-01	.0029
101832	60	12	.10555585 06 .857-01	-.0020
101932	60	12	.10556386 06 .857-01	-.0107
102032	60	12	.10557192 06 .857-01	.0107
102132	60	12	.10558004 06 .857-01	-.0039
102232	60	12	.10558821 06 .857-01	-.0068
102332	60	12	.10559643 06 .857-01	.0039
102432	60	12	.10560470 06 .854-01	-.0059
102532	60	12	.10561303 06 .854-01	.0146
102632	60	12	.10562142 06 .854-01	-.0039
102732	60	12	.10562986 06 .854-01	-.0088
102832	60	12	.10563835 06 .854-01	.0146
102932	60	12	.10564690 06 .854-01	.0000
103032	60	12	.10565550 06 .854-01	-.0010
103132	60	12	.10566416 06 .854-01	-.0088
103232	60	12	.10567287 06 .854-01	.0127
103332	60	12	.10568164 06 .854-01	-.0049
103432	60	12	.10569046 06 .854-01	.0059
103532	60	12	.10569934 06 .854-01	-.0049
103632	60	12	.10570827 06 .854-01	-.0049
103732	60	12	.10571726 06 .854-01	.0059
103832	60	12	.10572631 06 .854-01	.0098
103932	60	12	.10573541 06 .854-01	-.0078
104032	60	12	.10574456 06 .854-01	.0010
104132	60	12	.10575378 06 .852-01	.0039
104232	60	12	.10576305 06 .852-01	-.0010
104332	60	12	.10577238 06 .852-01	.0039
104432	60	12	.10578176 06 .852-01	.0020
104532	60	12	.10579121 06 .852-01	-.0078
104632	60	12	.10580071 06 .852-01	.0088
104732	60	12	.10581027 06 .852-01	.0010
104832	60	12	.10581988 06 .852-01	-.0156
104932	60	12	.10582955 06 .852-01	.0107
105032	60	12	.10583929 06 .852-01	-.0059
105132	60	12	.10584908 06 .852-01	.0029
105232	60	12	.10585893 06 .852-01	.0010
105332	60	12	.10586884 06 .852-01	.0088
105432	60	12	.10587881 06 .852-01	-.0107
105532	60	12	.10588884 06 .852-01	-.0068
105632	60	12	.10589893 06 .852-01	.0029
105732	60	12	.10590908 06 .852-01	.0029

STATION NUMBER 12 65/03/24 ITERATION NUMBER 3 PASS NUMBER 03/234

FREQUENCY 8259.0

TIME	TC	Q	CC3		
105832	60	12	.10591929	06 .852-01	-.0078
105932	60	12	.10592956	06 .852-01	.0039
110032	60	12	.10593989	06 .852-01	-.0127
110132	60	12	.10595029	06 .852-01	-.0068
110232	60	12	.10596074	06 .852-01	.0039
110332	60	12	.10597126	06 .852-01	.0010
110432	60	12	.10598185	06 .852-01	-.0146
110532	60	12	.10599249	06 .852-01	.0078
110632	60	12	.10600320	06 .852-01	.0000
110732	60	12	.10601397	06 .852-01	-.0059
110832	60	12	.10602481	06 .852-01	-.0068
110932	60	12	.10603571	06 .852-01	.0088
111032	60	12	.10604667	06 .852-01	-.0068
111132	60	12	.10605770	06 .852-01	-.0039
111232	60	12	.10606880	06 .852-01	.0010
111332	60	12	.10607996	06 .852-01	.0039
111432	60	12	.10609119	06 .852-01	-.0078
111532	60	12	.10610249	06 .852-01	-.0039
111632	60	12	.10611385	06 .852-01	.0000
111732	60	12	.10612528	06 .852-01	.0020
111832	60	12	.10613678	06 .852-01	.0020
111932	60	12	.10614835	06 .852-01	-.0010
112032	60	12	.10615999	06 .852-01	-.0068
112132	60	12	.10617170	06 .852-01	.0020
112232	60	12	.10618348	06 .852-01	.0059
112332	60	12	.10619533	06 .852-01	-.0107
112432	60	12	.10620725	06 .852-01	.0010
112532	60	12	.10621924	06 .852-01	.0068
112632	60	12	.10623131	06 .852-01	-.0098
112732	60	12	.10624345	06 .852-01	-.0020
112832	60	12	.10625566	06 .852-01	.0010
112932	60	12	.10626795	06 .852-01	.0117
113032	60	12	.10628032	06 .852-01	-.0029
113132	60	12	.10629276	06 .852-01	-.0107
113232	60	12	.10630528	06 .852-01	.0049
113332	60	12	.10631787	06 .852-01	-.0078
113432	60	12	.10633055	06 .852-01	.0020
113532	60	12	.10634330	06 .852-01	.0000

FREQUENCY 8282.0

114032	60	12	.10640828	06 .852-01	.0010
114132	60	12	.10642153	06 .852-01	.0068
114232	60	12	.10643485	06 .852-01	-.0049
114332	60	12	.10644827	06 .852-01	.0127
114432	60	12	.10646177	06 .852-01	-.0049
114832	60	12	.10651667	06 .852-01	-.0020
114932	60	12	.10653062	06 .852-01	-.0029
115032	60	12	.10654466	06 .852-01	.0020
115132	60	12	.10655880	06 .852-01	-.0029
115232	60	12	.10657304	06 .852-01	.0117
115332	60	12	.10658737	06 .852-01	-.0039

STATION NUMBER 12 65/03/24 ITERATION NUMBER 3 PASS NUMBER 03/234

FREQUENCY 8282.0

TIME	TC	Q	CC3			
115432	60	12	.10660180	06	.852-01	.0000
115532	60	12	.10661633	06	.852-01	.0039
115632	60	12	.10663096	06	.852-01	-.0098
115732	60	12	.10664569	06	.852-01	.0078
115832	60	12	.10666053	06	.852-01	-.0098
115932	60	12	.10667547	06	.852-01	.0146
120032	60	12	.10669051	06	.852-01	.0020
120132	60	12	.10670567	06	.852-01	-.0039
120232	60	12	.10672093	06	.852-01	-.0029
120332	60	12	.10673631	06	.852-01	.0049
120432	60	12	.10675180	06	.852-01	-.0020
120532	60	12	.10676741	06	.852-01	.0098
120632	60	12	.10678313	06	.852-01	-.0107
120732	60	12	.10679897	06	.852-01	-.0010
120832	60	12	.10681493	06	.852-01	.0068
120932	60	12	.10683101	06	.852-01	.0078
121032	60	12	.10684721	06	.852-01	.0010
121132	60	12	.10686355	06	.852-01	.0010
121232	60	12	.10688001	06	.852-01	.0059
121332	60	12	.10689660	06	.852-01	-.0039
121432	60	12	.10691333	06	.852-01	-.0127
121532	60	12	.10693019	06	.852-01	.0088
121632	60	12	.10694719	06	.852-01	.0098
121732	60	12	.10696433	06	.852-01	.0029
121832	60	12	.10698161	06	.852-01	-.0127
121932	60	12	.10699904	06	.852-01	.0078
122032	60	12	.10701662	06	.852-01	-.0029
122132	60	12	.10703435	06	.852-01	.0010
122232	60	12	.10705223	06	.852-01	.0010
122332	60	12	.10707027	06	.852-01	.0098
122432	60	12	.10708847	06	.852-01	.0068
122532	60	12	.10710684	06	.852-01	-.0078
122632	60	12	.10712537	06	.852-01	.0088
122732	60	12	.10714408	06	.852-01	.0039
122832	60	12	.10716296	06	.852-01	-.0088
122932	60	12	.10718202	06	.852-01	.0010
123032	60	12	.10720125	06	.852-01	.0117
123132	60	12	.10722068	06	.852-01	-.0146
123232	60	12	.10724030	06	.852-01	.0029
123332	60	12	.10726011	06	.852-01	.0078
123432	60	12	.10728012	06	.852-01	-.0020
123532	60	12	.10730033	06	.852-01	.0000
123632	60	12	.10732076	06	.852-01	.0107
123732	60	12	.10734139	06	.852-01	-.0098
123832	60	12	.10736225	06	.852-01	.0176
123932	60	12	.10738333	06	.852-01	.0029
124032	60	12	.10740464	06	.852-01	-.0078
124132	60	12	.10742619	06	.852-01	-.0049
124232	60	12	.10744797	06	.852-01	.0068
124332	60	12	.10747001	06	.852-01	.0039
124432	60	12	.10749230	06	.852-01	-.0039
124532	60	12	.10751486	06	.852-01	.0088

STATION NUMBER 12 65/03/24 ITERATION NUMBER 3 PASS NUMBER 03/234

FREQUENCY 8282.0

TIME	TC	Q	CC3	
124632	60	12	.10753768 06 .852-01	.0029
124732	60	12	.10756078 06 .852-01	-.0107
124832	60	12	.10758416 06 .852-01	.0068
124932	60	12	.10760783 06 .852-01	.0000
125032	60	12	.10763181 06 .852-01	-.0068
125132	60	12	.10765609 06 .852-01	.0098
125232	60	12	.10768069 06 .852-01	-.0088
125332	60	12	.10770562 06 .852-01	.0137
125432	60	12	.10773088 06 .852-01	-.0029
125532	60	12	.10775650 06 .852-01	.0000
125632	60	12	.10778247 06 .852-01	-.0068
125732	60	12	.10780881 06 .852-01	.0020
125832	60	12	.10783554 06 .852-01	.0107
125932	60	12	.10786266 06 .852-01	-.0088
130032	60	12	.10789018 06 .852-01	-.0010
130259	60	12	.10795943 06 .852-01	.0010
130359	60	12	.10798847 06 .852-01	-.0059
130459	60	12	.10801799 06 .852-01	.0137
130559	60	12	.10804799 06 .852-01	.0098
130659	60	12	.10807850 06 .852-01	-.0029
130759	60	12	.10810954 06 .852-01	-.0098
130859	60	12	.10814113 06 .852-01	.0039
130959	60	12	.10817328 06 .852-01	.0000
131059	60	12	.10820603 06 .852-01	.0068
131159	60	12	.10823938 06 .852-01	.0000
131259	60	12	.10827338 06 .852-01	.0068
131359	60	12	.10830803 06 .852-01	.0010
131459	60	12	.10834338 06 .852-01	.0029
131559	60	12	.10837945 06 .852-01	-.0137
131659	60	12	.10841626 06 .852-01	.0029
131759	60	12	.10845386 06 .852-01	.0029
131859	60	12	.10849228 06 .852-01	.0020
131959	60	12	.10853155 06 .852-01	-.0029
132059	60	12	.10857172 06 .852-01	.0137
132159	60	12	.10861282 06 .852-01	-.0039
132259	60	12	.10865490 06 .852-01	-.0020
132359	60	12	.10869801 06 .852-01	.0068
132459	60	12	.10874220 06 .852-01	-.0146
132559	60	12	.10878752 06 .852-01	.0000
132659	60	12	.10883403 06 .852-01	.0049
132759	60	12	.10888179 06 .852-01	-.0088
132859	60	12	.10893088 06 .852-01	.0049
132959	60	12	.10898136 06 .852-01	-.0068
133059	60	12	.10903330 06 .852-01	-.0059
133159	60	12	.10908681 06 .852-01	.0059
133259	60	12	.10914196 06 .852-01	.0049
133359	60	12	.10919886 06 .852-01	-.0068
133459	60	12	.10925760 06 .852-01	-.0039
133559	60	12	.10931832 06 .852-01	.0000
133659	60	12	.10938112 06 .852-01	-.0078
133759	60	12	.10944616 06 .852-01	.0039
133859	60	12	.10951358 06 .852-01	.0000

STATION NUMBER 12 65/03/24 ITERATION NUMBER 3 PASS NUMBER 03/234

FREQUENCY 8282.0

TIME	TC	Q	CC3	
133959	60	12	.10958355 06 .852-01	-.0010
134059	60	12	.10965625 06 .852-01	.0020
134159	60	12	.10973187 06 .852-01	-.0078
134259	60	12	.10981065 06 .852-01	.0010
134359	60	12	.10989282 06 .852-01	.0000
134459	60	12	.10997865 06 .852-01	-.0156
134559	60	12	.11006845 06 .852-01	.0020
134659	60	12	.11016255 06 .852-01	.0010
134759	60	12	.11026133 06 .852-01	-.0010
134859	60	12	.11036523 06 .852-01	-.0098
134959	60	12	.11047471 06 .852-01	-.0078
135059	60	12	.11059032 06 .852-01	.0107
135159	60	12	.11071269 06 .852-01	-.0117
135259	60	12	.11084253 06 .852-01	.0137
135359	60	12	.11098067 06 .852-01	-.0010
135459	60	12	.11112804 06 .852-01	-.0049
135559	60	12	.11128575 06 .852-01	.0117
135659	60	12	.11145511 06 .852-01	.0020

DATA STATISTICS STATION 3 ITERATION 3

PASS	DATA TYPE	BEGINNING TIME	END TIME	NUMBER OF POINTS	STD DEV	RMS	FIRST MOMENT	SECOND MOMENT
03/231	CC3	3/23-123317	3/23-160532	138	.686-02	.744-02	.289-02	.554-04
03/232	CC3	3/23-160632	3/23-165832	48	.903-02	.104-01	-.507-02	.107-03
03/233	CC3	3/24-091532	3/24-105732	99	.751-02	.758-02	.101-02	.574-04
03/234	CC3	3/24-105832	3/24-135659	171	.710-02	.710-02	.457-04	.504-04

STATION NUMBER 41 65/03/23 ITERATION NUMBER 3 PASS NUMBER 03/236

FREQUENCY 8268.0

TIME	TC	Q	CC3	
150232	60	41	.10580609 06 .854-01	-.0078
150332	60	41	.10580566 06 .854-01	.0068
150432	60	41	.10580527 06 .854-01	.0117
150532	60	41	.10580493 06 .854-01	-.0127
150632	60	41	.10580463 06 .854-01	.0039
150732	60	41	.10580437 06 .854-01	-.0068
150832	60	41	.10580416 06 .854-01	.0049
150932	60	41	.10580399 06 .854-01	-.0117
151032	60	41	.10580387 06 .854-01	.0137
151132	60	41	.10580379 06 .854-01	-.0059
151232	60	41	.10580375 06 .854-01	-.0029
151332	60	41	.10580376 06 .854-01	.0068
151432	60	41	.10580381 06 .854-01	-.0117
151532	60	41	.10580391 06 .852-01	.0098
151632	60	41	.10580404 06 .852-01	-.0117
151732	60	41	.10580423 06 .852-01	.0059
151832	60	41	.10580445 06 .852-01	-.0029
151932	60	41	.10580472 06 .852-01	-.0059
152032	60	41	.10580503 06 .852-01	-.0020
152132	60	41	.10580539 06 .852-01	.0078
152232	60	41	.10580579 06 .852-01	-.0098
152332	60	41	.10580624 06 .852-01	-.0039
152432	60	41	.10580672 06 .852-01	.0088
152532	60	41	.10580725 06 .852-01	-.0049
152632	60	41	.10580783 06 .852-01	.0039
152732	60	41	.10580845 06 .852-01	.0020
152832	60	41	.10580911 06 .852-01	-.0088
152932	60	41	.10580981 06 .852-01	.0039
153032	60	41	.10581056 06 .852-01	-.0107
153132	60	41	.10581135 06 .852-01	.0137
153232	60	41	.10581219 06 .852-01	-.0039
153332	60	41	.10581306 06 .852-01	.0020
153432	60	41	.10581399 06 .852-01	-.0039
153532	60	41	.10581495 06 .852-01	-.0010
153632	60	41	.10581596 06 .852-01	-.0078
153732	60	41	.10581701 06 .852-01	.0088
153832	60	41	.10581810 06 .852-01	-.0186
153932	60	41	.10581924 06 .852-01	.0117

FREQUENCY 8272.0

170232	60	41	.10605786 06 .852-01	-.0146
170332	60	41	.10606239 06 .852-01	-.0049
170432	60	41	.10606695 06 .852-01	.0010
170532	60	41	.10607155 06 .852-01	.0039
170632	60	41	.10607618 06 .852-01	.0039
170732	60	41	.10608085 06 .852-01	-.0166
170832	60	41	.10608555 06 .852-01	.0117
170932	60	41	.10609030 06 .852-01	-.0146
171032	60	41	.10609507 06 .852-01	.0078
171132	60	41	.10609989 06 .852-01	-.0068
171232	60	41	.10610474 06 .852-01	-.0068

STATION NUMBER 41 65/03/23 ITERATION NUMBER 3 PASS NUMBER 03/236

FREQUENCY 8272.0

TIME	TC	Q	CC3	
171332	60	41	.10610962 06 .852-01	.0088
171432	60	41	.10611454 06 .852-01	-.0117
171532	60	41	.10611950 06 .852-01	-.0020
171632	60	41	.10612449 06 .852-01	-.0107
171732	60	41	.10612952 06 .852-01	-.0029
171832	60	41	.10613458 06 .852-01	.0010
171932	60	41	.10613968 06 .852-01	.0039
172032	60	41	.10614481 06 .852-01	-.0098
172132	60	41	.10614997 06 .852-01	.0068
172432	60	41	.10616568 06 .852-01	.0010
172532	60	41	.10617099 06 .852-01	-.0029
172632	60	41	.10617632 06 .852-01	-.0068
172732	60	41	.10618169 06 .852-01	.0039
172832	60	41	.10618710 06 .852-01	-.0176
172932	60	41	.10619254 06 .852-01	.0098
173032	60	41	.10619801 06 .852-01	-.0127
173132	60	41	.10620352 06 .852-01	-.0020
173232	60	41	.10620906 06 .852-01	.0088
173332	60	41	.10621463 06 .852-01	-.0146
173432	60	41	.10622023 06 .852-01	-.0039
173532	60	41	.10622587 06 .852-01	.0078
173632	60	41	.10623155 06 .852-01	.0029
173732	60	41	.10623725 06 .852-01	-.0186
173832	60	41	.10624299 06 .852-01	-.0049
173932	60	41	.10624876 06 .852-01	.0107
174032	60	41	.10625456 06 .852-01	-.0078
174132	60	41	.10626039 06 .852-01	-.0078
174232	60	41	.10626626 06 .852-01	.0107
174332	60	41	.10627215 06 .852-01	-.0039
174432	60	41	.10627808 06 .852-01	-.0156
174532	60	41	.10628404 06 .852-01	.0068
174632	60	41	.10629003 06 .852-01	-.0010
174732	60	41	.10629606 06 .852-01	-.0078
174832	60	41	.10630211 06 .852-01	.0049
174932	60	41	.10630820 06 .852-01	-.0146
175032	60	41	.10631431 06 .852-01	.0029
175132	60	41	.10632046 06 .852-01	.0059
175232	60	41	.10632664 06 .852-01	-.0049
175332	60	41	.10633284 06 .852-01	-.0127
175432	60	41	.10633908 06 .852-01	-.0010
175532	60	41	.10634535 06 .852-01	-.0029
175632	60	41	.10635165 06 .852-01	-.0020
175732	60	41	.10635798 06 .852-01	.0029
175832	60	41	.10636434 06 .852-01	-.0049
175932	60	41	.10637072 06 .852-01	-.0088
180032	60	41	.10637714 06 .852-01	.0068
180132	60	41	.10638359 06 .852-01	-.0059
180232	60	41	.10639006 06 .852-01	.0029
180332	60	41	.10639657 06 .852-01	-.0020
180432	60	41	.10640310 06 .852-01	-.0020
180532	60	41	.10640966 06 .852-01	.0029
180632	60	41	.10641625 06 .852-01	-.0039

STATION NUMBER 41 65/03/23 ITERATION NUMBER 3 PASS NUMBER 03/236

FREQUENCY 8272.0

TIME	TC	Q	CC3	
180732	60	41	.10642287 06 .852-01	-.0068
180832	60	41	.10642952 06 .852-01	.0137
181832	60	41	.10649751 06 .852-01	.0068
181932	60	41	.10650446 06 .852-01	-.0078
182032	60	41	.10651143 06 .852-01	.0020
182132	60	41	.10651843 06 .852-01	.0020
182232	60	41	.10652546 06 .852-01	-.0078
182332	60	41	.10653251 06 .852-01	-.0088
182432	60	41	.10653959 06 .852-01	-.0039
182532	60	41	.10654669 06 .852-01	.0098
182632	60	41	.10655382 06 .852-01	-.0020
182732	60	41	.10656097 06 .852-01	-.0068
182832	60	41	.10656815 06 .852-01	-.0020
182932	60	41	.10657535 06 .852-01	-.0059
183032	60	41	.10658258 06 .852-01	-.0010
183132	60	41	.10658984 06 .852-01	-.0039
183232	60	41	.10659711 06 .852-01	.0020
183332	60	41	.10660442 06 .852-01	.0000
183432	60	41	.10661174 06 .852-01	-.0098
183532	60	41	.10661909 06 .852-01	.0078
183632	60	41	.10662646 06 .852-01	-.0156
183732	60	41	.10663386 06 .852-01	.0039
183832	60	41	.10664128 06 .852-01	.0000
183932	60	41	.10664873 06 .852-01	-.0107
184032	60	41	.10665619 06 .852-01	.0059
184132	60	41	.10666368 06 .852-01	.0000
184232	60	41	.10667119 06 .852-01	-.0127
184332	60	41	.10667873 06 .852-01	.0020
184432	60	41	.10668629 06 .852-01	-.0049
184532	60	41	.10669387 06 .852-01	-.0010
184632	60	41	.10670147 06 .852-01	-.0029
184732	60	41	.10670909 06 .852-01	-.0098
184832	60	41	.10671674 06 .852-01	-.0049
184932	60	41	.10672440 06 .852-01	-.0049
185032	60	41	.10673209 06 .852-01	.0068
185132	60	41	.10673980 06 .852-01	-.0020
185232	60	41	.10674753 06 .852-01	.0010
185332	60	41	.10675528 06 .852-01	.0000
185432	60	41	.10676305 06 .852-01	-.0049
185532	60	41	.10677085 06 .852-01	.0029
185632	60	41	.10677866 06 .852-01	-.0098
185732	60	41	.10678649 06 .852-01	.0078
185832	60	41	.10679434 06 .852-01	-.0117
185932	60	41	.10680222 06 .852-01	-.0010
190032	60	41	.10681011 06 .852-01	.0068
190132	60	41	.10681802 06 .852-01	-.0039
190232	60	41	.10682595 06 .852-01	-.0020
190332	60	41	.10683390 06 .852-01	-.0010
190432	60	41	.10684187 06 .852-01	-.0029
190532	60	41	.10684986 06 .852-01	-.0068
190632	60	41	.10685786 06 .852-01	.0039
190732	60	41	.10686588 06 .852-01	-.0029

STATION NUMBER 41 65/03/23 ITERATION NUMBER 3 PASS NUMBER 03/236

FREQUENCY 8272.0

TIME	TC	Q	CC3		
190832	60	41	.10687393	06 .852-01	.0049
190932	60	41	.10688199	06 .852-01	-.0059
191032	60	41	.10689007	06 .852-01	.0000
191132	60	41	.10689816	06 .852-01	-.0127
191232	60	41	.10690627	06 .852-01	.0088
191332	60	41	.10691440	06 .852-01	-.0059
191432	60	41	.10692255	06 .852-01	-.0020
191532	60	41	.10693071	06 .852-01	.0000
191632	60	41	.10693890	06 .852-01	.0029
191732	60	41	.10694709	06 .852-01	-.0107
191832	60	41	.10695531	06 .852-01	.0088
191932	60	41	.10696354	06 .852-01	-.0039
192032	60	41	.10697178	06 .852-01	.0000
192132	60	41	.10698004	06 .852-01	-.0117
192232	60	41	.10698832	06 .852-01	.0117
192332	60	41	.10699661	06 .852-01	-.0146
192432	60	41	.10700492	06 .852-01	-.0049
192532	60	41	.10701324	06 .852-01	.0059
192632	60	41	.10702158	06 .852-01	.0020
192732	60	41	.10702993	06 .852-01	-.0010
192832	60	41	.10703830	06 .852-01	.0000
192932	60	41	.10704668	06 .852-01	.0020
193032	60	41	.10705507	06 .852-01	-.0088
193132	60	41	.10706348	06 .852-01	-.0010
193232	60	41	.10707190	06 .852-01	-.0068
193332	60	41	.10708034	06 .852-01	.0078
193432	60	41	.10708879	06 .852-01	-.0078
193532	60	41	.10709725	06 .852-01	-.0029
193632	60	41	.10710573	06 .852-01	.0039
193732	60	41	.10711422	06 .852-01	-.0010
193832	60	41	.10712272	06 .852-01	-.0010
193932	60	41	.10713123	06 .852-01	-.0137
194032	60	41	.10713975	06 .852-01	.0117
194132	60	41	.10714829	06 .852-01	-.0088
194232	60	41	.10715684	06 .852-01	-.0068
194332	60	41	.10716540	06 .852-01	-.0010
194432	60	41	.10717397	06 .852-01	.0098
194532	60	41	.10718255	06 .852-01	-.0049
194632	60	41	.10719115	06 .852-01	.0010
194732	60	41	.10719975	06 .852-01	-.0039
194832	60	41	.10720837	06 .852-01	-.0029
194932	60	41	.10721699	06 .852-01	.0049
195032	60	41	.10722563	06 .852-01	-.0146
195132	60	41	.10723428	06 .852-01	.0059
195232	60	41	.10724293	06 .852-01	.0000
195332	60	41	.10725160	06 .852-01	.0010
195432	60	41	.10726027	06 .852-01	-.0068
195532	60	41	.10726896	06 .852-01	-.0078
195632	60	41	.10727765	06 .852-01	.0146
195732	60	41	.10728635	06 .852-01	-.0039
195832	60	41	.10729506	06 .852-01	.0020
195932	60	41	.10730378	06 .852-01	-.0166

STATION NUMBER 41 65/03/23 ITERATION NUMBER 3 PASS NUMBER 03/236

FREQUENCY 8272.0

TIME	TC	Q	CC3	
200032	60	41	.10731251 06 .852-01	.0049
200132	60	41	.10732125 06 .852-01	.0029
200232	60	41	.10732999 06 .852-01	-.0078
200332	60	41	.10733874 06 .852-01	.0078
200432	60	41	.10734750 06 .852-01	-.0010
200532	60	41	.10735627 06 .852-01	-.0010
200632	60	41	.10736504 06 .852-01	-.0068
200732	60	41	.10737382 06 .852-01	-.0039
200832	60	41	.10738261 06 .852-01	.0088
200932	60	41	.10739140 06 .852-01	-.0010
201032	60	41	.10740020 06 .852-01	-.0010
201132	60	41	.10740901 06 .852-01	.0098
201232	60	41	.10741782 06 .852-01	-.0020
201332	60	41	.10742663 06 .852-01	-.0029
201432	60	41	.10743546 06 .852-01	-.0098
201532	60	41	.10744429 06 .852-01	.0127
201632	60	41	.10745312 06 .852-01	-.0049
201732	60	41	.10746196 06 .852-01	-.0107
201832	60	41	.10747080 06 .852-01	.0137
201932	60	41	.10747965 06 .852-01	-.0010
202032	60	41	.10748850 06 .852-01	-.0020
202132	60	41	.10749736 06 .852-01	-.0088
202232	60	41	.10750622 06 .852-01	.0137
202332	60	41	.10751508 06 .852-01	-.0166
202432	60	41	.10752395 06 .852-01	-.0010
202732	60	41	.10755057 06 .852-01	-.0059
202832	60	41	.10755945 06 .852-01	-.0029
202932	60	41	.10756833 06 .852-01	-.0020
203032	60	41	.10757722 06 .852-01	.0137
203132	60	41	.10758611 06 .852-01	-.0068
203232	60	41	.10759499 06 .852-01	.0049
203332	60	41	.10760389 06 .852-01	-.0029
203432	60	41	.10761278 06 .852-01	-.0107
203732	60	41	.10763946 06 .852-01	-.0127
203832	60	41	.10764836 06 .852-01	.0078
203932	60	41	.10765726 06 .852-01	-.0059
204032	60	41	.10766615 06 .852-01	-.0039
204132	60	41	.10767505 06 .852-01	-.0010
204232	60	41	.10768395 06 .852-01	.0010
204332	60	41	.10769285 06 .852-01	.0039
204432	60	41	.10770174 06 .852-01	.0068
204532	60	41	.10771064 06 .852-01	-.0059
204632	60	41	.10771953 06 .852-01	-.0020
204732	60	41	.10772843 06 .852-01	.0029
204832	60	41	.10773732 06 .852-01	-.0068
204932	60	41	.10774621 06 .852-01	.0010
205032	60	41	.10775511 06 .852-01	-.0059
205132	60	41	.10776399 06 .852-01	.0068
205232	60	41	.10777288 06 .852-01	-.0137
205332	60	41	.10778176 06 .852-01	.0020
205432	60	41	.10779065 06 .852-01	.0029
205532	60	41	.10779953 06 .852-01	.0068

STATION NUMBER 41 65/03/23 ITERATION NUMBER 3 PASS NUMBER 03/236

FREQUENCY 8272.0

TIME	TC	Q	CC3		
205632	60	41	.10780840	06 .852-01	-.0029
205732	60	41	.10781728	06 .852-01	-.0098
205832	60	41	.10782615	06 .852-01	.0029
205932	60	41	.10783501	06 .852-01	.0029
210032	60	41	.10784388	06 .852-01	-.0107
210132	60	41	.10785274	06 .852-01	-.0049
210232	60	41	.10786159	06 .852-01	.0068
210332	60	41	.10787044	06 .852-01	.0049
210432	60	41	.10787929	06 .852-01	-.0088
210532	60	41	.10788813	06 .852-01	-.0010
210632	60	41	.10789697	06 .852-01	-.0059
210732	60	41	.10790580	06 .852-01	-.0049
210832	60	41	.10791463	06 .852-01	.0000
210932	60	41	.10792345	06 .852-01	.0107
211032	60	41	.10793227	06 .852-01	-.0059
211132	60	41	.10794108	06 .852-01	.0000
211232	60	41	.10794989	06 .852-01	-.0059
211332	60	41	.10795869	06 .852-01	-.0049
211432	60	41	.10796748	06 .852-01	.0020
211532	60	41	.10797627	06 .852-01	.0000
211632	60	41	.10798505	06 .852-01	.0039
211732	60	41	.10799382	06 .852-01	-.0186
211832	60	41	.10800258	06 .852-01	.0156
211932	60	41	.10801134	06 .852-01	-.0098
212032	60	41	.10802009	06 .852-01	-.0098
212132	60	41	.10802884	06 .852-01	.0137
212232	60	41	.10803757	06 .852-01	-.0049
212332	60	41	.10804630	06 .852-01	.0010
212432	60	41	.10805502	06 .852-01	-.0176
212532	60	41	.10806373	06 .852-01	.0049
212632	60	41	.10807243	06 .852-01	.0029
212732	60	41	.10808112	06 .852-01	-.0059
212832	60	41	.10808980	06 .852-01	-.0059
212932	60	41	.10809848	06 .852-01	.0020
213032	60	41	.10810715	06 .852-01	.0039
213132	60	41	.10811580	06 .852-01	-.0186
213232	60	41	.10812445	06 .852-01	.0020
213332	60	41	.10813308	06 .852-01	.0000
213432	60	41	.10814171	06 .852-01	.0068
213532	60	41	.10815032	06 .852-01	-.0068
213632	60	41	.10815893	06 .852-01	.0039
213732	60	41	.10816752	06 .852-01	-.0059
213832	60	41	.10817610	06 .852-01	-.0049
213932	60	41	.10818468	06 .852-01	-.0107
214032	60	41	.10819324	06 .852-01	.0137
214132	60	41	.10820179	06 .852-01	-.0029
214232	60	41	.10821032	06 .852-01	-.0068
214332	60	41	.10821885	06 .852-01	.0010
214432	60	41	.10822736	06 .852-01	-.0117
214532	60	41	.10823586	06 .852-01	.0039
214632	60	41	.10824435	06 .852-01	-.0020
214732	60	41	.10825283	06 .852-01	.0059

STATION NUMBER 41 65/03/23 ITERATION NUMBER 3 PASS NUMBER 03/236

FREQUENCY 8272.0

TIME	TC	Q	CC3			
214832	60	41	.10826129	06	.852-01	-.0068
214932	60	41	.10826974	06	.852-01	-.0078
215032	60	41	.10827818	06	.852-01	.0059
215132	60	41	.10828660	06	.852-01	.0000
215232	60	41	.10829501	06	.852-01	.0068
215332	60	41	.10830341	06	.852-01	-.0068
215432	60	41	.10831179	06	.852-01	-.0049
215532	60	41	.10832015	06	.852-01	-.0059
215632	60	41	.10832851	06	.852-01	.0068
215732	60	41	.10833685	06	.852-01	.0020
215832	60	41	.10834517	06	.852-01	-.0068
215932	60	41	.10835348	06	.852-01	.0176
220032	60	41	.10836178	06	.852-01	-.0098
220132	60	41	.10837006	06	.852-01	-.0059
220232	60	41	.10837832	06	.852-01	.0137
220332	60	41	.10838657	06	.852-01	-.0020
220432	60	41	.10839480	06	.852-01	.0000
220532	60	41	.10840302	06	.852-01	.0000
220632	60	41	.10841122	06	.852-01	-.0010
220732	60	41	.10841940	06	.852-01	.0146
220832	60	41	.10842757	06	.852-01	-.0020
220932	60	41	.10843572	06	.852-01	-.0029
221032	60	41	.10844385	06	.852-01	.0137
221132	60	41	.10845197	06	.852-01	-.0039
221232	60	41	.10846007	06	.852-01	-.0029
221332	60	41	.10846815	06	.852-01	-.0020
221432	60	41	.10847622	06	.852-01	-.0010
221532	60	41	.10848426	06	.852-01	.0039
221632	60	41	.10849229	06	.852-01	.0078
221732	60	41	.10850030	06	.852-01	-.0029
221832	60	41	.10850829	06	.852-01	.0049
221932	60	41	.10851627	06	.852-01	-.0029
222032	60	41	.10852422	06	.852-01	.0078
222132	60	41	.10853216	06	.852-01	-.0117
222232	60	41	.10854008	06	.852-01	.0039
222332	60	41	.10854798	06	.852-01	.0049
222432	60	41	.10855586	06	.852-01	-.0068
222532	60	41	.10856372	06	.852-01	-.0010
222632	60	41	.10857156	06	.852-01	.0098
222732	60	41	.10857937	06	.852-01	.0068
222832	60	41	.10858718	06	.852-01	-.0107
222932	60	41	.10859496	06	.852-01	.0098
223032	60	41	.10860271	06	.852-01	.0000
223132	60	41	.10861045	06	.852-01	-.0049
223232	60	41	.10861817	06	.852-01	-.0068
223332	60	41	.10862587	06	.852-01	.0127
223432	60	41	.10863355	06	.852-01	.0029
223532	60	41	.10864120	06	.852-01	-.0029
223632	60	41	.10864883	06	.852-01	-.0020
223732	60	41	.10865645	06	.852-01	.0020
223832	60	41	.10866404	06	.852-01	-.0049
223932	60	41	.10867161	06	.852-01	-.0068

STATION NUMBER 41 65/03/23 ITERATION NUMBER 3 PASS NUMBER 03/236

FREQUENCY 8272.0

TIME	TC	Q	CC3	
224032	60	41	.10867915 06 .852-01	.0127
224132	60	41	.10868668 06 .852-01	-.0117
224232	60	41	.10869418 06 .852-01	.0029
224332	60	41	.10870166 06 .852-01	.0068
224432	60	41	.10870911 06 .852-01	.0010
224532	60	41	.10871655 06 .852-01	.0000

FREQUENCY 8315.0

225232	60	41	.10876794 06 .852-01	-.0117
225332	60	41	.10877519 06 .852-01	.0098
225432	60	41	.10878241 06 .852-01	-.0107
225532	60	41	.10878961 06 .852-01	.0098
225632	60	41	.10879678 06 .852-01	-.0117
225732	60	41	.10880392 06 .852-01	.0078
225832	60	41	.10881105 06 .852-01	.0029

FREQUENCY 8321.0 65/03/24

000232	60	41	.10920828 06 .852-01	-.0098
000332	60	41	.10921347 06 .852-01	.0117
000432	60	41	.10921863 06 .852-01	.0020
000532	60	41	.10922376 06 .852-01	-.0078
000632	60	41	.10922885 06 .852-01	-.0010
000732	60	41	.10923391 06 .852-01	.0068
000832	60	41	.10923893 06 .852-01	.0000
000932	60	41	.10924392 06 .852-01	-.0068
001032	60	41	.10924888 06 .852-01	.0049
001132	60	41	.10925380 06 .852-01	.0020
001232	60	41	.10925868 06 .852-01	-.0010
001332	60	41	.10926353 06 .852-01	-.0020
001432	60	41	.10926835 06 .852-01	-.0010
001532	60	41	.10927313 06 .852-01	.0010
001632	60	41	.10927788 06 .852-01	.0059
001732	60	41	.10928259 06 .852-01	-.0049
001832	60	41	.10928726 06 .852-01	.0039
001932	60	41	.10929190 06 .852-01	-.0029
002032	60	41	.10929651 06 .852-01	.0107
002132	60	41	.10930107 06 .852-01	-.0078
002232	60	41	.10930561 06 .852-01	.0098
002332	60	41	.10931010 06 .852-01	-.0039
002432	60	41	.10931456 06 .852-01	.0029
002532	60	41	.10931899 06 .852-01	.0117
002632	60	41	.10932338 06 .852-01	-.0107
002732	60	41	.10932773 06 .852-01	.0039
002832	60	41	.10933204 06 .852-01	.0049
002932	60	41	.10933632 06 .852-01	-.0078
003032	60	41	.10934057 06 .852-01	.0000
003132	60	41	.10934477 06 .852-01	.0107
003232	60	41	.10934894 06 .852-01	.0078
003332	60	41	.10935307 06 .852-01	-.0078
003432	60	41	.10935717 06 .852-01	-.0039

STATION NUMBER 41 65/03/24 ITERATION NUMBER 3 PASS NUMBER 03/236

FREQUENCY 8321.0

TIME	TC	Q	CC3		
003532	60	41	.10936123	06 .852-01	.0039
003632	60	41	.10936525	06 .852-01	.0000
003732	60	41	.10936923	06 .852-01	-.0020
003832	60	41	.10937318	06 .852-01	.0010
003932	60	41	.10937709	06 .852-01	.0088
004032	60	41	.10938096	06 .852-01	.0029
004132	60	41	.10938480	06 .852-01	.0020
004232	60	41	.10938859	06 .852-01	.0049
004332	60	41	.10939235	06 .852-01	-.0049
004432	60	41	.10939607	06 .852-01	.0068
004532	60	41	.10939976	06 .852-01	.0068
004632	60	41	.10940340	06 .852-01	-.0059
004732	60	41	.10940701	06 .852-01	.0039
004832	60	41	.10941058	06 .852-01	.0000
004932	60	41	.10941411	06 .852-01	.0020
005032	60	41	.10941761	06 .852-01	.0088
005132	60	41	.10942106	06 .852-01	.0039
005232	60	41	.10942448	06 .852-01	-.0127
005332	60	41	.10942786	06 .852-01	.0098
005432	60	41	.10943120	06 .852-01	.0029
005532	60	41	.10943450	06 .852-01	.0029
005632	60	41	.10943776	06 .852-01	-.0088
005732	60	41	.10944098	06 .852-01	.0176
005832	60	41	.10944417	06 .852-01	-.0010
005932	60	41	.10944731	06 .852-01	.0049
010032	60	41	.10945042	06 .852-01	-.0029
010132	60	41	.10945349	06 .852-01	-.0039
010232	60	41	.10945651	06 .852-01	.0020
010332	60	41	.10945950	06 .852-01	-.0039
010432	60	41	.10946245	06 .852-01	.0127
010532	60	41	.10946536	06 .852-01	.0020
010632	60	41	.10946824	06 .852-01	-.0029
010932	60	41	.10947661	06 .852-01	.0049
011032	60	41	.10947932	06 .852-01	-.0088
011132	60	41	.10948200	06 .852-01	.0020
011232	60	41	.10948463	06 .852-01	.0010
011332	60	41	.10948723	06 .852-01	.0068
011432	60	41	.10948978	06 .852-01	-.0127
011532	60	41	.10949229	06 .852-01	.0068
011632	60	41	.10949477	06 .852-01	.0000
011732	60	41	.10949720	06 .852-01	-.0010
011832	60	41	.10949959	06 .852-01	.0049
011932	60	41	.10950195	06 .852-01	.0010
012032	60	41	.10950426	06 .852-01	-.0107
012132	60	41	.10950653	06 .852-01	-.0010
012232	60	41	.10950877	06 .852-01	-.0010
012332	60	41	.10951096	06 .852-01	.0059
012432	60	41	.10951311	06 .852-01	.0049
012532	60	41	.10951522	06 .852-01	-.0068
012632	60	41	.10951729	06 .852-01	.0059
012732	60	41	.10951932	06 .852-01	-.0078
012832	60	41	.10952131	06 .852-01	.0020

STATION NUMBER 41 65/03/24 ITERATION NUMBER 3 PASS NUMBER 03/236

FREQUENCY 8321.0

TIME	TC	Q	CC3	
012932	60	41	.10952326 06 .852-01	.0029
013332	60	41	.10953065 06 .852-01	-.0029
013432	60	41	.10953240 06 .852-01	.0010
013532	60	41	.10953410 06 .852-01	-.0029
013632	60	41	.10953576 06 .852-01	.0010
013732	60	41	.10953739 06 .852-01	.0107
013832	60	41	.10953897 06 .852-01	-.0039
013932	60	41	.10954051 06 .852-01	-.0107
014032	60	41	.10954201 06 .852-01	.0068
014132	60	41	.10954347 06 .852-01	-.0020
014232	60	41	.10954488 06 .852-01	-.0010
014332	60	41	.10954626 06 .852-01	-.0098
014432	60	41	.10954759 06 .852-01	.0049
014532	60	41	.10954889 06 .852-01	-.0049
014632	60	41	.10955014 06 .852-01	.0098
014732	60	41	.10955135 06 .852-01	-.0010
015232	60	41	.10955678 06 .852-01	.0010
015332	60	41	.10955774 06 .852-01	.0059
015432	60	41	.10955866 06 .852-01	-.0146
015532	60	41	.10955954 06 .852-01	.0068
015632	60	41	.10956038 06 .854-01	.0020
015732	60	41	.10956118 06 .854-01	.0059

DATA STATISTICS STATION 4 ITERATION 3

PASS	DATA TYPE	BEGINNING TIME	END TIME	NUMBER OF POINTS	STD DEV	RMS	FIRST MOMENT	SECOND MOMENT
03/236	CC3	3/23-150232	3/24-015732	481	.729-02	.733-02	-.794-03	.537-04

STATION NUMBER 51 65/03/23 ITERATION NUMBER 3 PASS NUMBER 03/239

FREQUENCY 8259.0

TIME	TC	Q	CC3		
230532	60	51	.10514473	06 .852-01	.0176
230632	60	51	.10514677	06 .852-01	-.0049
230732	60	51	.10514885	06 .852-01	-.0059
231032	60	51	.10515538	06 .852-01	.0039
231132	60	51	.10515764	06 .852-01	.0059
231232	60	51	.10515995	06 .852-01	-.0049
231332	60	51	.10516231	06 .852-01	.0078
231432	60	51	.10516471	06 .852-01	-.0088
231532	60	51	.10516715	06 .852-01	.0127
231632	60	51	.10516964	06 .852-01	-.0098
231732	60	51	.10517218	06 .852-01	.0068
232032	60	51	.10518005	06 .852-01	.0029
232132	60	51	.10518276	06 .852-01	.0078
232232	60	51	.10518551	06 .852-01	.0010
233232	60	51	.10521552	06 .852-01	.0176
233332	60	51	.10521876	06 .852-01	-.0068
233432	60	51	.10522204	06 .852-01	.0078
233532	60	51	.10522537	06 .852-01	-.0039
233632	60	51	.10522874	06 .852-01	.0078
233732	60	51	.10523216	06 .852-01	-.0088
233832	60	51	.10523562	06 .852-01	-.0010
233932	60	51	.10523912	06 .852-01	-.0029
234032	60	51	.10524266	06 .852-01	.0020
234132	60	51	.10524625	06 .852-01	-.0029
234232	60	51	.10524988	06 .852-01	.0156
234332	60	51	.10525356	06 .852-01	-.0088
234432	60	51	.10525727	06 .852-01	.0078
234532	60	51	.10526103	06 .852-01	-.0020
234632	60	51	.10526484	06 .852-01	-.0049
234732	60	51	.10526868	06 .852-01	-.0010
234832	60	51	.10527257	06 .852-01	.0117
234932	60	51	.10527650	06 .852-01	-.0020
235032	60	51	.10528047	06 .852-01	.0078
235132	60	51	.10528449	06 .852-01	-.0068
235232	60	51	.10528855	06 .852-01	.0039
235332	60	51	.10529265	06 .852-01	-.0127
235432	60	51	.10529679	06 .852-01	.0137
235532	60	51	.10530097	06 .852-01	-.0039
235632	60	51	.10530519	06 .852-01	-.0117
235732	60	51	.10530946	06 .852-01	.0049
235832	60	51	.10531377	06 .852-01	.0137

FREQUENCY 8274.0 65/03/24

020232	60	51	.10613242	06 .852-01	-.0010
020332	60	51	.10614094	06 .852-01	-.0117
020432	60	51	.10614949	06 .852-01	.0059
020532	60	51	.10615807	06 .852-01	-.0029
020632	60	51	.10616667	06 .852-01	-.0010
020732	60	51	.10617529	06 .852-01	-.0059
020832	60	51	.10618393	06 .852-01	.0156
020932	60	51	.10619260	06 .852-01	-.0020

STATION NUMBER 51 65/03/24 ITERATION NUMBER 3 PASS NUMBER 03/239

FREQUENCY 8274.0

TIME	TC	Q	CC3		
021032	60	51	.10620129	06 .852-01	-.0098
021132	60	51	.10621001	06 .852-01	.0098
021232	60	51	.10621874	06 .852-01	-.0107
021332	60	51	.10622750	06 .852-01	-.0010
021432	60	51	.10623628	06 .852-01	.0010
021532	60	51	.10624508	06 .852-01	-.0020
021632	60	51	.10625391	06 .852-01	-.0107
021732	60	51	.10626276	06 .852-01	.0098
021832	60	51	.10627162	06 .852-01	.0088
021932	60	51	.10628051	06 .852-01	-.0137
022032	60	51	.10628942	06 .852-01	.0088
022132	60	51	.10629835	06 .852-01	-.0049
022232	60	51	.10630731	06 .852-01	-.0068
022332	60	51	.10631628	06 .852-01	.0039
022432	60	51	.10632527	06 .852-01	-.0059
022532	60	51	.10633428	06 .852-01	-.0020
022632	60	51	.10634332	06 .852-01	-.0020
022732	60	51	.10635237	06 .852-01	-.0049
022832	60	51	.10636144	06 .852-01	.0059
022932	60	51	.10637053	06 .852-01	-.0020
023032	60	51	.10637964	06 .852-01	.0039
023132	60	51	.10638877	06 .852-01	-.0088
023232	60	51	.10639792	06 .852-01	.0078
023332	60	51	.10640709	06 .852-01	-.0088
023432	60	51	.10641628	06 .852-01	.0049
023532	60	51	.10642548	06 .852-01	.0010
023632	60	51	.10643470	06 .852-01	-.0049
023732	60	51	.10644394	06 .852-01	.0049
023832	60	51	.10645320	06 .852-01	-.0029
023932	60	51	.10646248	06 .852-01	-.0117
024032	60	51	.10647177	06 .852-01	.0127
024132	60	51	.10648108	06 .852-01	.0029
024232	60	51	.10649040	06 .852-01	-.0068
024532	60	51	.10651849	06 .852-01	-.0039
024632	60	51	.10652788	06 .852-01	-.0117
024732	60	51	.10653729	06 .852-01	.0127
024832	60	51	.10654671	06 .852-01	-.0117
024932	60	51	.10655615	06 .852-01	-.0010
025032	60	51	.10656561	06 .852-01	.0107
025132	60	51	.10657507	06 .852-01	-.0088
025232	60	51	.10658456	06 .852-01	.0059
025332	60	51	.10659406	06 .852-01	-.0098
025432	60	51	.10660357	06 .852-01	.0088
025532	60	51	.10661310	06 .852-01	-.0029
025632	60	51	.10662265	06 .852-01	.0039
025732	60	51	.10663220	06 .852-01	-.0039
025832	60	51	.10664177	06 .852-01	-.0068
025932	60	51	.10665136	06 .852-01	.0088
030032	60	51	.10666095	06 .852-01	-.0059
030132	60	51	.10667056	06 .852-01	.0010
030232	60	51	.10668019	06 .852-01	-.0068
030332	60	51	.10668983	06 .852-01	.0068

STATION NUMBER 51 65/03/24 ITERATION NUMBER 3 PASS NUMBER 03/239

FREQUENCY 8274.0

TIME	TC	Q	CC3	
030432	60	51	.10669947 06 .852-01	.0068
030532	60	51	.10670914 06 .852-01	-.0039
030632	60	51	.10671881 06 .852-01	.0068
030732	60	51	.10672850 06 .852-01	-.0137
030832	60	51	.10673819 06 .852-01	.0068
030932	60	51	.10674790 06 .852-01	-.0020
031032	60	51	.10675762 06 .852-01	.0107
031132	60	51	.10676735 06 .852-01	-.0039
031232	60	51	.10677709 06 .852-01	.0039
031532	60	51	.10680639 06 .852-01	.0127
031632	60	51	.10681617 06 .852-01	-.0049
031732	60	51	.10682597 06 .852-01	.0000
031832	60	51	.10683577 06 .852-01	-.0029
031932	60	51	.10684558 06 .852-01	.0000
032032	60	51	.10685541 06 .852-01	.0098
032132	60	51	.10686524 06 .852-01	-.0059
032232	60	51	.10687508 06 .852-01	.0039
032332	60	51	.10688493 06 .852-01	.0039
032432	60	51	.10689479 06 .852-01	-.0039
032532	60	51	.10690465 06 .852-01	-.0039
032632	60	51	.10691453 06 .852-01	.0049
032732	60	51	.10692441 06 .852-01	.0049
032832	60	51	.10693430 06 .852-01	-.0020
032932	60	51	.10694420 06 .852-01	.0000
033032	60	51	.10695410 06 .852-01	-.0049
033132	60	51	.10696402 06 .852-01	.0000
033232	60	51	.10697393 06 .852-01	.0137
033332	60	51	.10698386 06 .852-01	-.0127
033432	60	51	.10699379 06 .852-01	.0049
033532	60	51	.10700373 06 .852-01	-.0010
033632	60	51	.10701368 06 .852-01	.0049
033732	60	51	.10702363 06 .852-01	.0039
033832	60	51	.10703358 06 .852-01	-.0020
033932	60	51	.10704355 06 .852-01	.0029
034032	60	51	.10705351 06 .852-01	.0029
034132	60	51	.10706349 06 .852-01	-.0039
034232	60	51	.10707346 06 .852-01	.0029
034332	60	51	.10708344 06 .852-01	.0039
034432	60	51	.10709343 06 .852-01	.0010
034532	60	51	.10710342 06 .852-01	-.0059
034632	60	51	.10711341 06 .852-01	.0000
034732	60	51	.10712341 06 .852-01	.0010
034832	60	51	.10713342 06 .852-01	-.0010
034932	60	51	.10714342 06 .852-01	-.0059
035032	60	51	.10715343 06 .852-01	.0020
035132	60	51	.10716344 06 .852-01	.0059
035232	60	51	.10717346 06 .852-01	.0088
035332	60	51	.10718347 06 .852-01	-.0088
035432	60	51	.10719349 06 .852-01	.0059
035532	60	51	.10720351 06 .852-01	.0010
035632	60	51	.10721354 06 .852-01	-.0059
035732	60	51	.10722356 06 .852-01	.0020

STATION NUMBER 51 65/03/24 ITERATION NUMBER 3 PASS NUMBER 03/239

FREQUENCY 8274.0

TIME	TC	Q	CC3	
035832	60	51	.10723359 06 .852-01	.0078
035932	60	51	.10724362 06 .852-01	.0127
040032	60	51	.10725365 06 .852-01	-.0010
040132	60	51	.10726368 06 .852-01	-.0146
040232	60	51	.10727371 06 .852-01	.0039
040332	60	51	.10728374 06 .852-01	.0059
040632	60	51	.10731384 06 .852-01	-.0088
040732	60	51	.10732387 06 .852-01	.0088
040832	60	51	.10733391 06 .852-01	-.0068
040932	60	51	.10734394 06 .852-01	-.0049
041032	60	51	.10735397 06 .852-01	-.0020
041132	60	51	.10736400 06 .852-01	.0029
041232	60	51	.10737402 06 .852-01	-.0078
041332	60	51	.10738405 06 .852-01	-.0020
041432	60	51	.10739408 06 .852-01	.0068
041532	60	51	.10740410 06 .852-01	.0010
041632	60	51	.10741412 06 .852-01	-.0039
041732	60	51	.10742414 06 .852-01	-.0059
041832	60	51	.10743416 06 .852-01	-.0059
041932	60	51	.10744417 06 .852-01	-.0020
042032	60	51	.10745418 06 .852-01	.0039
042132	60	51	.10746419 06 .852-01	-.0039
042232	60	51	.10747419 06 .852-01	.0078
042332	60	51	.10748419 06 .852-01	-.0088
042432	60	51	.10749419 06 .852-01	-.0059
042532	60	51	.10750418 06 .852-01	.0010
042632	60	51	.10751417 06 .852-01	-.0049
042732	60	51	.10752416 06 .852-01	-.0059
042832	60	51	.10753413 06 .852-01	-.0029
042932	60	51	.10754411 06 .852-01	.0049
043032	60	51	.10755408 06 .852-01	.0010
043132	60	51	.10756405 06 .852-01	-.0146
043232	60	51	.10757401 06 .852-01	.0088
043332	60	51	.10758396 06 .852-01	.0029
043432	60	51	.10759391 06 .852-01	-.0127
043732	60	51	.10762372 06 .852-01	-.0078
043832	60	51	.10763365 06 .852-01	.0020
043932	60	51	.10764356 06 .852-01	.0010
044032	60	51	.10765347 06 .852-01	-.0098
044132	60	51	.10766338 06 .852-01	.0029
044232	60	51	.10767328 06 .852-01	-.0098
044332	60	51	.10768316 06 .852-01	.0010
044432	60	51	.10769305 06 .852-01	-.0137
044532	60	51	.10770292 06 .852-01	.0127
044632	60	51	.10771278 06 .852-01	-.0020
044732	60	51	.10772264 06 .852-01	-.0098
044832	60	51	.10773249 06 .852-01	-.0088
044932	60	51	.10774233 06 .852-01	.0020
045032	60	51	.10775216 06 .852-01	.0039
045132	60	51	.10776198 06 .852-01	-.0020
045232	60	51	.10777180 06 .852-01	-.0137
045332	60	51	.10778160 06 .852-01	-.0010

STATION NUMBER 51 65/03/24 ITERATION NUMBER 3 PASS NUMBER 03/239

FREQUENCY 8274.0

TIME	TC	Q	CC3		
045432	60	51	.10779139 06	.852-01	.0049
045532	60	51	.10780118 06	.852-01	-.0117
045632	60	51	.10781095 06	.852-01	.0137
045932	60	51	.10784021 06	.852-01	.0039
050032	60	51	.10784994 06	.852-01	-.0117
050132	60	51	.10785966 06	.852-01	.0176
050232	60	51	.10786937 06	.852-01	-.0088
050332	60	51	.10787907 06	.852-01	-.0068
050432	60	51	.10788876 06	.852-01	.0059
050532	60	51	.10789843 06	.852-01	-.0029
050632	60	51	.10790810 06	.852-01	.0010
050932	60	51	.10793701 06	.852-01	.0020
051032	60	51	.10794663 06	.852-01	-.0127
051132	60	51	.10795623 06	.852-01	.0029
051232	60	51	.10796582 06	.852-01	-.0010
051332	60	51	.10797539 06	.852-01	.0078
051432	60	51	.10798495 06	.852-01	-.0039
051532	60	51	.10799450 06	.852-01	-.0186
051632	60	51	.10800403 06	.852-01	.0156
051732	60	51	.10801355 06	.852-01	-.0039
051832	60	51	.10802306 06	.852-01	.0068
051932	60	51	.10803255 06	.852-01	-.0176
052032	60	51	.10804203 06	.852-01	.0059
052132	60	51	.10805149 06	.852-01	-.0068
052232	60	51	.10806094 06	.852-01	.0127
052332	60	51	.10807037 06	.852-01	-.0020
052432	60	51	.10807979 06	.852-01	-.0020
052532	60	51	.10808919 06	.852-01	-.0039
052632	60	51	.10809857 06	.852-01	-.0059
052732	60	51	.10810794 06	.852-01	.0068
052832	60	51	.10811730 06	.852-01	-.0127
052932	60	51	.10812663 06	.852-01	-.0010
053032	60	51	.10813596 06	.852-01	-.0059
053132	60	51	.10814526 06	.852-01	.0068
053232	60	51	.10815455 06	.852-01	.0020
053332	60	51	.10816382 06	.852-01	-.0029
053432	60	51	.10817307 06	.852-01	.0098
053532	60	51	.10818231 06	.852-01	-.0098
053632	60	51	.10819153 06	.852-01	.0039
053732	60	51	.10820073 06	.852-01	.0010
053832	60	51	.10820991 06	.852-01	.0010
053932	60	51	.10821908 06	.852-01	.0010
054232	60	51	.10824647 06	.852-01	.0117
054332	60	51	.10825556 06	.852-01	.0020
054632	60	51	.10828273 06	.852-01	-.0127
054732	60	51	.10829174 06	.852-01	.0049
054832	60	51	.10830074 06	.852-01	.0078
054932	60	51	.10830972 06	.852-01	-.0039
055232	60	51	.10833653 06	.852-01	.0000
055332	60	51	.10834543 06	.852-01	.0029
055632	60	51	.10837200 06	.852-01	.0020
055732	60	51	.10838081 06	.852-01	.0039

STATION NUMBER 51 65/03/24 ITERATION NUMBER 3 PASS NUMBER 03/239

FREQUENCY 8274.0

TIME	TC	Q	CC3			
060032	60	51	.10840713	06	.852-01	.0049
060132	60	51	.10841586	06	.852-01	.0098
060232	60	51	.10842456	06	.852-01	.0029
060332	60	51	.10843325	06	.852-01	-.0166
060432	60	51	.10844191	06	.852-01	.0039
060532	60	51	.10845055	06	.852-01	-.0029
060632	60	51	.10845917	06	.852-01	.0117
060732	60	51	.10846777	06	.852-01	.0000
060832	60	51	.10847634	06	.852-01	.0098
060932	60	51	.10848489	06	.852-01	-.0068
061032	60	51	.10849342	06	.852-01	-.0010
061132	60	51	.10850192	06	.852-01	.0117
061232	60	51	.10851040	06	.852-01	-.0029
061332	60	51	.10851886	06	.852-01	-.0088
061432	60	51	.10852729	06	.852-01	.0078
061532	60	51	.10853570	06	.852-01	-.0029
061632	60	51	.10854409	06	.852-01	.0117
061732	60	51	.10855245	06	.852-01	.0000
061832	60	51	.10856079	06	.852-01	-.0039
061932	60	51	.10856910	06	.852-01	.0000
062032	60	51	.10857739	06	.852-01	-.0049
062132	60	51	.10858565	06	.852-01	.0146
062232	60	51	.10859389	06	.852-01	.0088
062332	60	51	.10860210	06	.852-01	-.0049
062432	60	51	.10861029	06	.852-01	.0068
062532	60	51	.10861846	06	.852-01	.0088
062632	60	51	.10862659	06	.852-01	.0049
062732	60	51	.10863471	06	.852-01	-.0078
062832	60	51	.10864279	06	.852-01	.0059
062932	60	51	.10865085	06	.852-01	.0117
063032	60	51	.10865889	06	.852-01	-.0068
063132	60	51	.10866690	06	.852-01	.0166
063232	60	51	.10867488	06	.852-01	-.0156
063332	60	51	.10868284	06	.852-01	.0117
063432	60	51	.10869077	06	.852-01	.0000
063532	60	51	.10869867	06	.852-01	-.0039
063632	60	51	.10870655	06	.852-01	.0039
063732	60	51	.10871439	06	.852-01	.0205
063832	60	51	.10872222	06	.852-01	-.0020
063932	60	51	.10873001	06	.852-01	.0039
064032	60	51	.10873778	06	.852-01	.0029
064132	60	51	.10874552	06	.852-01	.0127
064232	60	51	.10875323	06	.852-01	-.0010
064332	60	51	.10876092	06	.852-01	-.0020
064432	60	51	.10876857	06	.852-01	.0088
064532	60	51	.10877620	06	.852-01	.0127
064632	60	51	.10878380	06	.852-01	-.0039
064732	60	51	.10879138	06	.852-01	.0059
064832	60	51	.10879892	06	.852-01	.0117
064932	60	51	.10880644	06	.852-01	-.0039
065032	60	51	.10881392	06	.852-01	.0098
065132	60	51	.10882138	06	.852-01	.0010

STATION NUMBER 51 65/03/24 ITERATION NUMBER 3 PASS NUMBER 03/239

FREQUENCY 8274.0

TIME	TC	Q	CC3		
065232	60	51	.10882881	06 .852-01	.0049
065332	60	51	.10883621	06 .852-01	.0039
065432	60	51	.10884358	06 .852-01	.0156
065532	60	51	.10885092	06 .852-01	-.0098
065632	60	51	.10885824	06 .852-01	.0117
065732	60	51	.10886552	06 .852-01	.0117
065832	60	51	.10887277	06 .852-01	.0078
065932	60	51	.10888000	06 .852-01	.0000
070032	60	51	.10888719	06 .852-01	.0059
070132	60	51	.10889436	06 .852-01	.0078
070232	60	51	.10890149	06 .852-01	.0078
070332	60	51	.10890860	06 .852-01	.0029
070432	60	51	.10891567	06 .852-01	-.0049
070532	60	51	.10892271	06 .852-01	.0020
070632	60	51	.10892973	06 .852-01	.0049
070732	60	51	.10893671	06 .852-01	.0059
071032	60	51	.10895747	06 .852-01	-.0068
071332	60	51	.10897796	06 .852-01	.0088
071432	60	51	.10898472	06 .852-01	.0107
071532	60	51	.10899146	06 .852-01	.0098
071632	60	51	.10899816	06 .852-01	-.0088
071732	60	51	.10900483	06 .852-01	.0195
071832	60	51	.10901147	06 .852-01	-.0029
071932	60	51	.10901808	06 .852-01	.0068
072032	60	51	.10902465	06 .852-01	-.0020
072132	60	51	.10903119	06 .852-01	.0039
072232	60	51	.10903770	06 .852-01	.0098
072332	60	51	.10904419	06 .852-01	-.0029
072432	60	51	.10905063	06 .852-01	.0000
072532	60	51	.10905705	06 .852-01	.0029
072632	60	51	.10906343	06 .852-01	.0039
072732	60	51	.10906978	06 .852-01	.0039
072832	60	51	.10907609	06 .852-01	.0039
072932	60	51	.10908238	06 .852-01	.0029
073032	60	51	.10908863	06 .852-01	.0010
073132	60	51	.10909485	06 .852-01	.0000
073232	60	51	.10910103	06 .852-01	-.0020
073332	60	51	.10910719	06 .852-01	.0107
073432	60	51	.10911331	06 .852-01	.0088
073532	60	51	.10911939	06 .852-01	.0059
073632	60	51	.10912545	06 .852-01	-.0137
073732	60	51	.10913147	06 .852-01	-.0010
073832	60	51	.10913745	06 .852-01	.0127
073932	60	51	.10914340	06 .852-01	-.0059
074032	60	51	.10914932	06 .852-01	.0088
074132	60	51	.10915521	06 .852-01	.0059
074432	60	51	.10917266	06 .852-01	.0029
074532	60	51	.10917841	06 .852-01	.0029
074632	60	51	.10918413	06 .852-01	.0039
074732	60	51	.10918981	06 .852-01	.0059
074832	60	51	.10919546	06 .852-01	-.0098
074932	60	51	.10920107	06 .852-01	-.0059

STATION NUMBER 51 65/03/24 ITERATION NUMBER 3 PASS NUMBER 03/239

FREQUENCY 8274.0

TIME	TC	Q	CC3		
075032	60	51	.10920665 06	.852-01	.0146
075132	60	51	.10921220 06	.852-01	-.0137
075232	60	51	.10921771 06	.852-01	.0088
075532	60	51	.10923403 06	.852-01	.0010
075632	60	51	.10923940 06	.852-01	-.0049
075732	60	51	.10924474 06	.852-01	-.0098
075832	60	51	.10925004 06	.852-01	.0049
075932	60	51	.10925531 06	.852-01	.0029
080032	60	51	.10926055 06	.852-01	-.0137
080132	60	51	.10926574 06	.852-01	.0049
080232	60	51	.10927091 06	.852-01	.0068
080332	60	51	.10927604 06	.852-01	-.0049
080432	60	51	.10928113 06	.852-01	.0010
080532	60	51	.10928619 06	.852-01	-.0078
080632	60	51	.10929121 06	.852-01	.0020
080932	60	51	.10930607 06	.852-01	.0098
081032	60	51	.10931095 06	.852-01	-.0068
081132	60	51	.10931580 06	.852-01	-.0039
081232	60	51	.10932062 06	.852-01	.0010
081332	60	51	.10932539 06	.852-01	-.0098
081432	60	51	.10933013 06	.852-01	.0156
081732	60	51	.10934414 06	.852-01	-.0117
081832	60	51	.10934874 06	.852-01	.0059
081932	60	51	.10935331 06	.852-01	-.0078
082032	60	51	.10935784 06	.852-01	.0137
082132	60	51	.10936233 06	.852-01	.0039
082232	60	51	.10936678 06	.852-01	-.0029
082332	60	51	.10937121 06	.852-01	-.0088
082432	60	51	.10937559 06	.852-01	.0059
082532	60	51	.10937994 06	.852-01	-.0107
082632	60	51	.10938426 06	.852-01	.0088
082932	60	51	.10939699 06	.852-01	-.0049
083032	60	51	.10940116 06	.852-01	-.0098
083132	60	51	.10940529 06	.852-01	.0049
083232	60	51	.10940939 06	.852-01	-.0117
083332	60	51	.10941346 06	.852-01	.0059
083432	60	51	.10941749 06	.852-01	-.0059
083532	60	51	.10942148 06	.852-01	-.0156
083832	60	51	.10943324 06	.852-01	-.0127
083932	60	51	.10943709 06	.852-01	-.0117
084032	60	51	.10944091 06	.852-01	.0068
084132	60	51	.10944469 06	.852-01	-.0049
084232	60	51	.10944843 06	.852-01	.0029
084332	60	51	.10945214 06	.852-01	-.0039
084432	60	51	.10945581 06	.852-01	-.0078
084532	60	51	.10945944 06	.852-01	-.0107
084632	60	51	.10946304 06	.852-01	.0068
084732	60	51	.10946661 06	.852-01	-.0078
084832	60	51	.10947013 06	.852-01	-.0029
084932	60	51	.10947363 06	.852-01	-.0127
085032	60	51	.10947708 06	.852-01	-.0029
085132	60	51	.10948051 06	.852-01	.0088

STATION NUMBER 51 65/03/24 ITERATION NUMBER 3 PASS NUMBER 03/239

FREQUENCY 8274.0

TIME	TC	Q	CC3		
085232	60	51	.10948389	06 .852-01	-.0107
085332	60	51	.10948724	06 .852-01	-.0117
085432	60	51	.10949056	06 .852-01	-.0098
085532	60	51	.10949384	06 .852-01	-.0059
085632	60	51	.10949708	06 .852-01	.0000
085732	60	51	.10950029	06 .852-01	-.0088

FREQUENCY 8327.0

090232	60	51	.10951582	06 .852-01	-.0068
090332	60	51	.10951882	06 .852-01	-.0039
090432	60	51	.10952178	06 .854-01	-.0156
090532	60	51	.10952471	06 .854-01	.0068
090632	60	51	.10952760	06 .854-01	-.0176
090732	60	51	.10953046	06 .854-01	-.0078
090832	60	51	.10953328	06 .854-01	.0039

DATA STATISTICS STATION 5 ITERATION 3

PASS	DATA TYPE	BEGINNING TIME	END TIME	NUMBER OF POINTS	STD DEV	RMS	FIRST MOMENT	SECOND MOMENT
03/239	CC3	3/23-230532	3/24-090832	426	.777-02	.778-02	.245-03	.605-04

ITERATION 3 GENERATED 10 PLOTS.

INPUT J MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.19191083 02	.89482909 02	.42695550 02	-.54583037-03	-.26678513-03	.28446279-03	.43920961 01	.10694885 01	.17588034 01
Y	.89482909 02	.44498125 03	.20892905 03	-.25306157-03	-.11619238-02	.37275715-03	.25847906 02	.12488102 02	.68661638 01
Z	.42695550 02	.20892905 03	.99509206 02	-.93152115-04	-.25463717-03	-.47147812-03	.10976132 02	.45151417 01	.36271292 01
DX	-.54583037-03	-.25306157-03	-.93152115-04	.10000003 03	-.15662259-07	.30693798-07	.50880372-04	-.44673781-03	.32625149-03
DY	-.26678513-03	-.11619238-02	-.25463717-03	-.15662259-07	.10000000 03	.90256181-07	.21713749-03	.86794367-04	-.97887918-04
DZ	.28446279-03	.37275715-03	-.47147812-03	.30693798-07	.90256181-07	.10000002 03	-.69783629-03	-.10404269-02	.15269107-03
KE	.43920961 01	.25847906 02	.10976132 02	.50880372-04	.21713749-03	-.69783629-03	.58601683 01	.58690205 01	-.38508728 00
RE	.10694885 01	.12488102 02	.45151417 01	-.44673781-03	.86794367-04	-.10404269-02	.58690205 01	.41736903 03	-.10312869 01
G	.17588034 01	.68661638 01	.36271292 01	.32625149-03	-.97887918-04	.15269107-03	-.38508728 00	-.10312869 01	.11431707 02
KM	-.49225777 00	-.45435567 01	-.16939822 01	.78088523-04	-.39726555-04	.33414194-03	-.18536432 01	-.51854105 01	.30307802 00
RI(03)	.68365370 02	.34525057 03	.19341530 03	.53394955-03	.17710516-02	-.33752379-02	.13543404 02	.56922353 02	.83273241 01
LA(03)	-.51432587 04	-.26076142 05	-.14668960 05	-.45726677-01	-.14959183 00	.28564300 00	-.99234160 03	-.45892778 04	-.63040125 03
LO(03)	-.18378942 05	-.87605000 05	-.45466633 05	.13563353 00	.34645622 00	-.68780483 00	-.62787201 04	-.41394943 04	-.17507593 04
RI(04)	-.17539595 02	-.13874302 03	-.30399502 02	.79953953-03	.23141325-02	-.45000932-02	-.41718171 02	-.53939859 02	.75327381 01
LA(04)	-.10295462 04	-.85996744 04	-.17634556 04	.54691004-01	.15910729 00	-.30915720 00	-.27284882 04	-.36505598 04	.51203905 03
LO(04)	-.18783138 05	-.84752363 05	-.39046771 05	-.99656077-01	-.33970589 00	.64499193 00	-.38300161 04	.10117374 05	-.19496522 04
RI(05)	-.60667923 02	-.48129862 03	-.18234475 03	.15544179-02	.53831019-02	-.10540231-01	-.72593021 02	-.93565779 02	.82045804 01
LA(05)	-.88131085 04	-.51542478 05	-.22276470 05	.15300405-01	.33200861 00	-.54542791 00	-.41961993 04	-.44417499 04	-.20416833 03
LO(05)	-.20098170 05	-.84647790 05	-.39351342 05	.30488275 00	.55709601 00	-.12126743 01	-.72444183 03	-.50965524 04	-.20896716 04

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	-.49225777 00	.68365370 02	-.51432587 04	-.18378942 05	-.17539595 02	-.10295462 04	-.18783138 05	-.60667923 02	-.88131085 04
Y	-.45435567 01	.34525057 03	-.26076142 05	-.87605000 05	-.13874302 03	-.85996744 04	-.84752363 05	-.48129862 03	-.51542478 05
Z	-.16939822 01	.19341530 03	-.14668960 05	-.45466633 05	-.30399502 02	-.17634556 04	-.39046771 05	-.18234475 03	-.22276470 05
DX	.78088523-04	.53394955-03	-.45726677-01	.13563353 00	.79953953-03	.54691004-01	-.99656077-01	.15544179-02	.15300405-01
DY	-.39726555-04	.17710516-02	-.14959183 00	.34645622 00	.23141325-02	.15910729 00	-.33970589 00	.53831019-02	.33200861 00
DZ	.33414194-03	-.33752379-02	.28564300 00	-.68780483 00	-.45000932-02	-.30915720 00	.64499193 00	-.10540231-01	-.54542791 00
KE	-.18536432 01	.13543404 02	-.99234160 03	-.62787201 04	-.41718171 02	-.27284882 04	-.38300161 04	-.72593021 02	-.41961993 04
RE	-.51854105 01	.56922353 02	-.45892778 04	-.41394943 04	-.53939859 02	-.36505598 04	.10117374 05	-.93565779 02	-.44417499 04
G	.30307802 00	.83273241 01	-.63040125 03	-.17507593 04	.75327381 01	.51203905 03	-.19496522 04	.82045804 01	-.20416833 03
KM	.15929736 01	-.16072501 02	.12958576 04	.12333661 04	.17887939 02	.12059030 04	-.27367559 04	.28721920 02	.14018195 04
RI(03)	-.16072501 02	.25442300 04	-.19227748 06	-.20931891 06	-.84685105 02	-.58632859 04	.15049535 05	-.14417946 03	-.30466649 05
LA(03)	.12958576 04	-.19227748 06	.16381185 08	.15574431 08	.71861447 04	.49710804 06	-.12491778 07	.12828110 05	.23890845 07
LO(03)	.12333661 04	-.20931891 06	.15574431 08	.64343059 08	-.18218303 05	-.12397631 07	.18510265 07	-.58961302 05	.31456270 07
RI(04)	.17887939 02	-.84685105 02	.71861447 04	-.18218303 05	.33520567 04	.21296926 06	.83645184 05	-.27848078 03	-.10483992 05
LA(04)	.12059030 04	-.58632859 04	.49710804 06	-.12397631 07	.21296926 06	.15193046 08	.51692854 07	-.19259597 05	-.78713229 06
LO(04)	-.27367559 04	.15049535 05	-.12491778 07	.18510265 07	.83645184 05	.51692854 07	.58070813 08	.27960302 05	.65276910 07
RI(05)	.28721920 02	-.14417946 03	.12828110 05	-.58961302 05	-.27848078 03	-.19259597 05	.27960302 05	.41393618 04	.22055070 06
LA(05)	.14018195 04	-.30466649 05	.23890845 07	.31456270 07	-.10483992 05	-.78713229 06	.65276910 07	.22055070 06	.15252332 08
LO(05)	.17561176 04	.49284267 04	-.14584086 06	-.12344696 08	-.36066485 05	-.23961789 07	-.18411233 07	.13770430 06	.12770627 08

LO(05)

X	-.20098170 05
Y	-.84647790 05
Z	-.39351342 05
DX	.30488275 00
DY	.55709601 00
DZ	-.12126743 01
KE	-.72444183 03
RE	-.50965524 04
G	-.20896716 04
KM	.17561176 04
RI(03)	.49284267 04
LA(03-	.14584086 06
LO(03-	.12344696 08
RI(04-	.36066485 05
LA(04-	.23961789 07
LO(04-	.18411233 07
RI(05)	.13770430 06
LA(05)	.12770627 08
LO(05)	.76950070 08

CASE 1 SPACE TRAJECTORIES 1

EPHEMERIS TAPE IV WITH MARS VELOCITIES. B-8 IS

GME	.39860137 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63783007 04				
G	.66709998-19	A	.88782497 29	B	.88800499 29	C	.88837498 29	OME	.41780741-02	AU	.14959900 09				
GMM	.49027482 04	GMS	.13271544 12	GMV	.32476952 06	GMA	.42977799 05	GMC	.37918700 08	GMJ	.12671062 09				
EGM	.39860320 06	MGM	.49027779 04	JA	.29200000-02	HA	.00000000 00	DA	.00000000 00	RA	.34170000 04				
ARA	.35670000 01	GB	.39545138 00	MAS	.37410000 03	GB1	.00000000 00	GB2	.00000000 00	SC	.10200000 09				

INJECTION CONDITIONS MOON 23571213037320240000000O J.D.= 2438843.02127314 MARCH 23,1965 12 30 38.000

GEOCENTRIC X0-.19399676 05 Y0-.26223645 06 Z0-.12476510 06 DX0 .13594896 00 DY0-.12091034 01 DZ0-.50967789 00
CARTESIAN GMC .000C0000 00 SGC .00000000 00 T0 .45038000 05 GHA .84426084 01 GH0 .18027050 03
DATE OF RUN 020166B 000000 EARTH IS THE CENTRAL BODY FOR INTEGRATION COWELL EQUATIONS OF MOTION

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. 23571213037320240000000O J.D.= 2438843.02127314 MARCH 23,1965 12 30 38.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.19399678 05	Y	-.26223645 06	Z	-.12476510 06	DX	.13594894 00	DY	-.12091033 01	DZ	-.50967789 00
R	.29105091 06	DEC	-.25383252 02	RA	.26576909 03	V	.13191605 01	PTH	.79926093 02	AZ	.76945120 02
R	.29105091 06	LAT	-.25383252 02	LON	.25732648 03	VE	.18994586 02	PTE	.39208632 01	AZE	.27015759 03
XS	.14897831 09	YS	.63717223 07	ZS	.27634203 07	DXS	-.89066856 00	DYS	.27394442 02	DZS	.11878768 02
XM	-.98402476 05	YM	-.35567249 06	ZM	-.15354183 06	DXM	.93475157 00	DYM	-.22045441 00	DZM	-.18962299 00
XT	-.98402476 05	YT	-.35567249 06	ZT	-.15354183 06	DXT	.93475157 00	DYT	-.22045441 00	DZT	-.18962299 00
RS	.14914011 09	VS	.29872292 02	RM	.39970121 06	VM	.97893693 00	RT	.39970121 06	VT	.97893693 00
GED	-.25534282 02	ALT	.28467667 06	LOS	.35400641 03	RAS	.24490185 01	RAM	.25453504 03	LOM	.24609243 03
DUT	.36000000 02	DT	.12000000 03	DR	.12988230 01	SHA	.28918613 06	DES	.10616948 01	DEM	-.22590454 02
DAC	.00000000 00	CCL	.28188101 03	MCL	.35139666 03	TCL	.35139666 03				

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE — 23571202520720251560000O J.D.= 2438841.42776166 MARCH 21,1965 22 15 58.607

SMA	.39905445 06	ECC	.98572046 00	B	.67196805 05	SLR	.11315259 05	APO	.79241058 06	RCA	.56983139 04
VH	.84752272-01	C3	-.99886461 00	C1	.67158600 05	TFP	.13767939 06	TF	-.38244275 02	PER	.41812628 05
TA	.16717328 03	MTA	.00000000 00	EA	.74063660 02	MA	.19756623 02	C3J	-.13710045 01	TFI	.00000000 00

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	-.19399678 05	Y	-.26223645 06	Z	-.12476510 06	DX	.13594894 00	DY	-.12091033 01	DZ	-.50967789 00
INC	.28344315 02	LAN	.32735918 03	APF	.12828444 03	MX	.96435616 00	MY	-.16843562 00	MZ	.20407759 00
WX	-.25607709 00	WY	-.39978900 00	WZ	.88011040 00	PX	-.14909944 00	PY	.91590822 00	PZ	.37266812 00
QX	-.95508894 00	QY	-.35791987-01	QZ	-.29415134 00	RX	-.59877930-01	RY	.36782626 00	RZ	-.92796472 00
BX	.95508849 00	BY	.35791970-01	BZ	.29415120 00	TX	.98700760 00	TY	.16067361 00	TZ	.00000000 00
DAP	.21880261 02	RAP	.99245998 02								
BTQ	.63731495 05	BRQ	-.21300408 05	B	.67196805 05	THA	.34151928 03				

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14899771 09	Y	-.66339587 07	Z	-.28881854 07	DX	.10266175 01	DY	-.28603545 02	DZ	-.12388445 02
R	.14917328 09	LAT	-.11093875 01	LON	.18254935 03	V	.31187983 02	PTH	.89376952 00	AZ	.11339322 03
XE	-.14897831 09	YE	-.63717223 07	ZE	-.27634203 07	DXE	.89066856 00	DYE	-.27394442 02	DZE	-.11878768 02
XT	-.14907671 09	YT	-.67273947 07	ZT	-.29169621 07	DXT	.18254201 01	DYT	-.27614896 02	DZT	-.12068390 02
LTE	-.10616948 01	LOE	.18244901 03	LTT	-.11198146 01	LOT	.18258383 03	RST	.14925694 09	VST	.30192063 02
EPS	.83399613 02	ESP	.11124820 00	SEP	.96489310 02	EPM	.14407451 03	EMP	.25292642 02	MEP	.10632839 02
MPS	.13170273 03	MSP	.35663121-01	SMP	.48261237 02	SEM	.10692129 03	EMS	.72931918 02	ESM	.14704286 00
RPM	.12569739 06	SPN	.82143951 02								
SAC	.60988525-10										
GCE	.78118987 02	GCT	.24951565 03	SIP	.13091049 03	CPT	.10317301 03	SIN	.10238076 03	D1	.41484540 00
REP	.29105091 06	VEP	.13191605 01	CPE	.78547795 02	CPS	.92848527 02	D2	.27902971 00	D3	.51180516-02

0 DAYS 18 HRS. 20 MIN. 53.337 SEC. — 23571217057420265310O003 J.D.= 2438843.78577936 MARCH 24,1965 06 51 31.337

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.10801502 05	Y	-.33518712 06	Z	-.15500596 06	DX	.10727168 00	DY	-.10344460 01	DZ	-.41968765 00
R	.36945084 06	DEC	-.24806670 02	RA	.26815426 03	V	.11214827 01	PTH	.82332668 02	AZ	.69919992 02
R	.36945083 06	LAT	-.24806670 02	LON	.34373588 03	VE	.24339827 02	PTE	.26172678 01	AZE	.27012105 03
XS	.14890649 09	YS	.81807504 07	ZS	.35478502 07	DXS	-.12838197 01	DYS	.27377040 02	DZS	.11871231 02
XM	-.35613144 05	YM	-.36527559 06	ZM	-.16389786 06	DXM	.96204923 00	DYM	-.70061278-01	DZM	-.12340678 00
XT	-.35613144 05	YT	-.36527559 06	ZT	-.16389786 06	DXT	.96204923 00	DYT	-.70061278-01	DZT	-.12340678 00
RS	.14917324 09	VS	.29867652 02	RM	.40194161 06	VM	.97245901 00	RT	.40194161 06	VT	.97245901 00
GED	-.24955195 02	ALT	.36307643 06	LOS	.78726211 02	RAS	.31446033 01	RAM	.26443145 03	LOM	.34001306 03
DUT	.36000000 02	DT	.48000000 03	DR	.11114560 01	SHA	.36798744 06	DES	.13628174 01	DEM	-.24064535 02
DAC	.00000000 00	CCL	.28254715 03	MCL	.35126263 03	TCL	.35126263 03				

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE — 23571202761320237430O003 J.D.= 2438841.48719874 MARCH 21,1965 23 41 33.972

SMA	.44285044 06	ECC	.99130613 00	B	.58268380 05	SLR	.76666867 04	APO	.88185079 06	RCA	.38500794 04
VH	.62687092-01	C3	-.90008123 00	C1	.55280664 05	TFP	.19859736 06	TF	-.36817785 02	PER	.48881536 05
TA	.17105443 03	MTA	.00000000 00	EA	.80375128 02	MA	.24376979 02	C3J	-.13658606 01	TFI	.18348149 02

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	-.10801502 05	Y	-.33518712 06	Z	-.15500596 06	DX	.10727168 00	DY	-.10344460 01	DZ	-.41968765 00
INC	.31509640 02	LAN	.31708926 03	APF	.13555095 03	MX	.93408798 00	MY	-.17422370 00	MZ	.31165244 00
WX	-.35584598 00	WY	-.38279217 00	WZ	.85255223 00	PX	-.11636583 00	PY	.92331334 00	PZ	.36599378 00
QX	-.92727241 00	QY	.31029526-01	QZ	-.37310122 00	RX	-.45764431-01	RY	.36312128 00	RZ	-.93061728 00
BX	.92727173 00	BY	-.31029503-01	BZ	.37310094 00	TX	.99215151 00	TY	.12504155 00	TZ	.00000000 00
DAP	.21468754 02	RAP	.97183156 02								
BTQ	.53380483 05	BRQ	-.23360826 05	B	.58268380 05	THA	.33636443 03				

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14891729 09	Y	-.85159375 07	Z	-.37028562 07	DX	.13910913 01	DY	-.28411486 02	DZ	-.12290918 02
R	.14920654 09	LAT	-.14220531 01	LON	.18327293 03	V	.30987325 02	PTH	.99520295 00	AZ	.11335296 03
XE	-.14890649 09	YE	-.81807504 07	ZE	-.35478502 07	DXE	.12838197 01	DYE	-.27377040 02	DZE	-.11871231 02
XT	-.14894210 09	YT	-.85460260 07	ZT	-.37117481 07	DXT	.22458689 01	DYT	-.27447101 02	DZT	-.11994637 02
LTE	-.13628174 01	LOE	.18314460 03	LTT	-.14252137 01	LOT	.18328392 03	RST	.14923324 09	VST	.30037620 02
EPS	.84757359 02	ESP	.14162004 00	SEP	.95101330 02	EPM	.14254694 03	EMP	.33983540 02	MEP	.34695046 01
MPS	.13187730 03	MSP	.27453512-18	SMP	.48111254 02	SEM	.98509901 02	EMS	.81337476 02	ESM	.15211196 00
RPM	.39999996 05	SPN	.83768187 02								
SAC	.60961341-10										
GCE	.77452849 02	GCT	.24871548 03	SIP	.12938702 03	CPT	.10382906 03	SIN	.10133878 03	D1	.13047323 01
REP	.36945084 06	VEP	.11214827 01	CPE	.77768451 02	CPS	.92658613 02	D2	.89942197 00	D3	.50893556-01

0 DAYS 18 HRS. 20 MIN. 53.337 SEC. 23571217057420265310003 J.D.= 2438843.78577936 MARCH 24,1965 06 51 31.337
CHANGE OF PHASE OCCURS AT THIS POINT EARTH IS THE CENTRAL BODY FOR INTEGRATION COWELL EQUATIONS OF MOTION

1 DAYS 1 HRS. 37 MIN. 41.952 SEC. 23571220542420277164007 J.D.= 2438844.08911981 MARCH 24,1965 14 08 19.952

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.10147854 05	Y	-.36463042 06	Z	-.16647238 06	DX	-.42136205 00	DY	-.22197133 01	DZ	-.67753951 00
R	.40096306 06	DEC	-.24530737 02	RA	.26840583 03	V	.23587567 01	PTH	.78395607 02	AZ	.31074911 03
R	.40096305 06	LAT	-.24530737 02	LON	.23448590 03	VE	.27059616 02	PTE	.48982872 01	AZE	.27065819 03
XS	.14887080 09	YS	.88981915 07	ZS	.38589472 07	DXS	-.14397719 01	DYS	.27368816 02	DZS	.11867677 02
XM	-.10342896 05	YM	-.36632777 06	ZM	-.16677866 06	DXM	.96565618 00	DYM	-.10252386-01	DZM	-.96373814-01
XT	-.10342896 05	YT	-.36632777 06	ZT	-.16677866 06	DXT	.96565618 00	DYT	-.10252386-01	DZT	-.96373814-01
RS	.14918641 09	VS	.29865813 02	RM	.40263896 06	VM	.97050752 00	RT	.40263896 06	VT	.97050752 00
GED	-.24678042 02	ALT	.39458857 06	LOS	.32950063 03	RAS	.34205698 01	RAM	.26838274 03	LOM	.23446280 03
DUT	.36000000 02	DT	.30000000 02	DR	.23105433 01	SHA	.39932734 06	DES	.14822125 01	DEM	-.24469824 02
DAC	.00000000 00	CCL	.28284063 03	MCL	.34555434 03	TCL	.34555434 03				

HELIOCENTRIC — EQUATORIAL COORDINATES

X	-.14888094 09	Y	-.92628218 07	Z	-.40254195 07	DX	.10184099 01	DY	-.29588529 02	DZ	-.12545217 02
R	.14922312 09	LAT	-.15457879 01	LON	.18356014 03	V	.32154326 02	PTH	.20656874 01	AZ	.11292830 03
XE	-.14887080 09	YE	-.88981915 07	ZE	-.38589472 07	DXE	.14397719 01	DYE	-.27368816 02	DZE	-.11867677 02
XT	-.14888114 09	YT	-.92645192 07	ZT	-.40257258 07	DXT	.24054281 01	DYT	-.27379068 02	DZT	-.11964051 02
LTE	-.14822125 01	LOE	.18342056 03	LTT	-.15459023 01	LOT	.18356078 03	RST	.14922343 09	VST	.29975623 02
EPS	.84669566 02	ESP	.15339293 00	SEP	.95177107 02	EPM	.16487749 03	EMP	.15058071 02	MEP	.63334395-01
MPS	.10022825 03	MSP	.27453512-18	SMP	.79771087 02	SEM	.95198905 02	EMS	.84647129 02	ESM	.15387055 00
RPM	.17357495 04	SPN	.83758140 02								
SAC	.60947797-10										
GCE	.77159363 02	GCT	.24271371 03	SIP	.10022825 03	CPT	.11627570 03	SIN	.11627570 03	D1	.58970616 03
REP	.40096306 06	VEP	.23587567 01	CPE	.77474875 02	CPS	.92582884 02	D2	.36491760 03	D3	-.20917297 04

SELENOCENTRIC — EQUATORIAL COORDINATES

X	.19504187 03	Y	.16973437 04	Z	.30628320 03	DX	-.13870182 01	DY	-.22094609 01	DZ	-.58116569 00
R	.17357495 04	DEC	.10163393 02	RA	.83444887 02	V	.26726934 01	PTH	-.64832948 02	AZ	.97928761 02
R	.17357488 04	LAT	-.12950452 02	LON	.35763234 03	VP	.26708014 01	PTP	-.64919455 02	AZP	.99055696 02
LTS	-.14810659 01	LNS	.27778849 03	LTE	.13461056 01	LNE	.23973853 01				
ALT	-.22504578 01	SHA	-.17081617 04	ALP	.24154074 01	DR	-.24189794 01	DP	.37517859-01	ASD	.90000000 02
HGE	.27533043 03	SVL	-.14211214 02	HNG	.10055479 03	SIA	.74877491 02				
SAC	.60947797-10										

SELENOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 23571220564120217705640 7 J.D.= 2438844.09561334 MARCH 24,1965 14 17 40.993

SMA	-.32813004 04	ECC	.11144201 01	B	.16139597 04	SLR	.79385184 03	APO	.00000000 00	RCA	.37544661 03
VH	.12223534 01	C3	.14941479 01	C1	.19728294 04	TFP	-.56104124 03	TF	.25784164 02	LTF	.25703382 02
TA	-.11913909 03	MTA	.15380900 03	EA	-.48004180 02	MA	-.11974798 02	C3J	-.13027514 01	TFI	.25628319 02
ZAE	.14030899 03	ZAP	.13443924 03	ZAC	.10279210 03	DEF	.12761800 03	IR	.37982159 04	GP	.25141456 01
OP1	.00000000 00	OY	.00000000 00	OP2	.38000000 02						

ALL VECTORS REFERENCED TO ORBIT PLANE OF TARGET

X	.16761491 04	Y	-.18799390 03	Z	-.40988876 03	DX	-.22865613 01	DY	.13570489 01	DZ	.27082365 00
INC	.20758648 02	LAN	.13372339 03	APF	.34091838 03	MX	.43426164-01	MY	.96346068 00	MZ	-.26430588 00
WX	.25614272 00	WY	.24497554 00	WZ	.93508172 00	PX	-.43228145 00	PY	.89426342 00	PZ	-.11586892 00
QX	-.86459449 00	QY	-.37453948 00	QZ	.33495745 00	RX	-.33787426-01	RY	.27975684-01	RZ	-.99903740 00
BX	.58503083 00	BY	.73078112 00	BZ	-.35170710 00	TX	.63775274 00	TY	.77024116 00	TZ	.00000000 00
SXI	-.76949973 00	SYI	.63713884 00	SZI	.43866035-01	DAI	.25141448 01	RAI	.14037555 03		
SXO	.62965415-02	SYO	-.96775594 00	SZO	.25181083 00	DAO	.14584693 02	RAO	.27037278 03		
ETE	.17696736 03	ETS	.92938293 01	ETC	.26259365 03						

BTO	.15106388 04	BRO	.56818812 03	B	.16139601 04	THA	.20612508 02

ALL VECTORS REFERENCED TO TRUE LUNAR EQU. PLANE

X	.16901546 04	Y	-.69882568 02	Z	-.38899581 03	DX	-.23489645 01	DY	.12206127 01	DZ	.36845466 00
INC	.15737869 02	LAN	.12294306 03	APF	.35485421 03	MX	.56955334-02	MY	.98824228 00	MZ	-.15278976 00
WX	.22762478 00	WY	.14749990 00	WZ	.96251269 00	PX	-.46916645 00	PY	.88277455 00	PZ	-.24327205-01
QX	-.85327005 00	QY	-.44604119 00	QZ	.27014339 00	RX	-.78059016-01	RY	.58257751-01	RZ	-.99524505 00
BX	.55858991 00	BY	.78987039 00	BZ	-.25314441 00	TX	.59811576 00	TY	.80140972 00	TZ	.00000000 00
SXI	-.79759906 00	SYI	.59527176 00	SZI	.97402133-01	DAI	.55895945 01	RAI	.14326493 03		
SXO	.44393378-01	SYO	-.98900497 00	SZO	.14106110 00	DAO	.81092529 01	RAO	.27257010 03		
ETE	.28053973 01	ETS	.31728729 02	ETC	.29411674 03						
BTT	.15608802 04	BRT	.41051725 03	B	.16139614 04	THA	.14735297 02				

U MATRIX FOR MAPPING FORWARD ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.95221151 00	.65338995 00	.16505643 00	-.13100595-03	.62069283-03	.12176315-03	.00000000 00	.00000000 00	.00000000 00
Y	.59762863 00	.18216834 01	.32009034 00	.32468214-03	.11293928-02	.26831928-03	.00000000 00	.00000000 00	.00000000 00
Z	.17490600 00	.36692175 00	.69390684 00	.86066543-04	.36747021-03	-.19830008-03	.00000000 00	.00000000 00	.00000000 00
DX	.88243621 05	.52351334 05	.13051203 05	-.13202431 02	.52601185 02	.10452407 02	.00000000 00	.00000000 00	.00000000 00
DY	.45507450 05	.15209689 06	.22896876 05	.27894044 02	.93064582 02	.23405208 02	.00000000 00	.00000000 00	.00000000 00
DZ	.12395370 05	.24920791 05	.66444652 05	.67640441 01	.28686202 02	-.19685882 02	.00000000 00	.00000000 00	.00000000 00
KE	.20254587-01	.62826906-01	.20919730-01	.11621467-04	.41265574-04	.55542757-05	.10000000 01	.00000000 00	.00000000 00
RE	.35830047 02	.49183559 02	.77061004 01	.19099753-01	.69776486-01	.96882842-02	.00000000 00	.10000000 01	.00000000 00
G	-.18095010 00	-.11085521 00	-.28619326-01	.23541685-04	-.10938343-03	-.21271994-04	.00000000 00	.00000000 00	.10000000 01
KM	-.11249670 01	-.18911496 01	-.48600209 00	-.26081114-03	-.15348721-02	-.29121723-03	.00000000 00	.00000000 00	.00000000 00
RI(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
Y	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
Z	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DX	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DY	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DZ	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
KE	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RE	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
G	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
KM	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(03)	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(03)	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(03)	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00
LO(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00
RI(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00
LA(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01
LO(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00

	LO(05)
X	.00000000 00
Y	.00000000 00
Z	.00000000 00
DX	.00000000 00
DY	.00000000 00
DZ	.00000000 00
KE	.00000000 00
RE	.00000000 00
G	.00000000 00
KM	.00000000 00
RI(03)	.00000000 00
LA(03)	.00000000 00
LO(03)	.00000000 00
RI(04)	.00000000 00
LA(04)	.00000000 00
LO(04)	.00000000 00
RI(05)	.00000000 00
LA(05)	.00000000 00
LO(05)	.10000000 01

12 COVARIANCE MATRIX AT IMPACT ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.55424448 00	-.16549832 01	.37924523 01	-.45598051-04	.78453618-03	-.17708753-02	.12413384 00	.21035763-01	-.63458559-02
Y	-.16549832 01	.59044573 01	-.13507519 02	-.52621336-04	-.28839833-02	.63150933-02	-.38061913 00	-.79144828-01	.15358939-01
Z	.37924523 01	-.13507519 02	.31156926 02	.13709172-03	.66497556-02	-.14547056-01	.78866003 00	.18092917 00	-.33804391-01
DX	-.45598051-04	-.52621336-04	.13709172-03	.43344858-07	.46242024-07	-.63951078-07	-.13839541-04	.14660097-05	.11039897-05
DY	.78453618-03	-.28839833-02	.66497556-02	.46242024-07	.14283776-05	-.31056184-05	.16566210-03	.39029882-04	-.68567710-05
DZ	-.17708753-02	.63150933-02	-.14547056-01	-.63951078-07	-.31056184-05	.67939521-05	-.37642824-03	-.84618902-04	.15942363-04
KE	.12413384 00	-.38061913 00	.78866003 00	-.13839541-04	.16566210-03	-.37642824-03	.35027859 00	.49187498-02	.12063581-01
RE	.21035763-01	-.79144828-01	.18092917 00	.14660097-05	.39029882-04	-.84618902-04	.49187498-02	.10788417-02	-.18704324-03
G	-.63458559-02	.15358939-01	-.33804391-01	.11039897-05	-.68567710-05	.15942363-04	.12063581-01	-.18704324-03	.89853597-01
KM	.97616483-02	.21007503 00	-.50962581 00	-.53120056-04	-.12312694-03	.23777934-03	.77238274-02	-.34372212-02	-.12949485-02
RI(03	-.29301040-01	.10701535 00	-.24801148 00	-.15278428-05	-.53232335-04	.11597440-03	-.67377109-02	-.14430520-02	.32042135-03
LA(03)	.18562475-03	-.67362838-03	.15586834-02	.88125736-08	.33363926-06	-.72838484-06	.38669272-04	.90535073-05	-.17954385-05
LO(03)	.12678866-03	-.90706943-04	.25965827-03	-.70439281-07	.34360099-07	-.11477556-06	.21309770-04	.32534852-06	.50934153-07
RI(04	-.30193570-01	.10552740 00	-.24258597 00	-.61636470-06	-.51714866-04	.11348858-03	-.57530236-02	-.14068235-02	.26596541-03
LA(04	-.18690331-03	.64813947-03	-.14855601-02	-.21754577-08	-.31647792-06	.69512164-06	-.36131109-04	-.86371557-05	.14747272-05
LO(04)	.81346641-04	.94285389-04	-.17248059-03	-.77573127-07	-.58271861-07	.85911114-07	.64017793-05	-.21776380-05	-.40108400-06
RI(05	-.33280892-01	.11361967 00	-.26313156 00	-.17753436-06	-.56000833-04	.12298639-03	.17164891-02	-.15112378-02	.35956941-03
LA(05	-.16326245-03	.59133623-03	-.12703186-02	-.17926813-08	-.27161140-06	.59966737-06	-.18301506-03	-.79257793-05	.57274475-06
LO(05)	.83363133-04	.43204280-04	-.56583945-04	-.69222295-07	-.30468746-07	.31247820-07	.35377955-05	-.13553276-05	-.10298124-05

	KM	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)	RI(05)	LA(05)
X	.97616483-02	-.29301040-01	.18562475-03	.12678866-03	-.30193570-01	-.18690331-03	.81346641-04	-.33280892-01	-.16326245-03
Y	.21007503 00	.10701535 00	-.67362838-03	-.90706943-04	.10552740 00	.64813947-03	.94285389-04	.11361967 00	.59133623-03
Z	-.50962581 00	-.24801148 00	.15586834-02	.25965827-03	-.24258597 00	-.14855601-02	-.17248059-03	-.26313156 00	-.12703186-02
DX	-.53120056-04	-.15278428-05	.88125736-08	-.70439281-07	-.61636470-06	-.21754577-08	-.77573127-07	-.17753436-06	-.17926813-08
DY	-.12312694-03	-.53232335-04	.33363926-06	.34360099-07	-.51714866-04	-.31647792-06	-.58271861-07	-.56000833-04	-.27161140-06
DZ	.23777934-03	.11597440-03	-.72838484-06	-.11477556-06	.11348858-03	.69512164-06	.85911114-07	.12298639-03	.59966737-06
KE	.77238274-02	-.67377109-02	.38669272-04	.21309770-04	-.57530236-02	-.36131109-04	.64017793-05	.17164891-02	-.18301506-03
RE	-.34372212-02	-.14430520-02	.90535073-05	.32534852-06	-.14068235-02	-.86371557-05	-.21776380-05	-.15112378-02	-.79257793-05
G	-.12949485-02	.32042135-03	-.17954385-05	.50934153-07	.26596541-03	.14747272-05	-.40108400-06	.35956941-03	.57274475-06
KM	.89777457-01	.45119144-02	-.28523957-04	.11713475-03	.35345251-02	.18124828-04	.13541558-03	.26169645-02	.20621674-04
RI(03)	.45119144-02	.56576817-02	.28535056-04	-.15699225-05	.20129327-02	.12312910-04	.59441227-06	.22040243-02	.97371307-05
LA(03	-.28523957-04	.28535056-04	.61904083-06	.17686198-07	-.12466953-04	-.76503674-07	-.64560822-08	-.13828577-04	-.58413664-07
LO(03)	.11713475-03	-.15699225-05	.17686198-07	.24440212-06	-.22128658-05	-.18542146-07	.24387863-06	-.31324201-05	-.13739586-07
RI(04)	.35345251-02	.20129327-02	-.12466953-04	-.22128658-05	.46400805-02	-.26806169-04	.47196788-06	.22064679-02	.90700007-05
LA(04)	.18124828-04	.12312910-04	-.76503674-07	-.18542146-07	-.26806169-04	.67103387-06	.10585025-08	.13221182-04	.63726220-07
LO(04)	.13541558-03	.59441227-06	-.64560822-08	.24387863-06	.47196788-06	.10585025-08	.27242243-06	-.83647858-06	.13489072-07
RI(05)	.26169645-02	.22040243-02	-.13828577-04	-.31324201-05	.22064679-02	.13221182-04	-.83647858-06	.42173018-02	-.21243476-04
LA(05)	.20621674-04	.97371307-05	-.58413664-07	-.13739586-07	.90700007-05	.63726220-07	.13489072-07	-.21243476-04	.67513351-06
LO(05)	.12333740-03	-.58002169-06	.15406667-10	.23240058-06	-.16928699-06	-.64089906-08	.24911336-06	-.19594400-05	.84012365-08

LO(05)

X	.83363133-04
Y	.43204280-04
Z	-.56583945-04
DX	-.69222295-07
DY	-.30468746-07
DZ	.31247820-07
KE	.35377955-05
RE	-.13553276-05
G	-.10298124-05
KM	.12333740-03
RI(03	-.58002169-06
LA(03)	.15406667-10
LO(03)	.23240058-06
RI(04	-.16928699-06
LA(04	-.64089906-08
LO(04)	.24911336-06
RI(05	-.19594400-05
LA(05)	.84012365-08
LO(05)	.24383513-06

IMPACT PARAMETERS 65/03/24 140819

13 N MATRIX (TARGET ORBITAL PLANE)

	B.RO	B.TO	TL	C3	S.TS	S.RS
B.RO	.75582498 02	-.23993064 02	.32142089-03	.56647414-01	-.37071364-02	.19676092-02
B.TO	-.23993063 02	.84214538 01	-.14494674-03	-.19114089-01	.12309292-02	-.66515925-03
TL	.32142091-03	-.14494672-03	.39431729-08	.31031867-06	-.19644105-07	.10860228-07
C3	.56647413-01	-.19114090-01	.31031869-06	.44360395-04	-.28869801-05	.15434696-05
S.TS	-.37071367-02	.12309292-02	-.19644105-07	-.28869803-05	.18894233-06	-.10040317-06
S.RS	.19676078-02	-.66515910-03	.10860223-07	.15434689-05	-.10040313-06	.53891525-07

14 NORMALIZED N MATRIX

	B.RO	B.TO	TL	C3	S.TS	S.RS
B.RO	.10000000 01	-.95100229 00	.58876307 00	.97829935 00	-.98098715 00	.97491775 00
B.TO	-.95100224 00	.10000000 01	-.79541177 00	-.98892277 00	.97583168 00	-.98735166 00
TL	.58876311 00	-.79541168 00	.10000000 01	.74197162 00	-.71968874 00	.74499915 00
C3	.97829934 00	-.98892280 00	.74197166 00	.10000000 01	-.99719814 00	.99825187 00
S.TS	-.98098723 00	.97583168 00	-.71968874 00	-.99719819 00	.99999999 00	-.99499878 00
S.RS	.97491709 00	-.98735144 00	.74499880 00	.99825139 00	-.99499843 00	.99999999 00

15 DM/DQ0 MATRIX

	B.RO	B.TO	TL	C3	S.TS	S.RS
X	-.11195955 00	-.72275805 00	.48868975 00	.14992374-05	-.19664073-03	-.25057991-04
Y	.36442298 00	.65089237 00	.61424753 00	-.34153891-05	-.43206788-03	-.52591701-04
Z	-.89287521 00	.36820810 00	.20002891 00	-.18970258-05	-.11702518-03	-.15040996-04
DX	-.11515044 05	-.74917956 05	.43729113 05	-.15934558 01	-.16347509 02	-.20116719 01
DY	.38217272 05	.59812329 05	.49030387 05	-.19927271 01	-.35649534 02	-.46811736 01
DZ	-.91763386 05	.34527938 05	.15522773 05	-.64295650 00	-.86662176 01	-.33613777 00

B	.16139422 04
B.RO	.56816220 03
B.TO	.15106294 04
B.RT	.41051725 03
B.TT	.15608802 04
TL	.25703385 02
SMAA	.91254181 01
SMIA	.85480742 00
THETA	.72227218 02
DEL T	.22606088 00
DEL B	.91653670 01
DEL S	.27633381 00
TF	.25628319 02

16 N MATRIX (TARGET EQUATORIAL PLANE)

	B.RT	B.TT	TL
B.RT	.79765673 02	-.16649971 02	.33457202-03
B.TT	-.16649970 02	.42382759 01	-.11127670-03
TL	.33457204-03	-.11127667-03	.39431729-08

Appendix G
ODP Format Description

ODP Format Description

The ODP printouts of Appendixes E and F are presented in the following sequence: Block No. references are only for identification purposes to the appendixes. All units are in kilometers and seconds unless otherwise specified.

Block No. — *Printout*

1 Control card input.

2 Input covariance matrix of estimated parameters from postmaneuver data *a priori*.

3 Inverse of Block No. 2.

4 Trajectory based on injection conditions from previous iteration. Its format is explained in Appendix D.

5 The normal equation coefficients combined with the *a priori* matrix at injection epoch.

6 Correlation matrix based on Block No. 5.

7 Solution vector and statistics of estimated parameters from last iteration (see Fig. G-1 for explanation of format).

8 Covariance matrix of estimated parameters, at injection epoch, from last iteration.

9 Correlation matrix of estimated parameters, at injection epoch, from last iteration.

10 Residual listings and data statistics for the tracking stations; first the residuals will be listed and then followed by the statistics (see Fig. G-2 for explanation of format).

The above sequence is repeated until the orbit converges. In the last iteration, a trajectory based on the converged estimated parameters is run out to lunar encounter. (See Appendix D for explanation of trajectory format.)

Following the trajectory printout is the U matrix (Block No. 11) that maps the covariance matrix at injection to encounter. Immediately below the U matrix is the covariance matrix (Block No. 12) on the estimated parameters at impact or closest approach epoch. This matrix is formed by mapping the covariance matrix at injection to impact in double precision.

Task Identification

ITERATION NUMBER X **EPOCH** yr/mo/day XX XX XX.XXX[a] **CLOCK** XX XX XX[b] **SOS**[c] .XXXXX **QSOS**[d] .XXXXX[d]

Q *DQ* **STDEVDQ** **OLD Q** **NEW Q** **NOMINAL Q** ***DQ* (NOM)**

X, Y, Z = Position space-fixed Cartesian component, km	*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 first iteration)	*Value of* estimated parameters on this iteration	*Initial estimate* of parameters	*Total difference* in new **Q** and nominal **Q**
DX, DY, DZ = Velocity space-fixed Cartesian, km/s						
RI = Radius *KE*, km = $GM_{\oplus}$, km^3/s^2						
LA = Latitude *RE*, deg = Radius of *earth to* scale ephemeris, km						
LO = Longitude *KM*, deg = $GM_{\mathbb{C}}$, km^3/s^2						

[a] GMT in h, min, s.

[b] Current Pacific Coast time in h, min, s.

[c] Weighted sum of the squares of the residuals (floating point numbers).

[d] 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 interation, and Γ is on *a priori* covariance on **Q** (floating point numbers).

Fig. G-1. Format explanation of Block No. 7 of ODP

STATION NUMBER XX yr/mo/day ITERATION NUMBER X PASS NUMBER XX

FREQUENCY XXXX.X (last digits in transmitter frequency 2966 XXXX.X in Hz)

TIME	TC	Q	CC3		
XX XX XX	XX	XX	.XXXXXXXX XX	.XXX XX	.XXXX[a]
h min s (GMT)	Doppler count time, s	Transmitting station number	Two-way doppler (CC3) value in Hz (floating point number)	Associated weight in floating point	Residual (observed minus calculated), Hz

[a]Residuals followed by an asterisk (*) have been deleted from fit.

Fig. G-2. Format explanation of Block No. 10 of ODP

There are three blocks following the covariance matrix. The first block (No. 13) 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 A of this report) (σ^2_{TL} is in h^2). The second block (No. 14) is simply the correlation matrix of Block No. 13 covariance matrix. The third block (No. 15) is a mapping matrix that maps injection components into the **B** · **T**, **B** · **R**, etc. system, which is shown in Fig. A-1. These components are defined as follows:

Key — *Definition*

B = Vector measured from center of moon perpendicular to incoming asymptote, km.

B · RO = **B** vector dotted on **R** axis, km (**T** axis in moon's orbital plane).

B · TO = **B** vector dotted on **T** axis, km (**T** axis in moon's orbital plane).

B · RT = **B** vector dotted on **R** axis, km (**T** axis in equatorial plane of moon).

B · TT = **B** vector dotted on **T** axis, km (**T** axis in equatorial plane of moon).

TL = Linearized time of flight, h.

SMAA = Largest eigenvalue of upper 2×2 of N matrix (commonly called semimajor axis of a 40% dispersion ellipse in **B**-plane).

SMIA = Semiminor axis of dispersion ellipse or the other eigenvalue of upper 2×2.

THETA = Orientation angle of semimajor axis of dispersion ellipse measured counterclockwise from **T** axis.

DEL T = Uncertainty in time of flight, s.

DEL B = $(N_{11} + N_{22})^{1/2}$ where Ns are from Block No. 13.

DEL S = V_∞ (*DEL T*) position uncertainty in direction of incoming asymptote. Where V_∞ = hyperbolic excess velocity, km/s.

TF = Orbital time of flight, in hours from injection epoch to impact or closest approach.

The block (No. 16) following the **B** plane parameters is formed by rotating the upper 3×3 of the covariance matrix N (target orbital plane) into the target equatorial plane.

References

1. Holzman, R. E., and Coltharp, C. D., *JPL Tracking Data Editing Program for IBM 7094,* Technical Memorandum 33-170. Jet Propulsion Laboratory, Pasadena, Calif., Aug. 1, 1964.

2. Hudson, R. H., Nead, M. W., and Warner, M. R., *The Orbit Determination Program of Jet Propulsion Laboratory,* Technical Memorandum 33-168. Jet Propulsion Laboratory, Pasadena, Calif., Mar. 18, 1964.

3. Holdridge, D. B., *Space Trajectories Program for IBM 7090 Computer,* Technical Report 32-223. Jet Propulsion Laboratory, Pasadena, Calif., Mar. 2, 1962.

4. Kizner, W., *A Method of Describing Miss Distance for Lunar and Interplanetary Trajectories,* External Publication 674. Jet Propulsion Laboratory, Pasadena, Calif., Aug. 1, 1959.

5. Clarke, V. C., Jr., "Earth Radius/Kilometer Conversion Factor for the Lunar Ephemeris," *AIAA J.,* Vol. 2, Feb. 1964.

6. Brouwer, D., "Relation Among Some Important Astronomical Constants," in *The System of Astronomical Constants,* Proceedings of International Astronomical Union Symposium No. 21, held in Paris, France, May 1963.

7. Anderson, J. D., Null, G. W., and Thornton, T. H., "The Evaluation of Certain Astronomical Constants from Radio Tracking of *Mariner II*," *Prog. Astronaut. Aeronaut.,* Vol. 14, Academic Press, Inc., New York, 1964.

8. Sjogren, W. L., Curkendall, D. W., Hamilton, T. W., Kirhofer, W. E., Liu, A. S., Trask, D. W., Winneberger, R. A., and Wollenhaupt, W. R., *The Ranger VI Flight Path and Its Determination from Tracking Data,* Technical Report 32-605. Jet Propulsion Laboratory, Pasadena, Calif., Dec. 15, 1964.

9. Wollenhaupt, W. R., Trask, D. W., Sjogren, W. L., Piaggi, E. G., Curkendall, D. W., Winneberger, R. A., Liu, A. S., and Berman, A. L., *Ranger VII Flight Path and Its Determination from Tracking Data,* Technical Report 32-694. Jet Propulsion Laboratory, Pasadena, Calif., Dec. 15, 1964.

10. Wollenhaupt, W. R., et al., *The Ranger VIII Flight Path and Its Determination from Tracking Data,* Technical Report 32-766. Jet Propulsion Laboratory, Pasadena, Calif. (to be published).

11. Clarke, V. C., Jr., *Constants and Related Data for Use in Trajectory Calculations,* Technical Report 32-604. Jet Propulsion Laboratory, Pasadena, Calif., Mar. 6, 1964.

12. *Topographic Lunar Map 1:5,000,000,* Edition 2-AMS. Army Map Service, Corps of Engineering, Washington, D.C., June 1964 (compiled in 1963).

13. *Lunar Chart LAC 60,* First Edition. Aeronautical Chart and Information Center, U.S. Air Force, St. Louis, Mo., Sept. 1962.

14. *Lunar Chart LAC 76,* First Edition. Aeronautical Chart and Information Center, U.S. Air Force, St. Louis, Mo., Apr. 1964.

15. *Lunar Chart LAC 77,* First Edition. Aeronautical Chart and Information Center, U.S. Air Force, St. Louis, Mo., May 1963.

References (contd)

16. Moyer, T. D., "Theoretical Basis for Double Precision Orbit Determination Program (DPODP)," in *The Deep Space Network,* Space Programs Summary 37-38, Vol. III, pp. 24–26 (and subsequent issues of Vol. III). Jet Propulsion Laboratory, Pasadena, Calif., Mar. 31, 1966.

17. Eckert, W. J., Walder, M. J., and Eckert, D., "The Transformations of the Lunar Coordinates and Orbital Parameters," *Astro. J.,* Vol. 71, pp. 314–332, June 1966.

18. Trask, D. W., and Muller, P. M., "Timing DSIF Two-Way Doppler Inherent Accuracy Limitations," in *The Deep Space Network,* Space Program Summary 37-39, Vol. III, pp. 7–16. Jet Propulsion Laboratory, Pasadena, Calif., May 31, 1966.

19. Rindfleisch, T. C., and Willingham, D. E., *Figure of Merit as a Measure of Picture Resolution,* Technical Report 32-666. Jet Propulsion Laboratory, Pasadena, Calif., Sept. 1, 1965.

20. Hall, E. H., *AFETR Special Report Test 300 (Ranger IX),* Systems Analysis Report 50-SR-66-11. Radio Corporation of America, Patrick Air Force Base, Florida, Apr. 1965.