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MSC-G-R-66-1
Supplemental Report 4

3150-6024-R8-000

PROGRAM TECHNICAL REPORT
TASK MSC/TRW G-14

GEMINI 7 INERTIAL GUIDANCE SYSTEM EVALUATION AND TRAJECTORY RECONSTRUCTION (U)

NAS 9-4810

15 FEBRUARY 1966

Issued as: Supplemental Report 4
To: Gemini Program Mission Report
Gemini VII
MSC-G-R-66-1
By: Gemini VII Mission Evaluation Team
National Aeronautics and Space Administration
Manned Spacecraft Center
Houston, Texas

TRW SYSTEMS

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Total Pages: 123

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Prepared for
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
Contract NAS 9-4810
Gemini MTCP

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TRW SYSTEMS

GROUP-4
DOWNGRADED AT 3 YEAR INTERVALS;
DECLASSIFIED AFTER 12 YEARS

[redacted]

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ABSTRACT

The report contains a detailed evaluation of the Gemini 7 inertial guidance system accuracy during the ascent and reentry phases of the mission. Total system error is found to be approximately equal to its specification, one standard deviation value. An analysis of the external tracking instrumentation accuracy is also included. The results of the error analyses are used to construct a reference Gemini 7 trajectory for the ascent and reentry portions of the mission.

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1. INTRODUCTION AND SUMMARY

Gemini Flight No. 7 was launched on 4 December 1965 from Complex 19 at Cape Kennedy, Florida. It was a 14-day manned orbital flight that included orbit adjustment maneuvers. This report, submitted to the NASA Manned Spacecraft Center by TRW Systems in response to Task MSC/TRW G-14 of the Mission Trajectory Control Program, presents the results obtained from analysis of the inertial guidance system (IGS) performance during ascent and reentry flight phases and provides a reconstruction of the spacecraft trajectory during ascent and reentry.

The following is a brief summary of the analysis results:

- There was no evidence of IGS or component malfunctions during the ascent and reentry flight phases.

- The inertial guidance system (IGS) performance during ascent was satisfactory. Best estimates of IGS errors at injection are as follows:

Δx	= 1440 ft	$\Delta \dot{x}$	= 7.3 ft/sec
Δy	= 830 ft	$\Delta \dot{y}$	= 10.0 ft/sec
Δz	= 230 ft	$\Delta \dot{z}$	= 0.3 ft/sec

- The dominant inertial measurement unit (IMU) errors of the flight were:

  (a) Y gyro (pitch) drifts of 0.55 deg/hr constant drift rate and -0.26 deg/hr/g input axis unbalance and

  (b) an X accelerometer scale factor error of approximately 217 parts per million

- The tracking data was of satisfactory quality. However, analysis indicated the presence of a refraction type error of approximately 12 parts per million in the index of refraction at the MISTRAM 100 K Q site. There is considerable uncertainty in this error magnitude and even in analytical error model, nevertheless the effect is clearly evident in the data. Also a 0.3 ft/sec range sum rate bias in the passive MISTRAM and approximate 0.1 milliradian azimuth bias in the GE Mod III data was found.

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- The GE MOD III-Burroughs/inertial guidance update procedure was correctly performed but the aforementioned azimuth bias in MOD III data resulted in a 20-second residual IGS azimuth misalignment during ascent.

- Failure of the onboard, delayed-time-telemetry tape recorder resulted in the loss of IGS data during most of the dynamic portion of reentry, making a detailed IGS evaluation impossible. However, a comparison of IGS data after telemetry blackout with a segment of very low elevation ground tracking data indicates an IGS navigation error of approximately 3 n mi.

Section 2 of this report provides a detailed description of the analysis performed for the ascent portion of flight; this includes a discussion of:

a) Inertial Measurement Unit (IMU) accelerometer and platform errors

b) The radio guidance/inertial guidance update procedures

c) Airborne computer navigation errors

Section 3 provides a description of the IMU error analysis performed for the reentry flight phase, Section 4 describes the external tracking system performance and quality, and Section 5 presents a discussion of the trajectory reconstruction for ascent and reentry. Appendix A contains the Gemini 7 ascent and reentry reconstructed trajectory and support data, including listings and plots of the thrust acceleration profile, and Appendix B contains a discussion of alterations to the TRW regression program (REMP).

2. INERTIAL GUIDANCE SYSTEM PERFORMANCE ANALYSIS

Comparisons of IGS telemetered quantities and external tracking data were made for the purpose of evaluating the Gemini 7 IGS performance. The IMU evaluation was based in part on thrust (sensed) velocity comparisons (Figure 1) generated by scaling and biasing telemetered accumulated accelerometer count data and comparing the results with external tracking data adjusted for gravity and transformed to guidance coordinates. The residuals from these comparisons were attributed to IMU and tracking system errors.

Comparisons were also made between the telemetered total inertial position and velocity outputs from the airborne computer and external tracking data (Figures 2 and 3). These comparisons, called total inertial comparisons, include IMU and tracking system errors as well as airborne computer navigation errors caused by gravity approximations, truncation errors, etc. The difference between the thrust and inertial comparison sets are called delta-delta comparisons (Figure 4) and they provide a measure of the airborne computer computational error alone.

The inertial and delta-delta comparisons are referenced to the IGS computer coordinate system, which is an inertial, orthogonal, right-handed system referenced to the center of the earth. The x and z axes lie in a plane parallel to the geodetic tangent plane at the launch site at the time of platform release, with the x axis defined by the launch azimuth, positive downrange. The y axis is positive down along the geodetic vertical, and the z axis is directed so as to complete the right-handed x, y, z set.

Position and velocity comparisons were also made in the external tracking measurement coordinates. These were made for the purpose of isolating IMU and tracker error coefficients by performing computer regressions on the differences.

External tracking data used in the evaluation included Quick-Look MISTRAM I 10K and 100K, GE/Mod III/Final, GE/Mod III/Burroughs, Final MISTRAM, Passive MISTRAM II, and BET. An analysis of these data sources is described in Section 4.

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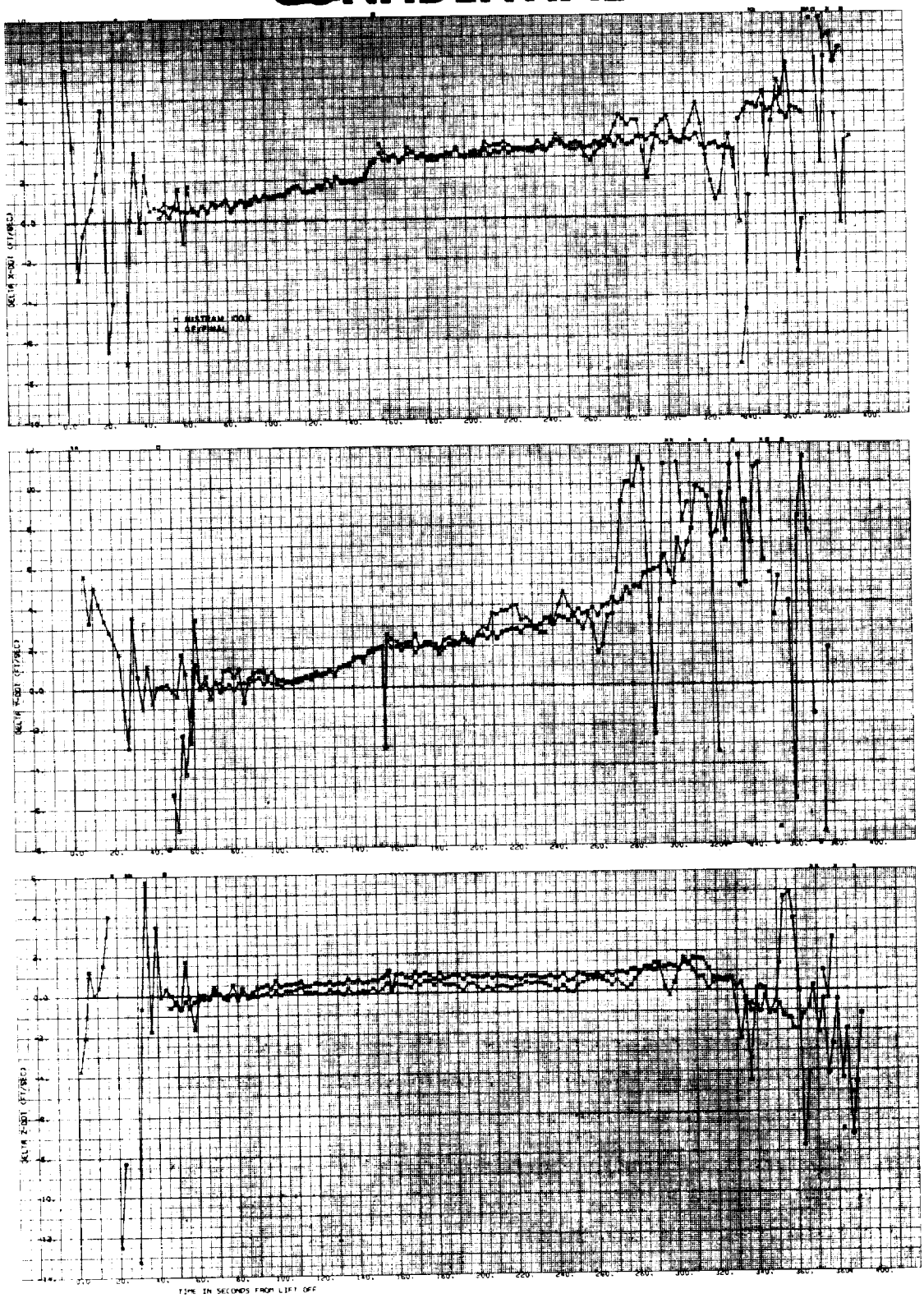

Figure 1. Thrust Velocity Comparison in Computer Coordinates

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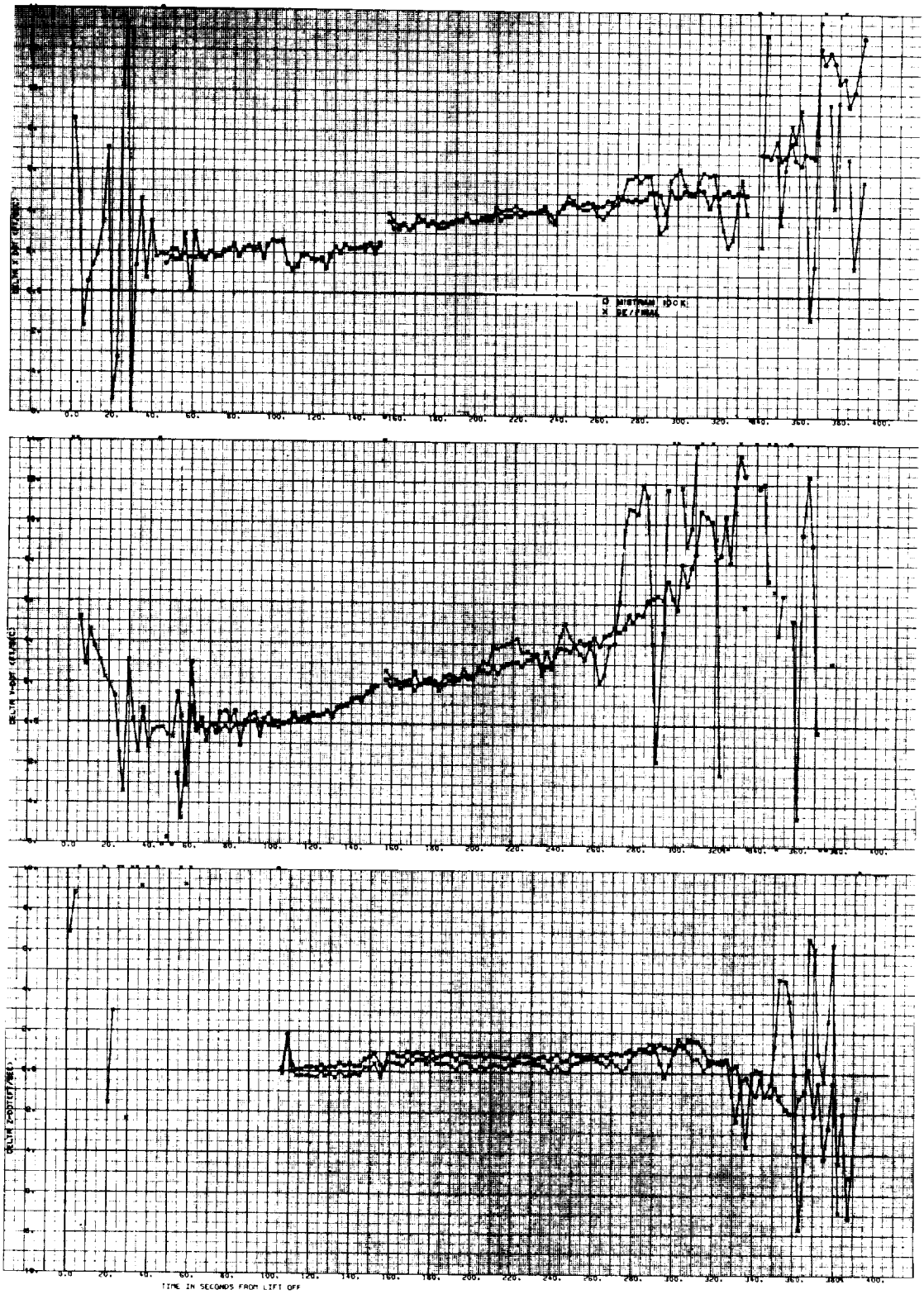

Figure 2. Total Inertial Velocity Comparison in Computer Coordinates

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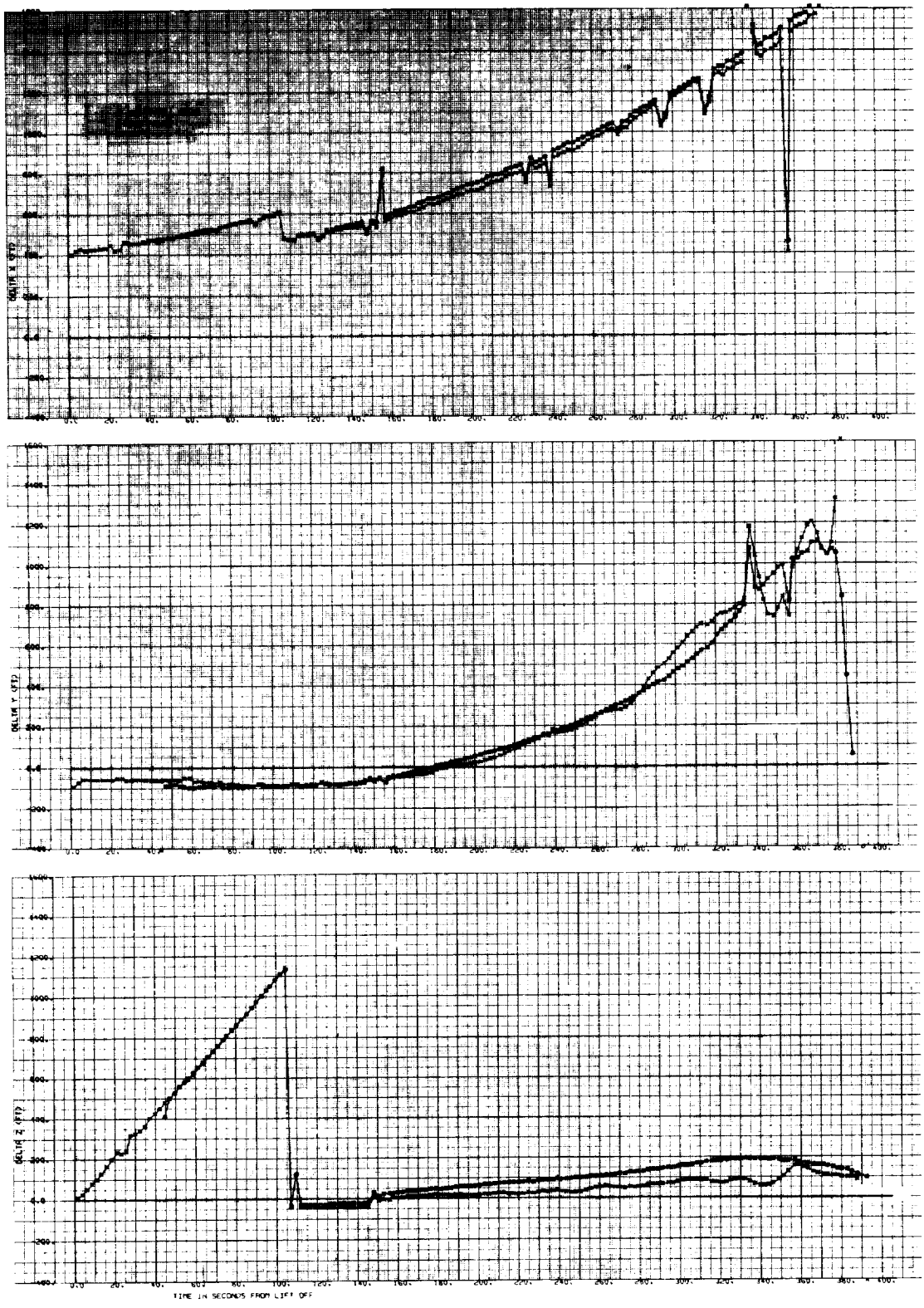

Figure 3. Total Inertial Position Comparison in Computer Coordinates

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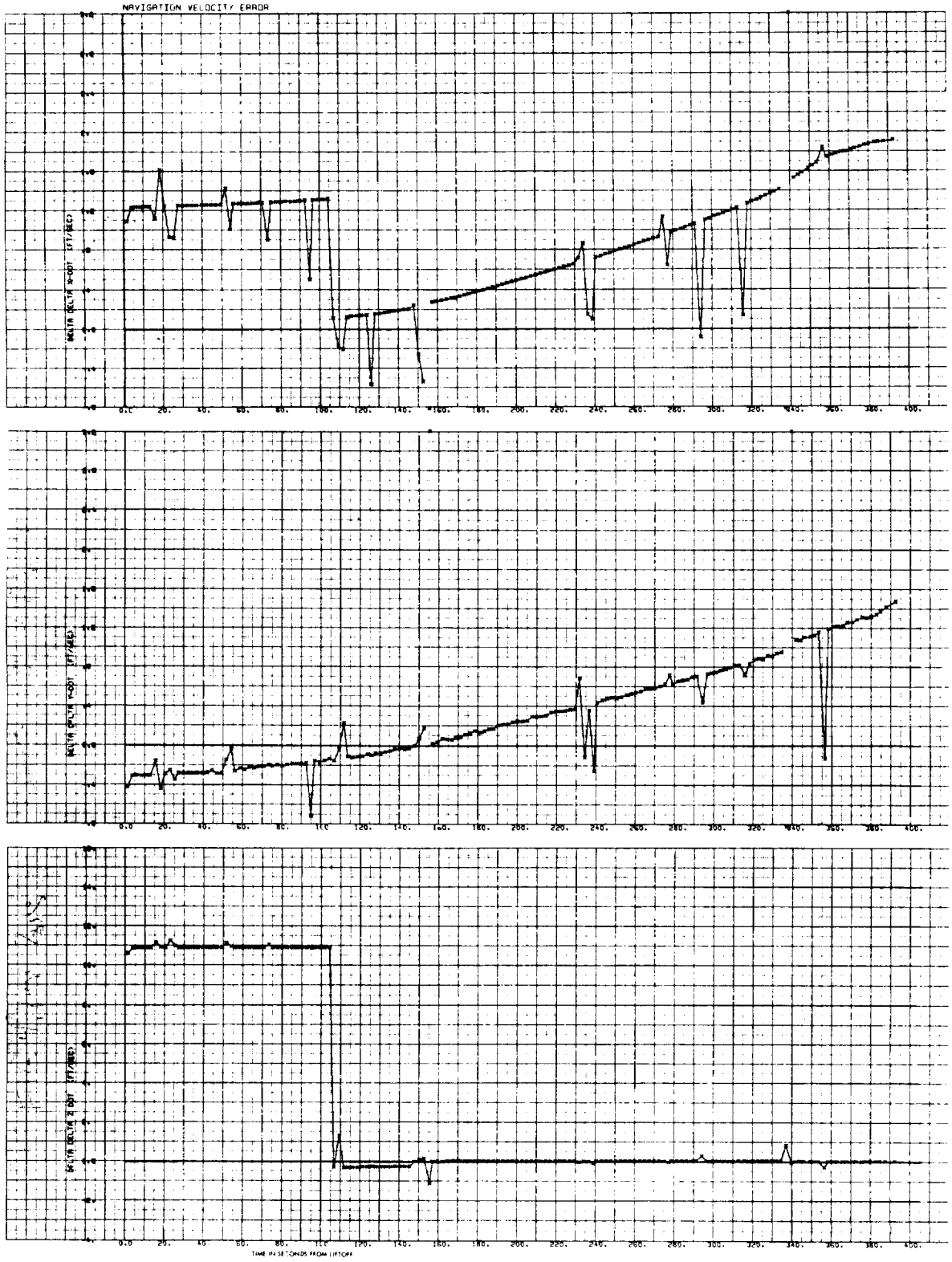

Figure 4. Navigation Velocity Error

The plots enclosed are referenced to liftoff time (19 hr 30 min 03.702 sec GMT) which occurred 3.512 seconds after IGS "go inertial."

2.1 IGS ERROR

The indicated IGS errors immediately following SECO (337 seconds from liftoff) and equally valid at separation (357 seconds from liftoff) are given in Table 1. These values were obtained by evaluation of the position and velocity comparisons (Figures 2 and 3). The column headed "IMU Error" represents the error contributed by the accelerometer, gyro, and platform alignment sources; the column headed "Navigation Equation Errors" is the contribution due to various approximations within the airborne computer as observed from the delta-delta comparisons*; and the column titled "Total Guidance Errors" is the sum of the two and represents the total IGS error. These total errors result in velocity magnitude and flight path angle errors at separation of the following amounts:

$$|V| = 9 \text{ ft/sec}$$
$$\gamma = -0.014 \text{ deg}$$

Table 1. Inertial Guidance Error at SECO

Observation	Unit	IMU Error	Navigation Equation Errors	Total Guidance Errors
$\dot{X}$	ft/sec	5.6 ± 0.5	1.7 ± 0.2	7.3 ± 0.5
$\dot{Y}$	ft/sec	9.9 ± 3.0	1.0 ± 0.1	10.9 ± 3.0
$\dot{Z}$	ft/sec	0.2 ± 1.0	0.1 ± 0.1	0.3 ± 1.0
X	ft	800 ± 50	640 ± 10	1440 ± 51
Y	ft	820 ± 50	10 ± 3	830 ± 50
Z	ft	220 ± 10	10 ± 3	230 ± 10

Note: The ± numbers are 1-sigma estimates.

*Level changes at 107 seconds in the $\dot{x}$ and $\dot{z}$ curves are due to updating the initial earth rate conditions by the onboard computer as a result of the RGS/IGS update routine.

Table 2 is a comparison of the navigation errors observed on this flight with those predicted by preflight simulation.**

Table 2. IGS Navigation Errors at SECO

Trajectory	Position (ft)			Velocity (ft/sec)		
	X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$
Actual	640	10	10	1.7	1.0	0.1
Simulation	175	60	-18	1.9	0.9	-0.15

2.2 IMU ANALYSIS

2.2.1 IMU Error

Analyses to recover IMU error source coefficients were performed by using the procedures and data processing programs as documented in Reference 1 except that the Recursive Error Modelling Program (REMP) was used for regression analysis. The IMU error source coefficients recovered in the analysis are presented in Table 3. These were ultimately derived from a hand fit to the MISTRAM and GE/Final thrust velocity residuals (Figure 1) and later substantiated by a computer regression analysis (see Section 2.2.2).

The most significant indications of the thrust velocity comparison plots are x and y velocity differences which build up to approximately 2.5 and 2 ft/sec at BECO and 6 and 10 ft/sec respectively at SECO. In addition, small z velocity errors are indicated until 310 seconds after which a negative slope of approximately 0.044 ft/sec^2 is indicated by MISTRAM data.

The dominant error sources which contributed to the x axis residuals were an x accelerometer scale factor error of approximately 217 parts per million (ppm) and an IGS time scale factor error of -32.2 ppm.

**The preflight values were determined from simulation results obtained by telephone from IBM. Since no exact simulation of the Gemini 7 trajectory was available, values were obtained by interpolating from a series of simulations for similar trajectories with various launch azimuths.

The time error was evidenced by 0.8 ft/sec and 2 ft/sec jumps in the x velocity residuals at BECO and SECO respectively. The accelerometer and time scale factor errors alone did not provide a satisfactory fit to the data however.

Table 3. IMU Analysis Recovered Error Coefficients

Error Source	Recovered Coefficient	Units
X Accelerometer Scale Factor	217	ppm
Y Accelerometer Output Axis Sqd Nonlinearity	100	ppm/cross g
Y Gyro Constant Drift Rate	0.55	deg/hr
Y Gyro Input Axis Unbalance	-0.26	deg/hr/g
Platform Misalignment about Y Accelerometer Axis	20	arc sec
Platform Misalignment about Z Accelerometer Axis	20	arc sec
IGS Time Scale Factor	-32.2	ppm
X Accelerometer Bias	19	ppm g
Y Accelerometer Bias	45	ppm g
Z Accelerometer Bias	-33	ppm g

Pitch type error sources were used to fit the y velocity residuals because they provided the necessary coupling in the x axis to null out the residual x axis velocity error. The pitch error sources which combined with the time accelerometer scale factor error sources to provide the best fit to both the x and y velocity residuals were: y gyro drifts of 0.55 degree per hour constant rate and -0.26 degree per hour per g input axis unbalance, and a pitch misalignment (PHIY) of 20 arc seconds.

The small z velocity residuals indicate negligible IMU error propagation in the z axis; however, a MISTRAM or GE/Mod III error is suggested by the systematic difference between the MISTRAM and Mod III residuals. By comparison of the difference between the two with propagations of possible MISTRAM and GE error sources, it was concluded that the observed tracker residuals are attributable to a -0.005 degree azimuth bias in the GE Mod III data. Since IGS z velocity updating was

accomplished with the Mod III data, the IGS experienced an equivalent residual azimuth misalignment (PHIZ) of 20 seconds after updating.

The z velocity slope of the MISTRAM residuals which exist even after SECO time suggests the presence of a MISTRAM error. Analyses revealed that a Q channel refraction error of approximately 6 n units would account for the velocity slope which occurred beyond SECO (see Section 5). A small residual velocity error still existed in the data after compensating for the refraction error. This was best fit by a z accelerometer output axis squared nonlinearity of approximately 100 ppm/cross g.

The fit associated with the recovered coefficients is presented in Figure 5, which also shows the preflight expected IMU errors presented in Table 4, propagated with the observed timing errors. Comparisons of the errors indicate that the actual pitch drift and resulting y velocity error approximates the preflight values. Conversely, the x accelerometer scale factor error and resulting x axis error was larger than the preflight values and the expected z axis drift was not evident during flight. However, the recovered scale factor error appears to be consistent with the accelerometer scale factor history. This is evident in Figure 6, which shows the variation of accelerometer scale factors between calibrations. The y and z accelerometer scale factors were somewhat constant for a three-month period just prior to launch and were most likely near their desired value during flight since their errors were not evidenced by the flight test data. The x accelerometer on the other hand demonstrated considerable scale factor variations throughout its calibration history.

Accelerometer biases were recovered during orbit phases of flight by determining the slope of IGS thrust velocities during an interval after insertion when no thrusting was being applied (Figure A-4 of Appendix A). The recovered biases are also presented in Table 3. Their small magnitudes are consistent with the accelerometer bias histories indicated in Figure 7.

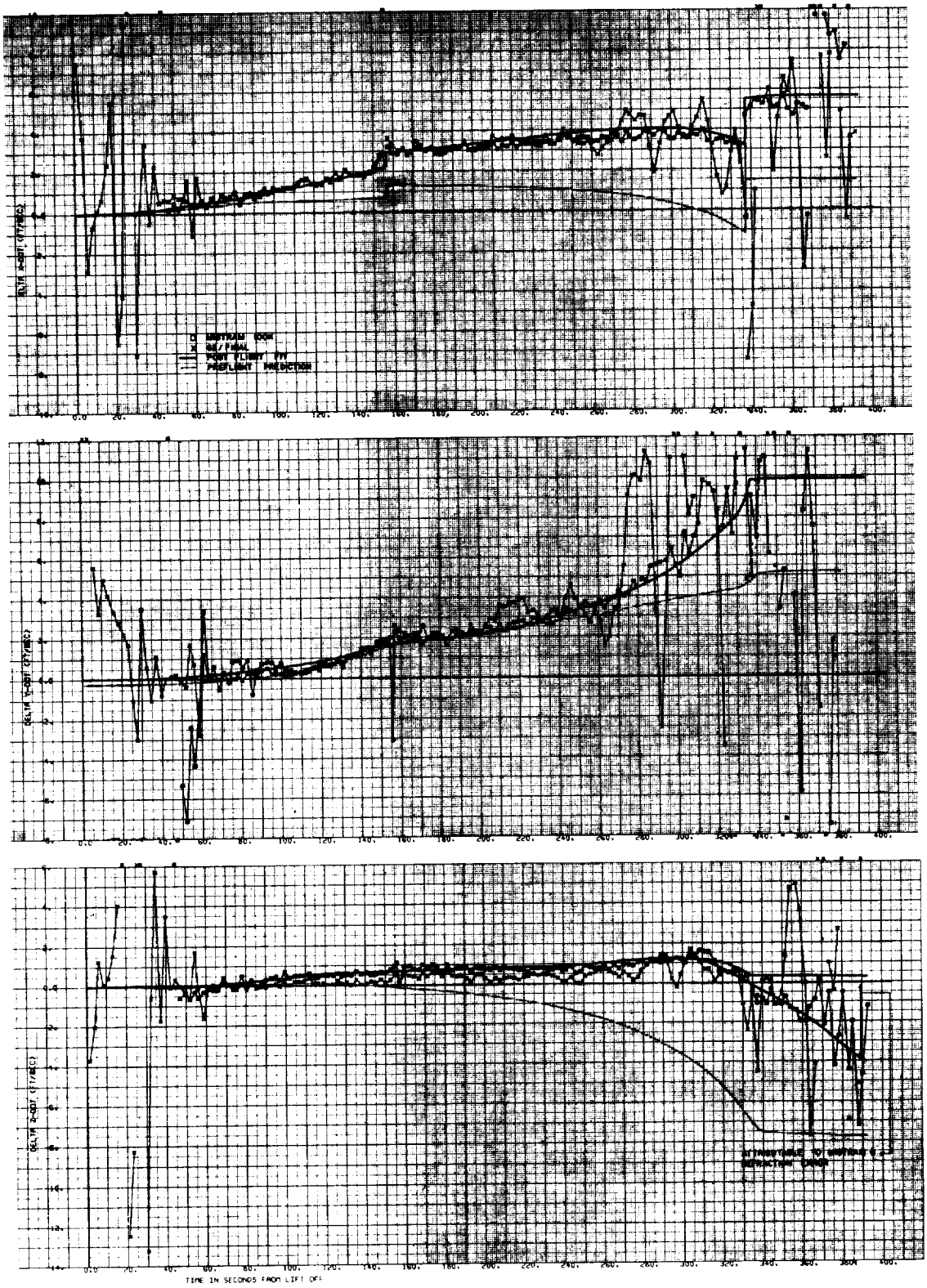

Figure 5. Thrust Velocity Comparison in Computer Coordinates

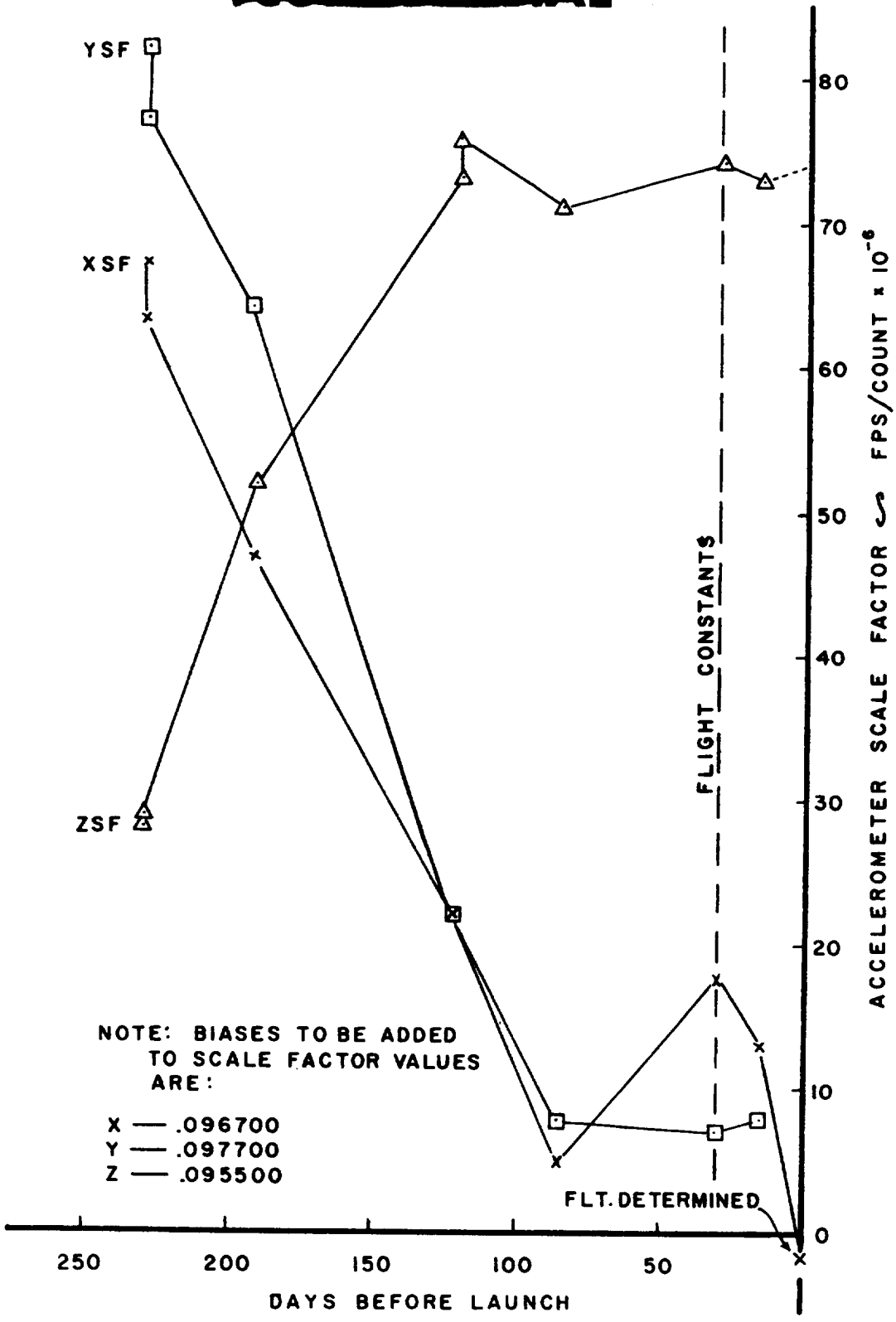

Figure 6. Gemini 7 Accelerometer Scale Factor History

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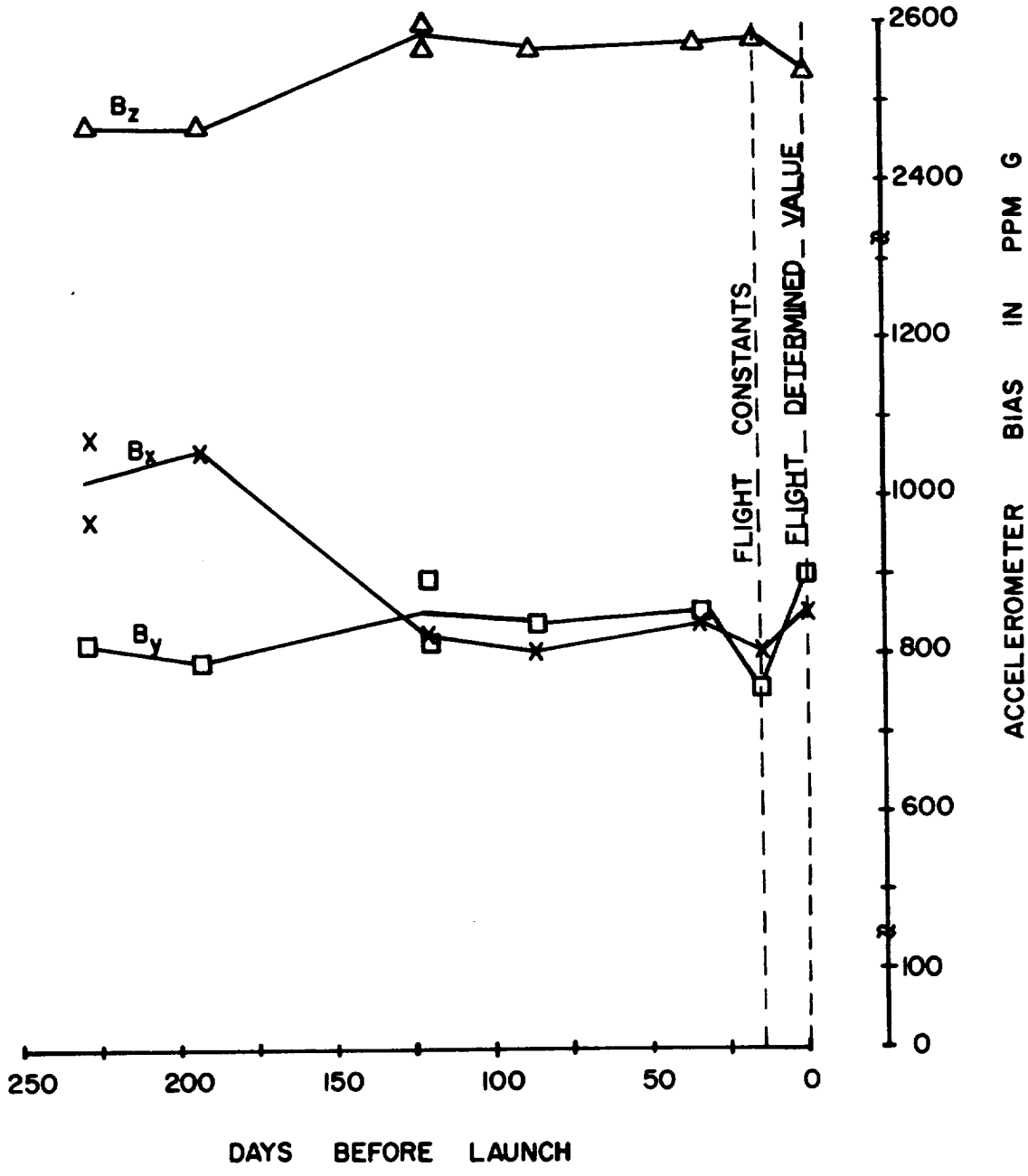

Figure 7. Gemini 7 Accelerometer Bias History

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Table 4. Preflight Expected Values of IMU Errors*

Error Source	Magnitude	Units
X Accelerometer Bias	-38	ppmg
Y Accelerometer Bias	100	ppmg
Z Accelerometer Bias	11.2	ppmg
X Accelerometer Scale Factor	40	ppm
Y Accelerometer Scale Factor	0	ppm
Z Accelerometer Scale Factor	10	ppm
X Gyro Constant Drift Rate	0.08	deg/hr
Y Gyro Constant Drift Rate	-0.07	deg/hr
Z Gyro Constant Drift Rate	0.02	deg/hr
X Gyro Input Axis Unbalance	-0.1	deg/hr/g
Y Gyro Input Axis Unbalance	0.22	deg/hr/g
Z Gyro Input Axis Unbalance	-0.11	deg/hr/g
X Gyro Spin Axis Unbalance	0.26	deg/hr/g
Y Gyro Spin Axis Unbalance	0	deg/hr/g
Z Gyro Spin Axis Unbalance	0.07	deg/hr/g

*Obtained from Honeywell.

2.2.2 Regression Analysis

A regression analysis was performed on the Gemini 7 IGS and tracker data. The following error model was chosen as a result of the hand fit. The regression program (REMP) assigned the coefficient values and the covariance matrix for these terms.

XSF = X accelerometer scale factor error
TSF = Timing scale factor
POX = X position bias
POY = Y position bias
POZ = Z position bias
PHIY = Platform misalignment about Y
YGIAU = Y gyro input axis unbalance
XGIAU = X gyro input axis unbalance
YGCDR = Y gyro constant drift rate

A2(1) = MISTRAM I timing bias
G2(4) = MISTRAM II timing bias
C2(3) = GE Mod III timing bias
G3(4) = MISTRAM II rate bias

Several other error sources were carried in the regression program as unmodeled effects; i.e., their effect is examined in the statistics of the recovered terms but no coefficients are solved for (see Appendix B for explanation of this technique).

The regression domain chosen was the following:

$\dot{P}$, $\dot{Q}$, $\dot{R}$SUM	10K MISTRAM
$\dot{P}$, $\dot{Q}$	100K MISTRAM
$\dot{R}$, $\dot{P}$, $\dot{Q}$	GE Final (Mod III)
$\dot{R}$SUM	Passive MISTRAM

Table 5 lists the assumed noise estimates for these parameters over various time spans in the fit.

The velocity domain was selected for two main reasons: 1) it is completely insensitive to tracker position bias (DC only), and 2) the IGS errors are less correlated in this domain, which usually affords a more reliable inversion of the normal matrix (i.e., less numerical errors in inversion). The coefficients which were recovered fit the ΔV curves (in IGS coordinates) quite well and are all of believable magnitudes.

The assumptions made in conjunction with the regression run are as follows:

a) The data noise was white (Gaussian).

b) The selected error model is sufficient to model all errors.

c) The tracker rate domain is the most desirable for regression purposes.

The MISTRAM I and II and GE Mod III rate residuals were fit quite well. The final recovered error coefficients are listed in Table 6 with their associated a posteriori 1-sigma uncertainties.

Table 5. Tracker Sigmas Used in Fit

Parameter	Sigma	From	To	Sigma	From	To	Sigma	From	To
$\dot{P}_{10K}$	0.01	50	160	0.0025	160	280	0.01	280	360
$\dot{Q}_{10K}$	0.01	50	160	0.0025	160	300	0.01	300	360
$\dot{R}_{SUM}$	0.1	50	360						
$\dot{P}_{100K}$	0.02	50	160	0.005	160	360			
$\dot{Q}_{100K}$	0.025	50	160	0.001	160	330	0.025	330	360
$\dot{R}_{MOD\ III}$	0.15	50	360						
$\dot{P}_{MOD\ III}$	0.25	50	320	0.5	320	360			
$\dot{Q}_{MOD\ III}$	0.25	50	320	0.5	320	360			
$\dot{R}SUM_{PASSIVE\ MISTRAM}$	0.1	180	360						

Note: Sigmas are all in ft/sec and the From/To times are in seconds from launch.

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Table 6. Recovered Error Coefficients

Error Terms	Coefficient	1 Sigma
XSF	189	100
PHIY	26	32
POX	27	11
POY	-68	112
POZ	27	64
TSF	-56	23
YGIAU	-0.18	0.72
XGIAU	-0.05	0.59
YGCDR	0.35	0.84
A2(1)	0.007	0.007
G2(4)	0.007	0.0066
C2(3)	0.007	0.0082
G3(4)	0.27	1.7
B5(2)	-12.4	30

The terms YGCDR, YGIAU, XGIAU, POY, G3(4), and B5(2) were not well recovered since the ratios of a posteriori to a priori recovered error coefficient uncertainties were large. The main cause for this is that so many "unmodeled errors" were carried in the a posteriori statistics. This means that these errors very likely represent some combination of the total error model; however, such a combination is impossible to determine using the data available. The term B5(2) is a refraction error in the MISTRAM 100K Q leg. This term was originally left out of the fit but the residuals indicated that it was definitely present.

Examination of the histories of recovered error coefficients in the fit as the error model is expanded reveals that the fit is very stable; little cancellation exists and all variations are well within the estimated uncertainties.

Figures 8 through 10 are the tracker rate residuals used in the fit with the fit itself superimposed on the residuals. It is obvious that some error remains in the data, especially in Mod III and the passive MISTRAM

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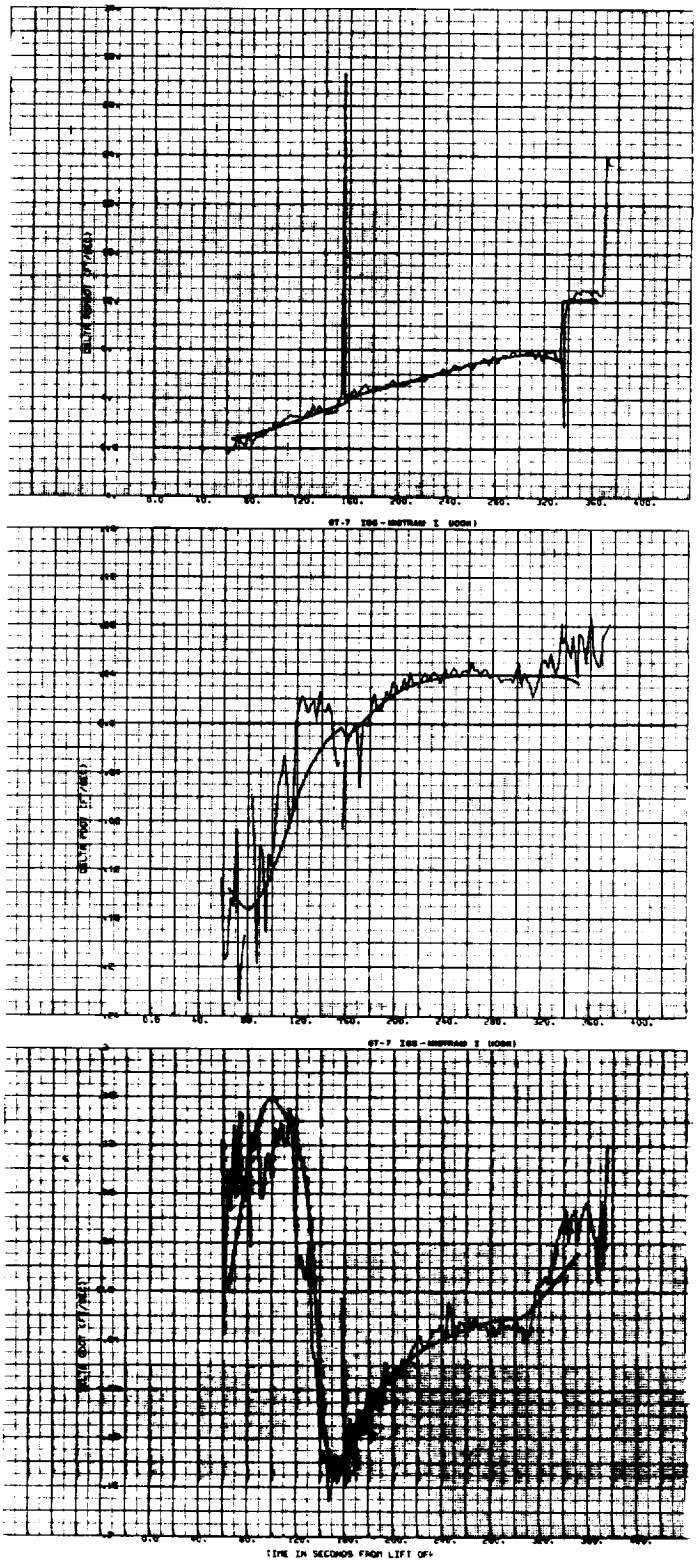

Figure 8. *GT-7 IGS Minus MISTRAM I*

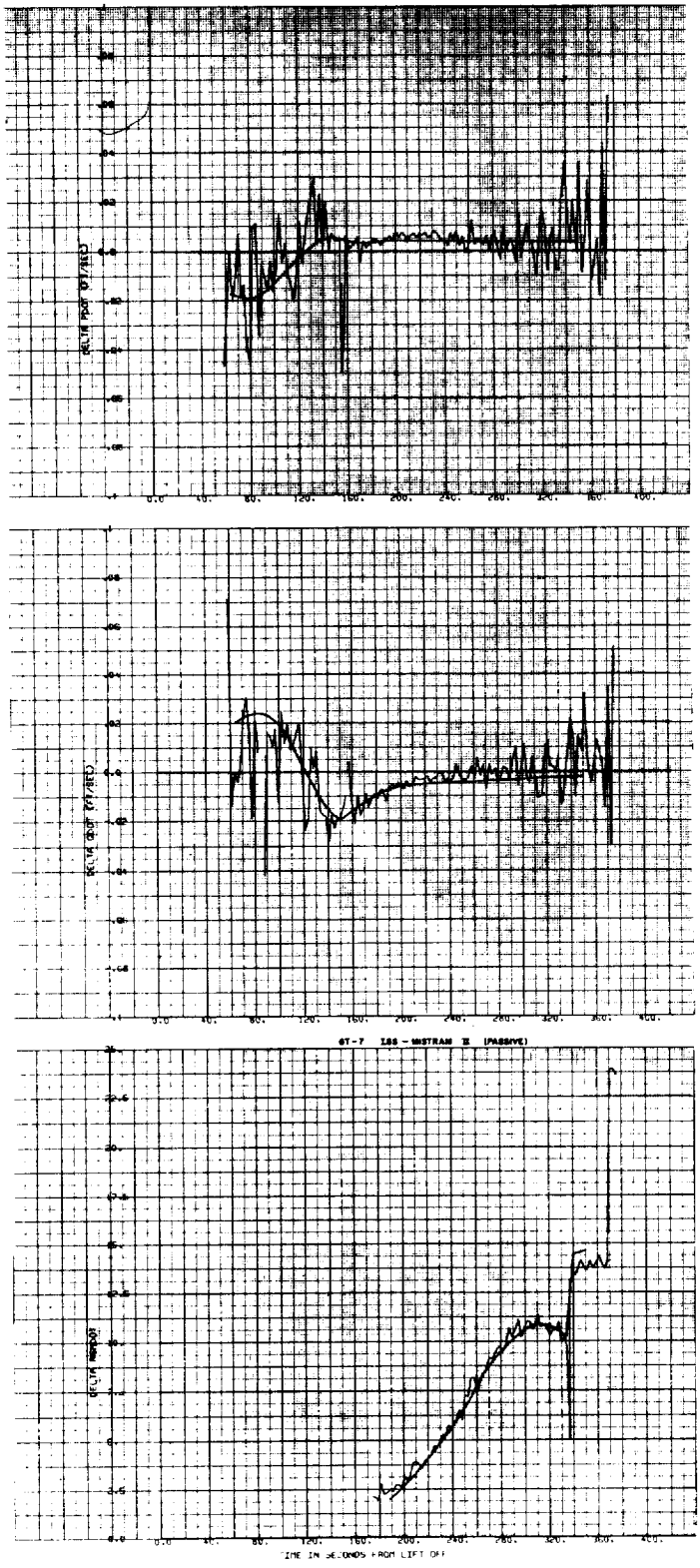

Figure 9. GT-7 IGS Minus MISTRAM I (10K)

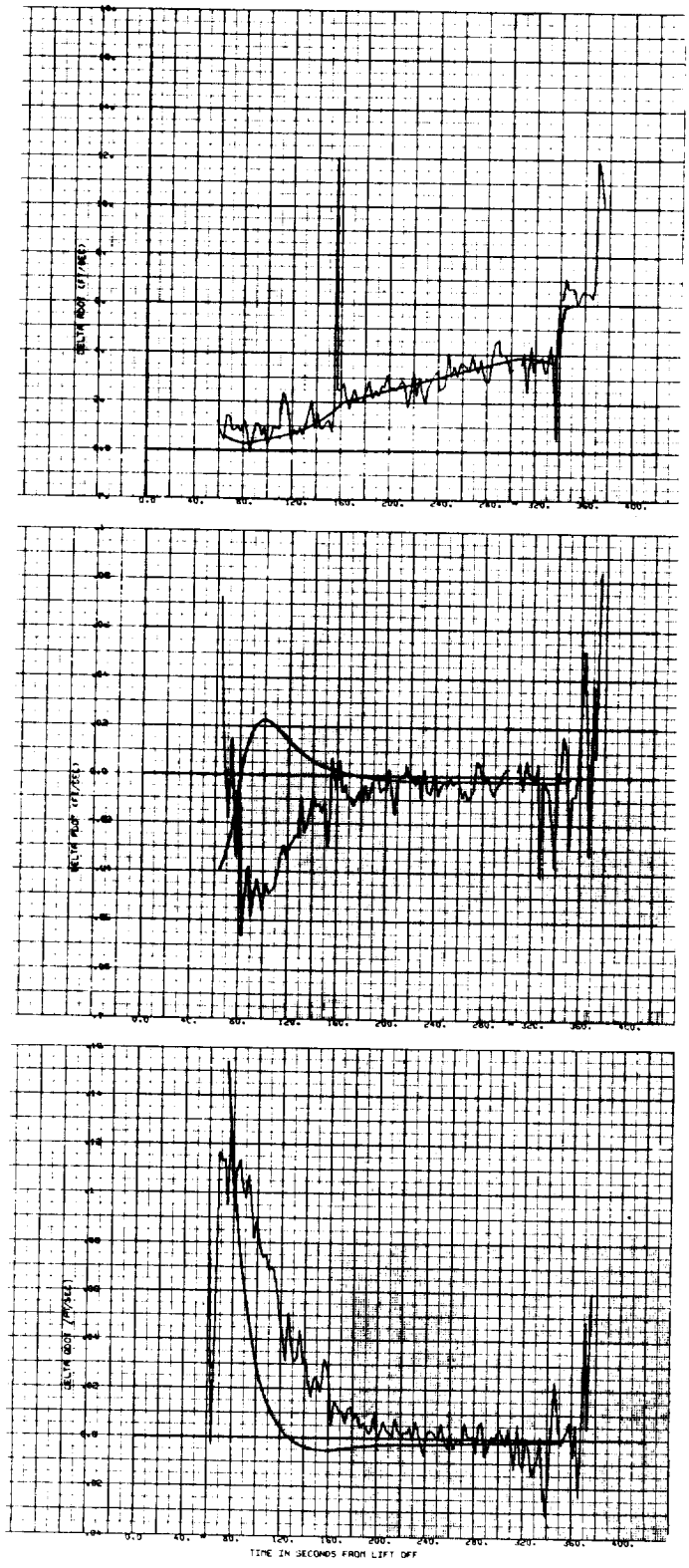

Figure 10. GT-7 IGS Minus GE

range sum rate data. It was decided that a sufficiently good estimate of IGS error was obtained and that further investigation would not benefit this analysis effort appreciably.

Three timing errors A2(1), C2(3), G2(4) were carried, representing timing biases in the MISTRAM I, GE Mod III and Passive MISTRAM, respectively. It is obvious that the tracking systems have little or no relative timing error between themselves; thus, the ≈ 0.0070 second recovered coefficient for all three trackers should be considered as a bias in the IGS time word of the same amount.

2.3 AZIMUTH UPDATE

An azimuth alignment correction is calculated at three separate times by the onboard computer. On the first pass through the navigation equations after platform release, the roll gimbal angle reading is compared with the desired value and the difference is used as a correction to the intended flight azimuth. This correction is called $\Delta\eta_x$, where a positive value implies that the platform is rotated clockwise from the desired azimuth.

Additional azimuth corrections are made during flight at 100 and 140 seconds after liftoff. These are calculated by comparing the cross-range (z direction) velocity as measured by GE/Burroughs with that derived from the airborne system and attributing the residual to a platform misalignment.

The calculated updates are not telemetered; however, they are obtained quite accurately from the data analysis. Table 7 summarizes the updates determined by the following methods:

a) Calculated from the telemetry data and simulation of the inflight calculations.

b) Calculated from the jumps in the inertial velocity comparisons or the delta-delta curve.

c) Derived by IBM during their postflight simulation.

The value indicated at 100 seconds includes that at 0 seconds. The value for 0 seconds in the delta-delta and TRW simulation column was determined from an observable jump in the IGS z velocity after Platform Go-Inertial. This jump corresponds to the IGS first correction.

Table 7. Azimuth Update

Time (Sec from liftoff)	Flight Calculation Simulation	Delta-Delta	IBM Postflight Simulation	Units
0	-0.00006	-0.00017	-0.00017	radians
100	-0.00834	-0.00857	-0.00849	radians
140	0.00003	0.00019	0.00012	radians
Total (100 and 140)	-0.00831	-0.00838	-0.00837	radians
	-0.4763	-0.4766	-0.4766	degrees

The total azimuth correction of -0.4763 has been included in all plots contained in this report.

The history of initial alignment error is:

GT-2	η_x = -0.29 degrees
GT-3	η_x = -0.52 degrees
GT-4	η_x = -0.12 degrees
GT-5	η_x = -0.27 degrees
GT-7	η_x = -0.48 degrees

Mean value = -0.34 degrees

1-sigma spec value = 0.25*

*Honeywell

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3. REENTRY

3.1 INITIAL CONDITIONS

The state vectors at retrofire, as calculated by the TRW postflight trajectory reconstruction (ESPOD) and as computed real time by the RTCC and used by the IGS, are given in Table 8.

Table 8. Reentry Initial Conditions*

	IGS (RTCC)	Postflight (ESPOD)	IGS-Postflight
x	18,485,400 ft	18,487,851 ft	-2,451 ft
y	11,702,400 ft	11,699,406 ft	2,994 ft
z	-49,500 ft	-51,845 ft	2,345 ft
$\dot{x}$	-11,874.9 ft/sec	-11,870.4 ft/sec	-4.5 ft/sec
$\dot{y}$	18,780.6 ft/sec	18,783.1 ft/sec	-2.5 ft/sec
$\dot{z}$	12,282.3 ft/sec	12,282.5 ft/sec	-0.2 ft/sec

*t = 18 December 1965, $13^h\ 28^m\ 07^s$

The coordinate system of the above vectors is that used by the RTCC: earth centered inertial, X through Greenwich at 0^h day of launch. This initial condition difference is somewhat greater than has been found on previous flights where the resultant differences have been less than 2,000 feet and 2 ft/sec. However, it was also noted that the quality of the "fit" to the pre-retro tracking station data was poorer than usual. This problem is being investigated as part of the orbit phase trajectory reconstruction.

3.2 POST-RETRO FREE FLIGHT

The best trajectory was fit to the post-retro fire tracking data (HAW and WHS), and the trajectory compared to the IGS output at two points under 400,000 feet. The result is shown in Table 9.

Based upon the accuracy of the telemetry data, there is no significant position difference between the IGS and postflight reconstruction trajectories just prior to atmospheric reentry and telemetry blackout.

Table 9. Comparison of Reconstructed Trajectory With IGS Output

Time From Retro-Fire, Altitude	Spacecraft Position		
	Geocentric Latitude (Deg)	Longitude (Deg)	Radius (Ft)
1307 sec, 383 K ft			
Reconstruction	28.874	257.899	21,292,216
IGS	28.874	257.901	21,293,093
1360 sec, 352 K ft			
Reconstruction	28.894	261.881	21,261,090
IGS	28.893	261.901	21,261,071

3.3 ATMOSPHERIC REENTRY

Because of the loss of the onboard tape recorder data, there is no telemetry available on the portion of reentry between 1400 and 1800 seconds after retrofire, or from approximately 350,000 to 120,000 feet altitude. Ground radar tracking during most of this interval has provided reasonable position data but very poor velocity data. There is, however, approximately 100 seconds of overlapping Grand Turk radar tracking and telemetry data after blackout. The spacecraft covers an altitude range from 120,000 feet to just after drogue deploy at about 60,000 feet. Figure 11 shows the ground trace of the spacecraft as measured by the IGS and as given by the GTI tracking data. The target and ship-estimated-pickup points are also shown. An impact summary is given in Table 10. The resultant IGS error at drogue deploy is 3 n mi.

Table 10. Gemini 7 Impact Summary

Source	Longitude (Deg)	Geocentric Latitude (Deg)
Target Point	-70.0	25.234
IGS (drogue deployment)	-70.10	25.280
GTI Radar (drogue deployment)	-70.145	25.254
Ship (pickup)	-70.146	25.216

Figure 12 is a position comparison between IGS and GTI tracking data in guidance coordinates. The spacecraft is almost due north of the

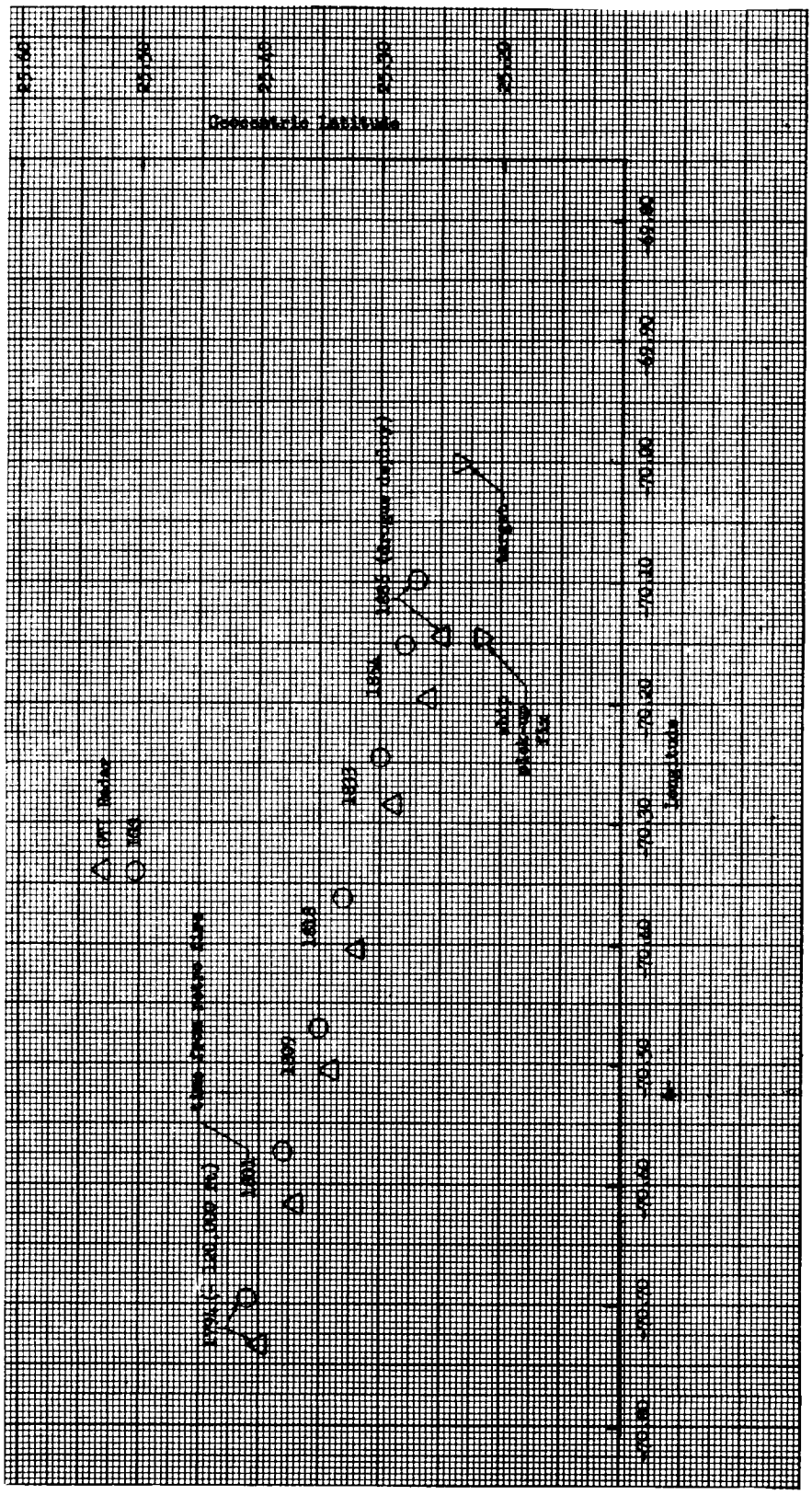

Figure 11. Gemini 7 Reentry Ground Trace

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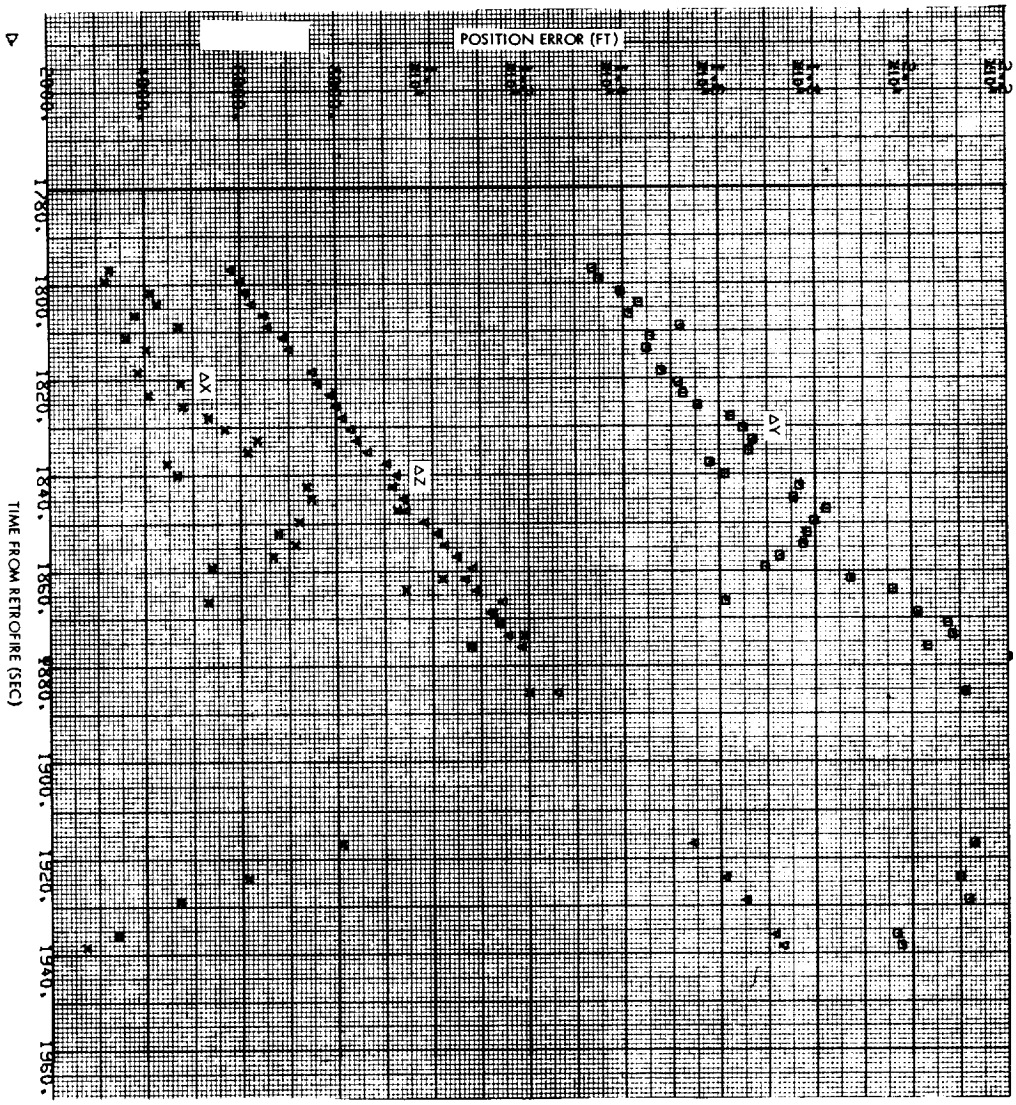

Figure 12. Gemini 7 Reentry IGS Minus GTI-18 Radar Positions

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GTI site at this time, but at an extremely low elevation angle. All the data is below 3°; after 1840 seconds, the spacecraft is below 1°; and after 1875 seconds the spacecraft is indicated as being below the horizon. Because of the low elevation, very large errors can be expected in the elevation measurement, which is mostly the x direction in the IGS coordinate set at this time. (The spacecraft has flown through a central angle of 113° since retorfire.) However, the range and azimuth measurement should be reasonable, resulting in valid z and y measurements, respectively. The smooth z curve reflects the good range measurement. The angular data after 1890 seconds is considered invalid.

As a rough measure of what this trend represents in terms of IGS accuracy, it was assumed that all the difference was due to IGS platform misalignment, that the spacecraft velocity could be considered a constant over the interval, and that the slope of the difference was IGS-sensed velocity error. The following errors result:

ΔV_x = 80 to 100 ft/sec		$\overline{V_x}$ =	13,000 ft/sec
ΔV_y = 90 ft/sec		$\overline{V_y}$ =	18,000 ft/sec
ΔV_z = 80 ft/sec		$\overline{V_z}$ =	400 ft/sec

Equivalent IGS Platform Misalignment is:

Pitch up: 0.3° to 0.4°
Roll positive: 0.4°

The ratio of x to y error is only approximately correct for a pitch error; however, the magnitude of the error is consistent with expected accuracies. The data is too poor to speculate further about the sources. No attempt was made to explain the initial position errors indicated on these curves at 1800 seconds because of uncertainty in initializing the IGS data.

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4. TRACKING SYSTEM PERFORMANCE

Tracking data available for analysis of the Gemini 7 IGS performance included the following:

a) GE Mod III/Burroughs

b) GE Mod III/Syracuse/Final

c) MISTRAM I Quick Look 10K and 100K

d) Passive MISTRAM

e) Range BET

Each of the above sets was used for position and velocity comparisons, as described in Section 2. The GE Mod III/Burroughs data were used for quick look analyses; however, detailed analyses were subsequently accomplished with the remaining sources. A TRW program (TOPS), which is used to produce powered flight best estimates of trajectory (BETs), was also used to aid the tracking data analysis.

For convenience, tracking system data were compared with inertial guidance data which has been corrected for guidance system errors derived from the hand fit results of Section 2.2.

Three main tracking system errors were extracted from the ensemble IMU/Tracker analysis scheme. These were:

a) An apparent refraction error in the Q_{100K} MISTRAM I system of ≈ 12 n units.

b) An azimuth bias of $\approx 10^{-4}$ radians in the GE Mod III data.

c) A range sum rate ($\dot{R}$) bias of ≈ 0.3 ft/sec in the passive MISTRAM data.

These errors were extracted by using the regression program (see Section 2.2) as well as by manually adjusting the observed residuals. It should be noted, however, that the uncertainities of these errors are large. The regression program included unmodeled effects for both the IMU and the tracking system, which resulted in relatively large a posteriori uncertainties.

4.1 GE MOD III

4.1.1 GE Mod III/Burroughs

The Burroughs raw data received consisted of raw counts recorded on punched paper tape at a rate of two data points per second. The data were transferred to magnetic tape at TRW and processed in the data reduction programs.

Figure 13 shows GE/Burroughs and GE/Final IGS coordinate velocity comparisons superimposed. Significant differences exist between them in the x and y directions. The x-difference is attributable to a 0.01-second timing error in the Burroughs, and the y-difference is most likely due to an incorrect refraction correction applied to the Burroughs data. This refraction correction is based upon ground refractometer measurements and is updated and refined by airborne measurements in the GE/Final data reduction.

4.1.2 GE Mod II/Syracuse/Final

The GE/Final data were processed by GE/Syracuse from the ten per second Flight Data Recorder output. The data were available raw and unsmoothed in natural coordinates and as smoothed Cartesian x, y, z data. The final GE natural coordinate data were used in the computer regression analyses discussed in Section 3.

In general, the quality of the GE/Final data was quite good. No major errors were apparent, although the moderately large (approximately 10^{-4} radian) azimuth bias mentioned in Section 3.2 serves to explain part of the z-coordinate difference between GE and MISTRAM comparisons (Figure 1). This azimuth error was verified by the TRW TOPS BET analysis (Section 4.4), which also showed less than 0.05-milliradian bias in the elevation measurements, and was further verified by the GE Mod III data analysis presented by General Electric in Reference 2.

Plots of the residuals between the GE/Final data and the corrected IGS trajectory are presented in Figures 16 and 17.

4.2 MISTRAM DATA

The quick look data received consisted of scaled and corrected but unsmoothed position data measurements. These are: range sum measurement, R; range difference measurements from 10,000 foot baselines, P_{10K} and Q_{10K}; and range difference measurements from 100,000 foot baselines, P_{100K} and Q_{100K}. Also range sum, P and Q, measurements from MISTRAM II (Passive mode) were obtained. The data were processed and differentiated in TRW programs to give essentially three sets of tracking data.

4.2.1 MISTRAM I

MISTRAM I/IGS compensated thrust coordinate comparisons are presented in Figures 18 through 21. (Also see Figure 1 for uncompensated IGS MISTRAM velocity comparisons.) These differences show a generally good agreement with GE/Final data in the x coordinate. The z coordinate plots, however, indicate an approximate 0.5 ft/sec difference with those of GE/Final, and while part of this is due to the aforementioned GE azimuth bias (Section 4.1), it was determined in the TOPS analysis (Section 4.5) that the MISTRAM 100K Q channel exhibited an error arising from an outlying site unaccounted refraction difference (see also the regression results of Section 2.2). The effect of this error is to "droop" the z coordinate comparisons after about 300 seconds (compare with the TOPS results of Figure 26). This error was not apparent in the 10K measurements.

The TOPS BET results also showed an approximate 2 n-units refraction error of the same type in the MISTRAM 100K P channel. The effect of this error is most pronounced in the vertical (y) direction, and was of such a sign as to manifest itself also as a "droop" beginning at about 300 seconds. However, the Q refraction error also propagates into the y channel and on this flight was of opposite sign to the P error, thereby resulting in some cancellation. The net effect of these two errors was to cause the y channel IGS/MISTRAM velocity differences to exhibit a negative slope after SECO, a phenomenon which is clearly apparent from Figure 7 and 18. The total magnitude of this combined refraction

error in the vertical channel is estimated at about -2 ft/sec at SECO. No other significant MISTRAM I errors were detected on this flight.

4.2.2 MISTRAM II (Passive Mode)

MISTRAM II/Compensated IGS comparisons are shown in Figures 22 and 23. The regression results (Section 2.2) showed an approximate 0.27 ft/sec range sum rate bias, which is confirmed by the TOPS BET. However, although in general MISTRAM II performed well on this flight compared to previous flights; its measurements could not be considered accurate enough to be used without benefit of measurements from other systems. For example, the P channel exhibited a large (approximately -6 foot) time varying bias, the source of which is unknown at present. Its character seemed to reflect both refraction and survey errors; however, a detailed analysis was not performed since it was not needed for the IMU analysis on this flight. The MISTRAM II Q channel also exhibited a refraction error of the same type as that found for MISTRAM I. The matnitude of this error was in the range of 5 to 10 n-units.

4.3 RANGE BET

Figures 24 and 25 show comparisons between compensated IGS and the AFETR Best Estimate of Trajectory (BET). This BET combined the measurements from MISTRAM I, 10K and 100K, MISTRAM II, GLOTRAC, GE Mod III, and C-band FPQ-6 radars Numbers 19.18 (Merritt Island), 3.18 (GBI), 7.18 (Grand Turk Island). The program is a conventional least squares adjustment in which a constant bias error model for each observation is specified. The problems of this model are exemplified by the comparisons of Figures 18 and 24, in which the BET shows remarkable agreement with the MISTRAM results, particularly in the x and z coordinates. This arises primarily because the MISTRAM data was heavily weighted in the adjustment, and because the program did not account for a refraction error. Furthermore, the estimate of MISTRAM 100K P bias was in gross error (by about 1 foot), thereby causing the BET vertical velocity estimates to be in error by about 10 ft/sec at SECO. The reason for the erroneous P bias estimate is not clear, but possibly arises from incorrect weighting of the other measurements used in the adjustment.

4.4 TOPS BET

Figures 26 and 27 show comparisons between compensated IGS data and the TRW TOPS (Trajectory Optimization System) BET program. The input to TOPS included MISTRAM I (R_{SUM}, P_{10}, Q_{10}, P_{100}, Q_{100}), MISTRAM II (R_{SUM}, P, Q), and GE Mod III (R, A, E, $\dot{R}$, $\dot{P}$, $\dot{Q}$) data described previously. The IMU/TOPS comparisons show good agreement, and the differences noted are within estimated 1-sigma limits. Since the TOPS BET was derived without the use of IMU measurements, these results serve to verify the conclusions reached in Section 2.2 of this report.

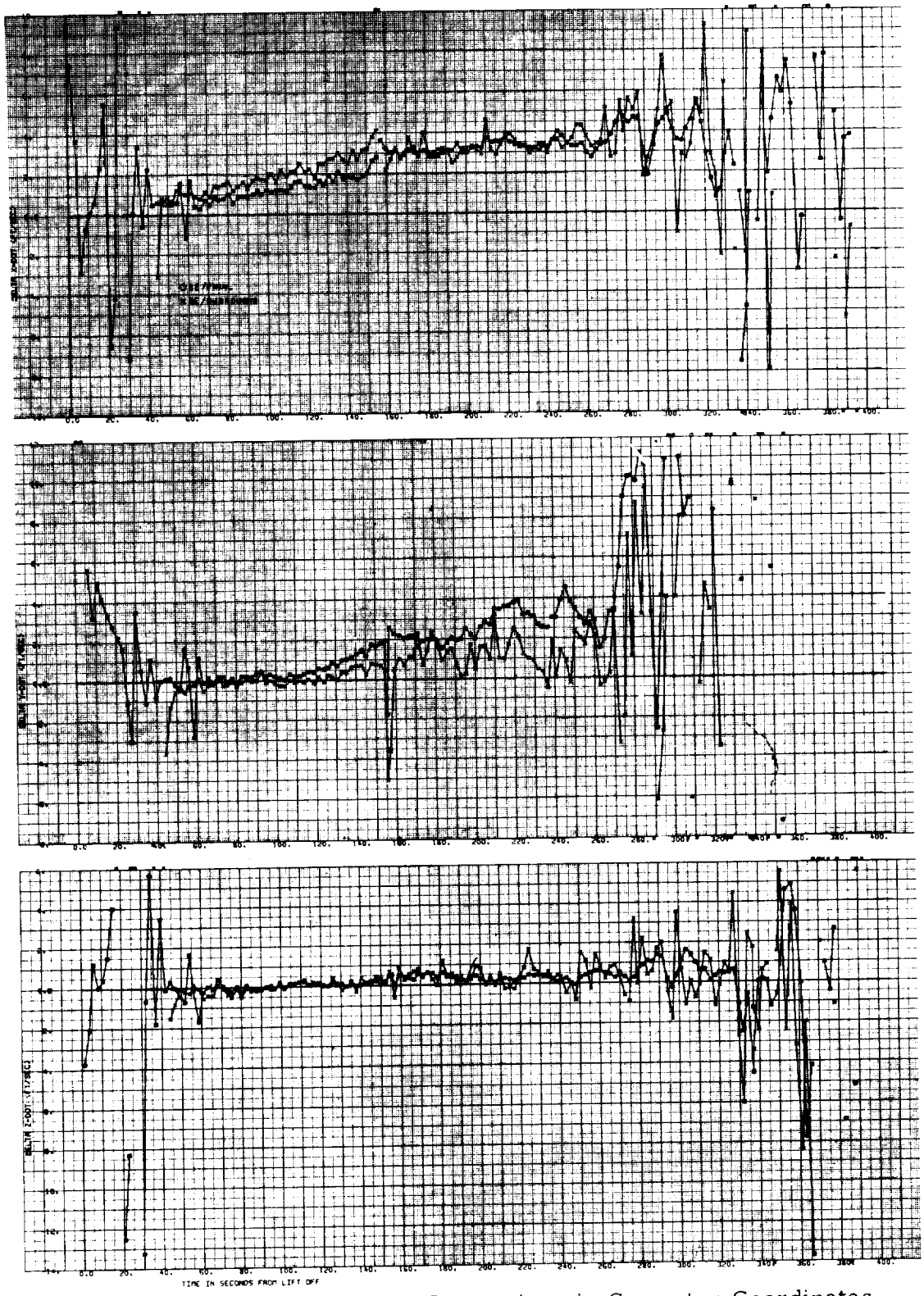


Figure 13. Thrust Velocity Comparison in Computer Coordinates

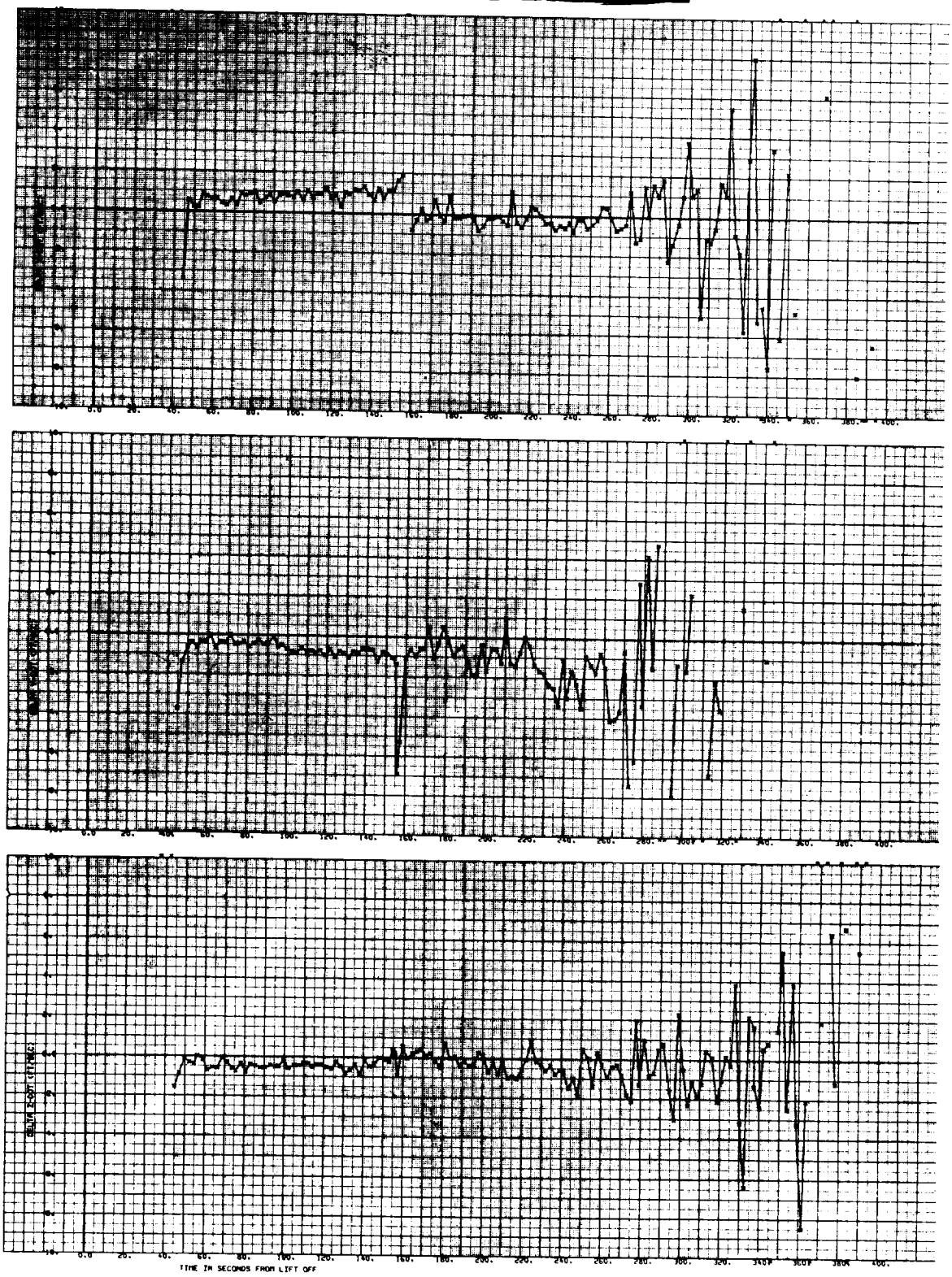


Figure 14. GE/Burroughs Thrust Velocity Comparison with IMU Errors Compensated

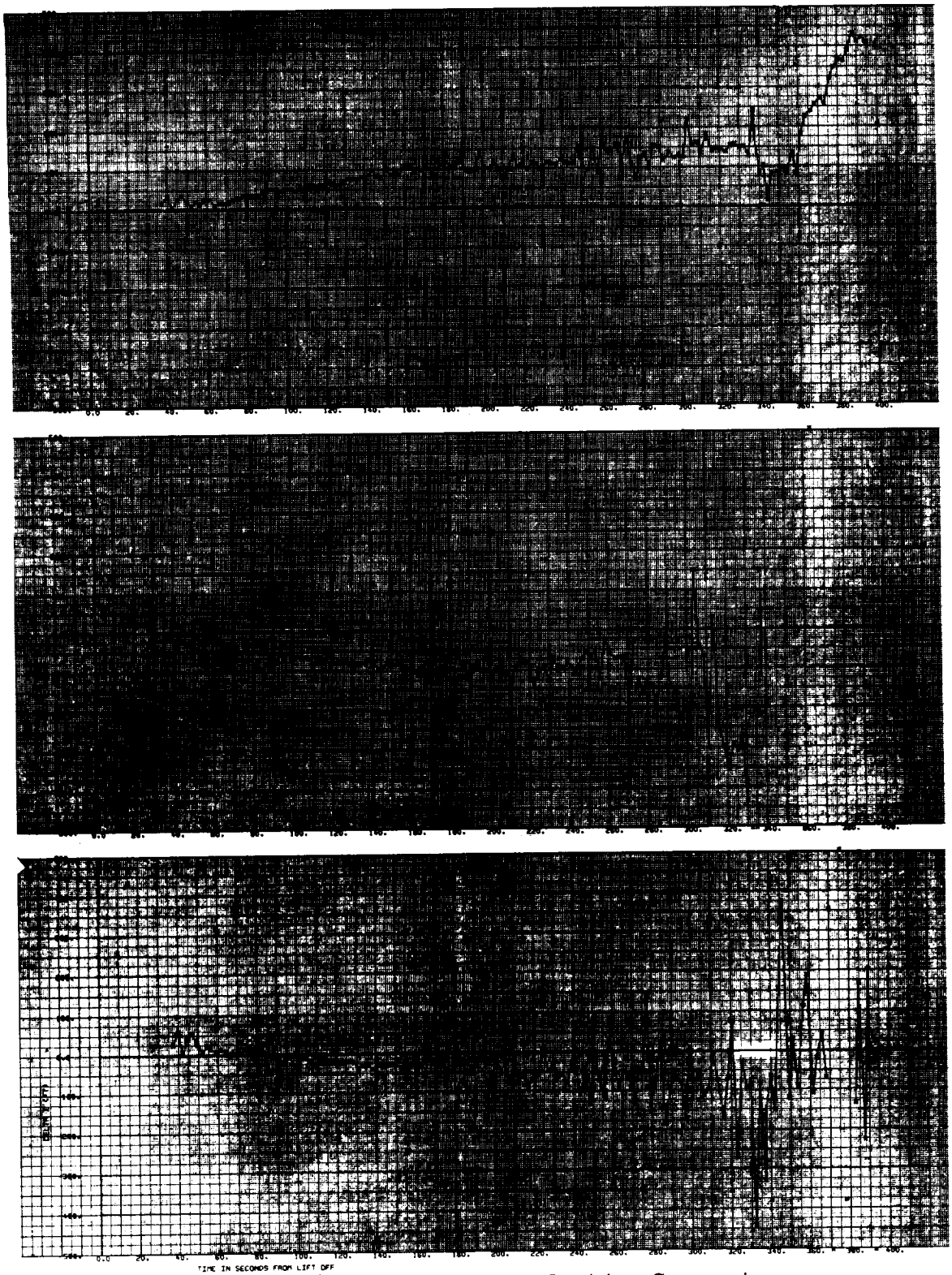


Figure 15. GE/Burroughs Thrust Position Comparison with IMU Errors Compensated

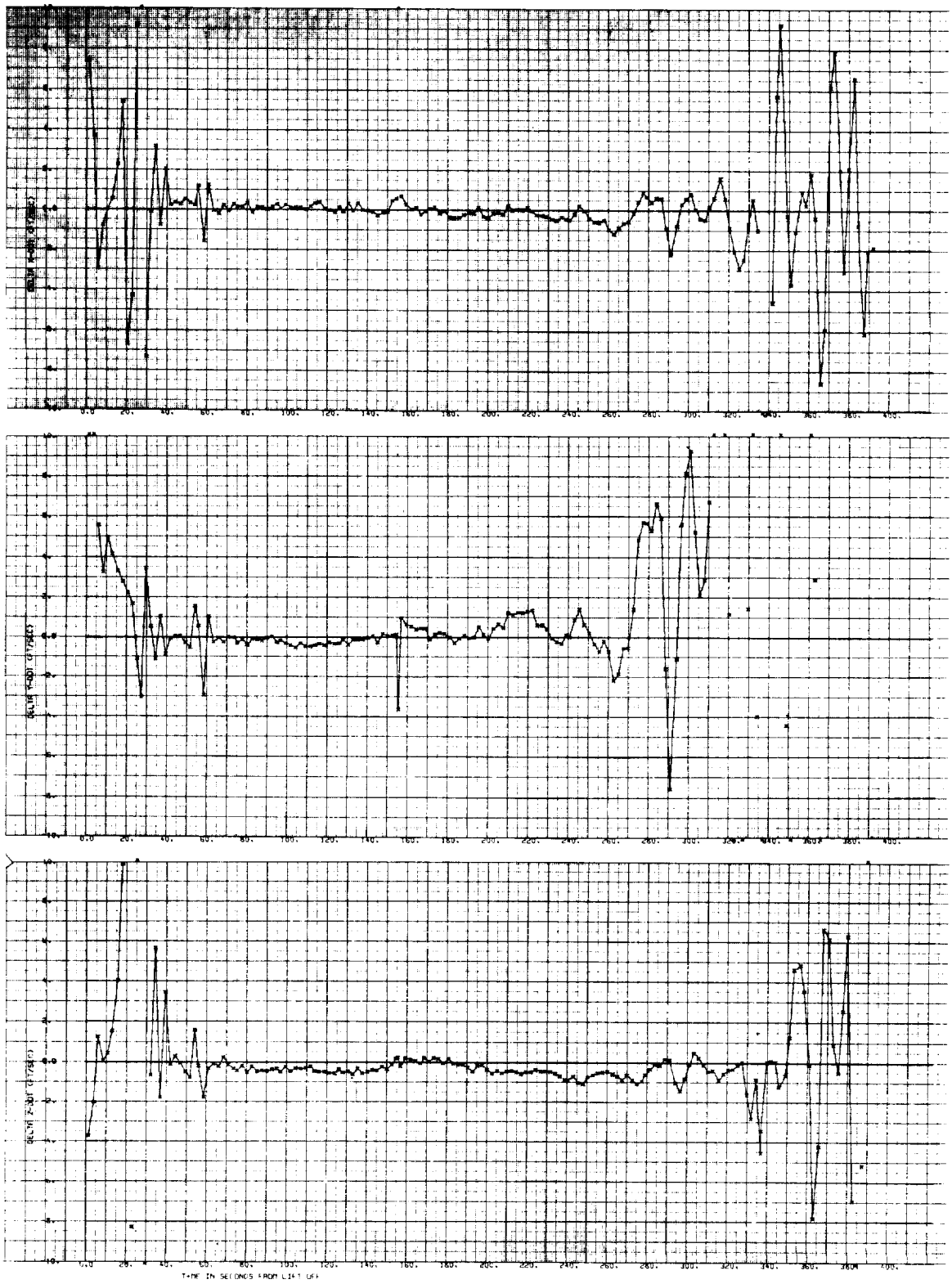


Figure 16. GE/Final Thrust Velocity Comparison with IMU Errors Compensated

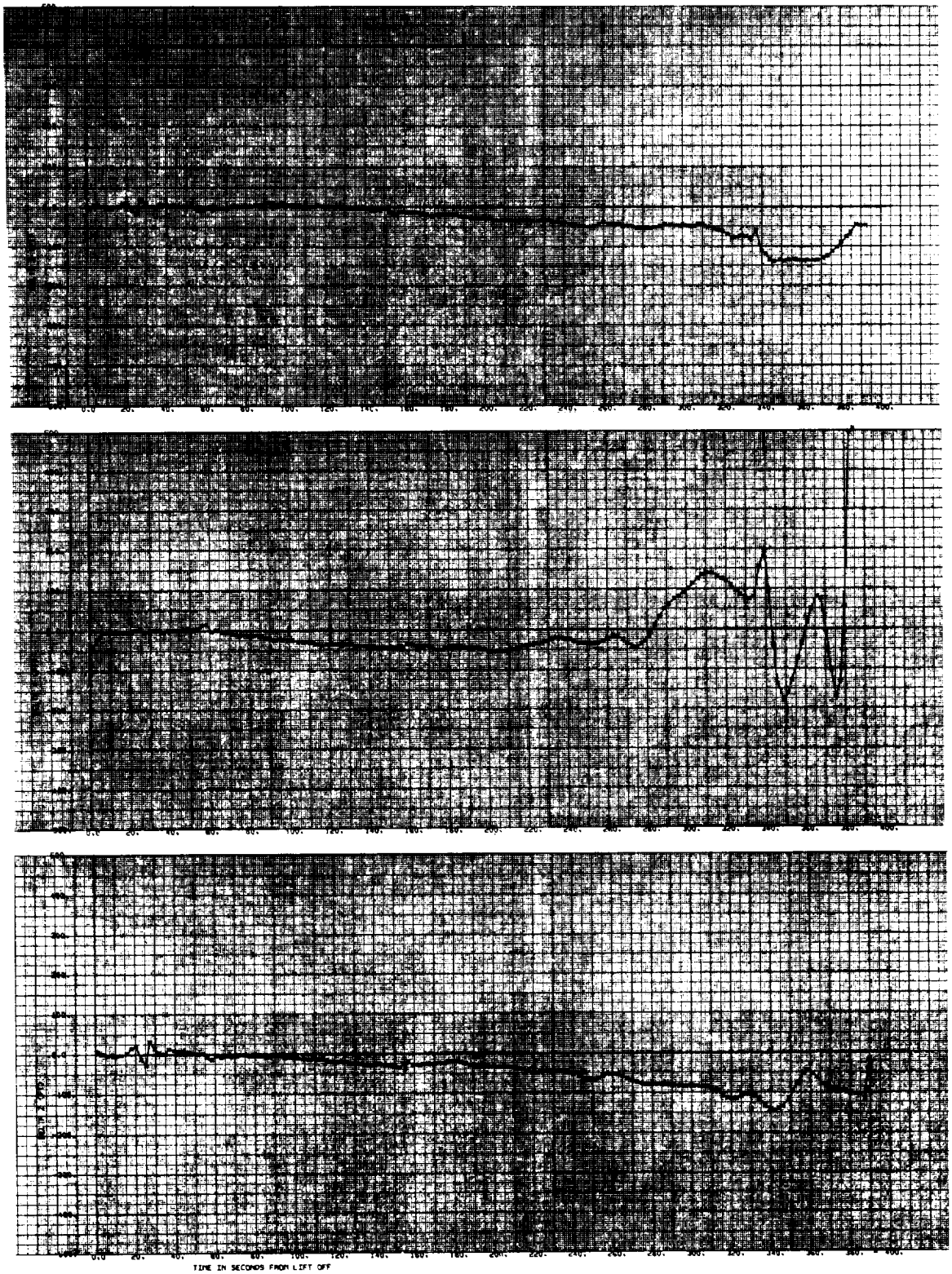


Figure 17. GE/Final Thrust Position Comparison with IMU Errors Compensated

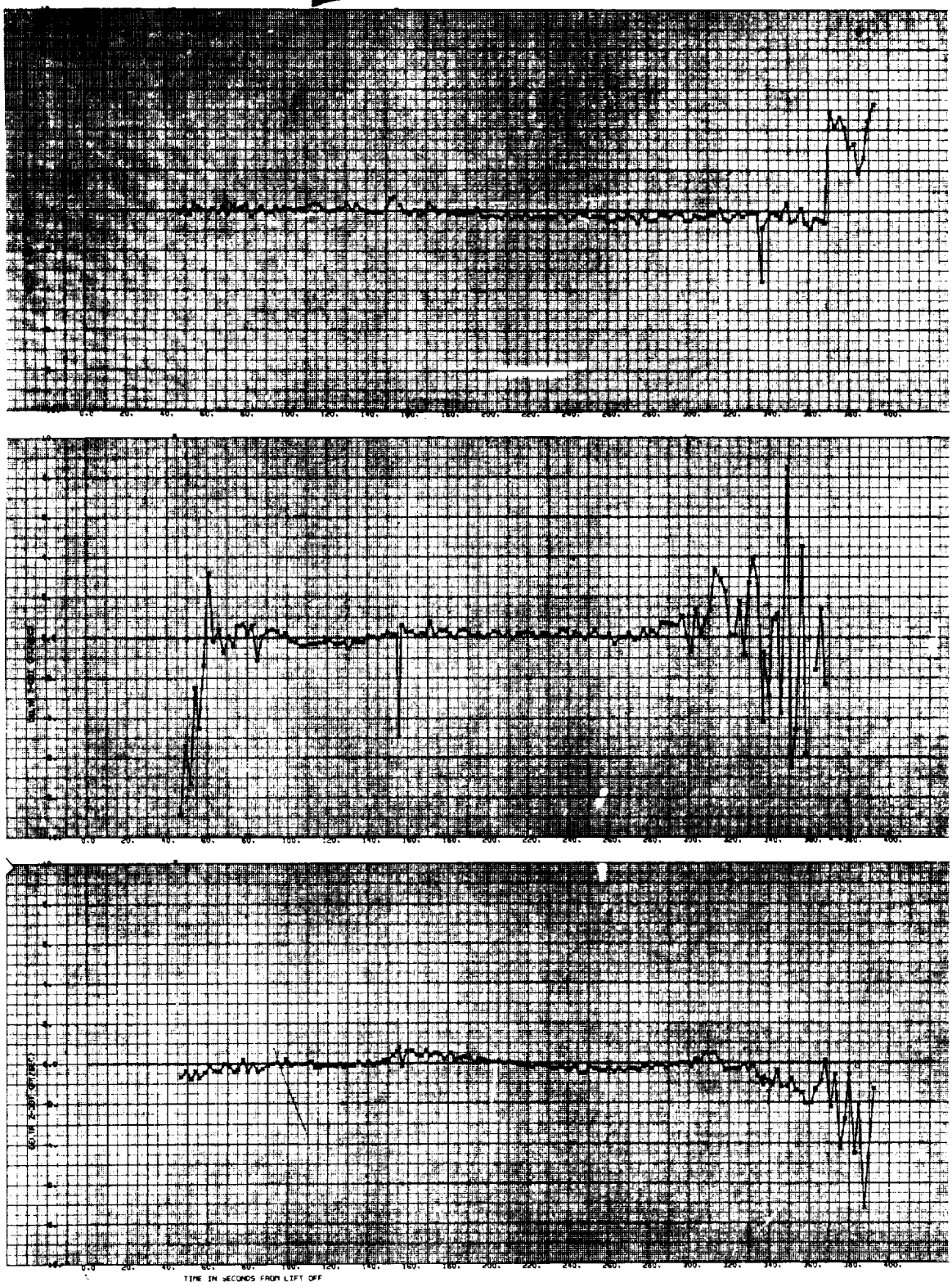


Figure 18. MISTRAM I 100K Thrust Velocity Comparison with IMU Errors Compensated

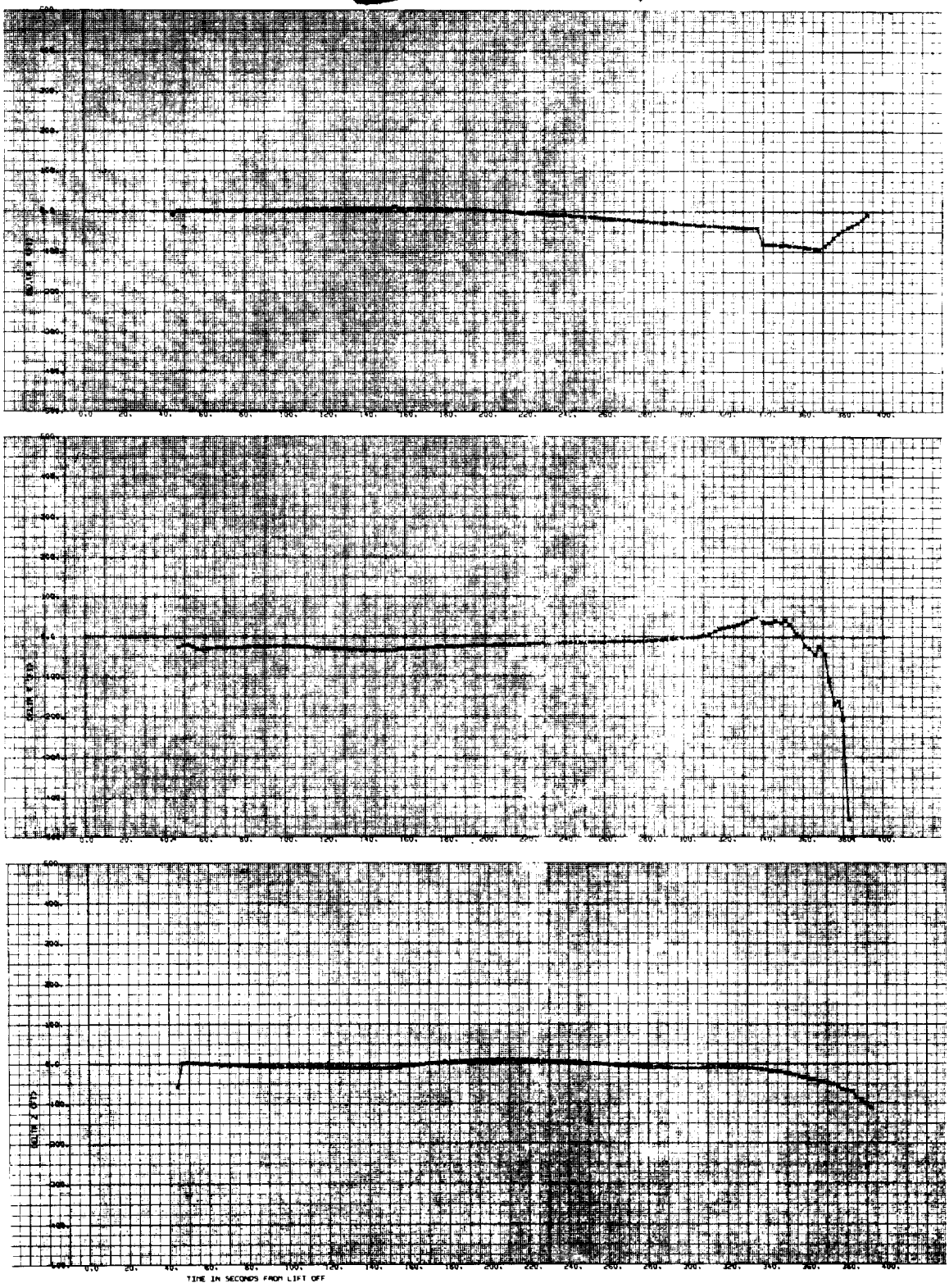


Figure 19. MISTRAM I 100K Thrust Position Comparison with IMU Errors Compensated

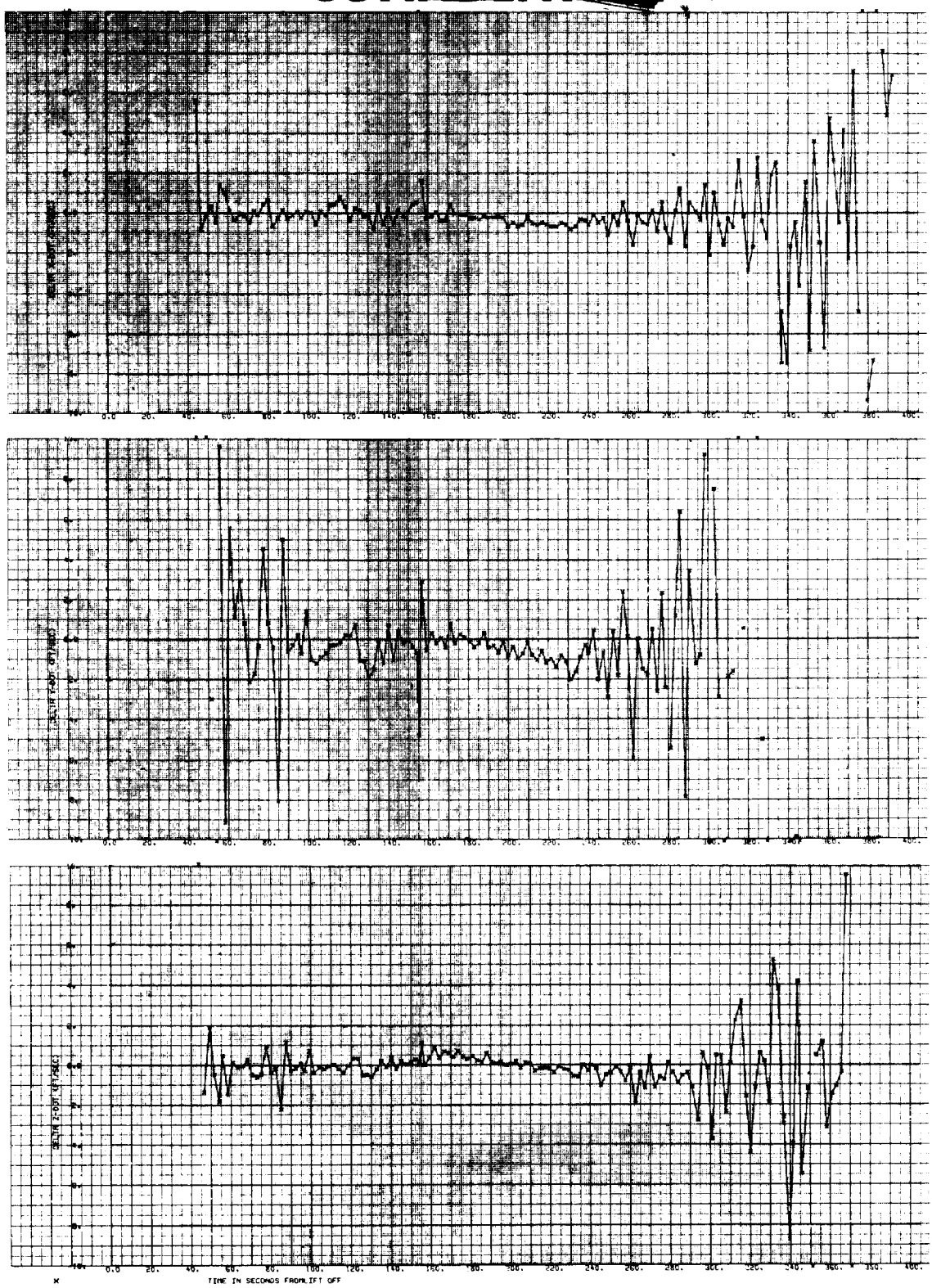
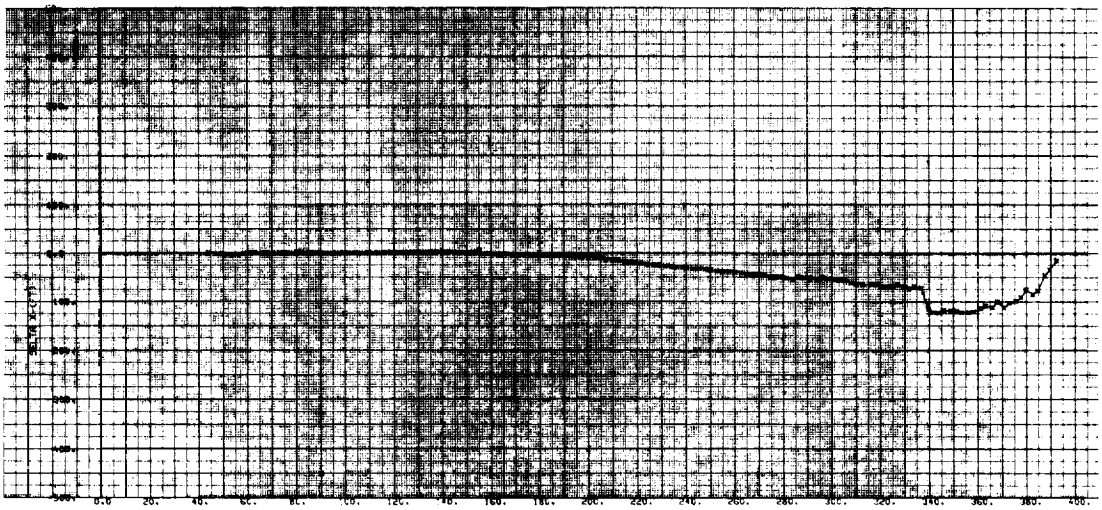
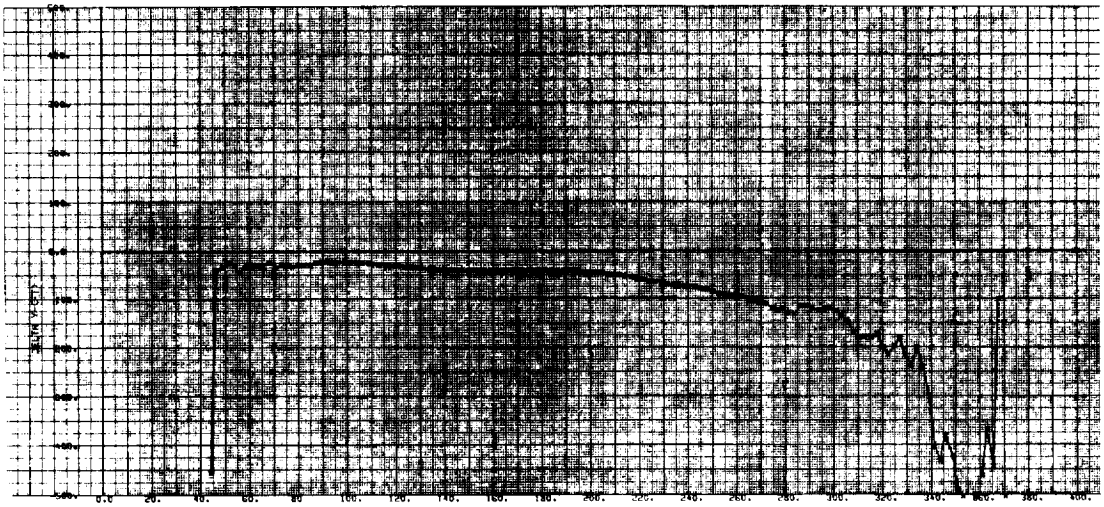
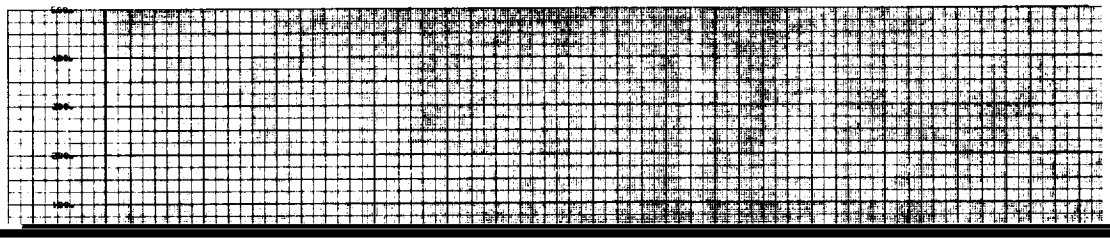


Figure 20. MISTRAM I 10K Thrust Velocity Comparison with IMU Errors Compensated







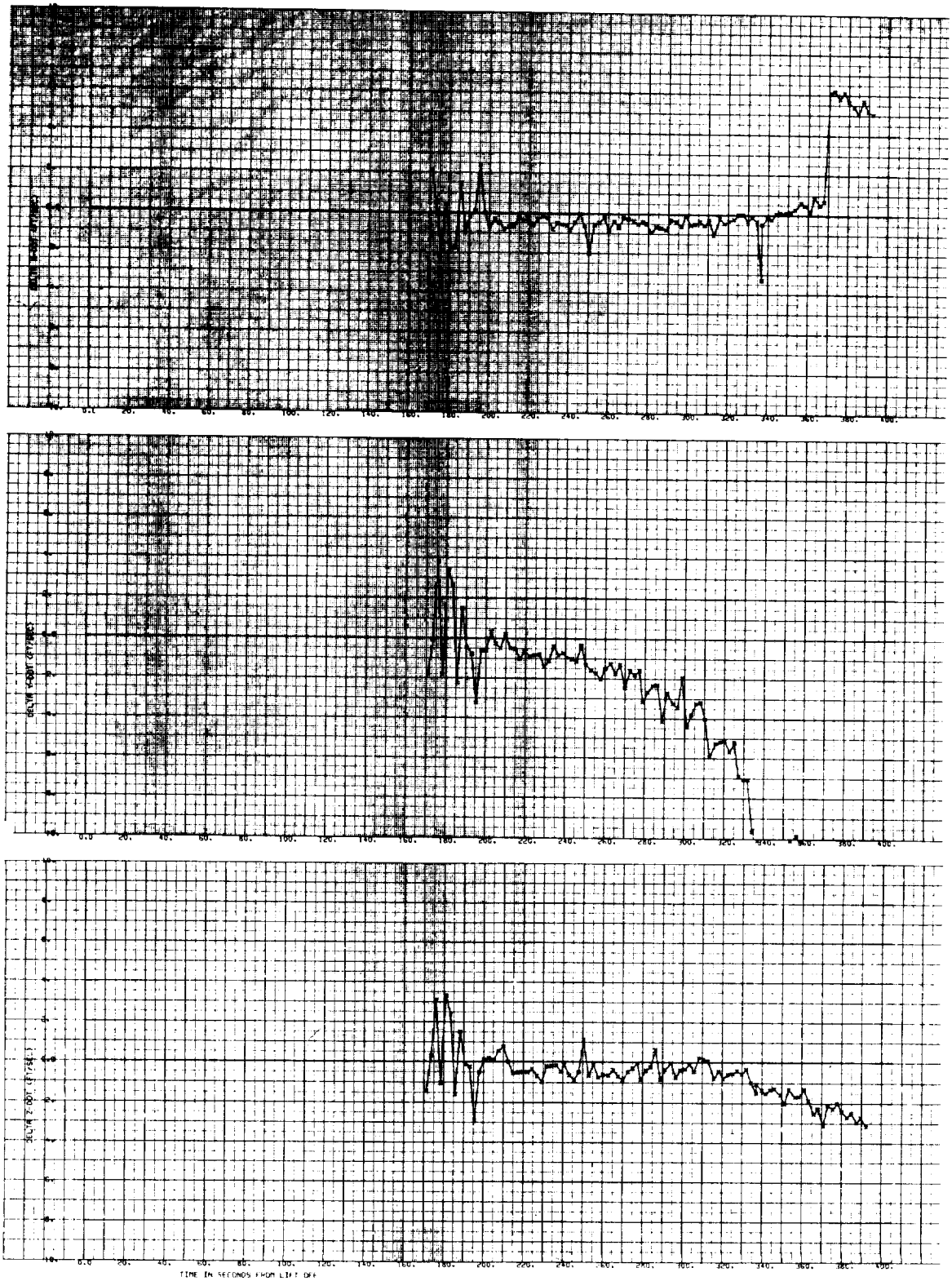


Figure 22. MISTRAM II Passive Thrust Velocity Comparison with IMU Errors Compensated

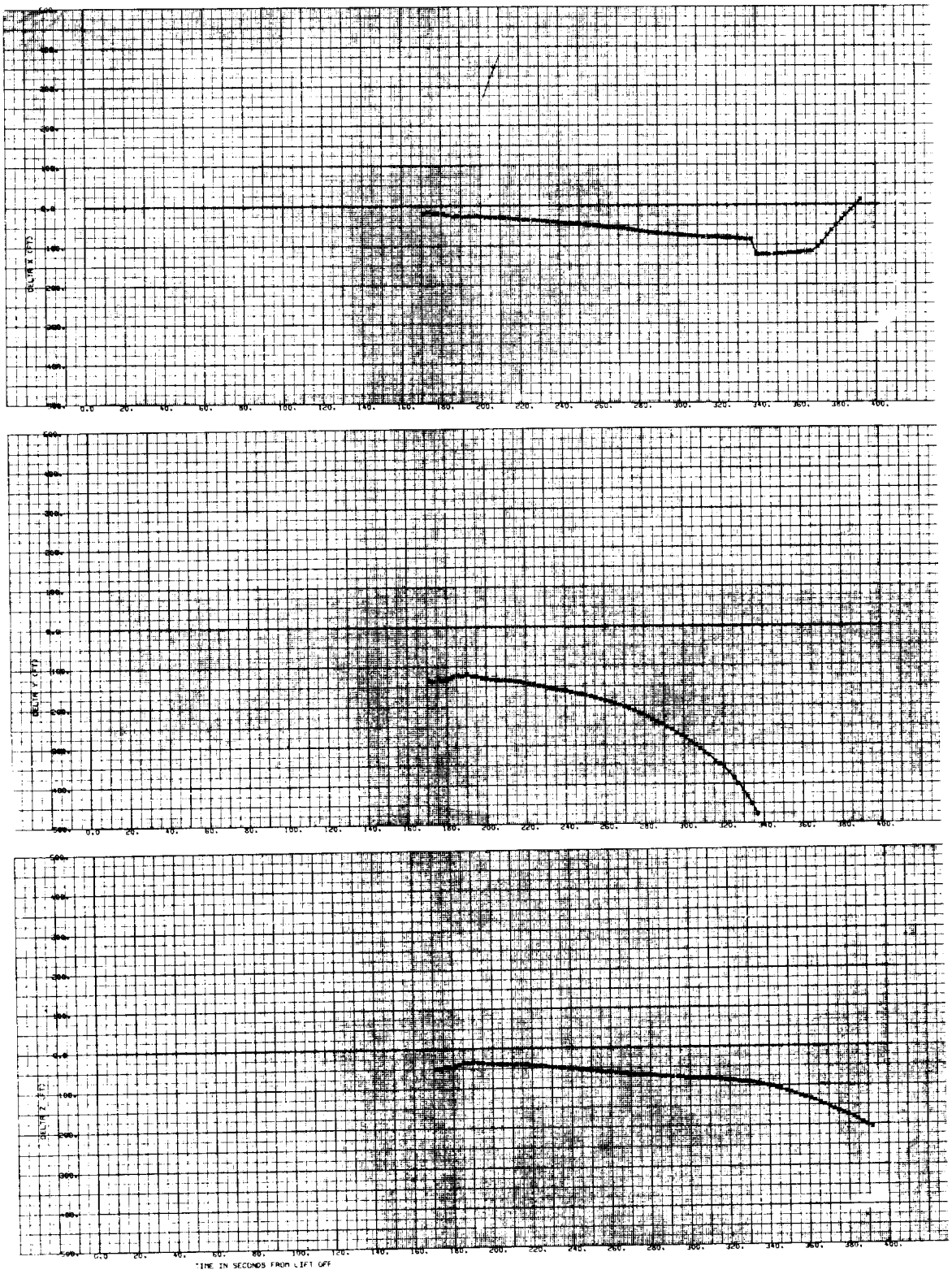


Figure 23. MISTRAM II Passive Thrust Position Comparison with IMU Errors Compensated

Figure 24. Range BET Thrust Velocity Comparison with IMU Errors Compensated

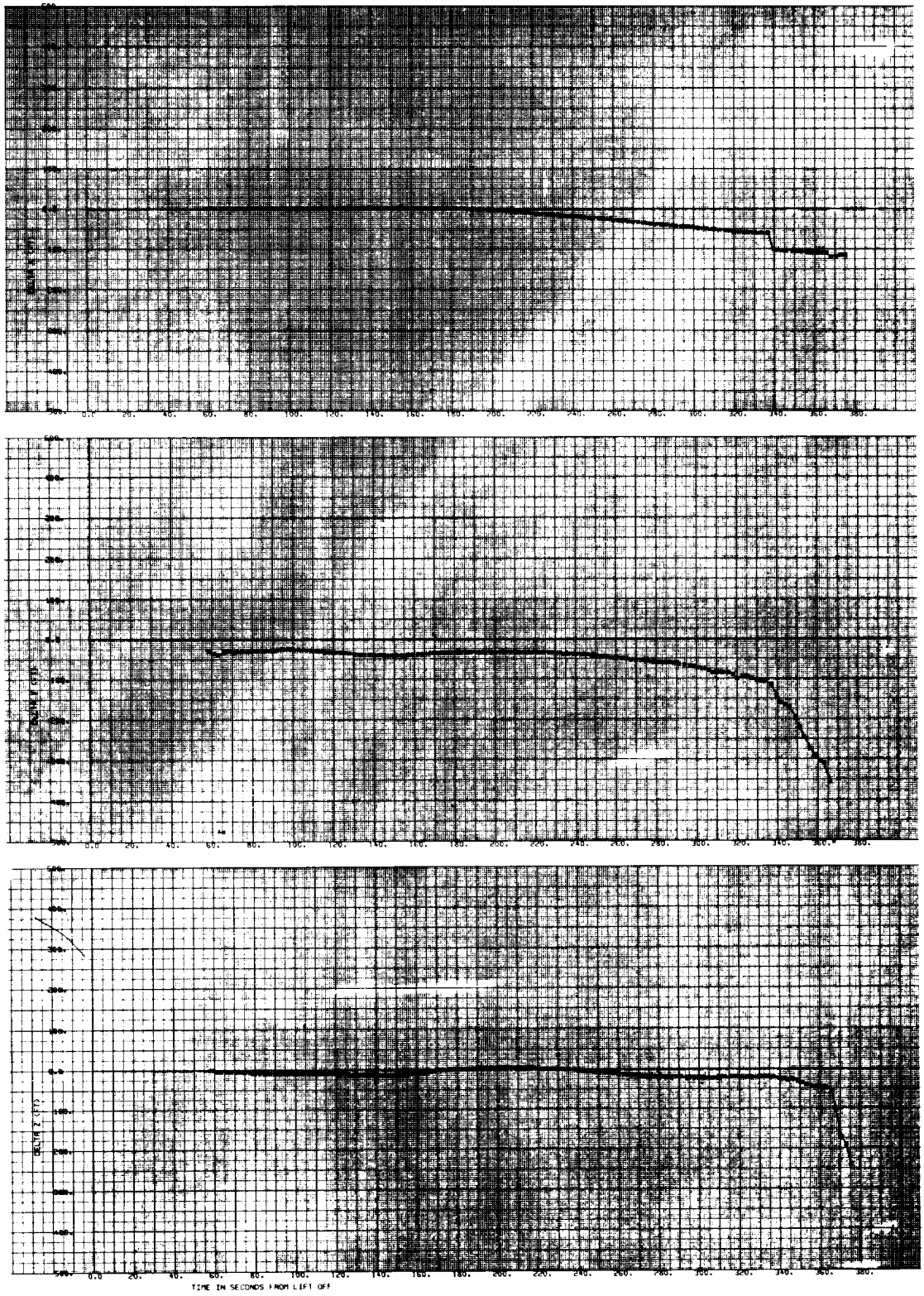


Figure 25. Range BET Thrust Position Comparison with IMU Errors Compensated

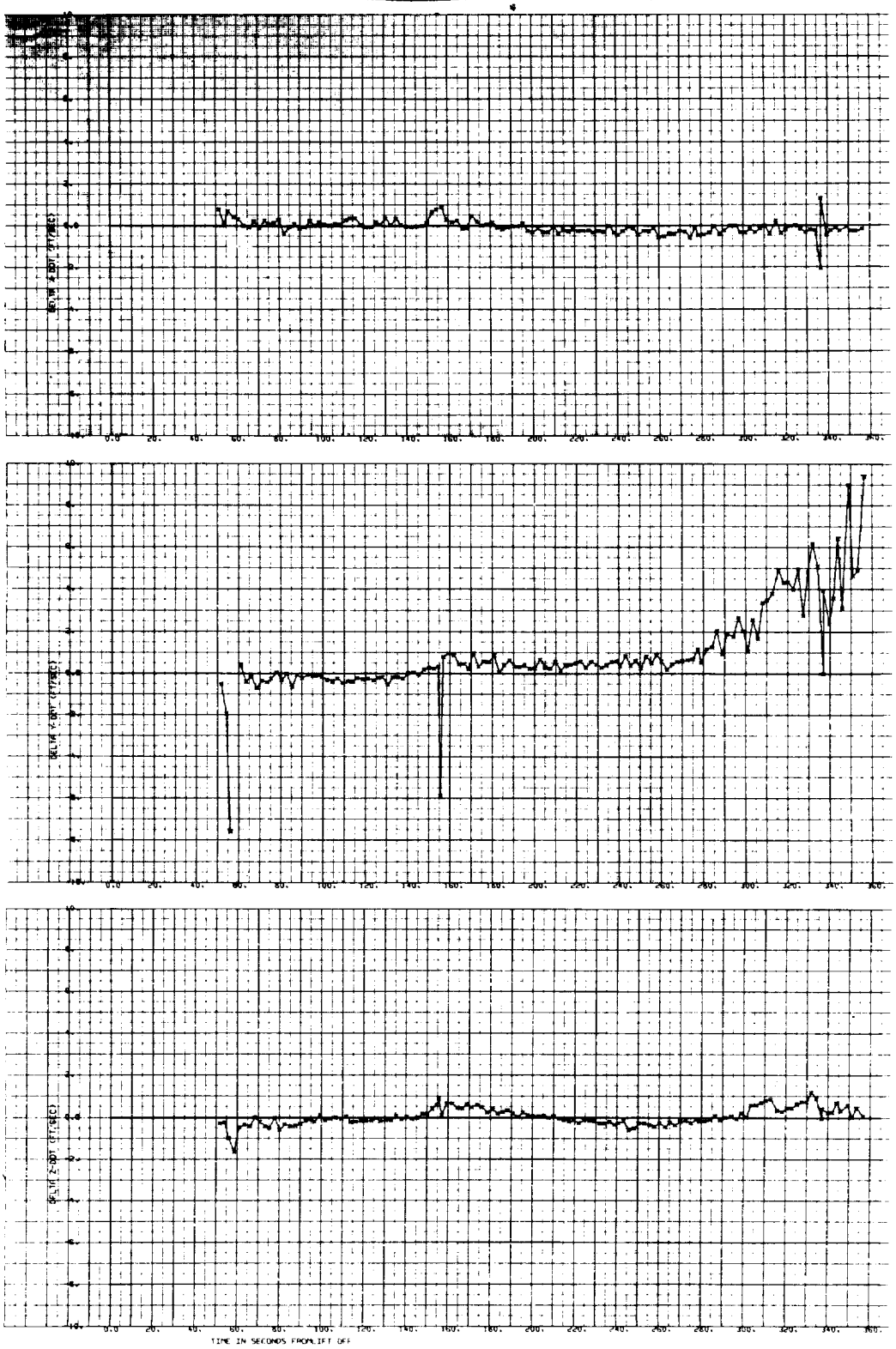


Figure 26. TOPS BET Thrust Velocity Comparison with IMU Errors Compensated

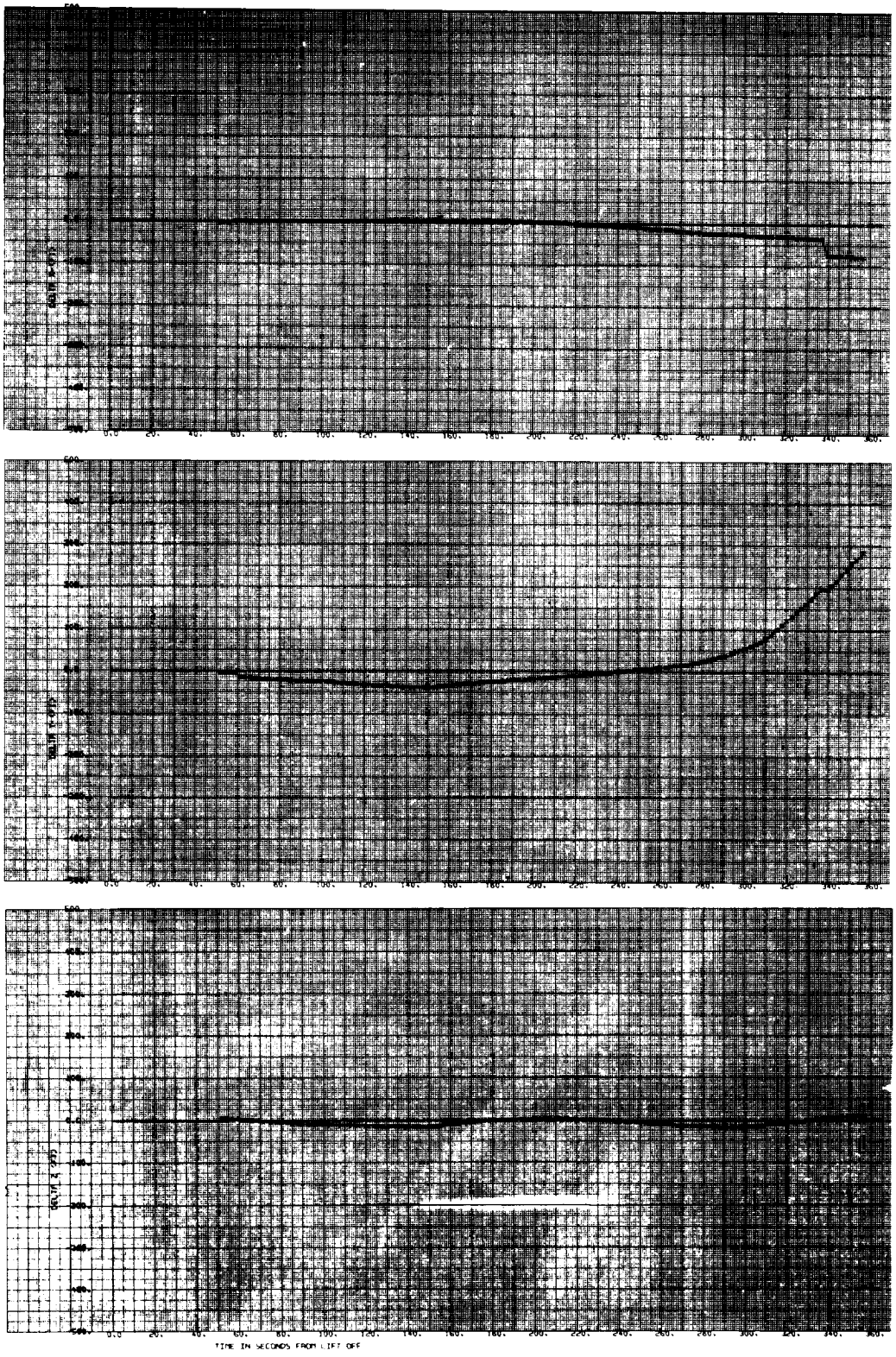


Figure 27. TOPS BET Thrust Position Comparison with IMU Errors Compensated

5. TRAJECTORY RECONSTRUCTION

This section provides a description of the trajectory reconstruction for the ascent and reentry flight phases presented in Tables A-1 and A-2 in Appendix A. The data are provided in an ECIG coordinate system with the origin at the center of the earth. The z axis is the North Polar, and the x-y plane is the equatorial plane with the x-z plane containing the Greenwich Meridian at Go-Inertial time. Trajectory parameters such as velocity magnitude, altitude, flight path angle, heading, latitude, and longitude are also presented.

The ascent reconstruction consists of corrected guidance data. Corrections applied to the ascent data were the IMU error source magnitudes presented in Table 3 in Section 3.

The reentry trajectory reconstruction was obtained by making use of the TOPS BET program. The BET was derived from four ETR tracking radars, the coverage of which was as follows:

Radar	Data Spans (In sec from retrofire)
0:18 (Patrick AFB)	1545-1740
19:18 (Merritt Island)	1537-1707
3:18 (GBI)	1548-1751
7:18 (GTI)	1710-1943
TOPS BET	1551-1745

The TOPS program requires overlapping coverage of at least two radars therefore the BET presented terminates at 1751 seconds.

Listings of the BET, uncorrected Grand Turk (7:18) and reconstructed IGS reentry trajectories and their associated trajectory parameters are presented in Appendix A. The IGS reentry trajectory is uncorrected since no conclusive IMU error analysis for the reentry flight phase was possible.

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APPENDIX A

TRAJECTORY PARAMETER LISTINGS AND PLOTS

PLOTS

LISTINGS

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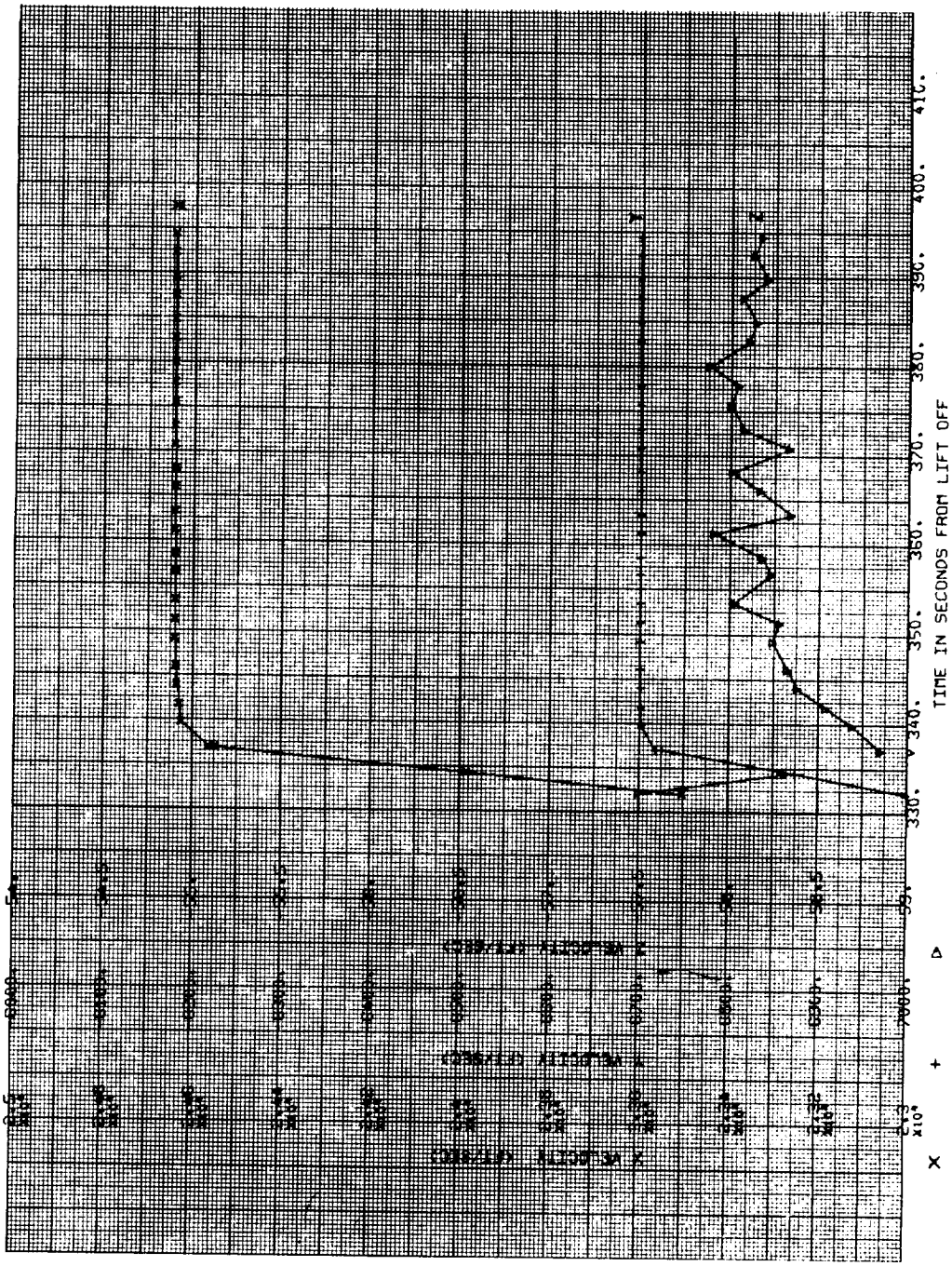

Figure A-1. Computed Thrust Velocity in Computer Coordinates

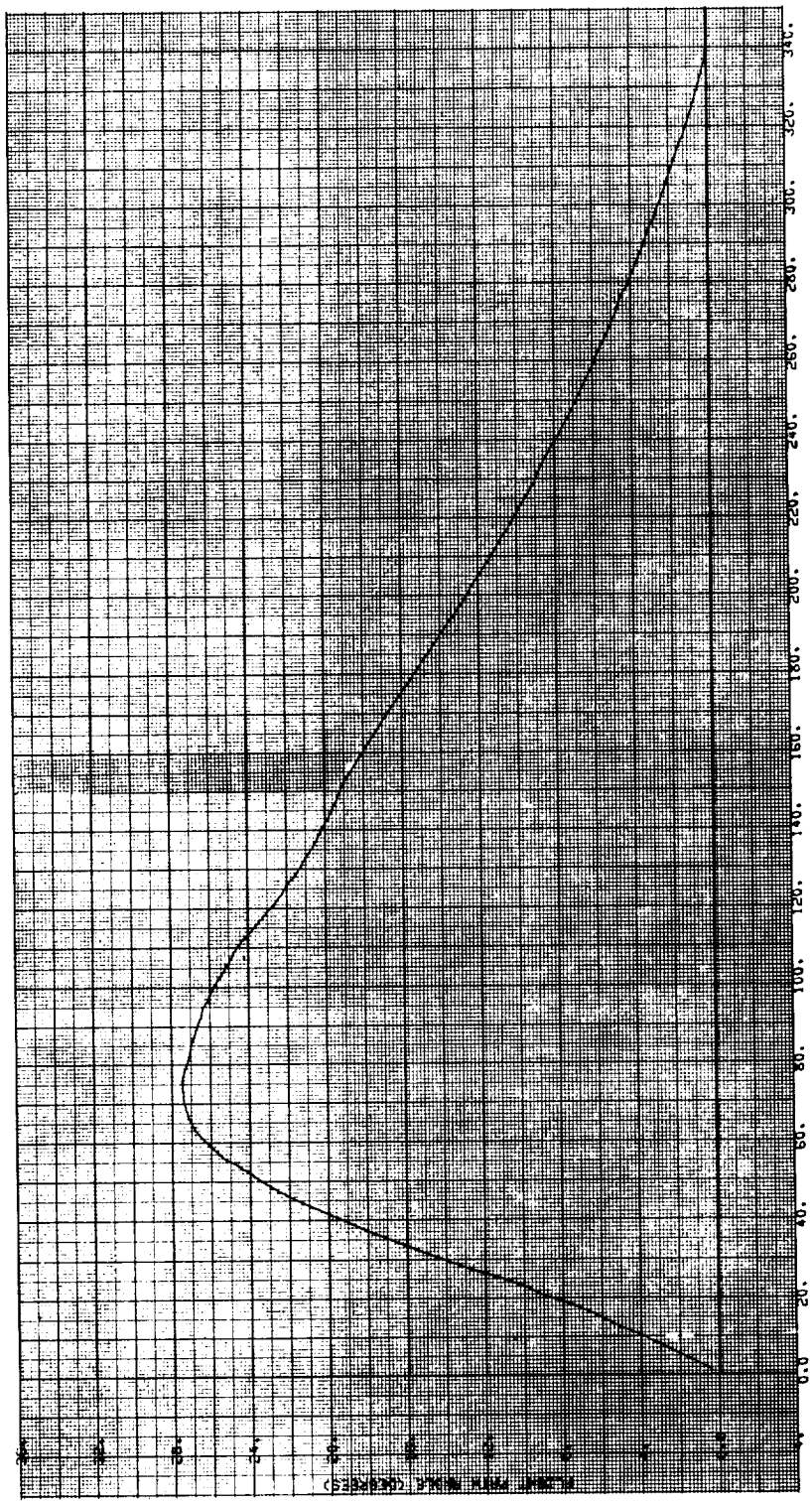

Figure A-2. Inertial Flight Path Angle


400.
380.
360.
340.

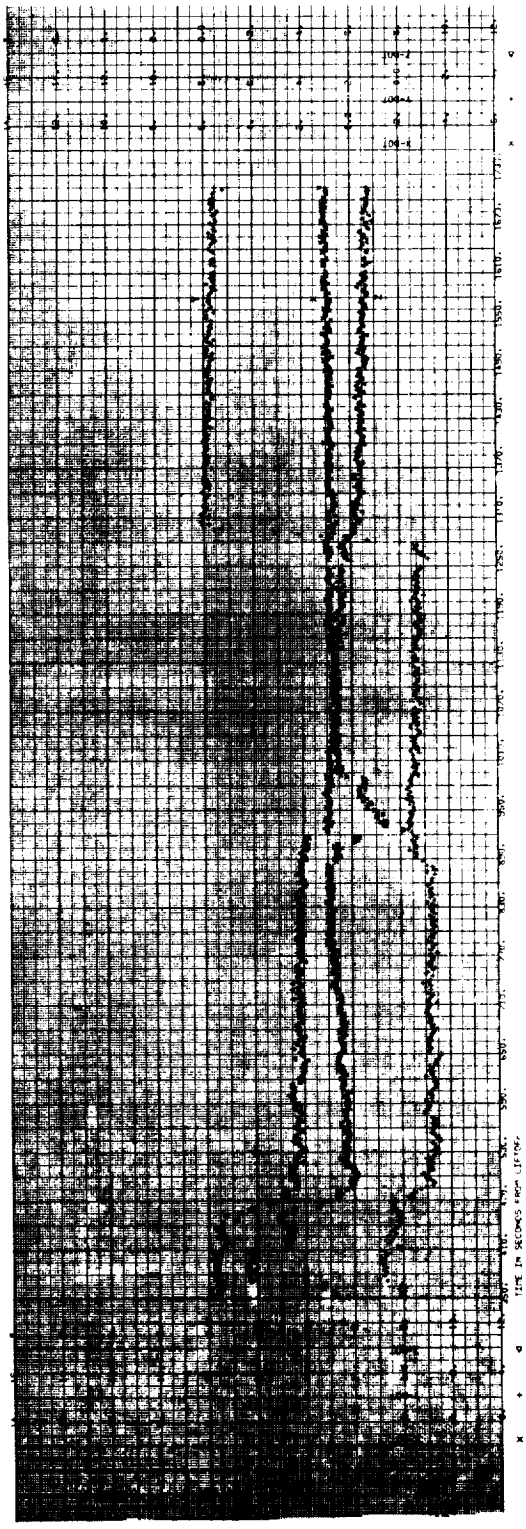

Figure A-4. Gemini 7 Revision 1 Booster Chase Sensed Velocity Increments (from 350 seconds)

Table A-1a. Reconstructed Ascent Trajectory

GEMINI TRAJECTORY IN ECIG

TIME IN SECONDS FROM LIFTOFF

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
1.370	3026412	-18152080	9927856	1325.237	210.146	5.703
3.707	3029512	-18151609	9927880	1327.770	192.533	14.892
6.044	3032618	-18151181	9927926	1330.591	173.774	24.622
8.381	3035731	-18150798	9927996	1333.278	154.001	34.845
10.718	3038850	-18150462	9928089	1336.491	133.403	45.496
13.053	3041975	-18150176	9928209	1339.815	111.560	56.700
15.828	3045700	-18149904	9928385	1344.233	84.305	70.619
18.165	3048845	-18149734	9928564	1347.882	60.805	82.972
20.510	3052011	-18149621	9928775	1352.452	35.727	96.451
22.991	3055373	-18149566	9929032	1357.499	8.092	111.583
25.437	3058700	-18149581	9929325	1363.979	-20.173	127.575
27.304	3061253	-18149639	9929575	1371.052	-41.854	140.279
29.747	3064618	-18149776	9929940	1384.101	-70.886	158.669
32.194	3068025	-18149986	9930351	1401.410	-100.080	177.520
34.638	3071475	-18150266	9930809	1423.100	-129.477	197.662
37.085	3074988	-18150619	9931319	1448.321	-159.179	218.850
39.528	3078562	-18151044	9931880	1478.177	-189.091	240.829
41.973	3082217	-18151544	9932497	1512.467	-219.461	264.129
44.416	3085958	-18152117	9933171	1550.682	-250.046	287.395
46.861	3089800	-18152767	9933903	1592.688	-281.016	312.252
49.310	3093755	-18153492	9934700	1638.542	-311.695	338.589
51.778	3097861	-18154301	9935570	1688.687	-343.480	366.104
54.224	3102057	-18155179	9936499	1743.919	-374.476	393.659
56.093	3105359	-18155900	9937254	1790.092	-397.358	414.905
58.538	3109815	-18156908	9938304	1855.147	-426.992	443.471
60.986	3114441	-18157989	9939424	1924.044	-456.197	472.325
63.449	3119269	-18159148	9940626	1997.769	-484.250	503.777
65.929	3124319	-18160381	9941913	2077.030	-510.171	534.680
68.394	3129543	-18161668	9943271	2161.657	-533.603	567.833
70.886	3135040	-18163024	9944731	2250.929	-554.165	604.453
73.376	3140762	-18164428	9946285	2345.872	-573.275	642.585
75.277	3145295	-18165532	9947533	2422.870	-587.438	670.273
77.746	3151407	-18167004	9949230	2529.563	-604.327	704.362
80.243	3157866	-18168531	9951033	2644.483	-619.704	739.148

Table A-1a. Reconstructed Ascent Trajectory — Continued

GEMINI TRAJECTORY IN ECIG

TIME IN SECONDS FROM LIFTOFF

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
82.696	3164496	-18170072	9952885	2761.251	-637.567	771.024
85.142	3171393	-18171658	9954809	2880.974	-658.951	803.901
87.617	3178681	-18173312	9956847	3008.086	-676.775	841.947
90.072	3186228	-18174993	9958959	3141.215	-693.214	878.365
92.520	3194084	-18176711	9961153	3279.139	-710.768	915.848
94.991	3202367	-18178489	9963468	3424.436	-726.794	957.302
96.896	3208998	-18179883	9965321	3541.407	-737.239	989.402
99.355	3217899	-18181711	9967805	3699.234	-749.456	1030.981
101.855	3227356	-18183598	9970436	3867.140	-759.832	1073.721
104.351	3237225	-18185505	9973171	4042.319	-767.716	1117.450
106.872	3247650	-18187448	9976044	4227.332	-773.007	1162.122
109.366	3258429	-18189380	9978999	4418.206	-775.627	1207.603
111.860	3269696	-18191315	9982069	4617.400	-775.746	1253.515
113.767	3278647	-18192793	9984492	4775.014	-774.435	1289.067
116.264	3290836	-18194721	9987770	4989.108	-769.063	1336.217
118.758	3303556	-18196628	9991161	5212.350	-759.041	1382.653
121.259	3316882	-18198509	9994676	5445.823	-745.876	1428.828
123.728	3330619	-18200336	9998261	5684.440	-734.389	1475.760
126.187	3344898	-18202130	10001950	5930.189	-724.028	1525.060
128.092	3356383	-18203501	10004893	6126.651	-715.703	1564.535
130.551	3371769	-18205248	10008805	6388.968	-705.564	1616.915
133.000	3387746	-18206965	10012829	6659.747	-695.862	1669.810
135.447	3404387	-18208654	10016984	6941.470	-684.698	1725.812
137.897	3421744	-18210317	10021281	7234.437	-672.927	1783.860
140.344	3439820	-18211948	10025720	7539.547	-660.101	1843.921
142.800	3458727	-18213553	10030325	7859.059	-646.394	1906.580
145.247	3478364	-18215117	10035070	8191.657	-631.654	1971.804
147.722	3499067	-18216660	10040034	8543.405	-615.186	2040.797
150.169	3520417	-18218145	10045115	8907.930	-597.610	2112.358
152.651	3543008	-18219604	10050453	9296.119	-578.144	2188.819
154.552	3560967	-18220688	10054670	9605.816	-562.111	2249.646
155.609	3571215	-18221277	10057067	9782.776	-552.784	2284.397
157.036	3585173	-18222039	10060312	9804.681	-516.968	2270.144
159.488	3609324	-18223236	10065863	9893.391	-459.059	2257.454

Table A-1a. Reconstructed Ascent Trajectory — Continued

GEMINI TRAJECTORY IN ECIG

TIME IN SECONDS FROM LIFTOFF

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
161.944	3633734	-18224291	10071392	9984.752	-400.505	2244.793
164.393	3658293	-18225200	10076873	10078.165	-341.814	2232.400
166.708	3681732	-18225927	10082028	10167.774	-286.391	2220.949
168.808	3703167	-18226476	10086681	10250.806	-236.059	2211.319
171.230	3728111	-18226977	10092023	10348.483	-176.719	2199.417
173.650	3753284	-18227327	10097331	10448.136	-111.403	2185.442
176.074	3778731	-18227513	10102610	10549.538	-42.531	2170.028
178.495	3804395	-18227532	10107844	10652.751	27.240	2154.549
180.922	3830373	-18227380	10113054	10757.371	98.090	2139.500
183.343	3856544	-18227057	10118215	10863.575	169.653	2124.097
185.765	3882984	-18226557	10123341	10971.117	242.810	2108.729
188.185	3909665	-18225880	10128426	11080.262	316.768	2093.528
190.604	3936601	-18225024	10133471	11191.043	391.467	2078.306
193.024	3963818	-18223985	10138482	11303.291	467.241	2062.968
195.443	3991309	-18222761	10143456	11417.281	544.494	2047.814
197.865	4019099	-18221349	10148397	11532.549	622.396	2032.385
200.285	4047148	-18219747	10153296	11649.725	701.657	2016.789
202.712	4075564	-18217946	10158171	11768.892	782.277	2001.047
205.132	4104189	-18215955	10162995	11889.389	863.593	1985.464
207.551	4133096	-18213767	10167779	12011.711	945.778	1969.613
209.971	4162314	-18211377	10172526	12136.041	1029.704	1953.645
212.393	4191858	-18208781	10177238	12261.918	1114.301	1937.563
214.813	4221685	-18205980	10181907	12389.846	1200.601	1921.057
217.232	4251812	-18202971	10186533	12519.557	1287.861	1904.452
219.651	4282267	-18199747	10191122	12651.445	1376.537	1887.710
222.078	4313132	-18196298	10195682	12785.511	1466.698	1870.575
224.498	4344236	-18192639	10200188	12921.543	1557.790	1853.616
226.918	4375671	-18188757	10204653	13059.675	1650.381	1836.127
229.338	4407444	-18184650	10209075	13200.080	1743.932	1818.533
231.761	4439599	-18180310	10213459	13343.087	1838.775	1800.737
234.186	4472129	-18175735	10217804	13488.621	1935.274	1782.647
236.610	4505016	-18170924	10222105	13636.753	2033.033	1764.482
239.035	4538264	-18165874	10226360	13787.008	2132.119	1745.879
240.697	4561266	-18162274	10229252	13891.596	2200.785	1733.225

Table A-1a. Reconstructed Ascent Trajectory — Continued

GEMINI TRAJECTORY IN ECIG

TIME IN SECONDS FROM LIFTOFF

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
243.148	4595494	-18156755	10233475	14048.234	2304.234	1714.124
245.593	4630041	-18150993	10237643	14207.560	2408.767	1694.498
248.041	4665022	-18144966	10241767	14369.581	2515.435	1674.705
250.487	4700375	-18138679	10245840	14534.191	2624.347	1654.665
252.936	4736163	-18132119	10249865	14702.352	2735.499	1633.859
255.381	4772324	-18125292	10253835	14873.498	2848.217	1612.916
257.829	4808951	-18118178	10257758	15048.062	2963.593	1591.522
260.276	4845994	-18110783	10261626	15225.752	3080.997	1569.887
262.732	4883597	-18103071	10265453	15408.007	3201.209	1547.591
265.178	4921516	-18095091	10269212	15593.332	3323.310	1525.111
267.628	4959953	-18086797	10272920	15782.691	3447.862	1502.148
270.074	4998798	-18078207	10276567	15976.034	3575.010	1479.064
272.521	5038121	-18069304	10280156	16173.446	3704.590	1455.289
274.968	5077947	-18060076	10283688	16375.159	3837.235	1430.999
277.416	5118290	-18050516	10287161	16582.177	3972.891	1406.215
279.089	5146150	-18043791	10289499	16725.966	4067.175	1389.031
281.545	5187493	-18033629	10292879	16941.465	4208.912	1362.767
283.992	5229221	-18023152	10296181	17161.452	4353.760	1336.228
286.442	5271546	-18012303	10299421	17387.312	4502.960	1308.409
288.844	5313570	-18001310	10302530	17614.031	4652.680	1280.731
291.161	5354647	-17990357	10305467	17838.273	4800.777	1253.333
294.207	5409441	-17975431	10309228	18142.339	5000.920	1216.610
296.525	5451759	-17963662	10312015	18380.768	5157.038	1188.211
298.842	5494637	-17951527	10314735	18625.906	5316.967	1159.552
301.166	5538220	-17938978	10317396	18878.958	5481.686	1129.949
303.486	5582325	-17926063	10319983	19138.650	5651.337	1099.273
305.805	5627004	-17912760	10322494	19405.945	5826.094	1067.421
308.123	5672311	-17899045	10324932	19681.148	6006.998	1034.823
310.440	5718228	-17884915	10327290	19965.260	6193.430	1001.006
312.766	5765011	-17870285	10329578	20259.786	6386.239	966.316
315.816	5827409	-17850411	10332453	20662.112	6649.092	918.916
318.135	5875697	-17834749	10334542	20979.965	6857.441	881.547
320.453	5924717	-17818602	10336541	21310.052	7073.481	842.739
322.780	5974706	-17801881	10338455	21654.386	7298.648	802.374

Table A-1a. Reconstructed Ascent Trajectory — Continued

GEMINI TRAJECTORY IN ECIG

TIME IN SECONDS FROM LIFTOFF

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
325.102	6025384	-17784669	10340270	22011.580	7532.151	760.777
327.421	6076866	-17766921	10341985	22384.400	7773.852	718.288
329.738	6129186	-17748618	10343600	22773.812	8023.793	675.101
332.064	6182613	-17729661	10345118	23183.703	8284.137	630.845
334.382	6236854	-17710143	10346528	23612.637	8555.509	585.108
336.979	6298829	-17687511	10347978	24116.111	8872.037	532.376
337.025	6299950	-17687099	10348003	24125.980	8881.605	530.193
339.794	6366807	-17662365	10349411	24157.609	8978.927	487.700
341.816	6415629	-17644161	10350367	24144.361	9032.050	457.937
343.950	6467155	-17624820	10351311	24128.743	9087.686	426.381
346.066	6518198	-17605531	10352180	24111.645	9141.719	395.211
349.170	6592987	-17577038	10353336	24084.042	9220.274	349.299
351.298	6644215	-17557360	10354045	24064.596	9273.991	317.668
353.429	6695472	-17537541	10354689	24044.643	9327.703	286.267
356.586	6771339	-17507967	10355518	24014.513	9406.698	239.254
358.492	6817099	-17489990	10355947	23995.979	9454.212	211.090
361.227	6882677	-17464044	10356470	23969.537	9522.906	170.672
363.295	6932234	-17444295	10356791	23949.294	9574.044	139.742
366.026	6997613	-17418051	10357117	23921.999	9642.249	99.279
368.094	7047047	-17398063	10357291	23901.554	9693.811	68.761
370.831	7112439	-17371434	10357423	23876.414	9762.695	27.868
372.900	7161826	-17351178	10357449	23855.266	9814.404	-2.765
375.627	7226831	-17324327	10357386	23827.275	9881.840	-43.090
377.848	7279718	-17302321	10357254	23804.327	9936.663	-76.026
379.991	7330720	-17280965	10357057	23781.985	9989.606	-107.651
382.729	7395780	-17253528	10356707	23753.176	10056.963	-148.444
384.794	7444817	-17232703	10356368	23731.135	10107.876	-179.194
387.526	7509621	-17204993	10355824	23702.179	10175.022	-219.573
389.596	7558646	-17183885	10355337	23679.970	10225.878	-250.439
392.334	7623448	-17155791	10354596	23650.211	10293.000	-290.979

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Table A-1b. Reconstructed Ascent Trajectory Associated Parameters

GEMINI 7 RECONSTRUCTED ASCENT TRAJECTORY

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1.370	1341.8	12.4	.528	90.002	-2.0	28.507	-80.555
3.707	1341.8	32.6	1.392	90.022	50.5	28.507	-80.555
6.044	1342.1	54.1	2.310	90.045	151.5	28.507	-80.555
8.381	1342.6	76.7	3.275	90.070	304.0	28.507	-80.555
10.718	1343.9	100.4	4.281	90.097	510.5	28.507	-80.555
13.053	1345.7	125.3	5.342	90.129	773.5	28.507	-80.555
15.828	1348.8	156.5	6.660	90.171	1164.5	28.507	-80.555
18.165	1351.9	183.5	7.798	90.194	1561.0	28.507	-80.555
20.510	1356.4	212.5	9.011	90.208	2025.0	28.507	-80.555
22.991	1362.2	244.6	10.344	90.214	2591.7	28.507	-80.555
25.437	1370.2	277.9	11.700	90.205	3230.0	28.507	-80.555
27.304	1379.0	304.0	12.732	90.188	3773.0	28.507	-80.555
29.747	1395.1	340.1	14.104	90.125	4559.5	28.507	-80.555
32.194	1416.3	377.7	15.437	90.064	5436.5	28.507	-80.555
34.638	1442.7	417.3	16.737	89.975	6404.5	28.507	-80.555
37.085	1473.6	459.1	17.995	89.869	7469.5	28.507	-80.554
39.528	1509.8	503.2	19.190	89.757	8631.7	28.507	-80.554
41.973	1551.2	550.5	20.332	89.627	9896.5	28.507	-80.553
44.416	1597.0	600.2	21.389	89.520	11266.5	28.507	-80.552
46.861	1647.4	653.2	22.392	89.386	12746.0	28.507	-80.551
49.310	1702.2	709.1	23.316	89.218	14338.5	28.507	-80.549
51.778	1762.0	769.3	24.194	89.055	16061.2	28.507	-80.547
54.224	1826.9	832.3	24.948	88.905	17886.5	28.508	-80.545
56.093	1880.3	882.7	25.436	88.792	19361.7	28.508	-80.543
58.538	1954.9	952.3	25.996	88.642	21397.0	28.508	-80.540
60.986	2033.3	1025.0	26.477	88.501	23555.5	28.508	-80.537
63.449	2116.8	1102.2	26.884	88.300	25851.5	28.509	-80.533
65.929	2204.9	1182.4	27.162	88.117	28286.2	28.509	-80.528

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Table A-1b. Reconstructed Ascent Trajectory Associated Parameters — Continued

GEMINI 7 RECONSTRUCTED ASCENT TRAJECTORY

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
68.394	2298.1	1266.8	27.348	87.879	30928.7	28.510	-80.523
70.886	2396.0	1355.5	27.459	87.556	33521.2	28.510	-80.518
73.376	2499.3	1449.4	27.507	87.226	36335.0	28.511	-80.511
75.277	2581.9	1524.3	27.488	87.034	38566.0	28.511	-80.506
77.746	2694.8	1626.2	27.378	86.849	41568.2	28.512	-80.498
80.243	2815.3	1735.3	27.206	86.675	44723.0	28.513	-80.490
82.696	2937.3	1847.3	27.057	86.604	47940.2	28.514	-80.481
85.142	3063.1	1964.9	26.970	86.564	51273.5	28.515	-80.471
87.617	3196.5	2090.0	26.833	86.426	54780.5	28.516	-80.460
90.072	3334.9	2219.7	26.646	86.332	58388.5	28.518	-80.448
92.520	3478.4	2355.4	26.475	86.253	62116.7	28.519	-80.435
94.991	3629.6	2499.1	26.291	86.127	66022.0	28.520	-80.421
96.896	3750.6	2614.1	26.113	86.034	69125.7	28.522	-80.409
99.355	3913.0	2768.8	25.859	85.930	73255.2	28.523	-80.393
101.855	4085.1	2933.1	25.572	85.831	77594.7	28.525	-80.376
104.351	4264.0	3104.3	25.261	85.730	82068.2	28.527	-80.357
106.872	4452.2	3284.7	24.919	85.633	86729.7	28.529	-80.337
109.366	4645.9	3470.9	24.564	85.533	91479.7	28.531	-80.315
111.860	4847.4	3665.0	24.192	85.442	96367.7	28.533	-80.292
113.767	5006.6	3818.8	23.902	85.376	100196.5	28.535	-80.274
116.264	5222.3	4027.3	23.500	85.288	105332.7	28.538	-80.248
118.758	5446.2	4244.0	23.065	85.210	110594.0	28.541	-80.221
121.259	5679.7	4470.4	22.615	85.148	115995.2	28.544	-80.192
123.728	5919.0	4703.4	22.217	85.102	121455.5	28.547	-80.161
126.187	6166.2	4945.0	21.848	85.059	127031.2	28.550	-80.129
128.092	6364.0	5138.8	21.580	85.028	131449.2	28.553	-80.103
130.551	6628.5	5398.3	21.255	84.998	137284.2	28.556	-80.067
133.000	6901.5	5666.8	20.952	84.984	143252.5	28.560	-80.030

Table A-1b. **Reconstructed Ascent Trajectory Associated Parameters — Continued**

GEMINI 7 RECONSTRUCTED ASCENT TRAJECTORY

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
135.447	7185.9	5947.0	20.660	84.961	149378.0	28.564	-79.990
137.897	7481.8	6239.0	20.382	84.942	155677.2	28.568	-79.949
140.344	7790.2	6543.5	20.113	84.926	162147.2	28.572	-79.905
142.800	8113.2	6863.0	19.855	84.914	168825.0	28.576	-79.859
145.247	8449.7	7196.1	19.609	84.903	175671.0	28.581	-79.810
147.722	8805.7	7548.8	19.368	84.892	182797.0	28.586	-79.759
150.169	9174.9	7914.9	19.140	84.882	190055.7	28.591	-79.705
152.651	9568.2	8305.4	18.917	84.871	197644.0	28.596	-79.648
154.552	9882.1	8617.1	18.752	84.864	203614.2	28.601	-79.602
155.609	10061.6	8795.3	18.663	84.860	206997.7	28.603	-79.576
157.036	10077.3	8809.1	18.465	84.882	211569.2	28.606	-79.540
159.488	10158.0	8886.4	18.134	84.923	219364.5	28.612	-79.478
161.944	10241.8	8966.8	17.804	84.965	227098.7	28.618	-79.415
164.393	10328.1	9049.9	17.481	85.007	234735.2	28.623	-79.351
166.708	10411.4	9130.3	17.181	85.048	241892.5	28.629	-79.291
168.808	10489.2	9205.5	16.915	85.083	248330.0	28.634	-79.235
171.230	10581.0	9294.4	16.606	85.126	255694.5	28.639	-79.170
173.650	10674.8	9385.0	16.269	85.166	262981.2	28.645	-79.105
176.074	10770.4	9477.5	15.919	85.207	270191.5	28.651	-79.038
178.495	10868.4	9572.5	15.571	85.247	277304.5	28.656	-78.971
180.922	10968.4	9669.5	15.227	85.285	284345.7	28.662	-78.903
183.343	11070.5	9768.7	14.887	85.325	291281.7	28.668	-78.834
185.765	11174.5	9869.9	14.547	85.362	298130.5	28.674	-78.764
188.185	11280.6	9973.3	14.212	85.398	304883.5	28.679	-78.694
190.604	11389.0	10079.1	13.882	85.435	311544.2	28.685	-78.622
193.024	11499.4	10186.9	13.554	85.472	318117.2	28.691	-78.550
195.443	11612.1	10297.2	13.228	85.506	324598.7	28.697	-78.477
197.865	11726.7	10409.3	12.908	85.542	330994.7	28.702	-78.403

Table A-1b. Reconstructed Ascent Trajectory Associated Parameters — Continued

GEMINI 7 RECONSTRUCTED ASCENT TRAJECTORY

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
200.285	11843.7	10524.0	12.589	85.578	337293.5	28.708	-78.328
202.712	11963.3	10641.4	12.272	85.614	343517.0	28.714	-78.251
205.132	12084.8	10760.7	11.962	85.650	349630.7	28.720	-78.175
207.551	12208.6	10882.5	11.656	85.687	355649.2	28.726	-78.097
209.971	12335.2	11007.0	11.351	85.723	361577.2	28.732	-78.018
212.393	12463.8	11133.7	11.051	85. 0	367416.2	28.738	-77.938
214.813	12595.1	11263.1	10.753	85.	373156.5	28.744	-77.857
217.232	12728.7	11394.9	10.460	85.6	378800.0	28.750	-77.775
219.651	12865.2	11529.6	10.169	85.874	384350.2	28.756	-77.692
222.078	13004.4	11667.1	9.882	85.913	389820.0	28.762	-77.608
224.498	13146.2	11807.3	9.600	85.952	395179.7	28.767	-77.522
226.918	13290.8	11950.3	9.320	85.992	400443.0	28.773	-77.436
229.338	13438.2	12096.2	9.046	86.033	405610.0	28.779	-77.349
231.761	13588.8	12245.4	8.777	86.075	410687.7	28.785	-77.260
234.186	13742.6	12397.8	8.510	86.118	415673.5	28.791	-77.170
236.610	13899.7	12553.5	8.249	86.162	420563.5	28.797	-77.079
239.035	14059.5	12712.0	7.991	86.207	425356.5	28.804	-76.987
240.657	14171.0	12822.7	7.818	86.237	428587.0	28.808	-76.923
243.148	14338.5	12989.0	7.562	86.282	433266.5	28.814	-76.827
245.593	14509.3	13158.6	7.311	86.330	437837.0	28.820	-76.731
248.041	14683.6	13331.8	7.063	86.377	442314.0	28.826	-76.633
250.487	14861.3	13508.5	6.818	86.424	446686.7	28.832	-76.533
252.936	15043.3	13689.4	6.574	86.472	450961.2	28.838	-76.433
255.381	15229.1	13874.2	6.336	86.521	455127.7	28.844	-76.331
257.829	15419.1	14063.3	6.099	86.571	459195.7	28.850	-76.227
260.276	15613.1	14256.4	5.866	86.621	463160.2	28.856	-76.122
262.732	15812.6	14455.0	5.635	86.672	467031.5	28.862	-76.015
265.178	16015.9	14657.6	5.409	86.723	470784.0	28.868	-75.907

Table A-1b. Reconstructed Ascent Trajectory Associated Parameters — Continued

GEMINI 7 RECONSTRUCTED ASCENT TRAJECTORY

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
267.628	16224.2	14865.1	5.187	86.776	474437.0	28.874	-75.798
270.074	16437.4	15077.5	4.968	86.829	477978.0	28.880	-75.696
272.521	16655.6	15295.0	4.753	86.883	481413.2	28.886	-75.574
274.968	16879.1	15517.8	4.540	86.938	484742.7	28.892	-75.459
277.416	17108.9	15747.0	4.330	86.993	487965.2	28.898	-75.343
279.089	17268.9	15906.6	4.189	87.032	490105.0	28.902	-75.262
281.545	17509.1	16146.2	3.982	87.090	493153.7	28.908	-75.143
283.992	17755.0	16391.6	3.779	87.148	496079.5	28.914	-75.022
286.442	18008.1	16644.1	3.575	87.207	498895.0	28.919	-74.899
288.844	18262.6	16898.2	3.380	87.266	501542.0	28.925	-74.776
291.161	18515.0	17150.1	3.193	87.324	503990.0	28.930	-74.656
294.207	18857.7	17492.3	2.953	87.401	507047.7	28.937	-74.496
296.525	19126.9	17761.1	2.776	87.461	509252.0	28.943	-74.371
298.842	19404.1	18037.9	2.603	87.521	511352.0	28.948	-74.245
301.166	19690.6	18324.1	2.432	87.582	513352.7	28.953	-74.116
303.486	19985.3	18618.5	2.262	87.645	515242.7	28.958	-73.986
305.805	20289.1	18922.1	2.093	87.709	517021.5	28.963	-73.853
308.123	20602.8	19235.6	1.925	87.772	518688.2	28.968	-73.718
310.440	20927.1	19559.6	1.758	87.838	520238.5	28.973	-73.582
312.766	21263.8	19896.1	1.595	87.904	521679.0	28.978	-73.442
315.816	21724.3	20356.4	1.384	87.994	523388.5	28.985	-73.255
318.135	22089.1	20721.0	1.224	88.062	524549.0	28.989	-73.109
320.453	22468.4	21100.1	1.066	88.132	525585.2	28.994	-72.962
322.780	22864.6	21496.2	.909	88.203	526499.0	28.998	-72.811
325.102	23276.3	21907.8	.755	88.276	527280.5	29.003	-72.657
327.421	23705.9	22337.3	.606	88.349	527931.2	29.007	-72.500
329.738	24154.6	22785.9	.464	88.425	528452.5	29.011	-72.341
332.064	24626.5	23257.8	.329	88.502	528848.2	29.015	-72.178

Table A-1b. Reconstructed Ascent Trajectory Associated Parameters — Continued

GEMINI 7 RECONSTRUCTED ASCENT TRAJECTORY

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
334.382	25120.7	23752.0	.196	88.581	529116.0	29.019	-72.012
336.979	25700.9	24332.1	.055	88.671	529261.2	29.023	-71.821
337.025	25713.6	24344.8	.045	88.672	529262.2	29.024	-71.818
339.794	25776.2	24407.4	.032	88.776	529311.7	29.028	-71.617
341.816	25781.8	24413.0	.033	88.852	529344.7	29.031	-71.461
343.950	25786.2	24417.4	.035	88.933	529380.0	29.034	-71.302
346.066	25788.8	24420.0	.037	89.014	529417.0	29.036	-71.144
349.170	25790.3	24421.5	.039	89.132	529473.7	29.040	-70.913
351.298	25791.0	24422.2	.041	89.213	529514.5	29.042	-70.755
353.429	25791.3	24422.5	.043	89.293	529556.7	29.044	-70.596
356.586	25791.5	24422.7	.046	89.414	529622.0	29.046	-70.360
358.492	25791.3	24422.5	.047	89.487	529663.2	29.047	-70.218
361.227	25791.7	24422.9	.049	89.590	529724.2	29.049	-70.014
363.295	25791.7	24422.8	.052	89.670	529772.2	29.050	-69.860
366.026	25791.5	24422.7	.054	89.774	529838.2	29.051	-69.657
368.094	25791.8	24423.0	.056	89.852	529889.7	29.051	-69.503
370.831	25794.4	24425.6	.058	89.957	529960.0	29.052	-69.299
372.900	25794.5	24425.6	.059	90.036	530014.2	29.052	-69.144
375.627	25794.4	24425.5	.062	90.140	530088.5	29.051	-68.941
377.848	25794.3	24425.5	.064	90.224	530150.5	29.051	-68.775
379.991	25794.3	24425.4	.066	90.306	530212.5	29.050	-68.616
382.729	25794.1	24425.2	.068	90.410	530294.2	29.049	-68.412
384.794	25793.9	24425.0	.070	90.489	530357.0	29.048	-68.258
387.526	25794.0	24425.1	.073	90.593	530443.2	29.046	-68.054
389.596	25794.0	24425.1	.074	90.672	530510.0	29.044	-67.900
392.334	25793.8	24424.9	.077	90.777	530600.7	29.042	-67.696

Table A-2a. Reconstructed Reentry Trajectory and Associated Parameters (BET)

GEMINI GUIDANCE ANALYSIS PROGRAM 01/08/66
NASA - MANNED SPACECRAFT CENTER

ECIG COORDINATES
(GUIDANCE TIME BASE)

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
1551.000	4100235.500-16245833.250	9892132.750	24921.710	4383.644	-3417.718
1552.000	4125153.406-18241438.750	9888722.500	24951.552	4324.301	-3398.619
1553.000	4150073.875-18237054.250	9885351.500	24911.335	4388.543	-3468.256
1554.000	4174996.812-18232692.250	9881947.750	24887.552	4437.976	-3402.687
1555.000	4199871.000-18228235.250	9878510.625	24858.641	4470.549	-3516.740
1556.000	4224703.375-18223727.750	9875012.125	24856.125	4481.579	-3385.530
1557.000	4249544.875-18219237.000	9871547.500	24816.728	4530.978	-3528.455
1558.000	4274353.750-18214687.250	9868034.750	24792.701	4562.890	-3473.559
1559.000	4299163.562-18210158.000	9864546.250	24793.026	4553.018	-3488.441
1560.000	4323926.187-18205565.500	9861003.000	24761.294	4591.007	-3545.135
1561.000	4348686.375-18200975.750	9857487.250	24739.664	4612.809	-3544.607
1562.000	4373446.312-18196355.750	9853935.125	24730.985	4646.017	-3530.668
1563.000	4398154.250-18191692.500	9850394.000	24712.176	4646.596	-3592.667
1564.000	4422845.625-18187021.500	9846780.125	24672.482	4690.292	-3589.689
1565.000	4447534.937-18182352.750	9843188.125	24676.959	4686.453	-3623.292
1566.000	4472160.562-18177611.000	9839604.125	24653.614	4714.132	-3611.957
1567.000	4496813.437-18172890.000	9835970.125	24598.948	4772.493	-3623.200
1568.000	4521411.687-18168112.250	9832338.500	24601.809	4764.169	-3646.337
1569.000	4546061.125-18163340.250	9828690.250	24581.282	4782.708	-3643.517
1570.000	4570657.750-18158547.250	9825037.500	24570.445	4790.294	-3636.679
1571.000	4595112.937-18153731.500	9821383.750	24537.568	4824.766	-3672.511
1572.000	4619639.750-18148881.250	9817710.750	24529.200	4861.266	-3682.184
1573.000	4644151.250-18144039.750	9814024.250	24512.539	4840.235	-3675.617
1574.000	4668619.687-18139140.500	9810318.500	24453.264	4893.180	-3688.552
1575.000	4693069.437-18134260.000	9806602.750	24443.727	4900.042	-3722.703
1576.000	4717478.937-18129322.500	9802869.750	24394.136	4942.039	-3738.700
1577.000	4741872.812-18124381.250	9799115.625	24394.807	4922.750	-3725.952
1578.000	4766247.437-18119423.250	9795346.875	24341.743	4987.016	-3757.106
1579.000	4790585.187-18114445.000	9791592.375	24296.067	5023.399	-3805.016
1580.000	4814892.750-18109436.250	9787817.375	24295.325	5009.804	-3778.217
1581.000	4839182.000-18104421.500	9784036.375	24265.767	5026.003	-3790.011
1582.000	4863435.500-18099385.750	9780236.750	24249.487	5035.812	-3811.744
1583.000	4887681.687-18094348.000	9776420.500	24222.267	5059.815	-3813.247

Table A-2a. Reconstructed Reentry Trajectory and Associated Parameters (BET) — Continued

1584.000	4911881.750-18089276.750	9772001.000	24197.722	5076.086	-3826.063
1585.000	4936002.937-18084189.250	9768771.375	24177.481	5087.054	-3844.218
1586.000	4960221.062-18079087.000	9764931.375	24139.341	5105.261	-3846.326
1587.000	4984538.437-18073962.500	9761082.625	24100.889	5131.331	-3864.101
1588.000	5008431.437-18068823.500	9757218.250	24080.698	5151.296	-3871.040
1589.000	5032506.750-18063671.250	9753340.625	24055.284	5160.566	-3877.577
1590.000	5056655.125-18058506.250	9749456.000	24042.477	5176.538	-3879.940
1591.000	5080586.937-18053321.000	9745579.750	24035.110	5187.470	-3890.740
1592.000	5104586.187-18048117.750	9741673.125	23988.799	5231.399	-3900.332
1593.000	5128593.437-18042887.000	9737853.375	23943.900	5254.800	-3924.665
1594.000	5152517.500-18037643.250	9733925.750	23957.463	5230.311	-3825.974
1595.000	5176392.875-18032313.500	9729898.250	23875.090	5299.845	-3952.253
1596.000	5200231.625-18027050.000	9725954.125	23818.581	5328.515	-3964.790
1597.000	5224065.250-18021724.500	9722012.500	23807.333	5341.902	-3946.340
1598.000	5247881.062-18016370.750	9718061.000	23761.866	5336.041	-3964.814
1599.000	5271594.312-18011023.500	9714082.750	23804.098	5390.664	-3937.936
1600.000	5295363.875-18005631.500	9710142.375	23732.966	5398.076	-3967.626

Table A-2a. Reconstructed Reentry Trajectory and Associated Parameters (BET) — Continued

GEMINI GUIDANCE ANALYSIS PROGRAM 01/08/66
NASA - MANNED SPACECRAFT CENTER

ECIG COORDINATES
(GUIDANCE TIME BASE)

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
1601.000	5319055.375-18000241.500	9706165.000	23648.322	5375.675	-3960.480
1602.000	5342686.062-17994823.500	9702174.625	23623.175	5420.954	-3993.167
1603.000	5366304.062-17989396.250	9698209.000	23610.009	5439.261	-3962.195
1604.000	5389847.687-17983951.000	9694198.000	23541.511	5456.883	-3982.605
1605.000	5413381.250-17978491.500	9690227.625	23474.707	5462.659	-4020.316
1606.000	5436856.125-17973007.500	9686229.750	23462.166	5500.783	-3980.021
1607.000	5460306.250-17967498.000	9682243.875	23426.731	5500.883	-3989.756
1608.000	5483698.812-17961989.750	9678241.250	23393.230	5538.989	-3980.601
1609.000	5507058.812-17956482.250	9674244.625	23299.114	5507.487	-4007.571
1610.000	5530374.312-17950942.500	9670253.375	23282.222	5547.298	-4003.724
1611.000	5553642.375-17945359.750	9666210.375	23278.622	5565.501	-3986.858
1612.000	5576856.375-17939809.500	9662178.500	23217.022	5580.189	-3999.783
1613.000	5600041.000-17934203.250	9658161.875	23168.937	5592.078	-4024.289
1614.000	5623189.312-17928611.000	9654148.250	23111.828	5599.305	-4019.815
1615.000	5646306.687-17922984.500	9650152.750	23086.379	5641.555	-3988.457
1616.000	5669357.500-17917330.250	9646135.000	23039.432	5644.030	-4019.080
1617.000	5692369.375-17911691.000	9642099.125	22999.424	5671.113	-4018.386
1618.000	5715335.437-17906031.750	9638079.500	22950.496	5690.205	-4021.917
1619.000	5738265.375-17900347.750	9634065.000	22886.258	5691.264	-4057.311
1620.000	5761129.250-17894647.750	9630012.125	22866.765	5724.933	-4016.785
1621.000	5783958.062-17888952.750	9625973.625	22801.484	5707.632	-4032.168
1622.000	5806733.562-17883224.250	9621946.500	22735.120	5702.953	-4051.517
1623.000	5829448.250-17877497.250	9617917.000	22696.455	5762.866	-4029.958
1624.000	5852123.812-17871754.000	9613877.375	22649.378	5756.847	-4046.068
1625.000	5874738.062-17866024.250	9609825.000	22607.364	5749.457	-4028.907
1626.000	5897327.437-17860249.000	9605781.125	22554.644	5767.964	-4044.772
1627.000	5919844.687-17854477.000	9601751.625	22507.722	5784.135	-4029.390
1628.000	5942330.875-17848685.500	9597721.750	22455.504	5783.779	-4056.250
1629.000	5964775.812-17842879.000	9593703.250	22426.465	5798.677	-4026.018
1630.000	5987179.812-17837040.250	9589668.125	22365.335	5821.707	-4021.260
1631.000	6009517.000-17831216.250	9585628.250	22308.753	5830.656	-4061.799
1632.000	6031782.187-17825425.000	9581564.125	22259.778	5870.149	-4034.701
1633.000	6054034.062-17819540.500	9577544.250	22214.917	5910.500	-4006.589

Table A-2a. Reconstructed Reentry Trajectory and Associated Parameters (BET) — Continued

1634.000	6076215.875-17813665.250	9573516.125	22145.982	5840.010	-4064.476
1635.000	6098349.875-17807766.750	9569462.250	22116.744	5873.554	-4031.447
1636.000	6120427.562-17801901.750	9565426.750	22052.644	5895.316	-4049.319
1637.000	6142452.812-17796026.750	9561372.125	21989.555	5930.586	-4058.006
1638.000	6164414.937-17790134.750	9557305.750	21938.259	5854.077	-4058.994
1639.000	6186323.687-17784171.500	9553234.375	21893.572	5954.178	-4042.687
1640.000	6208184.187-17778232.250	9549175.000	21833.620	5912.881	-4058.755
1641.000	6229975.687-17772354.750	9545105.750	21762.210	5989.344	-4078.215
1642.000	6251698.625-17766470.000	9541026.125	21690.315	5948.714	-4101.743
1643.000	6273383.375-17760407.000	9536942.125	21638.261	5909.944	-4104.887
1644.000	6294953.625-17754430.750	9532827.625	21575.947	5967.759	-4109.950
1645.000	6316547.437-17748571.500	9528742.125	21525.115	5901.853	-4090.808
1646.000	6338041.687-17742703.500	9524678.375	21462.191	5951.266	-4074.592
1647.000	6359472.875-17736729.250	9520553.125	21419.931	5998.243	-4075.974
1648.000	6380838.625-17730825.500	9516465.750	21345.137	5945.167	-4091.198
1649.000	6402149.937-17724868.750	9512356.125	21273.437	5999.416	-4133.064
1650.000	6423404.562-17718969.500	9508268.000	21222.689	5895.326	-4098.531

Table A-2a. Reconstructed Reentry Trajectory and Associated Parameters (BET) — Continued

GEMINI GUIDANCE ANALYSIS PROGRAM 01/08/66
NASA * MANNED SPACECRAFT CENTER

ECIG COORDINATES
(GUIDANCE TIME BASE)

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
1651.000	6444573.062-17712829.500	9504132.375	21142.740	5929.876	-4129.435
1652.000	6465710.500-17707119.250	9501107.125	20990.476	6574.462	-4428.904
1653.000	6486718.937-17700910.250	9495832.375	21027.520	5873.552	-4027.847
1654.000	6507698.125-17694878.250	9491724.750	20986.282	5759.919	-4043.215
1655.000	6528646.125-17689121.000	9487728.500	20899.593	5838.945	-4078.096
1656.000	6549499.750-17683162.000	9483612.125	20816.038	6067.690	-4132.698
1657.000	6570278.687-17677180.000	9479484.375	20768.585	5809.366	-4077.254
1658.000	6590977.125-17671116.500	9475331.750	20664.530	6102.850	-4174.876
1659.000	6611660.000-17665277.750	9471309.000	20615.852	6083.049	-4092.063
1660.000	6632218.375-17659197.000	9467154.750	20570.476	5744.683	-4027.177
1661.000	6652732.000-17653188.750	9463027.625	20457.115	6157.232	-4181.197
1662.000	6673206.062-17647358.000	9459001.250	20408.339	5890.664	-4101.753
1663.000	6693561.562-17641295.250	9454825.750	20333.890	6120.780	-4101.936
1664.000	6713902.562-17635572.250	9450834.875	20312.407	5754.603	-4054.701
1665.000	6734106.812-17629508.000	9446652.250	20175.384	6171.642	-4128.128
1666.000	6754269.500-17623423.250	9442546.250	20116.489	6079.245	-4151.893
1667.000	6774378.875-17617550.750	9438512.750	20032.130	6102.717	-4174.733
1668.000	6794353.125-17611369.000	9434307.625	20034.718	5656.116	-3942.394
1669.000	6814337.687-17605595.750	9430303.625	19986.714	5583.105	-3835.216
1670.000	6834218.375-17599738.750	9426242.250	19760.979	6342.889	-4248.491
1671.000	6853962.625-17593534.250	9422006.000	19697.331	6216.975	-4229.963
1672.000	6873730.312-17587803.000	9418087.250	19711.849	5758.747	-3957.741
1673.000	6893334.312-17581580.250	9413920.750	19500.450	6340.253	-4397.817
1674.000	6912880.187-17575697.000	9409763.750	19537.210	5368.726	-3785.478
1675.000	6932257.500-17569379.500	9405537.875	19430.156	6119.022	-4177.790
1676.000	6951801.875-17563821.500	9401707.000	19386.091	6022.604	-3937.851
1677.000	6971065.875-17557696.000	9397536.875	19293.712	5840.542	-4082.813
1678.000	6990243.250-17551205.250	9393308.375	19161.030	6176.713	-4159.323
1679.000	7009454.812-17545596.500	9389310.250	19129.389	5830.148	-4064.845
1680.000	7028536.000-17539651.750	9385259.125	18998.546	6271.094	-4186.358
1681.000	7047612.562-17534078.000	9381384.125	18959.158	5863.342	-4070.457
1682.000	7066469.187-17527864.500	9377173.125	18820.208	5951.435	-4288.185
1683.000	7085322.437-17521730.000	9373246.875	18797.597	5965.824	-4012.960

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Table A-2a. Reconstructed Reentry Trajectory and Associated Parameters (BET) — Continued

1684.000	7104064.625-17515631.000	9369207.000	18623.957	6413.208	-4260.959
1685.000	7122816.000-17519066.500	9365297.125	18573.912	6290.424	-4170.172
1686.000	7141446.937-17534324.250	9361432.000	18674.994	5526.514	-3684.530
1687.000	7159924.312-17497936.000	9357450.500	18384.358	6474.857	-4364.993
1688.000	7178380.000-17492295.250	9353468.375	18363.909	6020.954	-4068.714
1689.000	7196746.937-17486414.500	9349557.625	18329.091	5605.131	-3940.593
1690.000	7214859.500-17479592.750	9345300.375	18062.445	6834.808	-4175.812
1691.000	7233235.187-17474015.500	9341779.125	18372.959	4816.875	-3511.280
1692.000	7251252.125-17468353.500	9337718.000	18149.780	5662.995	-3671.625
1693.000	7269300.875-17462546.500	9333893.375	17862.552	6208.694	-4111.262
1694.000	7287358.312-17457120.750	9331295.250	17857.489	5965.660	-4079.069
1695.000	7305146.500-17450542.250	9326233.375	17858.466	6121.542	-3613.939
1696.000	7322958.000-17445258.250	9322519.375	17706.813	6230.319	-3766.732
1697.000	7340[illegible]-17438728.000	9318505.750	17657.979	5683.394	-3855.459
1698.000	7357892.562-17432986.250	9314022.875	17525.482	5957.981	-3911.134
1699.000	7375621.125-17427160.500	9310769.250	17602.627	5448.610	-3268.648
1700.000	7393228.875-17421992.250	9307251.375	17211.933	6126.577	-4474.565

Table A-2a. Reconstructed Reentry Trajectory and Associated Parameters (BET) — Continued

GEMINI GUIDANCE ANALYSIS PROGRAM 01/08/66
NASA • MANNED SPACECRAFT CENTER

ECIG COORDINATES
(GUIDANCE TIME BASE)

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
17[illegible].000	7[illegible]42[illegible].312-17415398.500	9303261.625	17414.357	5459.945	-3472.572
1702.000	7427[illegible]86.[illegible]-17410479.250	9299763.375	17103.216	6326.772	-4003.206
1703.000	7444935.812-17404151.250	9295768.375	16942.602	6645.646	-4082.329
1704.000	7461[illegible]52.500-17397452.750	9291967.000	16875.495	6978.711	-3795.455
1705.000	7478[illegible]73.25[illegible]-17391933.250	9288535.375	17125.422	5759.518	-3294.208
1706.000	7496[illegible]41.500-17386587.250	9285266.500	17150.216	4614.516	-3160.535
1707.000	7513134.312-17381511.000	9281472.250	16896.561	5749.058	-3639.641
1708.000	7529717.625-17375619.750	9277721.375	16734.655	5849.102	-3349.599
1709.000	7546422.937-17369228.750	9274456.875	16933.358	4534.123	-2745.854
1710.000	7563147.187-17364657.500	9271085.125	16575.024	5901.221	-4094.681
1711.000	7579445.500-17356352.000	9267192.750	16638.541	4593.293	-2979.837
1712.000	7595774.687-17352637.250	9263759.125	16153.000	6383.359	-3763.755
1713.000	7611787.875-17346294.250	9259821.375	15800.859	6851.386	-4352.053
1714.000	7627772.937-17340151.000	9255887.375	16075.909	5946.086	-3703.969
1715.000	7643827.812-17334411.250	9252441.250	16209.398	4712.520	-3291.434
1716.000	7659831.750-17328596.250	9248922.500	15708.031	6282.037	-3596.162
1717.000	7675753.437-17323966.000	9245515.625	15928.111	5196.381	-3374.263
1718.000	7691494.625-17317938.250	9242156.500	15340.251	4983.164	-3426.312
1719.000	7707146.312-17312190.500	9238382.625	15099.621	7389.414	-4248.830
1720.000	7722698.000-17305477.750	9234451.500	15219.030	6346.181	-4009.332
1721.000	7737534.250-17299129.750	9230247.750	14423.892	6125.315	-3833.826
1722.000	7753194.625-17294236.250	9226960.250	15845.857	4200.934	-3166.548
1723.000	7768456.750-17288766.000	9223241.750	15008.564	5854.325	-3927.240
1724.000	7783[illegible]3.875-17283336.250	9220081.750	15261.864	5122.339	-3327.417
1725.000	7796[illegible]60.375-17277678.250	9216267.250	14809.067	6031.790	-3773.816
1726.000	7813[illegible]47.375-17271558.000	9212523.500	14778.019	5926.052	-3661.327
1727.000	7828[illegible]25.812-17265517.500	9209028.750	14927.288	5208.024	-3380.352
1728.000	7842[illegible]947.875-17260113.000	9205424.125	14611.226	5592.964	-3517.302
1729.000	7857[illegible]274.875-17253712.250	9201434.500	14273.081	6467.958	-4222.864
1730.000	7871757.875-17248145.000	9197652.625	14082.163	4678.673	-3396.249
1731.000	7[illegible]6361.[illegible]-17243521.500	9194379.250	14595.512	4479.713	-3345.334
1732.000	79[illegible]775.187-17238477.250	9191095.125	14352.798	5074.311	-3416.051
1733.000	7915[illegible]1.562-17233188.750	9187675.500	14264.748	4831.671	-3481.317

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Table A-2a. Reconstructed Reentry Trajectory and Associated Parameters (BET) — Continued

1734.000	7525138.250-1722820.750	9184994.500	14102.701	4955.891	-2882.447
1735.000	7543183.437-1722257.500	9181124.125	13682.060	6531.665	-4426.279
1736.000	7561465.687-1721256.250	9176623.625	13409.634	6826.381	-4284.402
1737.000	7579976.937-1720093.000	9172776.750	13502.594	6076.415	-3427.662
1738.000	7598689.500-1718916.250	9169289.250	13682.323	5049.075	-3527.987
1739.000	7617472.187-1717955.375	9166134.500	13865.596	4516.272	-2602.872
1740.000	8011627.687-1715634.750	9163681.750	14288.622	2502.921	-2132.123
1741.000	8032279.125-1715536.250	9161923.750	13402.745	4579.219	-2965.004
1742.000	8052922.500-1716809.250	9157496.000	12227.640	4703.535	-2896.037
1743.000	8052935.812-1718248.500	9155169.250	13342.010	4562.538	-3024.773
1744.000	8065572.875-1717d043.250	9152280.875	13187.522	4648.674	-3098.705
1745.000	8078647.812-1717d725.500	9149136.750	12922.915	5391.873	-3129.590

Table A-2a. Reconstructed Reentry Trajectory and Associated Parameters (BET) — Continued

GT-7 BET TRACKER REENTRY

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189434.281	25534.1	24184.5	-1.231	98.053	245063.2	28.037	-83.815
1189435.281	25550.5	24201.4	-1.013	98.114	245113.7	28.027	-83.742
1189436.281	25531.6	24182.8	-1.160	98.220	244622.5	28.017	-83.668
1189437.281	25508.1	24158.7	-1.130	98.076	244166.0	28.007	-83.595
1189438.281	25504.5	24151.9	-1.257	98.303	243634.0	27.998	-83.522
1189439.281	25482.8	24133.2	-1.073	98.065	243051.2	27.988	-83.449
1189440.281	25472.5	24123.5	-1.266	98.336	242531.7	27.978	-83.376
1189441.281	25447.5	24098.1	-1.215	98.231	241963.0	27.968	-83.303
1189442.281	25447.5	24098.9	-1.143	98.307	241454.0	27.958	-83.230
1189443.281	25431.6	24083.0	-1.222	98.416	240866.0	27.948	-83.157
1189444.281	25414.4	24065.7	-1.206	98.429	240363.5	27.938	-83.084
1189445.281	25410.1	24061.2	-1.191	98.404	239827.5	27.927	-83.012
1189446.281	25410.6	24052.2	-1.158	98.567	239286.0	27.917	-82.939
1189447.281	25369.6	24021.1	-1.231	98.547	238716.7	27.907	-82.866
1189448.281	25370.0	24029.8	-1.180	98.653	238199.2	27.897	-82.794
1189449.281	25356.8	24010.4	-1.173	98.638	237648.0	27.887	-82.721
1189450.281	25318.2	23969.8	-1.258	98.636	237107.5	27.876	-82.649
1189451.281	25322.8	23974.5	-1.196	98.727	236548.0	27.866	-82.576
1189452.281	25305.9	23957.6	-1.171	98.736	236014.0	27.855	-82.504
1189453.281	25295.8	23947.5	-1.116	98.753	235480.5	27.845	-82.432
1189454.281	25275.8	23927.5	-1.169	98.824	234962.2	27.834	-82.359
1189455.281	25275.9	23927.7	-1.166	98.840	234426.5	27.824	-82.287
1189456.281	25254.8	23906.8	-1.079	98.886	233918.7	27.813	-82.215
1189457.281	25209.3	23861.2	-1.159	98.894	233371.2	27.803	-82.143
1189458.281	25206.4	23858.5	-1.145	98.991	232865.5	27.792	-82.071
1189459.281	25188.9	23821.1	-1.202	99.016	232321.2	27.781	-81.999
1189460.281	25163.9	23816.8	-1.083	99.047	231790.7	27.770	-81.927
1189461.281	25129.8	23782.8	-1.202	99.078	231209.7	27.759	-81.855

Table A-2a. Reconstructed Reentry Trajectory and Associated Parameters (BET) — Continued

GT-7 BET TRACKER REENTRY

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189462.281	25100.0	23752.5	-1.281	99.172	230749.5	27.749	-81.784
1189463.281	25096.4	23748.7	-1.156	99.169	230221.2	27.738	-81.712
1189464.281	25089.0	23721.3	-1.151	99.212	229711.0	27.727	-81.641
1189465.281	25054.5	23711.0	-1.135	99.261	229195.7	27.716	-81.569
1189466.281	25037.2	23689.7	-1.131	99.295	228699.0	27.705	-81.498
1189467.281	25018.7	23671.3	-1.122	99.340	228190.7	27.694	-81.427
1189468.281	25004.1	23656.8	-1.107	99.400	227689.0	27.683	-81.355
1189469.281	24971.3	23624.0	-1.099	99.423	227194.5	27.672	-81.284
1189470.281	24942.2	23595.0	-1.123	99.467	226696.7	27.661	-81.213
1189471.281	24927.5	23580.7	-1.114	99.496	226202.5	27.650	-81.142
1189472.281	24906.3	23559.1	-1.086	99.535	225716.2	27.638	-81.071
1189473.281	24897.6	23550.4	-1.060	99.558	225238.7	27.627	-81.000
1189474.281	24894.5	23547.4	-1.030	99.603	224773.5	27.616	-80.930
1189475.281	24860.5	23513.3	-1.086	99.612	224299.7	27.604	-80.859
1189476.281	24825.5	23478.5	-1.117	99.673	223864.7	27.593	-80.788
1189477.281	24818.4	23470.6	-.890	99.534	223396.5	27.582	-80.718
1189478.281	24773.5	23426.7	-1.142	99.754	222816.5	27.570	-80.647
1189479.281	24727.3	23380.5	-1.175	99.786	222351.5	27.559	-80.577
1189480.281	24716.4	23369.4	-1.126	99.769	221862.0	27.548	-80.507
1189481.281	24674.3	23327.5	-1.095	99.851	221369.5	27.536	-80.437
1189482.281	24722.5	23375.2	-1.081	99.766	220872.7	27.525	-80.367
1189483.281	24660.4	23313.4	-1.105	99.858	220398.2	27.513	-80.297
1189484.281	24572.9	23226.0	-1.035	99.910	219917.5	27.502	-80.227
1189485.281	24563.9	23217.2	-1.113	99.962	219420.5	27.490	-80.157
1189486.281	24556.5	23203.2	-1.058	99.913	218952.2	27.479	-80.087
1189487.281	24491.7	23144.8	-1.052	99.974	218457.2	27.467	-80.018
1189488.281	24434.5	23088.4	-1.120	100.084	217994.7	27.455	-79.949
1189489.281	24424.8	23077.8	-1.094	99.993	217512.0	27.444	-79.879

Table A-2a. Reconstructed Reentry Trajectory and Associated Parameters (BET) — Continued

G1-7 BET TRACKER REENTRY

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189490.281	24392.4	23045.5	-1.062	100.050	217035.C	27.432	-79.810
1189491.281	24367.4	23020.3	-1.084	100.024	216564.5	27.421	-79.741
1189492.281	24284.3	22938.2	-1.110	100.281	216116.7	27.409	-79.672
1189493.281	24266.5	22917.7	-1.066	100.138	215660.7	27.397	-79.604
1189494.281	24264.5	22917.4	-1.021	100.116	215159.7	27.386	-79.535
1189495.281	24210.9	22864.0	-1.035	100.165	214705.7	27.374	-79.466
1189496.281	24171.6	22824.9	-1.056	100.239	214229.7	27.362	-79.398
1189497.281	24117.8	22771.1	-1.038	100.259	213786.0	27.351	-79.330
1189498.281	24098.0	22756.9	-1.041	100.181	213340.7	27.339	-79.262
1189499.281	24056.8	22711.9	-1.046	100.279	212871.0	27.327	-79.193
11895CC.281	24026.7	22679.8	-1.062	100.282	212423.C	27.316	-79.126
11895C1.281	23985.0	22638.0	-1.072	100.304	211980.2	27.304	-79.058
1189502.281	23929.8	22582.2	-1.092	100.415	211536.5	27.292	-78.990
1189503.281	23912.3	22565.2	-1.065	100.326	211070.5	27.281	-78.923
1189504.281	23848.3	22501.5	-1.028	100.416	210633.2	27.269	-78.855
1189505.281	23787.1	22440.5	-1.021	100.500	210184.7	27.257	-78.788
1189506.281	23760.9	22413.9	-1.082	100.421	209746.5	27.245	-78.721
1189507.281	23717.2	22370.5	-1.057	100.498	209305.7	27.234	-78.654
1189508.281	23672.4	22325.5	-.988	100.506	208880.5	27.222	-78.587
1189509.281	23629.3	22282.5	-1.017	100.555	208440.0	27.210	-78.521
1189510.281	23585.8	22238.9	-1.003	100.539	208015.2	27.198	-78.454
1189511.281	23540.5	22193.9	-1.006	100.633	207591.2	27.187	-78.388
1189512.281	23511.3	22164.3	-.960	100.585	207174.7	27.175	-78.322
1189513.281	23457.9	22110.8	-.983	100.585	206737.7	27.163	-78.255
1189514.281	23413.2	22066.6	-1.025	100.697	206318.2	27.151	-78.189
1189515.281	23371.7	22024.7	-1.048	100.628	205920.7	27.139	-78.124
1189516.281	23334.3	21986.8	-1.071	100.555	205466.7	27.128	-78.058
1189517.281	23280.9	21914.5	-.978	100.800	205062.5	27.116	-77.993

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Table A-2a. Reconstructed Reentry Trajectory and Associated Parameters (BET) — Continued

GT-7 BET TRACKER REENTRY

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189518.281	23235.6	21066.8	-.965	100.723	204618.7	27.104	-77.927
1189519.281	23183.4	21836.6	-1.019	100.772	204221.2	27.092	-77.862
1189520.281	23134.0	21787.1	-1.068	100.786	203816.5	27.080	-77.797
1189521.281	23085.2	21719.5	-.906	100.915	203399.0	27.069	-77.732
1189522.281	23040.1	21699.9	-1.066	100.794	202929.0	27.057	-77.667
1189523.281	22981.4	21634.8	-.984	100.914	202495.7	27.045	-77.603
1189524.281	22936.8	21590.2	-1.159	100.902	202114.2	27.033	-77.538
1189525.281	22862.2	21510.1	-1.095	101.039	201727.0	27.021	-77.474
1189526.281	22803.3	21457.5	-.996	101.128	201201.0	27.009	-77.410
1189527.281	22760.2	21414.2	-1.111	101.105	200737.0	26.997	-77.346
1189528.281	22691.3	21345.5	-.929	101.178	200392.0	26.985	-77.283
1189529.281	22641.7	21295.4	-1.004	101.118	200056.0	26.973	-77.219
1189530.281	22614.3	21267.9	-1.077	101.097	199608.0	26.961	-77.156
1189531.281	22532.1	21186.2	-.981	101.233	199241.0	26.949	-77.093
1189532.281	22486.3	21140.7	-1.142	101.256	198827.2	26.937	-77.030
1189533.281	22404.4	21058.9	-.861	101.381	198487.0	26.926	-76.967
1189534.281	22343.5	20998.3	-.975	101.445	197903.0	26.914	-76.905
1189535.281	22437.4	21093.2	-2.750	101.364	197752.2	26.902	-76.843
1189536.281	22200.9	20854.9	-.711	101.356	197054.7	26.889	-76.780
1189537.281	22115.8	20770.8	-.473	101.568	196595.7	26.878	-76.718
1189538.281	22074.1	20729.1	-.685	101.585	196430.5	26.866	-76.657
1189539.281	22072.7	20727.2	-1.249	101.459	196036.2	26.854	-76.595
1189540.281	21948.2	20603.5	-.604	101.691	195617.2	26.841	-76.534
1189541.281	21947.6	20602.6	-1.380	101.583	195116.7	26.829	-76.473
1189542.281	21880.6	20534.7	-1.230	101.452	194880.5	26.818	-76.412
1189543.281	21733.9	20389.2	-.393	101.764	194366.7	26.806	-76.351
1189544.281	21769.0	20423.9	-1.517	101.635	193933.7	26.794	-76.290
1189545.281	21693.9	20289.4	-.824	101.824	193704.5	26.782	-76.230

Table A-2a. Reconstructed Reentry Trajectory and Associated Parameters (BET) — Continued

GT-7 BET TRACKER REENTRY

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189546.281	21627.7	20282.6	-1.339	101.566	193202.7	26.769	-76.170
1189547.281	21497.7	20153.5	-.433	101.956	193076.2	26.757	-76.110
1189548.281	21498.3	20152.8	-1.508	101.633	192954.2	26.745	-76.051
1189549.281	21421.2	20076.6	-1.327	101.841	192876.2	26.734	-75.991
1189550.281	21353.2	20008.8	-1.426	101.900	191802.7	26.722	-75.932
1189551.281	21187.8	19843.3	-.387	101.961	191172.5	26.710	-75.873
1189552.281	21103.3	19757.9	.223	101.835	190997.5	26.698	-75.814
1189553.281	21184.4	19840.1	-2.132	101.872	190714.7	26.686	-75.756
1189554.281	21083.8	19740.0	-1.833	102.027	190040.7	26.674	-75.697
1189555.281	20913.7	19569.6	-.398	102.006	189932.0	26.662	-75.639
1189556.281	20971.6	19629.8	-2.389	102.340	189271.0	26.650	-75.581
1189557.281	20706.8	19362.9	.757	102.172	188897.7	26.638	-75.523
1189558.281	20794.9	19451.2	-1.561	102.168	188111.2	26.626	-75.466
1189559.281	20678.5	19332.1	-1.055	101.747	188182.5	26.614	-75.409
1189560.281	20567.7	19224.6	-.847	102.379	187577.2	26.602	-75.352
1189561.281	20557.2	19213.3	-1.785	102.154	186621.0	26.591	-75.295
1189562.281	20407.6	19064.0	-.848	102.421	186538.7	26.579	-75.238
1189563.281	20440.1	19096.3	-2.093	102.162	186129.5	26.567	-75.182
1189564.281	20256.3	18915.3	-.989	102.462	186125.2	26.555	-75.126
1189565.281	20199.2	18859.1	-1.551	102.923	185386.0	26.543	-75.070
1189566.281	20125.7	18781.5	-1.209	102.248	184858.0	26.532	-75.015
1189567.281	20152.8	18810.0	-2.689	102.296	184290.5	26.520	-74.959
1189568.281	20048.7	18705.2	-2.290	102.269	184244.5	26.509	-74.904
1189569.281	19821.0	18475.5	.293	102.120	184053.0	26.497	-74.850
1189570.281	19914.7	18569.3	-2.714	101.869	183239.2	26.486	-74.795
1189571.281	19749.4	18406.2	-1.569	102.487	183055.7	26.474	-74.741
1189572.281	19567.9	18225.7	-.405	102.775	182693.2	26.463	-74.687
1189573.281	19558.6	18413.8	-3.876	101.700	181329.5	26.452	-74.632

Table A-2a. Reconstructed Reentry Trajectory and Associated Parameters (BET) — Continued

GT-7 BET TRACKER REENTRY

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189574.281	19315.7	17974.8	2.239	102.840	181927.7	26.440	-74.579
1189575.281	19364.6	18017.8	-.224	102.095	181118.0	26.429	-74.526
1189576.281	19352.6	18009.8	-2.380	102.509	180820.7	26.418	-74.472
1189577.281	19264.4	17962.5	-1.702	102.800	180555.2	26.406	-74.420
1189578.281	19221.3	17871.4	-1.424	101.387	180188.2	26.395	-74.367
1189579.281	19147.0	17798.9	-2.004	101.666	180010.0	26.384	-74.315
1189580.281	18946.5	17603.4	-.777	102.719	178831.5	26.373	-74.262
1189581.281	18919.2	17575.3	-1.628	102.505	177502.0	26.362	-74.210
1189582.281	18761.3	17411.6	.697	101.547	178158.5	26.351	-74.159
1189583.281	18809.8	17474.9	-3.053	103.842	178499.2	26.339	-74.108
1189584.281	18577.7	17230.9	.242	102.143	177298.7	26.329	-74.057
1189585.281	18670.1	17326.2	-2.961	102.345	177854.0	26.318	-74.006
1189586.281	18651.6	17308.0	-4.005	102.125	176871.0	26.307	-73.956
1189587.281	18651.8	17302.7	-4.485	100.887	175652.2	26.297	-73.905
1189588.281	18365.8	17014.4	-.358	101.326	175628.2	26.286	-73.855
1189589.281	18039.2	16696.9	2.860	102.702	175830.7	26.276	-73.805
1189590.281	18217.0	16871.0	-1.006	102.353	176047.0	26.264	-73.756
1189591.281	18013.3	16662.3	-1.044	101.430	174552.5	26.254	-73.706
1189592.281	17743.6	16396.9	3.611	101.745	174790.2	26.245	-73.657
1189593.281	17861.1	16543.7	-2.521	103.512	175441.2	26.234	-73.609
1189594.281	17516.2	16171.8	2.912	102.387	174336.7	26.223	-73.560
1189595.281	17775.9	16429.9	-3.537	101.957	174034.5	26.213	-73.512
1189596.281	17756.0	16420.3	-5.906	102.927	172849.7	26.203	-73.465
1189597.281	17536.0	16191.0	-2.289	102.459	171836.5	26.192	-73.417
1189598.281	17198.4	15857.6	1.858	103.235	171409.0	26.182	-73.370
1189599.281	17350.1	16002.1	-3.345	101.684	171212.0	26.172	-73.323
1189600.281	17090.7	15746.2	.166	102.773	171077.7	26.162	-73.277
1189601.281	16955.4	15614.0	.620	103.305	170622.7	26.152	-73.230

Table A-2a. Reconstructed Reentry Trajectory and Associated Parameters (BET) — Continued

GT-7 BET TRACKER REENTRY

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189602.281	17339.4	16004.2	-7.989	101.938	169996.0	26.141	-73.184
1189603.281	16970.2	15631.2	-4.701	102.923	168211.7	26.131	-73.138
1189604.281	17032.7	15696.7	-3.514	102.763	166825.0	26.121	-73.093
1189605.281	16696.3	15360.9	3.416	103.910	167237.2	26.110	-73.048
1189606.281	16561.7	15244.3	-3.419	103.580	166608.7	26.100	-73.003
1189607.281	16438.8	15095.1	-.069	102.974	166389.2	26.091	-72.958
1189608.281	16430.2	15085.2	-3.891	102.881	165584.0	26.080	-72.914
1189609.281	16338.0	14995.4	-3.431	102.737	164415.0	26.070	-72.870
1189610.281	16167.1	14824.6	-.706	103.090	163763.0	26.061	-72.826
1189611.281	16035.6	14692.7	-2.428	102.912	162875.5	26.051	-72.783
1189612.281	16229.2	14898.7	-6.431	103.672	161219.0	26.041	-72.740
1189613.281	15779.9	14443.4	.624	104.161	160405.7	26.030	-72.697
1189614.281	15576.1	14236.2	1.657	103.548	160651.7	26.020	-72.655
1189615.281	15602.0	14261.9	-.954	103.608	160475.2	26.010	-72.613
1189616.281	15372.8	14028.7	.235	102.986	160074.2	26.001	-72.572
1189617.281	15256.6	13987.2	-.129	102.070	160046.0	25.992	-72.531
1189618.281	15764.1	14471.8	-7.676	104.414	159041.2	25.982	-72.489
1189619.281	15645.2	14321.2	-8.750	103.493	156160.5	25.972	-72.448
1189620.281	15198.4	13854.7	-5.088	102.031	154744.2	25.962	-72.407
1189621.281	15103.9	13777.9	-2.458	105.568	154853.2	25.952	-72.368
1189622.281	14816.8	13468.2	1.723	102.107	153900.5	25.943	-72.328
1189623.281	14662.0	13346.6	9.672	104.250	155310.7	25.934	-72.289
1189624.281	14474.6	13132.5	.280	103.378	155953.7	25.925	-72.250
1189625.281	14334.6	12985.4	-.195	102.867	155856.2	25.916	-72.212
1189626.281	14421.3	13080.4	.253	103.592	156207.5	25.907	-72.174
1189627.281	14522.1	12961.9	-.352	103.724	157204.2	25.897	-72.136
1189628.281	14348.1	13002.4	-3.192	102.453	156668.5	25.888	-72.098

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Table A-2b. Reconstructed Reentry Trajectory and Associated Parameters (7:18 Radar)

GEMINI GUIDANCE ANALYSIS PROGRAM 01/10/66
NASA • MANNED SPACECRAFT CENTER

ECIG COORDINATES
(GUIDANCE TIME BASE)

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
711.000	6294132.250-17861666.750		9266236.875	15570.862	2629.238	-4049.121
712.000	6311213.000-17858444.500		9262978.875	17141.559	2331.898	-3053.877
713.000	6328094.187-17853789.750		9259465.625	16517.355	5600.880	-3830.688
714.000	6344116.437-17848611.000		9255469.875	16694.507	5227.332	-3614.112
715.000	6360666.875-17843229.000		9251765.750	15645.093	3701.231	-3886.600
716.000	6377023.000-17839805.750		9248339.500	16604.913	5466.207	-3604.514
717.000	6393061.500-17834555.000		9244464.250	15410.116	4967.872	-4066.531
718.000	6409066.250-17830045.250		9240837.125	17433.083	2025.040	-2536.235
719.000	6425690.875-17826478.000		9237668.250	15831.038	4835.181	-3731.163
720.000	6441056.562-17821594.500		9233758.375	14862.729	4685.149	-4140.317
721.000	6456643.250-17816581.500		9229950.500	15930.364	5221.491	-3623.633
722.000	6473047.062-17812712.750		9226754.000	16091.720	2964.840	-3151.042
723.000	6488594.687-17808066.750		9223109.625	15047.003	4817.238	-3743.460
724.000	6503992.937-17804041.500		9219612.375	15072.743	4549.247	-3761.125
725.000	6518964.250-17799217.750		9215790.000	15192.696	4985.419	-3695.328
726.000	6533979.937-17794324.000		9212040.250	14299.905	4427.810	-3953.870
727.000	6549756.500-17789581.500		9208794.125	15789.593	3251.476	-3015.569
728.000	6564348.750-17785359.250		9205632.000	14804.592	3640.555	-3454.540
729.000	6579601.000-17781328.000		9201699.000	15016.327	2819.703	-3166.610
730.000	6594382.750-17776718.750		9198115.000	13663.394	4165.233	-3938.483
731.000	6609019.312-17772055.250		9194519.875	13897.064	4106.735	-3767.698
732.000	6623680.937-17767290.750		9190969.750	14476.175	4589.113	-3571.808
733.000	6638154.062-17763399.750		9187574.125	15064.974	3962.778	-3152.582
734.000	6652562.625-17758984.750		9184107.125	15199.354	3219.802	-2901.747
735.000	6667091.625-17754746.750		9180768.000	13694.773	4273.363	-3634.368
736.000	6681477.375-17751045.250		9177550.875	15111.296	1984.757	-2551.009
737.000	6695594.125-17746674.000		9174136.375	14195.778	4567.122	-3396.844
738.000	6709449.500-17742196.750		9170664.375	14279.510	4738.315	-3343.684
739.000	6723242.625-17737737.500		9167217.625	13886.953	4610.464	-3440.285
740.000	6737176.625-17733171.500		9163853.750	13415.388	4282.357	-3476.829
741.000	6750692.562-17728818.000		9160450.250	13528.044	4423.822	-3406.839
742.000	6764245.000-17724660.000		9157154.750	13136.025	2697.908	-3099.161
743.000	6777690.562-17720771.500		9153936.125	13928.605	4561.916	-3189.924

Table A-2b. Reconstructed Reentry Trajectory and Associated Parameters (7:18 Radar) — Continued

744.000	6790921.562-17716515.500	9150610.375	13040.264	4104.586	-3340.456
745.000	6804194.750-17712197.250	9147349.125	13031.167	4236.450	-3311.256
746.000	6817177.062-17708006.250	9144078.375	13073.495	4166.152	-3219.511
747.000	6830133.187-17703873.750	9140874.250	13191.040	4246.600	-3146.163
748.000	6842939.625-17699754.500	9137683.000	13339.369	4511.102	-3098.912
749.000	6855649.187-17695669.750	9134521.250	11945.829	3598.074	-3235.061
750.000	6868497.875-17691501.750	9131427.875	12688.097	4137.918	-3118.256
751.000	6880853.312-17687514.750	9128289.875	12377.045	3867.442	-3063.740
752.000	6893277.437-17683578.500	9125245.250	12206.512	3948.571	-3094.285
753.000	6905512.250-17679677.250	9122205.125	12219.815	4018.291	-3057.309
754.000	6917787.187-17675701.000	9119206.750	12151.980	3958.485	-3004.774
755.000	6929808.937-17671637.750	9116173.875	11860.242	3976.186	-3019.343
756.000	6941767.562-17667648.500	9113193.125	11386.033	4942.672	-3354.928
757.000	6953305.750-17663490.250	9110122.000	11929.788	3913.365	-2901.962
758.000	6965003.875-17659740.500	9107249.500	11437.845	3659.064	-2871.342
759.000	6976441.375-17655805.500	9104313.250	11229.013	3523.382	-2847.494
760.000	6987725.062-17651843.000	9101389.250	11382.023	3699.461	-2818.205

Table A-2b. Reconstructed Reentry Trajectory and Associated Parameters (7:18 Radar) — Continued

GEMINI GUIDANCE ANALYSIS PROGRAM 01/10/66
NASA • MANNED SPACECRAFT CENTER

ECIG COORDINATES
(GUIDANCE TIME BASE)

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
761.000	6999058.000-17648194.500	9099610.875	11339.513	3618.221	-2738.320
762.000	7009666.250-17643121.000	9095343.750	10799.416	3078.490	-2650.270
763.000	7020529.312-17639724.500	9092636.250	11065.107	3455.477	-2657.079
764.000	7031718.000-17636161.000	9090002.375	11692.402	3777.715	-2575.623
765.000	7042463.812-17633082.250	9087462.125	10560.751	2870.210	-2501.991
766.000	7053182.812-17629755.000	9084895.625	10650.747	3416.471	-2578.553
767.000	7063759.250-17626334.750	9082325.625	10724.228	3511.290	-2544.546
768.000	7073894.937-17622680.250	9079649.625	9672.256	5313.989	-3219.020
769.000	7083568.750-17618974.000	9076995.375	10214.187	3197.573	-2456.603
770.000	7093836.875-17615250.250	9074350.625	9556.065	4406.149	-2882.509
771.000	7103769.687-17611680.750	9071793.000	10485.687	3404.826	-2402.055
772.000	7113560.875-17608587.500	9069415.500	9624.756	3106.671	-2376.993
773.000	7123420.187-17605157.750	9066978.125	9443.095	3218.006	-2425.424
774.000	7132408.187-17601029.250	9064236.250	9286.866	3966.993	-2622.942
775.000	7141477.937-17597270.500	9061664.125	9492.061	3380.009	-2383.397
776.000	7151066.312-17594163.000	9059401.000	9590.620	3035.309	-2216.733
777.000	7160063.437-17591338.750	9057197.625	9069.582	3037.978	-2251.964
778.000	7169057.000-17587642.750	9054813.875	9042.083	3066.251	-2233.250
779.000	7177676.500-17583869.750	9052258.375	8573.590	5039.106	-2880.942
780.000	7186230.062-17580277.500	9049858.625	8992.885	2988.208	-2127.292
781.000	7195072.000-17577456.000	9047783.875	8495.600	2690.599	-2064.183
782.000	7203195.937-17573972.250	9045446.375	8338.450	2660.459	-2019.547
783.000	7211615.062-17571220.750	9043414.250	7667.213	2363.311	-1953.256
784.000	7220003.937-17567949.500	9041228.500	8212.405	2644.980	-1965.792
785.000	7228223.562-17565318.750	9039278.500	8224.336	2608.464	-1926.606
786.000	7236229.125-17562778.000	9037373.125	8195.689	2635.501	-1907.252
787.000	7243473.750-17558573.250	9035068.000	7875.510	2286.670	-1799.776
788.000	7251555.312-17556347.750	9033140.625	8600.491	2791.541	-1896.137
789.000	7258567.750-17553675.250	9031214.000	7943.756	3217.048	-2057.614
790.000	7266067.125-17550528.000	9029180.750	7097.045	6169.742	-3094.068
791.000	7273555.125-17547348.750	9027152.500	8442.627	2801.737	-1832.306
792.000	7280857.000-17544279.500	9025183.875	7381.272	2189.711	-1643.114
793.000	7287898.312-17541435.500	9023303.125	5741.835	5720.139	-2939.464

Table A-2b. Reconstructed Reentry Trajectory and Associated Parameters (7:18 Radar) — Continued

794.000	7294632.937-17538512.500	9021406.625	7896.803	2457.336	-1680.151
795.000	7301191.437-17535957.000	9019666.000	6501.102	3855.115	-2201.486
796.000	7307995.000-17532776.000	9017724.750	6691.896	2875.968	-1821.915
797.000	7313990.687-17529423.500	9015716.125	6504.957	2267.745	-1577.544
798.000	7320574.437-17526593.500	9013943.250	6359.295	2930.274	-1791.307
799.000	7326876.500-17524318.000	9012385.375	6163.479	1962.278	-1452.014
800.000	7332886.875-17520948.750	9010439.250	5605.582	4893.831	-2511.139
801.000	7338654.250-17517585.750	9008653.750	6751.737	2207.334	-1460.363
802.000	7344863.562-17515988.250	9007266.875	6580.329	2052.396	-1400.756
803.000	7350445.312-17513161.250	9005577.875	5524.080	1827.593	-1313.766
804.000	7356209.375-17510551.250	9003986.125	5438.629	2563.419	-1573.872
805.000	7361837.500-17507621.000	9002296.750	5311.051	2009.907	-1335.932
806.000	7367305.375-17505904.500	9001076.250	5657.395	1841.804	-1248.381
807.000	7372577.812-17503561.500	8999645.500	4733.688	2774.478	-1606.304
808.000	7377715.312-17500975.750	8998138.125	5874.715	2707.347	-1546.697
809.000	7382518.500-17498009.500	8996501.375	5879.272	1680.124	-1137.248
810.000	7387968.562-17496219.000	8995322.000	5668.638	1964.178	-1230.723

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Table A-2b. Reconstructed Reentry Trajectory and Associated Parameters (7:18 Radar) — Continued

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ECIG COORDINATES
(GUIDANCE TIME BASE)

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
811.000	7393113.375-17494295.750	8994123.500	4810.519	1474.730	-1020.074
812.000	7397860.250-17491239.500	8992492.500	4865.122	1552.587	-1034.138
813.000	7402432.750-17489772.250	8991505.875	4761.449	1494.152	-995.627
814.000	7407003.062-17487600.500	8990251.875	5141.062	1908.725	-1155.194
815.000	7411531.625-17485194.000	8988913.875	4802.546	1861.326	-1119.360
816.000	7416084.187-17482980.250	8987672.750	4479.395	1678.504	-1016.162
817.000	7420242.250-17481192.750	8986625.500	3849.147	3097.712	-1550.540
818.000	7424665.812-17478505.750	8985382.750	3961.061	1126.404	-765.360
819.000	7428718.062-17476813.000	8984231.125	4380.422	1420.482	-874.491
820.000	7432636.750-17474532.750	8983024.750	3246.652	1086.921	-693.895
821.000	7436191.062-17472010.000	8981742.375	3067.426	1123.164	-693.176
822.000	7440317.437-17470425.750	8980834.625	3290.054	1787.285	-951.581
823.000	7444061.687-17468779.250	8979926.875	4011.136	1988.063	-1057.921
824.000	7447685.500-17466410.750	8978734.875	4106.871	2523.936	-1271.158
825.000	7451202.937-17464000.250	8977529.000	2507.752	1794.039	-893.492
826.000	7454366.125-17461430.250	8976295.875	2995.437	1033.858	-598.252
827.000	7457880.500-17459636.000	8975369.750	2643.372	2420.765	-1139.175
828.000	7461146.187-17457457.500	8974318.625	3339.749	3840.153	-1751.423
829.000	7464056.500-17455560.750	8973381.125	3342.736	1135.411	-616.565
830.000	7467213.687-17454044.500	8972617.125	2990.221	973.972	-533.064
831.000	7470462.375-17452094.500	8971676.250	3996.851	1305.943	-717.124
832.000	7473571.562-17450456.750	8970874.875	3294.854	1102.206	-580.697
833.000	7476614.625-17448375.750	8969905.250	2829.306	819.635	-427.950
834.000	7479867.187-17447215.000	8969322.875	3004.543	1048.866	-510.422
835.000	7482758.750-17445417.750	8968479.875	619.020	4666.305	-1924.547
836.000	7484008.250-17440723.500	8966495.875	4809.397	-1385.824	408.145
837.000	7488425.062-17443346.500	8967463.875	3306.951	-497.391	128.742
838.000	7491412.687-17441668.500	8966689.750	2009.989	6639.251	-2813.115
839.000	7492745.812-17438002.000	8965159.875	5463.789	-2346.523	840.481
840.000	7496181.500-17438860.500	8965454.875	4736.840	-3549.997	1397.714
841.000	7498853.875-17436601.000	8964458.125	1471.428	6966.046	-2921.046
842.000	7499820.625-17432924.750	8962949.625	2395.147	1272.068	-539.981
843.000	7503219.062-17431857.000	8962443.625	1876.179	621.623	-229.718

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Table A-2b. Reconstructed Reentry Trajectory and Associated Parameters (7:18 Radar) — Continued

844.000	7505520.187-17431105.250	8962122.375	1409.518	489.163	-127.334
845.000	7507477.687-17428062.000	8960829.250	2196.900	667.645	-255.322
846.000	7509632.937-17427275.000	8960525.875	1653.883	310.085	-43.668
847.000	7511438.187-17423630.250	8958587.250	2076.594	528.630	-205.616
848.000	7513376.375-17423319.000	8958915.250	2211.942	883.577	-325.436
849.000	7516036.750-17422350.750	8958502.250	2634.996	960.158	-404.350
850.000	7517660.500-17421027.250	8958003.875	1521.038	5322.622	-2302.374
851.000	7521256.437-17420997.500	8957954.125	1701.402	116.547	20.357
852.000	7521990.500-17419158.500	8957292.250	1864.083	822.189	-271.242
853.000	7524573.562-17417908.000	8956781.125	609.206	2995.024	-1146.702
854.000	7526201.687-17416554.250	8956286.000	2134.803	2182.686	-901.650
855.000	7527987.875-17414430.250	8955411.875	1345.300	571.975	-148.086
856.000	7530156.000-17413668.250	8955148.125	1453.345	666.031	-192.376
857.000	7532375.062-17412852.750	8954850.000	1190.619	551.249	-104.322
858.000	7534009.125-17412243.500	8954689.250	2739.187	970.264	-402.922
859.000	7536301.250-17411247.500	8954305.000	1043.299	935.919	-263.232
860.000	7538025.000-17409187.500	8953480.625	-1057.470	6244.589	-2469.960

Table A-2b. Reconstructed Reentry Trajectory and Associated Parameters (7:18 Radar) — Continued

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ECIG COORDINATES
(GUIDANCE TIME BASE)

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
861.000	7539066.250-17405215.500	8951855.500	5804.520	1251.179	-754.677
862.000	7540304.125-17403598.000	8951247.625	475.015	2243.845	-856.737
863.000	7543053.687-17406732.250	8952698.125	-607.290	5306.289	-2134.959
864.000	7543537.125-17402669.000	8951051.500	3769.649	-3436.815	1511.296
865.000	7546558.875-17403239.250	8951356.750	2612.732	-2458.842	1157.763
866.000	7550165.937-17405335.750	8952274.500	-1213.811	6284.215	-2527.286
867.000	7548024.437-17397760.500	8949238.500	775.806	1603.215	-581.448
868.000	7549072.062-17396770.250	8948956.875	1365.200	159.333	43.096
869.000	7550078.750-17392185.750	8947022.250	2884.079	-4938.476	2315.269
870.000	7551764.125-17393049.750	8947531.500	-151.891	5404.937	-2277.705
871.000	7553348.250-17391055.750	8946770.625	1920.828	-1056.504	608.425
872.000	7557026.375-17394161.000	8948175.250	1829.041	144.010	14.021
873.000	7557450.562-17391265.500	8947061.375	918.946	3454.229	-1407.873
874.000	7557489.187-17386103.000	8944935.375	1011.297	1722.685	-654.825
875.000	7559879.312-17387769.250	8945808.125	4605.414	-1634.725	649.388
876.000	7561221.687-17385955.000	8945111.125	975.133	1834.270	-651.822
877.000	7561863.687-17382034.250	8943504.125	1214.614	-4871.470	2452.939
878.000	7433862.562-17427575.250	8966673.750	-2797701.719	-1010089.836	352162.617
879.000	7565201.625-17382674.500	8944068.750	1290.755	536.563	-93.268
880.000	7566990.875-17381634.250	8943714.250	856.815	1588.181	-590.624
881.000	7568760.062-17380503.500	8943313.000	1434.570	497.148	-96.753
882.000	7570604.187-17380289.750	8943357.000	3679.482	-1299.433	590.771
883.000	7572301.000-17380686.000	8943681.875	2152.609	-1562.853	834.108
884.000	7572031.500-17376422.000	8941956.500	-411.407	4575.316	-1884.741
885.000	7574041.187-17375236.250	8941529.750	2936.561	-2386.539	1108.641
886.000	7576508.937-17377559.000	8942692.000	452.028	2233.776	-830.731
887.000	7576080.250-17373034.250	8940884.875	105.646	3089.658	-1153.136
888.000	7577558.687-17372881.250	8941004.250	7435.217	-14439.009	6516.255
889.000	7579157.125-17371164.250	8940345.875	6102.052	-9974.014	4598.382
890.000	7581137.375-17370795.250	8940314.750	1116.454	438.562	12.410
891.000	7582765.437-17371267.000	8940686.125	1158.127	355.211	-25.687
892.000	7583772.250-17370029.500	8940285.250	-5585.250	16385.601	-6989.375
893.000	7584220.125-17367154.750	8939192.125	2170.511	-1995.819	1048.285

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Table A-2b. Reconstructed Reentry Trajectory and Associated Parameters (7:18 Radar) — Continued

894.000	7566929.000-17365664.500	8940530.375	-393.256	5879.991	-2528.933
895.000	7586437.062-17363392.250	8937784.625	-138.020	3631.539	-1399.757
896.000	7567946.375-17362437.250	8937454.750	-707.284	8105.334	-3487.502
897.000	7589302.187-17362276.750	8937587.625	7442.894	-14266.195	6417.975
898.000	7551900.187-17364652.000	8938677.375	3.014	3512.883	-1346.227
899.000	7593664.187-17365248.250	8935212.750	2076.932	-1367.166	772.234
900.000	7593568.187-17361227.750	8937612.250	777.694	1623.339	-506.708
901.000	7555066.187-17356457.250	8936488.675	-1336.396	6560.258	-2700.584
902.000	7556367.500-17357990.750	8936447.000	3356.766	-4781.133	2294.156
903.000	7557921.312-17358330.750	8936799.250	691.173	1806.898	-603.082
904.000	7559148.500-17357818.750	8936744.000	1151.698	384.988	26.092
905.000	7555826.375-17356020.750	8936149.375	1934.949	-1056.297	579.255
906.000	7601741.625-17356586.750	8936777.675	1316.801	749.935	-92.133
907.000	7602774.937-17355899.000	8936507.125	2283.397	-1377.369	828.908
908.000	7603936.562-17354671.000	8936216.000	1277.079	2463.842	-958.926
909.000	7605466.937-17353823.500	8935915.750	1360.332	539.059	-47.314
910.000	7606757.437-17353260.250	8935870.000	1370.342	610.216	-56.184

Table A-2b. Reconstructed Reentry Trajectory and Associated Parameters (7:18 Radar) — Continued

GEMINI GUIDANCE ANALYSIS PROGRAM 01/10/66
NASA • MANNED SPACECRAFT CENTER

ECIG COORDINATES
(GUIDANCE TIME BASE)

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
911.000	7608168.812-17352675.000	8935799.500	1909.158	758.635	-171.532
912.000	7609803.250-17352011.000	8935662.500	1329.934	521.243	-38.666
913.000	7611135.937-17351458.000	8935625.750	1294.665	530.623	-75.527
914.000	7612765.187-17350826.000	8935502.500	1811.692	729.631	-185.788
915.000	7614023.875-17350237.750	8935437.375	1341.801	551.636	-55.454
916.000	7615258.437-17349686.500	8935366.750	1192.376	511.153	-45.343
917.000	7616520.625-17349140.250	8935348.875	826.579	1570.375	-526.555
918.000	7617300.500-17347771.750	8934949.000	1352.981	528.444	-95.242
919.000	7618735.500-17347724.250	8935140.125	1412.136	173.858	116.909
920.000	7620147.437-17347406.250	8935197.375	1739.771	210.639	23.645
921.000	7622050.000-17346754.750	8935062.375	1354.779	605.673	-66.600
922.000	7623292.937-17346257.500	8935045.875	1166.155	552.712	-30.094
923.000	7624059.000-17345871.500	8935111.250	1345.734	576.327	-50.991
924.000	7626565.312-17344909.000	8934807.750	4566.441	1617.209	-815.573
925.000	7628235.875-17344238.000	8934684.375	1033.808	448.671	50.008
926.000	7629118.375-17343819.500	8934732.875	743.125	372.699	143.360
927.000	7629125.375-17343692.000	8935002.125	822.209	419.003	85.152
928.000	7630324.000-17343168.750	8934990.125	1314.778	558.737	-29.627
929.000	7632737.062-17342376.250	8934793.250	2811.283	700.301	-150.651
930.000	7635070.562-17341484.000	8934496.625	715.502	364.765	93.571
931.000	7635966.437-17341073.750	8934651.875	1244.990	565.359	91.627
932.000	7636866.312-17340696.250	8934627.000	904.149	417.866	53.113
933.000	7637468.812-17340322.250	8934814.750	-4175.956	-1147.561	1285.665
934.000	7637088.437-17340285.750	8935180.375	3476.415	1245.237	-569.582
935.000	7640652.437-17338972.250	8934566.875	1680.582	683.454	-111.370
936.000	7642085.750-17338375.500	8934552.375	940.972	542.592	83.170
937.000	7644178.687-17337564.750	8934396.375	2218.135	860.562	-188.425
938.000	7644653.187-17337262.500	8934575.625	612.460	377.489	37.820
939.000	7643951.437-17337214.000	8934929.125	-92.823	474.279	139.012
940.000	7643762.562-17337069.000	8935274.250	1362.816	400.991	152.172
941.000	7644807.750-17336598.500	8935441.125	1016.338	96.188	361.861
942.000	7646056.375-17336344.500	8935606.000	1243.060	46.702	-1060.449

Table A-2b. Reconstructed Reentry Trajectory and Associated Parameters (7:18 Radar) — Continued

GT-7 RE-ENTRY RADAR 7.18

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189594.281	16302.1	14989.7	2.255	107.217	171463.5	26.224	-73.559
1189595.281	17566.9	16239.2	5.928	104.202	172402.5	26.213	-73.511
1189596.281	17856.7	16510.4	-4.714	101.493	171967.5	26.203	-73.463
1189597.281	17863.2	16513.9	-3.172	101.446	170633.2	26.193	-73.416
1189598.281	16540.1	15209.7	-.405	104.953	169437.7	26.183	-73.367
1189599.281	17849.2	16499.0	-3.804	101.114	169959.0	26.172	-73.322
1189600.281	16694.0	15358.5	-4.511	103.497	168655.2	26.162	-73.275
1189601.281	17732.6	16405.2	8.025	103.266	168109.5	26.151	-73.229
1189602.281	16968.3	15625.0	-3.035	102.658	168763.2	26.141	-73.182
1189603.281	16124.3	14794.3	-4.386	104.424	167604.0	26.131	-73.137
1189604.281	17151.4	15804.1	-3.746	101.749	166445.0	26.121	-73.092
1189605.281	16663.2	15328.7	3.636	103.986	166814.7	26.110	-73.046
1189606.281	16236.7	14896.4	-3.795	102.982	166047.2	26.100	-73.001
1189607.281	16187.3	14848.8	-2.963	103.506	165852.7	26.090	-72.957
1189608.281	16411.2	15068.5	-3.937	102.562	164722.2	26.080	-72.914
1189609.281	15483.1	14153.0	-3.827	104.599	163591.0	26.070	-72.870
1189610.281	16400.5	15060.4	2.953	103.282	163394.2	26.060	-72.825
1189611.281	15632.1	14296.4	.110	104.276	162413.5	26.050	-72.783
1189612.281	15603.5	14273.5	3.404	104.765	162269.2	26.040	-72.740
1189613.281	14817.2	13491.9	-3.703	105.346	161427.0	26.030	-72.697
1189614.281	14972.9	13642.7	-2.867	104.817	160500.5	26.021	-72.655
1189615.281	15600.6	14259.9	-3.222	103.153	159528.5	26.011	-72.613
1189616.281	15893.3	14548.0	.111	102.788	159312.0	26.001	-72.572
1189617.281	15805.3	14464.8	2.975	103.264	158620.2	25.992	-72.531
1189618.281	14799.2	13465.3	-3.297	104.206	158170.5	25.982	-72.489
1189619.281	15453.1	14130.0	7.468	104.382	158197.7	25.972	-72.449
1189620.281	15294.4	13950.9	-3.053	102.783	157500.7	25.963	-72.408
1189621.281	15412.2	14066.4	-3.341	102.308	156617.0	25.953	-72.369

Table A-2b. Reconstructed Reentry Trajectory and Associated Parameters (7:18 Radar) — Continued

GT-7 RE-ENTRY RADAR 7.18

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189622.281	15031.3	13689.7	-3.612	102.956	155750.5	25.944	-72.329
1189623.281	14505.2	13168.5	-3.268	103.831	154885.7	25.935	-72.289
1189624.281	14635.1	13295.3	-3.405	103.311	154059.5	25.926	-72.250
1189625.281	13763.7	12439.2	2.502	105.745	153466.2	25.917	-72.212
1189626.281	14999.8	13652.8	-2.837	102.269	153108.7	25.907	-72.174
1189627.281	14073.2	12736.2	-2.848	103.878	152336.2	25.898	-72.136
1189628.281	14096.9	12758.2	-3.216	103.538	151563.2	25.889	-72.098
1189629.281	14093.9	12753.3	-2.720	103.354	150808.2	25.880	-72.061
1189630.281	14210.4	12867.1	-2.651	102.927	150132.5	25.872	-72.024
1189631.281	14418.5	13071.8	-3.167	102.246	149434.5	25.863	-71.988
1189632.281	12888.5	11558.7	-2.351	104.994	148755.2	25.854	-71.952
1189633.281	13705.2	12363.9	-2.886	103.212	148090.5	25.846	-71.915
1189634.281	13324.2	11985.1	-2.289	103.658	147406.2	25.837	-71.881
1189635.281	13197.1	11858.7	-2.871	103.673	146836.0	25.828	-71.845
1189636.281	13221.9	11881.8	-2.995	103.401	146243.5	25.820	-71.811
1189637.281	13128.9	11788.3	-2.756	103.359	145628.2	25.812	-71.776
1189638.281	12868.2	11529.2	-3.301	103.475	144849.5	25.804	-71.742
1189639.281	12858.0	11528.3	-8.252	102.876	144142.7	25.795	-71.708
1189640.281	12886.3	11544.3	-2.664	103.164	143124.7	25.787	-71.676
1189641.281	12347.4	11009.0	-2.446	103.748	142595.5	25.779	-71.643
1189642.281	12108.4	10771.7	-2.202	104.038	141804.7	25.772	-71.610
1189643.281	12295.5	10955.5	-2.528	103.490	140952.2	25.764	-71.579
1189644.281	12213.7	10872.5	-2.056	103.370	140450.0	25.756	-71.547
1189645.281	11538.1	10203.4	-.641	104.439	138315.2	25.749	-71.516
1189646.281	11892.7	10552.2	-1.701	103.510	137905.0	25.741	-71.486
1189647.281	12554.6	11206.5	-1.695	102.321	137509.2	25.734	-71.454
1189648.281	11226.2	9891.3	.249	104.428	137418.2	25.726	-71.425
1189649.281	11478.7	10137.9	-2.025	103.431	137105.5	25.719	-71.395

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Table A-2b. Reconstructed Reentry Trajectory and Associated Parameters (7:18 Radar) — Continued

GT-7 RE-ENTRY RADAR 7.18

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189650.281	11567.8	10224.7	-2.177	103.052	136671.5	25.712	-71.366
1189651.281	11495.8	10184.8	-13.005	102.012	135854.5	25.704	-71.338
1189652.281	10981.3	9641.4	-1.557	103.595	134988.2	25.698	-71.310
1189653.281	10910.6	9583.9	-9.015	102.747	134048.2	25.691	-71.282
1189654.281	11283.3	9938.3	-1.754	102.792	133302.2	25.684	-71.254
1189655.281	10389.3	9050.7	-2.043	103.690	132990.0	25.677	-71.228
1189656.281	10267.0	8929.7	-3.018	103.708	132398.5	25.671	-71.200
1189657.281	10433.7	9100.3	-7.158	102.756	130802.7	25.664	-71.175
1189658.281	10353.9	9013.4	-3.497	103.084	129621.2	25.658	-71.149
1189659.281	10300.8	8958.2	-1.296	103.162	129298.7	25.652	-71.123
1189660.281	9826.8	8487.7	-2.466	103.508	129042.2	25.645	-71.099
1189661.281	9805.5	8465.7	-2.591	103.356	128164.2	25.639	-71.074
1189662.281	10353.7	9047.4	-14.122	101.416	126663.2	25.633	-71.050
1189663.281	9712.2	8369.9	-2.008	103.066	125543.2	25.628	-71.026
1189664.281	9147.4	7809.7	-1.442	103.771	125309.5	25.622	-71.002
1189665.281	8982.6	7644.5	-1.504	103.686	124168.7	25.616	-70.980
1189666.281	8257.5	6926.1	-1.286	104.558	123875.5	25.610	-70.957
1189667.281	8848.9	7509.7	-1.523	103.501	123076.2	25.605	-70.934
1189668.281	8840.6	7500.4	-1.167	103.398	122858.5	25.599	-70.912
1189669.281	8617.8	7476.5	-1.303	103.225	122665.7	25.593	-70.891
1189670.281	8395.9	7058.8	.206	103.833	120962.2	25.589	-70.871
1189671.281	9238.9	7893.1	-1.112	102.596	120748.0	25.583	-70.850
1189672.281	8814.0	7474.2	-5.384	102.406	120104.2	25.578	-70.831
1189673.281	9899.8	8673.1	-23.989	99.627	119189.7	25.573	-70.811
1189674.281	9082.1	7734.7	-1.285	102.283	118249.7	25.568	-70.790
1189675.281	7872.6	6533.4	.172	103.444	117380.0	25.563	-70.771
1189676.281	8621.4	7448.4	-27.964	100.088	116621.2	25.559	-70.752
1189677.281	8439.2	7094.1	-.210	102.630	115700.0	25.554	-70.734

Table A-2b. Reconstructed Reentry Trajectory and Associated Parameters (7:18 Radar) — Continued

GT-7 RE-ENTRY RADAR 7.18

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189678.281	7872.3	6565.6	-13.981	101.584	115094.0	25.550	-70.717
1189679.281	7508.1	6173.7	-6.528	102.477	113968.2	25.545	-70.698
1189680.281	7067.2	5728.4	-2.468	103.112	112392.5	25.541	-70.682
1189681.281	7227.4	5896.7	-7.925	102.176	111560.2	25.537	-70.665
1189682.281	6629.3	5293.1	-.952	103.567	111187.0	25.533	-70.649
1189683.281	7853.5	6636.2	-24.043	100.130	109636.2	25.529	-70.632
1189684.281	7252.0	5907.4	-.855	102.464	108410.7	25.525	-70.617
1189685.281	7033.9	5690.8	-.051	102.688	108316.7	25.521	-70.601
1189686.281	5965.0	4629.4	-1.478	103.391	107185.0	25.517	-70.587
1189687.281	6215.1	4889.4	-8.385	102.322	106341.7	25.513	-70.572
1189688.281	5833.7	4497.5	-3.795	102.858	105144.2	25.510	-70.557
1189689.281	6079.2	4738.4	-.807	102.744	105104.2	25.506	-70.544
1189690.281	5717.1	4420.0	-13.534	101.872	104385.7	25.503	-70.531
1189691.281	6650.9	5314.6	-7.361	101.427	103386.7	25.500	-70.518
1189692.281	6219.5	4877.2	1.655	102.480	101900.0	25.497	-70.505
1189693.281	6124.2	4779.5	-1.584	102.084	101816.5	25.493	-70.492
1189694.281	5133.9	3796.2	.314	102.853	101508.2	25.490	-70.479
1189695.281	5210.5	3870.6	-.243	102.567	99934.2	25.487	-70.467
1189696.281	5088.7	3749.0	.087	102.544	99898.2	25.484	-70.457
1189697.281	5604.3	4260.6	-2.767	101.855	99162.0	25.481	-70.446
1189698.281	5271.2	3929.5	-3.629	101.852	98181.2	25.478	-70.434
1189699.281	4890.3	3549.1	-2.934	101.884	97411.5	25.476	-70.423
1189700.281	5178.4	3945.6	-21.302	99.848	96942.0	25.473	-70.414
1189701.281	4188.6	2854.0	1.852	102.565	96068.0	25.470	-70.403
1189702.281	4687.3	3344.3	-.082	101.871	95264.5	25.468	-70.393
1189703.281	3493.4	2160.7	-.855	102.280	94235.7	25.466	-70.384
1189704.281	3339.3	2008.5	-2.484	102.083	92844.7	25.463	-70.375
1189705.281	3863.2	2553.3	-10.862	100.760	92598.0	25.461	-70.366

Table A-2b. Reconstructed Reentry Trajectory and Associated Parameters (7:18 Radar) — Continued

GT-7 RE-ENTRY RADAR 7.18

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189706.281	4600.1	3271.2	-8.553	100.727	92165.0	25.459	-70.358
1189707.281	4985.2	3683.3	-13.763	100.054	90968.2	25.457	-70.349
1189708.281	3210.3	1971.3	-17.850	99.856	89694.2	25.455	-70.341
1189709.281	3224.8	1887.9	-.925	101.396	88151.0	25.453	-70.333
1189710.281	3761.0	2588.1	-24.518	98.778	87509.2	25.451	-70.326
1189711.281	5382.2	4266.5	-30.780	97.896	86440.7	25.449	-70.318
1189712.281	3583.7	2239.2	-.306	100.823	85462.7	25.448	-70.312
1189713.281	3189.7	1848.8	.467	100.877	84996.7	25.446	-70.306
1189714.281	4265.5	2918.1	.405	100.912	84127.5	25.444	-70.298
1189715.281	3522.5	2176.6	.140	100.573	83528.7	25.443	-70.292
1189716.281	2976.6	1637.8	2.764	100.487	82467.0	25.441	-70.285
1189717.281	3223.0	1874.8	-.342	99.924	82410.5	25.439	-70.279
1189718.281	5085.4	4594.6	-61.733	90.295	81586.0	25.438	-70.273
1189719.281	5021.7	4051.2	37.265	104.270	77283.0	25.437	-70.268
1189720.281	3346.6	2290.5	29.457	102.612	81448.5	25.435	-70.263
1189721.281	7485.5	6751.5	-53.280	93.547	80788.0	25.433	-70.257
1189722.281	6005.5	5162.3	45.165	104.807	77564.2	25.433	-70.253
1189723.281	6082.2	5544.7	59.441	107.463	79628.2	25.431	-70.249
1189724.281	7695.7	7055.4	-57.747	92.186	78293.0	25.430	-70.243
1189725.281	2765.2	1442.4	-8.974	98.283	74926.0	25.430	-70.240
1189726.281	1989.8	651.4	1.623	98.112	75069.5	25.428	-70.234
1189727.281	1497.4	196.9	1.662	96.187	75096.5	25.427	-70.230
1189728.281	2310.3	968.1	3.038	98.479	72716.2	25.426	-70.226
1189729.281	1683.3	452.8	10.805	96.855	72705.2	25.425	-70.223
1189730.281	2152.7	832.1	5.776	98.855	69665.2	25.424	-70.218
1189731.281	2404.0	1051.1	-1.921	97.698	70069.2	25.424	-70.216
1189732.281	2833.5	1481.6	-.526	98.829	70040.5	25.423	-70.212
1189733.281	5995.4	5306.5	-54.111	94.126	69381.7	25.422	-70.209

Table A-2b. Reconstructed Reentry Trajectory and Associated Parameters (7:18 Radar) — Continued

GT-7 RE-ENTRY RADAR 7.18

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189734.281	1705.5	610.5	17.814	97.923	70551.0	25.420	-70.204
1189735.281	2055.3	707.9	-3.629	96.678	69005.0	25.420	-70.204
1189736.281	3264.4	2781.4	-57.636	88.898	68673.7	25.419	-70.199
1189737.281	3183.5	2056.8	-26.712	96.493	67922.0	25.419	-70.197
1189738.281	1469.3	167.8	-2.155	95.380	66426.0	25.418	-70.194
1189739.281	1610.2	290.4	-4.035	95.690	66458.2	25.417	-70.191
1189740.281	1316.2	131.0	-3.249	93.497	66450.0	25.416	-70.188
1189741.281	2933.8	1580.8	.125	98.795	66461.7	25.416	-70.187
1189742.281	1426.1	519.4	-21.140	92.083	66293.5	25.415	-70.184
1189743.281	6758.1	6629.3	-76.727	75.474	64851.0	25.414	-70.181
1189744.281	5985.6	4650.9	6.967	101.427	61235.0	25.414	-70.177
1189745.281	2448.4	2057.7	-57.149	88.992	60078.0	25.413	-70.176
1189746.281	5751.8	5540.9	-74.132	80.845	64285.5	25.412	-70.177
1189747.281	5320.3	4942.9	65.794	106.481	60385.0	25.412	-70.175
1189748.281	3770.0	3493.0	67.155	104.210	62074.2	25.411	-70.171
1189749.281	6881.3	6740.0	-77.933	74.653	65501.7	25.410	-70.168
1189750.281	1873.6	1299.8	-43.894	91.271	57152.0	25.411	-70.169
1189751.281	1375.1	405.2	15.941	95.667	56587.5	25.411	-70.169
1189752.281	6169.8	6172.6	82.974	115.883	52320.2	25.411	-70.165
1189753.281	5867.2	5547.0	-69.915	87.677	53861.2	25.410	-70.165
1189754.281	2275.1	1838.4	53.467	98.058	52452.5	25.410	-70.163
1189755.281	1834.8	693.0	17.302	97.939	56951.7	25.408	-70.160
1189756.281	3841.6	3245.3	-54.683	92.005	54227.7	25.408	-70.160
1189757.281	2102.2	1366.5	-39.730	93.194	49052.7	25.409	-70.158
1189758.281	4929.9	4042.2	41.920	103.173	51668.2	25.408	-70.157
1189759.281	2177.2	1468.5	-41.676	91.328	50349.7	25.407	-70.156
1189760.281	5587.8	5952.1	81.393	-82.748	46644.0	25.407	-70.153
1189761.281	2995235.3	2996605.2	-.033	-82.510	48634.7	25.475	-70.567

Table A-2b. Reconstructed Reentry Trajectory and Associated Parameters (7:18 Radar) — Continued

GT-7 RE-ENTRY RADAR 7.18

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189762.281	1400.9	97.3	-.773	93.856	48619.7	25.406	-70.153
1189763.281	1898.8	1261.6	-41.561	92.371	48251.0	25.406	-70.151
1189764.281	1521.4	200.8	2.430	95.187	47780.2	25.405	-70.149
1189765.281	3946.7	3097.6	42.345	101.888	48287.2	25.405	-70.148
1189766.281	2787.8	2439.8	60.621	99.416	49367.0	25.404	-70.148
1189767.281	4965.4	4749.3	-72.914	83.896	44998.5	25.405	-70.148
1189768.281	3943.1	3557.1	62.986	103.937	44558.7	25.404	-70.145
1189769.281	2425.7	2044.8	-57.373	88.020	47871.5	25.403	-70.145
1189770.281	3299.5	3019.2	-66.039	83.686	43195.0	25.404	-70.145
1189771.281	17499.4	17471.6	85.216	134.414	43653.2	25.404	-70.145
1189772.281	12564.3	12462.4	81.833	115.999	42526.7	25.403	-70.142
1189773.281	1199.6	189.2	2.181	90.374	42923.0	25.402	-70.141
1189774.281	1211.6	227.1	5.382	93.858	44078.0	25.402	-70.141
1189775.281	18669.1	18613.7	-84.545	54.160	43228.7	25.402	-70.141
1189776.281	3129.4	2900.5	67.303	99.667	40542.0	25.402	-70.140
1189777.281	6412.8	6125.8	-71.877	87.741	44338.7	25.401	-70.140
1189778.281	3894.4	3661.6	-69.885	82.394	37625.0	25.402	-70.138
1189779.281	8852.1	8549.3	-72.911	87.024	37256.2	25.401	-70.137
1189780.281	17323.7	17290.6	84.965	133.340	37653.7	25.401	-70.137
1189781.281	3762.0	3487.5	-67.849	83.728	41278.5	25.400	-70.137
1189782.281	2603.7	2223.4	58.290	98.018	42367.2	25.400	-70.137
1189783.281	1870.0	1280.3	-43.174	88.183	38340.0	25.400	-70.136
1189784.281	7218.4	7079.6	-78.399	76.084	36105.5	25.400	-70.133
1189785.281	6276.2	6172.4	78.835	107.606	36153.0	25.399	-70.133
1189786.281	2026.4	1504.5	-47.907	88.211	37170.0	25.399	-70.133
1189787.281	1214.6	205.7	5.192	91.089	37167.2	25.399	-70.133
1189788.281	2279.3	1837.7	53.162	99.261	35669.7	25.399	-70.134
1189789.281	1518.2	222.2	-6.916	90.595	37433.0	25.399	-70.134

Table A-2b. Reconstructed Reentry Trajectory and Associated Parameters (7:18 Radar) — Continued

GT-7 RE-ENTRY RADAR 7.18

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189790.281	2792.5	2335.5	56.303	96.645	36791.2	25.399	-70.134
1189791.281	2936.2	2136.7	-42.579	93.269	36236.7	25.399	-70.133
1189792.281	1464.0	107.1	1.062	92.549	35805.2	25.398	-70.132
1189793.281	1501.1	131.3	-1.216	91.798	35778.2	25.398	-70.132
1189794.281	2061.5	696.7	-.228	95.170	35776.2	25.398	-70.131
1189795.281	1429.0	82.5	1.358	92.375	35760.7	25.398	-70.130
1189796.281	1401.2	84.6	-.055	93.391	35771.2	25.397	-70.130
1189797.281	1961.9	603.0	-.736	95.662	35794.0	25.397	-70.129
1189798.281	1451.8	94.6	.283	92.554	35729.0	25.397	-70.129
1189799.281	1298.1	96.5	-.407	92.021	35714.0	25.397	-70.129
1189800.281	1851.1	1224.6	-41.419	90.192	35690.0	25.397	-70.129
1189801.281	1455.6	132.4	.541	94.404	34669.7	25.397	-70.129
1189802.281	1427.6	425.5	17.088	92.880	35233.5	25.397	-70.130
1189803.281	1752.6	587.4	15.505	96.623	35507.7	25.396	-70.130
1189804.281	1485.5	122.4	-1.428	92.168	35602.5	25.396	-70.128
1189805.281	1290.9	103.3	-2.048	90.512	35636.0	25.396	-70.128
1189806.281	1464.8	97.7	-.360	92.036	35623.2	25.396	-70.129
1189807.281	4912.5	3562.6	-.285	100.440	35608.2	25.395	-70.125
1189808.281	1128.1	259.6	1.336	87.821	35607.7	25.395	-70.124
1189809.281	843.6	571.3	1.577	79.923	35603.5	25.395	-70.125
1189810.281	926.7	471.1	-.689	83.842	35616.5	25.396	-70.129
1189811.281	1428.5	58.2	.148	91.383	35614.5	25.396	-70.130
1189812.281	2901.1	1560.6	7.533	96.907	35752.7	25.395	-70.126
1189813.281	808.5	589.1	-.090	82.606	35737.2	25.394	-70.123
1189814.281	1370.4	94.1	1.041	86.252	35790.5	25.394	-70.124
1189815.281	997.5	389.9	.366	86.758	35795.5	25.394	-70.125
1189816.281	4517.6	5844.4	-.307	-71.508	35786.0	25.395	-70.127
1189817.281	3736.4	2385.6	-.097	99.657	35774.5	25.396	-70.132

Table A-2b. Reconstructed Reentry Trajectory and Associated Parameters (7:18 Radar) — Continued

GT-7 RE-ENTRY RADAR 7.18

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189818.281	1817.7	449.0	-.007	93.881	35746.5	25.394	-70.125
1189819.281	1089.4	334.2	-3.702	83.391	35745.7	25.394	-70.125
1189820.281	2386.7	1018.5	.404	95.199	35771.5	25.394	-70.122
1189821.281	720.4	677.2	-5.756	83.903	35771.7	25.394	-70.125
1189822.281	502.9	1366.7	-46.886	18.035	35627.2	25.396	-70.131
1189823.281	1428.7	239.4	9.277	87.576	35586.5	25.397	-70.135
1189824.281	1083.1	636.5	24.296	78.908	35650.2	25.397	-70.136
1189825.281	1634.6	1177.3	-1.307	134.967	35966.2	25.397	-70.136

Table A-2c. Reconstructed Reentry Trajectory and Associated Parameters (IGS)

GEMINI-7 REENTRY SEGMENT 4

EARTH CENTERED INERTIAL GREENWICH COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
1794.1875	8567339.50	-16960283.00	9027329.00	6600.88	3286.55	-1744.13
1796.6875	8583500.50	-16952170.75	9023051.12	6328.02	3203.11	-1678.15
1799.0625	8598210.00	-16944667.75	9019146.12	6058.92	3115.16	-1610.27
1801.4375	8612294.25	-16937274.00	9015401.37	5792.06	3027.11	-1543.12
1803.8125	8625727.87	-16930200.75	9011818.62	5527.83	2937.66	-1474.00
1806.1875	8638552.87	-16923415.75	9008396.75	5272.18	2851.80	-1407.53
1808.6875	8651422.75	-16916385.00	9004955.37	5023.77	2772.81	-1345.57
1811.0625	8662950.00	-16909977.25	9001889.87	4683.37	2623.27	-1235.05
1813.4375	8673800.12	-16903840.75	8999024.75	4453.60	2544.31	-1176.80
1815.8125	8683910.75	-16897116.00	8996704.87	4017.70	2392.40	-1063.12
1818.6875	8703703.37	-16886222.75	8991114.37	3809.15	2322.07	-1009.28
1821.0625	8712516.12	-16880791.75	8988781.12	3612.11	2251.45	-955.58
1823.4375	8720872.25	-16875525.75	8986573.12	3424.68	2183.19	-903.76
1825.8125	8728794.37	-16870417.75	8984485.87	3246.51	2118.18	-853.07
1828.1875	8736303.62	-16865461.00	8982518.25	3077.08	2055.88	-804.74
1830.6875	8743721.37	-16860465.25	8980606.37	2857.18	1940.87	-724.77
1833.0625	8750335.50	-16855924.00	8978831.87	2712.57	1883.37	-685.35
1835.4375	8756418.37	-16851514.50	8977348.25	2578.28	1829.74	-648.21
1837.8125	8762588.37	-16847237.50	8975552.62	2449.15	1771.00	-611.23
1840.1875	8768266.25	-16843088.75	8974443.00	2322.10	1721.66	-575.87
1842.6875	8773962.25	-16838829.25	8973037.75	2224.62	1686.02	-548.29
1845.0625	8779130.25	-16834866.50	8971766.00	2127.34	1650.91	-522.70
1847.4375	8784045.25	-16831041.00	8970583.37	2011.56	1570.60	-473.16
1849.8125	8788726.12	-16827350.00	8969497.25	1930.24	1537.57	-448.93
1852.1875	8793224.25	-16823730.50	8968438.50	1857.66	1502.75	-423.23
1854.6875	8797782.00	-16820015.25	8967372.25	1788.55	1474.71	-418.02
1857.0625	8801937.50	-16816591.00	8966425.00	1710.83	1406.78	-370.68
1859.4375	8805930.87	-16813280.50	8965541.62	1651.98	1381.09	-364.15
1861.8125	8809730.62	-16810031.00	8964603.62	1598.40	1355.25	-340.07

Table A-2c. Reconstructed Reentry Trajectory and Associated Parameters (IGS) — Continued

GEMINI-7 REENTRY SEGMENT 4

EARTH CENTERED INERTIAL GREENWICH COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
1866.1875	8813532.25	-16806840.75	8963879.37	1552.42	1331.45	-335.75
1869.6875	8817344.12	-16803522.25	8963045.75	1513.10	1323.27	-331.15
1871.0625	8820918.87	-16800420.50	8962290.25	1480.34	1281.21	-305.00
1873.4375	8824398.37	-16797395.25	8961570.50	1440.73	1273.96	-293.53
1875.8125	8827910.62	-16794381.75	8960878.00	1423.80	1263.59	-287.27
1878.1875	8831144.62	-16791388.25	8960179.75	1400.61	1257.29	-280.72
1880.4375	8841078.50	-16782603.25	8958256.00	1334.24	1166.17	-239.95
1914.6875	8881206.25	-16749511.12	8952845.50	1233.93	951.72	-106.32
1923.8125	8890026.62	-16742823.50	8952156.25	1241.98	925.53	-87.16
1928.5625	8895016.25	-16738421.75	8951755.62	1237.82	927.80	-81.51
1935.8125	8904914.62	-16731765.25	8951224.87	1244.51	908.49	-62.14
1938.1875	8907865.12	-16729605.75	8951084.12	1240.07	910.10	-63.21
1943.0625	8913909.12	-16725149.00	8950775.37	1230.12	918.30	-64.24
1955.0625	8928856.00	-16714414.25	8950057.75	1252.18	870.81	-55.37
1957.4375	8931821.87	-16712347.75	8949922.87	1245.43	869.40	-58.17
1959.8125	8934776.12	-16710283.62	8949780.87	1242.32	868.79	-61.44
1962.1875	8937717.37	-16708223.87	8949632.50	1234.53	865.73	-63.53
1964.5625	8940643.87	-16706160.50	8949485.25	1229.85	871.87	-60.42
1967.0625	8943731.25	-16704007.87	8949354.00	1240.08	850.20	-44.66
1969.4375	8946670.50	-16701986.12	8949250.25	1235.10	852.38	-42.71
1974.1875	8952536.37	-16697912.12	8949040.75	1230.54	842.06	-41.68
1979.0625	8958541.25	-16693747.12	8948878.00	1237.06	845.78	-28.79
2010.1875	8998634.50	-16670801.75	8949508.87	1339.22	628.63	66.33
2012.5625	9001805.00	-16668308.75	8949648.75	1330.64	628.50	48.44
2015.0625	9005104.50	-16667743.75	8949735.87	1308.98	623.37	21.26
2017.4375	9008221.62	-16666297.12	8949781.87	1315.91	594.91	17.47
2019.8125	9011341.25	-16664886.75	8949806.50	1311.13	592.77	3.20
2022.1875	9014435.25	-16663485.62	8949786.62	1294.35	587.08	-20.00
2024.5625	9017497.87	-16662098.62	8949709.50	1274.33	580.05	-45.03

Table A-2c. Reconstructed Reentry Trajectory and Associated Parameters (IGS) -- Continued

GEMINI-7 REENTRY SEGMENT 4

EARTH CENTERED INERTIAL GREENWICH COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
2027.0625	9020676.62	-16660695.75	8945579.62	1274.67	569.31	-58.84
2029.4375	9023491.00	-16659389.37	8940410.37	1263.67	542.43	-83.70
2031.8125	9026671.87	-16658100.00	8940173.87	1246.40	535.77	-115.50
2034.5625	9032552.00	-16655581.00	8948538.50	1229.26	528.64	-151.99
2039.0625	9035621.62	-16654301.62	8948132.87	1225.42	494.88	-172.51
2043.8125	9041404.50	-16651987.12	8947182.00	1208.46	479.66	-227.85
2048.5625	9047097.75	-16649704.37	8946011.62	1188.70	463.59	-264.94
2055.8125	9055604.12	-16646500.62	8943801.00	1157.91	440.21	-320.06
2057.9375	9058070.00	-16645702.37	8943193.62	1162.92	395.69	-336.34
2060.5625	9061093.62	-16644662.75	8942265.25	1140.73	396.44	-370.97
2063.0625	9063933.87	-16643668.50	8941306.87	1131.47	399.04	-395.74
2065.4375	9066614.62	-16642728.12	8940346.87	1126.04	392.94	-412.70
2067.8125	9069275.00	-16641842.00	8939336.87	1114.29	353.37	-437.84
2070.1875	9071901.75	-16641011.75	8938260.50	1097.67	345.73	-460.97
2075.0625	9077230.87	-16639318.00	8935940.37	1092.35	349.13	-494.56
2077.4375	9079815.87	-16638496.12	8934732.12	1076.92	343.03	-522.93
2079.8125	9082366.25	-16637728.25	8933462.00	1070.71	303.60	-546.65
2084.5625	9087440.75	-16636289.25	8930780.25	1065.96	302.29	-582.53
2087.0625	9090090.62	-16635538.50	8929291.50	1045.87	298.32	-608.45
2089.4375	9092553.75	-16634874.50	8927830.75	1036.84	260.82	-621.63
2091.8125	9095011.25	-16634254.87	8926334.62	1032.64	260.04	-638.30
2094.1875	9097454.12	-16633639.12	8924791.87	1024.50	257.62	-660.90
2096.5625	9099856.37	-16633034.62	8923189.75	1006.92	251.56	-688.35
2101.4375	9104772.00	-16631886.25	8919753.00	1006.18	219.60	-721.63
2106.1875	9109488.25	-16630871.25	8916213.12	983.40	207.73	-768.82
2108.5625	9111816.50	-16630385.87	8914357.37	968.80	201.08	-793.06
2110.9375	9114127.00	-16629944.00	8912463.00	976.85	170.38	-801.30
2113.4375	9116551.50	-16629520.00	8910429.12	962.32	168.28	-825.85
2115.8125	9118815.62	-16629128.62	8908430.62	943.80	161.22	-847.07

Table A-2c. Reconstructed Reentry Trajectory and Associated Parameters (IGS) — Continued

GEMINI-7 REENTRY SEGMENT 4

EARTH CENTERED INERTIAL GREENWICH COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
2118.1875	9121046.12	-16628753.62	8906367.25	934.45	154.58	-880.49
2120.5625	9123276.12	-16628393.87	8904223.97	943.52	148.40	-874.46

Table A-2c. Reconstructed Reentry Trajectory and Associated Parameters (IGS) — Continued

GEMINI-7 REENTRY SEGMENT 4

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189677.484	7577.3	6237.1	-5.376	102.196	123939.7	25.561	-70.696
1189679.984	7288.3	5948.5	-5.662	102.068	122143.5	25.551	-70.652
1189682.359	7000.6	5661.1	-5.930	101.928	120421.7	25.541	-70.612
1189684.734	6716.0	5377.0	-6.215	101.780	118691.0	25.532	-70.574
1189687.109	6431.1	5092.6	-6.512	101.606	116953.5	25.523	-70.538
1189689.484	6157.1	4819.1	-6.830	101.471	115210.2	25.515	-70.504
1189691.984	5893.8	4556.8	-7.213	101.226	113362.2	25.507	-70.471
1189694.359	5508.5	4171.1	-7.399	100.885	111634.7	25.500	-70.441
1189696.734	5262.4	3926.1	-7.776	100.664	109941.0	25.494	-70.413
1189701.484	4795.5	3461.8	-8.583	100.172	106539.5	25.482	-70.363
1189703.984	4573.9	3242.1	-9.056	99.891	104739.7	25.476	-70.339
1189706.359	4362.3	3032.3	-9.496	99.588	103025.5	25.472	-70.318
1189708.734	4160.7	2832.8	-9.944	99.266	101313.5	25.467	-70.298
1189711.109	3969.2	2643.6	-10.404	98.910	99605.2	25.463	-70.280
1189713.484	3787.2	2464.3	-10.880	98.538	97901.7	25.459	-70.263
1189715.984	3529.3	2207.5	-11.081	97.983	96157.2	25.456	-70.246
1189718.359	3372.7	2054.5	-11.532	97.640	94548.2	25.453	-70.232
1189720.734	3227.3	1913.1	-11.984	97.283	92949.2	25.450	-70.219
1189723.109	3084.1	1774.1	-12.371	96.935	91366.5	25.448	-70.207
1189725.484	2955.5	1649.8	-12.767	96.540	89804.2	25.445	-70.196
1189727.984	2844.7	1545.5	-13.347	96.141	88165.0	25.443	-70.185
1189730.359	2743.0	1450.6	-13.868	95.764	86602.7	25.441	-70.176
1189732.734	2595.6	1305.4	-13.811	95.248	85085.0	25.440	-70.167
1189735.109	2508.5	1225.1	-14.227	94.868	83615.5	25.438	-70.159
1189737.484	2428.3	1152.4	-14.578	94.646	82156.2	25.437	-70.152
1189739.984	2356.9	1090.3	-15.064	94.383	80625.2	25.436	-70.145
1189742.359	2247.2	981.9	-14.740	93.952	79218.0	25.435	-70.139
1189744.734	2183.8	927.4	-15.095	93.646	77863.0	25.434	-70.134

Table A-2c. Reconstructed Reentry Trajectory and Associated Parameters (IGS) — Continued

GEMINI-7 REENTRY SEGMENT 5

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189747.109	2124.6	877.2	-15.394	93.377	76517.0	25.433	-70.129
1189749.484	2072.6	833.0	-15.610	93.099	75184.5	25.432	-70.124
1189751.984	2037.2	809.5	-16.108	92.907	73780.0	25.431	-70.120
1189754.359	1981.4	751.8	-15.627	92.560	72474.5	25.431	-70.116
1189756.734	1952.1	730.9	-15.921	92.189	71204.5	25.430	-70.112
1189759.109	1926.7	715.7	-16.255	92.294	69927.5	25.430	-70.109
1189761.484	1904.5	701.2	-16.498	92.074	68644.5	25.429	-70.106
1189768.734	1788.2	584.6	-15.341	91.393	64968.0	25.428	-70.097
1189799.984	1561.9	322.4	-10.440	89.400	53155.7	25.427	-70.074
1189807.109	1551.4	291.4	-9.263	89.194	51258.5	25.428	-70.071
1189811.859	1549.1	291.3	-9.300	88.947	50071.0	25.428	-70.069
1189819.109	1542.1	267.6	-8.315	88.626	48355.7	25.429	-70.065
1189821.484	1539.5	268.8	-8.456	88.607	47822.2	25.429	-70.064
1189826.359	1543.6	276.6	-8.690	88.532	46702.5	25.429	-70.062
1189838.359	1526.2	229.0	-6.950	89.017	44196.2	25.430	-70.057
1189840.734	1520.0	227.3	-7.080	89.082	43754.5	25.431	-70.056
1189843.109	1517.2	227.0	-7.169	89.182	43307.2	25.431	-70.055
1189845.484	1509.2	223.8	-7.265	89.239	42856.0	25.431	-70.055
1189847.859	1508.8	228.4	-7.471	89.010	42397.0	25.431	-70.054
1189850.359	1504.2	204.2	-6.394	88.860	41942.2	25.431	-70.053
1189852.734	1501.3	205.2	-6.514	88.725	41541.2	25.431	-70.052
1189857.484	1503.6	214.6	-6.866	88.511	40710.0	25.432	-70.050
1189862.359	1498.8	195.6	-6.022	88.369	39889.7	25.432	-70.049
1189893.484	1481.0	144.3	4.051	88.943	39073.5	25.435	-70.039
1189895.859	1472.4	127.9	3.593	89.611	39307.5	25.436	-70.039
1189898.359	1450.0	101.5	2.995	90.486	39317.7	25.436	-70.038
1189900.734	1444.2	119.4	3.971	91.110	39726.2	25.435	-70.038
1189903.109	1438.9	115.5	3.739	91.624	39856.2	25.435	-70.037

Table A-2c. Reconstructed Reentry Trajectory and Associated Parameters (IGS) — Continued

GEMINI-7 REENTRY SEGMENT 4

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189905.484	1421.4	107.8	3.284	92.447	40164.0	25.435	-70.037
1189907.859	1403.1	108.0	2.781	93.353	40341.0	25.434	-70.037
1189910.359	1389.2	137.1	3.584	94.389	40534.2	25.434	-70.037
1189912.734	1377.7	150.8	3.212	95.382	40728.2	25.433	-70.037
1189915.109	1361.8	171.3	2.599	96.623	40892.2	25.432	-70.037
1189919.859	1346.7	200.6	1.906	98.082	41143.0	25.430	-70.037
1189922.359	1333.7	238.3	2.658	99.505	41275.2	25.428	-70.038
1189927.109	1320.0	290.2	1.865	101.910	41521.0	25.425	-70.039
1189931.859	1296.1	342.9	2.107	104.097	41733.0	25.421	-70.040
1189939.109	1279.4	392.5	.630	106.369	41950.0	25.415	-70.044
1189941.234	1273.6	431.1	2.017	107.988	42010.5	25.412	-70.045
1189943.859	1263.3	461.3	.910	109.404	42093.0	25.409	-70.046
1189946.359	1263.3	481.7	.167	110.350	42120.0	25.406	-70.047
1189948.734	1262.0	499.5	-.043	111.175	42120.5	25.404	-70.049
1189951.109	1248.3	544.4	.681	113.169	42134.0	25.400	-70.050
1189953.484	1239.7	570.6	.186	114.371	42153.5	25.397	-70.052
1189958.359	1248.9	597.5	-.686	115.607	42120.0	25.390	-70.056
1189960.734	1245.3	627.6	-1.321	116.967	42065.0	25.387	-70.058
1189963.109	1239.9	669.2	-.463	118.920	42015.5	25.383	-70.060
1189967.859	1251.8	700.6	-1.190	120.314	41922.2	25.375	-70.064
1189970.359	1246.2	728.7	-1.950	121.598	41832.7	25.370	-70.067
1189972.734	1236.7	761.1	-1.019	123.182	41752.0	25.366	-70.069
1189975.109	1241.7	775.7	-1.423	123.825	41685.0	25.362	-70.071
1189977.484	1246.0	798.1	-1.889	124.816	41595.0	25.357	-70.074
1189979.859	1245.3	828.3	-2.558	126.193	41475.7	25.352	-70.077
1189984.734	1257.5	872.3	-2.018	128.169	41222.0	25.342	-70.082
1189989.484	1265.4	923.1	-2.921	130.410	40954.7	25.332	-70.088
1189991.859	1268.6	951.1	-3.438	131.648	40783.0	25.326	-70.091

Table A-2c. Reconstructed Reentry Trajectory and Associated Parameters (IGS) — Continued

GEMINI-7 REENTRY SEGMENT 4

TIME FROM LIFTOFF (SECONDS)	INERTIAL VEL. MAGNITUDE (FT/SEC)	RELATIVE VEL. MAGNITUDE (FT/SEC)	INERTIAL FLT. PATH ANGLE (DEGREES)	INERTIAL HEADING ANGLE (DEGREES)	ALTITUDE (FEET)	GEODETIC LAT. (DEGREES)	GEODETIC LONG. (DEGREES)
1189994.234	1275.0	970.2	-2.321	132.528	40626.0	25.321	-70.094
1189996.734	1279.6	995.5	-2.949	133.616	40473.5	25.315	-70.098
1189999.109	1285.0	1029.8	-3.641	135.111	40292.7	25.309	-70.101
1190001.484	1293.2	1055.1	-3.998	136.155	40093.2	25.302	-70.105
1190003.859	1329.2	1092.F	-4.306	137.318	39851.7	25.297	-70.108

Table A-3. PCM Edit Listing for Ascent Flight Phase

GEMINI EDIT PROGRAM

TIME IN SECONDS FROM LIFTOFF

COMPUTED POSITION VELOCITY AND ACCELERATION IN GUIDANCE THRUST COORDINATES

TIME (SECS)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)	XDDOT (FT/SEC*2)	YDDOT (FT/SEC*2)	ZDDOT (FT/SEC*2)
1.368	-	-391	-	-.16	-169.22	-.06	-.13	-40.83	-.15
3.705	-1	-868	-1	-.56	-264.51	-.54	-.17	-41.17	-.20
6.042	-3	-1628	-3	-.88	-361.09	-1.12	-.17	-41.54	-.25
8.379	-5	-2586	-6	-1.48	-458.77	-1.70	-.16	-42.04	-.28
10.716	-9	-3773	-11	-1.69	-557.44	-2.38	-.13	-42.53	-.31
13.051	-13	-5191	-17	-2.00	-657.41	-3.15	-.09	-43.00	-.33
15.826	-19	-7183	-27	-2.12	-777.71	-4.22	-.02	-43.60	-.30
18.163	-24	-9119	-38	-2.33	-879.76	-4.80	.07	-44.14	-.24
20.508	-29	-11304	-50	-1.87	-984.10	-5.29	.26	-44.73	-.16
22.989	-33	-13884	-63	-1.30	-1095.92	-5.58	.71	-45.37	-.09
25.435	-35	-16701	-77	.61	-1207.73	-5.47	1.66	-45.98	-.01
27.302	-31	-19036	-88	4.18	-1293.73	-5.77	2.67	-46.43	.02
29.745	-11	-22337	-101	12.58	-1408.22	-5.38	4.29	-47.00	.04
32.192	34	-25924	-115	25.13	-1523.81	-5.48	5.97	-47.56	.05
34.636	116	-29790	-128	42.04	-1640.69	-5.39	7.64	-48.06	.02
37.083	243	-33950	-141	62.43	-1758.96	-5.21	9.34	-48.62	.02
39.526	425	-38393	-154	87.37	-1878.32	-5.32	11.03	-49.14	-.07
41.971	673	-43132	-167	116.67	-1999.36	-5.33	12.71	-49.67	-.15
44.414	998	-48165	-181	149.73	-2121.11	-6.22	14.31	-50.17	-.14
46.859	1408	-53503	-197	186.57	-2244.54	-6.63	15.86	-50.68	-.09
49.308	1915	-59150	-213	227.37	-2369.07	-6.36	17.55	-51.18	-.05
51.776	2530	-65156	-228	272.23	-2496.38	-6.38	19.48	-51.55	-.14
54.222	3256	-71415	-244	322.23	-2622.99	-6.99	21.64	-51.81	-.28
56.091	3897	-76408	-258	364.48	-2719.71	-7.70	23.26	-51.92	-.38
58.536	4861	-83214	-278	424.44	-2847.01	-8.70	25.27	-52.10	-.33
60.984	5977	-90340	-301	488.26	-2974.71	-10.00	27.17	-52.13	-.18
63.447	7264	-97826	-325	557.31	-3103.80	-9.45	29.23	-52.02	.12
65.927	8737	-105681	-349	632.15	-3232.09	-9.48	31.43	-51.81	.72
68.392	10394	-113805	-371	713.00	-3359.58	-7.47	33.68	-51.61	1.40
70.884	12277	-122337	-383	799.35	-3487.76	-2.03	35.99	-51.51	1.94
73.374	14391	-131183	-380	891.70	-3616.14	4.28	38.52	-51.28	1.72
75.275	16147	-138151	-368	966.55	-3713.75	7.18	40.63	-51.12	1.32
77.744	18660	-147475	-349	1070.41	-3839.24	8.70	43.18	-51.00	.44

Table A-3. PCM Edit Listing for Ascent Flight Phase — Continued

GEMINI EDIT PROGRAM

TIME IN SECONDS FROM LIFTOFF

COMPUTED POSITION VELOCITY AND ACCELERATION IN GUIDANCE THRUST COORDINATES

TIME (SECS)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)	XDDOT (FT/SEC*2)	YDDOT (FT/SEC*2)	ZDDOT (FT/SEC*2)
80.241	21472	-157219	-325	1182.69	-3965.82	9.93	45.21	-51.43	-.41
82.694	24512	-167102	-303	1295.93	-4092.00	7.14	47.03	-52.11	-.68
85.140	27821	-177267	-292	1411.40	-4221.86	3.09	49.00	-52.67	-.75
87.615	31467	-187881	-283	1535.39	-4353.11	3.72	51.35	-53.08	-.56
90.070	35395	-198727	-275	1665.36	-4482.57	2.39	53.92	-53.35	-.26
92.518	39634	-209857	-272	1799.89	-4613.91	.58	56.49	-53.64	-.13
94.989	44257	-221427	-270	1942.35	-4747.64	1.49	59.31	-53.78	.11
97.494	49065	-233565	-266	2057.43	-4849.80	2.23	61.66	-53.71	.25
99.953	53314	-242653	-260	2212.94	-4981.63	2.55	64.79	-53.47	.20
101.453	59052	-255274	-254	2378.80	-5115.15	2.78	68.00	-53.25	.22
104.349	65204	-268207	-246	2552.40	-5247.87	3.59	71.25	-52.98	.36
106.870	71870	-281608	-236	2736.25	-5380.99	4.49	74.63	-52.69	.50
109.364	78930	-295192	-222	2926.48	-5513.11	6.17	78.00	-52.42	.60
111.858	86476	-309103	-205	3125.42	-5642.42	7.75	81.48	-52.06	.71
113.765	92583	-319954	-189	3283.06	-5741.78	8.96	84.32	-51.56	.75
116.262	101047	-334452	-164	3497.86	-5870.10	11.22	88.13	-50.79	.74
118.756	110049	-349250	-133	3722.52	-5995.24	13.19	91.90	-50.35	.57
121.257	119652	-364358	-99	3957.81	-6119.17	14.37	95.52	-50.57	.34
123.726	129717	-379659	-63	4197.86	-6244.59	14.48	98.90	-51.37	.17
126.185	140342	-395172	-27	4444.86	-6372.80	14.77	102.41	-52.46	.06
128.090	148998	-407409	1	4642.35	-6473.33	15.09	105.26	-53.24	-.09
130.549	160735	-423489	39	4905.80	-6605.50	14.79	109.21	-54.11	-.25
132.998	173081	-439830	72	5177.47	-6739.17	13.12	113.43	-54.94	-.32
135.445	186096	-456488	104	5460.46	-6874.51	12.71	117.98	-55.71	-.30
137.895	199828	-473603	135	5754.76	-7011.95	12.20	122.91	-56.50	-.23
140.342	214284	-490823	164	6061.35	-7151.06	11.59	128.16	-57.36	-.25
142.798	229562	-508560	191	6382.45	-7292.96	10.87	133.87	-58.26	-.21
145.245	245588	-526584	217	6716.80	-7436.74	10.34	139.99	-59.24	-.13
147.720	262643	-545169	242	7070.59	-7584.39	10.20	146.68	-60.31	.02
150.167	280392	-563911	268	7437.34	-7733.22	10.34	153.79	-61.45	.20
152.649	299336	-583209	294	7828.08	-7887.22	11.06	161.01	-62.62	.38
155.609	323225	-606918	329	8317.32	-8074.59	12.51	169.61	-64.00	.60
157.034	335081	-618427	347	8347.13	-8084.78	11.47	41.32	-14.22	-.97

Table A-3. PCM Edit Listing for Ascent Flight Phase — Continued

GEMINI EDIT PROGRAM

TIME IN SECONDS FROM LIFTOFF

COMPUTED POSITION VELOCITY AND ACCELERATION IN GUIDANCE THRUST COORDINATES

TIME (SECS)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)	XDDOT (FT/SEC*2)	YDDOT (FT/SEC*2)	ZDDOT (FT/SEC*2)
159.486	355671	-638293	372	8446.60	-8118.66	9.13	41.68	-14.01	-1.00
161.942	376541	-658275	391	8548.88	-8152.43	6.60	42.04	-13.81	-1.04
164.391	397508	-678275	404	8653.28	-8186.21	3.98	42.80	-13.91	-1.04
166.706	417750	-697267	410	8753.34	-8218.48	1.44	43.75	-13.90	-1.05
168.806	436226	-714554	411	8845.95	-8248.25	-.50	44.61	-13.46	-1.02
171.228	457781	-734571	407	8954.90	-8281.33	-3.23	45.49	-12.70	-1.00
173.648	479595	-754653	396	9066.95	-8308.43	-5.47	46.67	-10.90	-.96
176.072	501710	-774820	380	9181.41	-8332.05	-7.70	47.61	-9.86	-.87
178.493	524078	-795019	359	9297.90	-8354.97	-9.94	48.41	-9.37	-.83
180.920	546784	-815322	333	9416.13	-8377.50	-11.59	49.16	-9.07	-.75
183.341	569725	-835630	302	9536.10	-8399.23	-13.53	49.90	-8.75	-.66
185.763	592967	-855957	268	9657.81	-8419.76	-14.99	50.67	-8.44	-.60
188.183	616487	-876396	230	9781.34	-8439.79	-16.25	51.43	-8.15	-.53
190.602	640299	-896835	189	9906.75	-8459.33	-17.51	52.21	-7.87	-.46
193.022	664424	-917329	145	10033.88	-8478.07	-18.67	52.95	-7.57	-.40
195.441	688863	-937867	99	10163.13	-8495.91	-19.34	53.71	-7.22	-.35
197.863	713635	-958464	51	10293.84	-8513.06	-20.21	54.50	-6.87	-.31
200.283	738706	-979085	1	10426.76	-8529.21	-20.98	55.30	-6.54	-.29
202.710	764173	-999802	-50	10562.01	-8544.56	-21.66	56.15	-6.23	-.26
205.130	789897	-1020497	-103	10698.81	-8559.32	-22.14	57.00	-5.89	-.23
207.549	815944	-1041219	-159	10837.64	-8573.38	-22.81	57.84	-5.57	-.21
209.969	842341	-1061981	-213	10978.88	-8586.14	-23.20	58.72	-5.17	-.20
212.391	869103	-1082791	-270	11121.87	-8598.50	-23.68	59.60	-4.78	-.19
214.811	896193	-1103612	-328	11267.27	-8609.39	-24.16	60.51	-4.39	-.19
217.230	923626	-1124450	-387	11414.71	-8619.55	-24.64	61.46	-3.97	-.19
219.649	951429	-1145320	-447	11564.65	-8628.73	-25.02	62.41	-3.61	-.17
222.076	979678	-1166270	-508	11717.12	-8636.91	-25.50	63.40	-3.21	-.17
224.496	1008220	-1187180	-570	11871.80	-8644.40	-25.79	64.41	-2.83	-.18
226.916	1037138	-1208106	-633	12028.91	-8650.59	-26.27	65.47	-2.47	-.21
229.336	1066440	-1229047	-698	12188.53	-8656.18	-26.85	66.53	-2.10	-.25
231.759	1096167	-1250026	-764	12351.05	-8660.98	-27.53	67.67	-1.73	-.27
234.184	1126316	-1271031	-831	12516.47	-8664.58	-29.21	68.79	-1.33	-.30
236.609	1156969	-1292045	-900	12684.79	-8667.38	-28.89	69.81	-.90	-.31

Table A-3. PCM Edit Listing for Ascent Flight Phase — Continued

GEMINI EDIT PROGRAM

TIME IN SECONDS FROM LIFTOFF

COMPUTED POSITION VELOCITY AND ACCELERATION IN GUIDANCE THRUST COORDINATES

TIME (SECS)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)	XDDOT (FT/SEC*2)	YDDOT (FT/SEC*2)	ZDDOT (FT/SEC*2)
239.033	1187934	-1313064	-971	12855.53	-8669.09	-29.76	71.02	-.51	-.30
240.695	1209300	-1327473	-1021	12974.35	-8669.86	-30.25	72.12	-.10	-.32
243.146	1241307	-1348716	-1096	13152.44	-8669.18	-30.83	73.41	.48	-.33
245.591	1273689	-1369913	-1173	13333.43	-8667.50	-31.90	74.62	1.06	-.31
248.039	1306558	-1391129	-1252	13517.61	-8664.33	-32.68	75.96	1.68	-.31
250.485	1339854	-1412319	-1332	13704.89	-8659.37	-33.16	77.37	2.33	-.29
252.934	1373640	-1433511	-1415	13896.12	-8652.71	-34.04	78.85	3.00	-.30
255.379	1407858	-1454661	-1499	14090.74	-8644.76	-34.82	80.36	3.65	-.30
257.827	1442598	-1475813	-1585	14289.33	-8634.92	-35.50	81.93	4.33	-.28
260.274	1477914	-1496932	-1672	14491.50	-8623.58	-36.09	83.57	5.02	-.28
262.720	1513645	-1518087	-1762	14698.79	-8610.35	-36.87	85.28	5.71	-.29
265.176	1549860	-1539133	-1853	14909.56	-8595.53	-37.55	87.08	6.42	-.28
267.626	1586654	-1560174	-1946	15124.89	-8579.02	-38.33	88.91	7.15	-.28
270.072	1623922	-1581139	-2040	15344.74	-8560.61	-38.82	90.80	7.94	-.28
272.519	1661733	-1602056	-2136	5569.15	-8540.31	-39.61	92.84	8.79	-.28
274.966	1700114	-1622929	-2234	5798.49	-8517.72	-40.29	94.72	9.57	-.30
277.414	1739080	-1643753	-2334	6033.73	-8493.03	-41.08	97.02	10.49	-.33
279.087	1766038	-1657945	-2403	16197.13	-8474.99	-41.57	98.83	11.36	-.33
281.543	1806119	-1678725	-2506	16442.03	-8445.72	-42.55	101.29	12.60	-.35
283.990	1846661	-1699356	-2611	16692.07	-8413.97	-43.23	103.44	13.65	-.35
286.440	1887873	-1719929	-2718	16948.77	-8378.73	-44.22	106.02	14.85	-.34
288.842	1928882	-1740005	-2825	17206.44	-8341.70	-45.00	108.97	16.11	-.34
291.159	1969050	-1759292	-2931	17461.22	-8303.27	-45.79	111.80	17.18	-.33
294.205	2022758	-1784501	-3072	17806.49	-8248.94	-46.77	115.03	18.38	-.32
296.523	2064334	-1803567	-3181	18077.03	-8205.03	-47.56	118.13	19.47	-.31
298.840	2106546	-1822528	-3292	18355.01	-8158.63	-48.16	121.73	20.84	-.32
301.164	2149539	-1841433	-3405	18641.79	-8108.95	-48.95	125.20	22.34	-.34
303.484	2193134	-1860187	-3519	18936.11	-8055.28	-49.74	128.83	24.05	-.33
305.803	2237384	-1878796	-3636	19238.94	-7997.62	-50.73	132.71	25.88	-.31
308.121	2282346	-1897266	-3754	19550.87	-7935.39	-51.13	136.84	27.70	-.28
310.438	2328005	-1915572	-3873	19872.65	-7868.97	-51.83	141.79	29.77	-.28
312.764	2374617	-1933795	-3994	20206.04	-7798.37	-52.43	146.57	31.56	-.29
315.814	2436931	-1957429	-4156	20661.07	-7698.53	-53.53	152.19	34.22	-.27

Table A-3. PCM Edit Listing for Ascent Flight Phase — Continued

GEMINI EDIT PROGRAM

TIME IN SECONDS FROM LIFTOFF

COMPUTED POSITION VELOCITY AND ACCELERATION IN GUIDANCE THRUST COORDINATES

TIME (SECS)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)	XDDOT (FT/SEC*2)	YDDOT (FT/SEC*2)	ZDDOT (FT/SEC*2)
318.133	2485265	-1975190	-4281	21020.57	-7616.18	-53.93	157.31	36.30	-.26
320.451	2534428	-1992746	-4406	21393.61	-7528.25	-54.54	164.16	39.30	-.23
322.778	2584664	-2010157	-4534	21782.50	-7433.95	-55.15	170.67	41.86	-.23
325.100	2635692	-2027258	-4662	22185.71	-7333.47	-55.56	177.72	44.37	-.23
327.419	2687632	-2044185	-4792	22605.94	-7227.62	-56.07	185.45	46.83	-.25
329.736	2740523	-2060806	-4922	23044.15	-7116.58	-56.69	193.92	49.46	-.30
332.062	2794636	-2077218	-5055	23504.61	-6999.17	-57.50	203.07	52.49	-.33
334.380	2849682	-2093302	-5189	23985.95	-6873.98	-58.32	212.18	55.51	-.37
336.979	2912754	-2110972	-5342	24550.71	-6725.31	-59.33	222.40	58.89	-.41
339.792	2982013	-2129826	-5507	24625.33	-6701.92	-58.69	1.66	-.48	.05
341.814	3031799	-2143373	-5626	24630.88	-6700.89	-58.54	1.59	-.16	.05
343.948	3084385	-2157677	-5751	24635.27	-6699.87	-58.38	1.52	.18	.05
346.064	3136522	-2171855	-5874	24637.92	-6699.55	-58.32	.72	.20	.02
348.168	3212989	-2192647	-6055	24639.48	-6699.41	-58.24	.40	.12	.03
351.296	3265420	-2206902	-6179	24640.20	-6699.19	-58.28	.29	.06	.01
353.427	3317926	-2221177	-6303	24640.63	-6699.06	-58.02	.09	-.00	.01
356.584	3395722	-2242327	-6486	24640.83	-6699.03	-58.23	.03	.02	.02
358.490	3442694	-2255058	-6597	24640.78	-6699.18	-58.18	.02	.01	-.01
361.225	3510071	-2273415	-6756	24641.19	-6698.91	-57.91	.06	-.00	-.00
363.293	3561038	-2287271	-6876	24641.23	-6699.18	-58.34	.07	.01	.00
366.024	3628345	-2305569	-7035	24641.14	-6699.01	-58.17	.26	.05	-.02
368.092	3679287	-2319419	-7155	24641.49	-6698.98	-58.01	.38	.12	.01
370.829	3746743	-2337755	-7315	24644.12	-6698.41	-58.33	.36	.10	.01
372.868	3797740	-2351616	-7435	24644.16	-6698.08	-58.08	.12	.05	.01
375.625	3864934	-2369879	-7593	24644.19	-6698.21	-58.00	.00	-.00	.04
377.846	3919661	-2384754	-7722	24644.22	-6698.29	-58.04	.00	-.03	.00
379.989	3972487	-2399112	-7846	24644.26	-6698.37	-57.88	-.05	.01	-.02
382.727	4039946	-2417448	-8005	24644.19	-6698.40	-58.10	-.02	-.00	-.01
384.792	4090847	-2431283	-8125	24644.04	-6698.27	-58.14	.18	-.05	-.02
387.524	4159185	-2449585	-8284	24644.25	-6699.40	-58.06	.11	-.03	-.00
389.332	4204646	-2461789	-8383	24644.22	-6698.30	-58.13	-.31	-.00	-.00
391.405	4257759	-2475676	-8484	24644.07	-6698.17	-58.17	.32	-.06	.00
393.146	4305290	-2514031	-8843	24644.09	-6698.30	-58.09	-.03	-.01	-.00

Table A-3. PCM Edit Listing for Ascent Flight Phase — Continued

GEMINI EDIT PROGRAM

TIME IN SECONDS FROM LIFTOFF

COMPUTED POSITION VELOCITY AND ACCELERATION IN GUIDANCE THRUST COORDINATES

TIME (SECS)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)	XDDOT (FT/SEC*2)	YDDOT (FT/SEC*2)	ZDDOT (FT/SEC*2)
399.224	4446503	-2527950	-8963	24643.94	-6698.17	-57.94	.01	-.03	-.00
401.972	4514224	-2566358	-9123	24644.06	-6698.41	-58.25	.01	-.01	-.00
404.050	4565439	-2560278	-9244	24644.10	-6698.47	-58.10	.02	.00	.01
406.790	4632970	-2578633	-9403	24644.22	-6698.30	-58.02	-.13	-.03	-.00
408.870	4684232	-2592566	-9524	24644.07	-6698.17	-57.87	-.18	-.06	-.04
411.618	4751952	-2610974	-9684	24642.64	-6699.00	-58.38	-.20	-.04	-.08
413.694	4803115	-2624882	-9805	24642.68	-6698.87	-58.42	-.12	-.02	-.08
416.436	4870666	-2643245	-9966	24642.60	-6698.50	-58.73	.01	.06	-.02

APPENDIX B

TRW REGRESSION PROGRAM (REMP) MODIFICATIONS

A change has been implemented in the TRW regression program (REMP) that allows the effect of unmodeled error uncertainties to be reflected in the a posteriori statistics of the error coefficients. This means that if a set of known functions are purposely omitted from the solution due to correlation or restrictions on model size, the uncertainties of these omitted errors can be effectively added to the uncertainties in the errors that are solved for. This change is mathematically sound and can be described in the following equations.

The usual expression for C_K, the a posteriori covariance matrix of the error coefficients, is

$$C_K = \left(B^T \sigma_m^{-1} B + C_{K_o}^{-1} \right)^{-1} \tag{1}$$

where

$B \equiv$ partial derivations of measurements with respect to error coefficients

$\sigma_m \equiv$ assumed white noise covariance matrix of data

$C_{K_o} \equiv$ a priori error coefficient uncertainties.

The more valid expression for C_K, in light of functions which truly exist but are not solved for, is

$$C_K = (B^T \sigma_m^{-1} B + C_{K_o}^{-1})^{-1} \left[B^T \sigma_m^{-1} (\sigma_m + \beta \Sigma_o \beta^T) \sigma_m^{-1} B + C_{K_o}^{-1} \right] \tag{2}$$

$$(B^T \sigma_m^{-1} B + C_{K_o}^{-1})^{-1}$$

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$$C_K = (B^T \sigma_m^{-1} B + C_{K_o}^{-1})^{-1} \left[B^T \sigma_m^{-1} (\sigma_m + \beta \Sigma_o \beta^T) \sigma_m^{-1} B + C_{K_o}^{-1} \right] (B^T \sigma_m^{-1} B + C_{K_o}^{-1})^{-1} \tag{2}$$

where

$\beta \equiv$ partial derivatives of measurements with respect to omitted error coefficients

$\Sigma_o \equiv$ a priori statistics of omitted terms

with manipulation, Equation 2 can be written as

$$C_K = C_K^* + C_K^* B^T \sigma_m^{-1} \beta \Sigma_o \beta^T \sigma_m^{-1} B C_K^* = C_K^* + \Delta C_K$$

where

$$C_K^* = (B^T \sigma_m^{-1} B + C_{K_o}^{-1})^{-1}$$

The REMP program now computes the ΔC_K term and prints out both C_K and ΔC_K, omitting the old C_K^* terms. It is obvious that the uncertainties of the solved-for error coefficients will now be larger than before (ΔC_K being always positive), sometimes much larger, depending of course on β and Σ_o.

Table B-1 lists the unmodeled error sources considered in the Gemini 7 analysis. The associated 1-sigma a priori uncertainties are also listed.

Table B-1. Unmodeled Errors and 1-Sigma Uncertainties

Symbol	Error Source	1-Sigma Uncertainties
B_X	X accelerometer bias	100 ppm
B_Y	Y accelerometer bias	100 ppm
B_Z	Z accelerometer bias	100 ppm
YSF	Y accelerometer scale factor	160 ppm
ZSF	Z accelerometer scale factor	160 ppm
PHIX	Platform misalignment about x accel axis	44.8 arc sec
A5(1)	MISTRAM I 10K P Leg refraction	15 n units
A6(1), A7(1), A8(1)	MISTRAM I 10K P Leg Internal X, Y, Z Survey	5 ppm
B6(1), B7(1), B8(1)	MISTRAM I 10K Q Leg Internal X, Y, Z Survey	5 ppm
A5(2)	MISTRAM I 100K P Leg Refraction	15 n units
A6(2), A7(2), A8(2)	MISTRAM I 100K P Leg Internal X, Y, Z Survey	5 ppm
B6(2), B7(2), B8(2)	MISTRAM I 100K Q Leg Internal X, Y, Z Survey	5 ppm
C4(3)	GE/Final Range Refraction	15 n units

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1. F. B. Lavenhar, "Preliminary Gemini G and C Data Reduction and Analysis Plan," Space Technology Laboratories, 4160-6009-TU000, 30 October 1964.

2. "Evaluation Report of Mod IIIA Radio Tracking System and Mod III G Missile Borne Guidance Equipment With Gemini Launch Vehicle 7 (U)," Technical Operating Report GE No. 66A200, 7 January 1966. (C)

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