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SUPPLEMENTAL REPORT 4

INERTIAL GUIDANCE SYSTEM EVALUATION TRAJECTORY RECONSTRUCTION (U)

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MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

11 OCTOBER 1965

PUBLISHED AS SUPPLEMENT 4
TO GEMINI V MISSION REPORT
MSC-G-R-65-4,
BY: GEMINI V MISSION EVALUATION TEAM
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

TRW SYSTEMS

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GEMINI GT-5

INERTIAL GUIDANCE SYSTEM EVALUATION

TRAJECTORY RECONSTRUCTION (U)

11 October 1965

by

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

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1.0 INTRODUCTION

GEMINI flight GT-5 was launched on 21 August 1965 from Complex 19 at Cape Kennedy, Florida. This was a 121 orbit, eight day manned orbital flight which included orbit adjustment maneuvers.

The purpose of this report is to present the results from analysis of the inertial guidance system performance during the ascent and re-entry flight phases and to provide a reconstruction of the spacecraft trajectory during ascent and re-entry.

The contents of this report are as follows:

Section 2.0 Provides a summary of the significant analysis results determined from this flight.

Section 3.0 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 procedure;
c. Airborne computer navigation errors.

Section 4.0 Provides a description of the IMU error analysis performed for the re-entry flight phase.

Section 5.0 Describes the external tracking system performance and quality.

Section 6.0 Provides tabular listings of the trajectory reconstruction for ascent and re-entry.

Appendix A Contains support data such as listings and plots of the thrust acceleration profile for ascent and re-entry.

2.0 SUMMARY

The following is a brief summary of the analysis results.

2.1 There was no evidence during the ascent phase of accelerometer, gyro or computer malfunctions.

2.2 The inertial guidance system (IGS) performance during ascent was satisfactory; the following are estimates of IGS errors at injection:

$\Delta X = 607$ ft	$\Delta \dot{X} = 2.4$ ft/sec
$\Delta Y = 347$ ft	$\Delta \dot{Y} = 1.7$ ft/sec
$\Delta Z = -131$ ft	$\Delta \dot{Z} = -3.8$ ft/sec

2.3 There was no single dominant IMU error during the ascent flight phase and IMU error coefficients recovered by analyses were generally nominal.

2.4 Analysis of the IMU azimuth update procedure indicated successful accomplishment of the RGS/IGS update.

2.5 The tracking data was of exceptionally poor quality. The GE Mod III Burroughs and final data were very noisy late in flight. The MISTRAM 100K P calibration channel was again inoperative resulting in a P bias of approximately 2.8 ft. In addition, the quick look MISTRAM I had a discontinuity in the range measurement of -27 ft at BECO and a refraction error of approximately 39 PPM.

2.6 The ascent PCM telemetry data was satisfactory for analysis but had a complete data drop out between 42 and 71 seconds.

2.7 The inertial measurement unit exhibited small errors during re-entry. These were primarily due to Y and Z accelerometer bias errors.

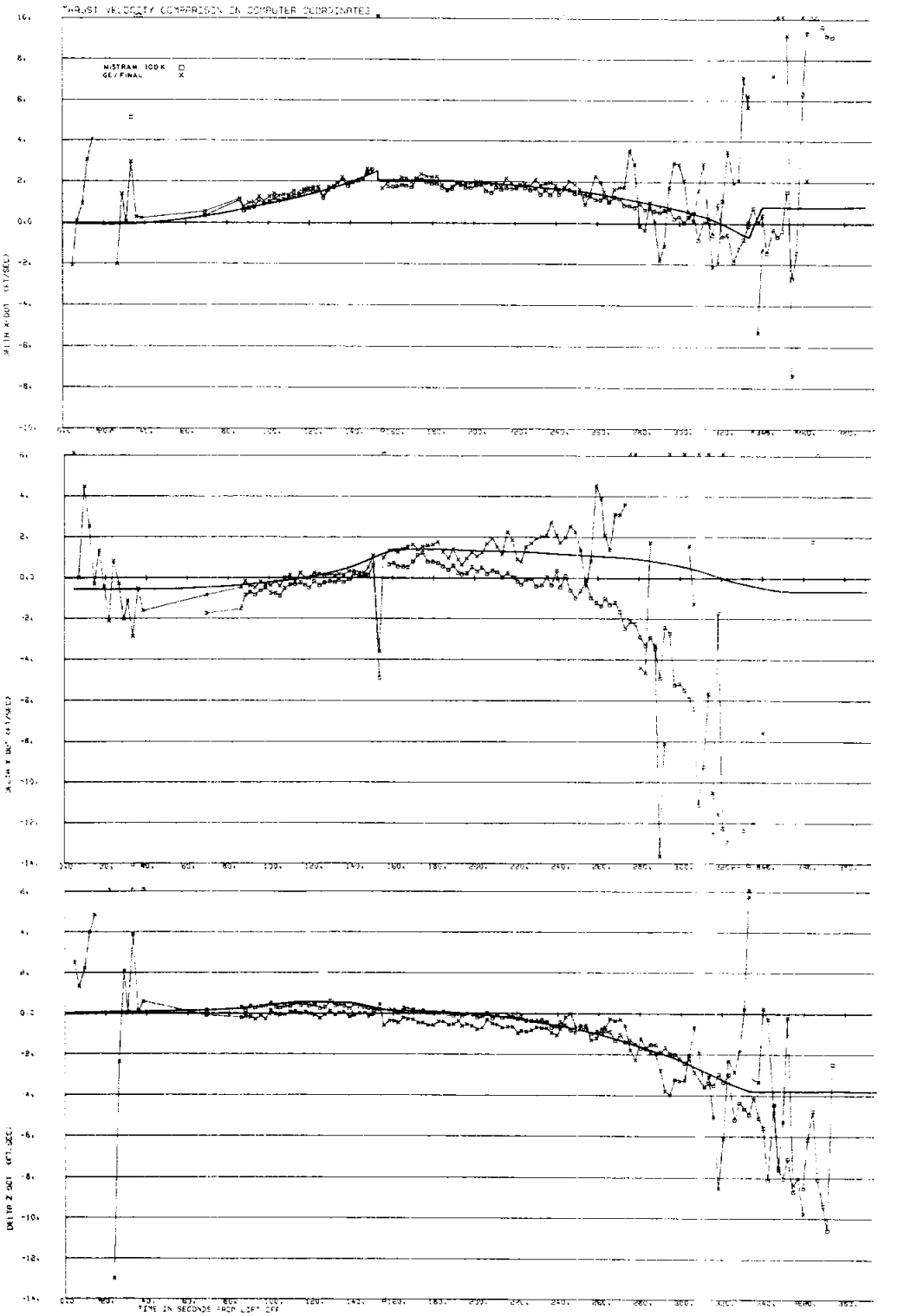
3.0 INERTIAL GUIDANCE SYSTEM PERFORMANCE ANALYSIS

3.1 Introduction

Comparisons of inertial guidance system telemetered quantities and external tracking data were made for the purpose of evaluating the GT-5 inertial guidance system performance. The IMU evaluation was based in part on thrust 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 the guidance set. 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 navigation error.

The thrust, inertial and DELTA-DELTA comparisons are referenced to IGS computer coordinates which are defined as: 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 "go inertial" time and 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 directed so as to complete the right-handed x, y, z set.



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[a] Heavy black line is plot of thrust velocity with errors listed in table 3A removed. (Note added by NASA Gemini V Mission Evaluation Team.)

Figure 1

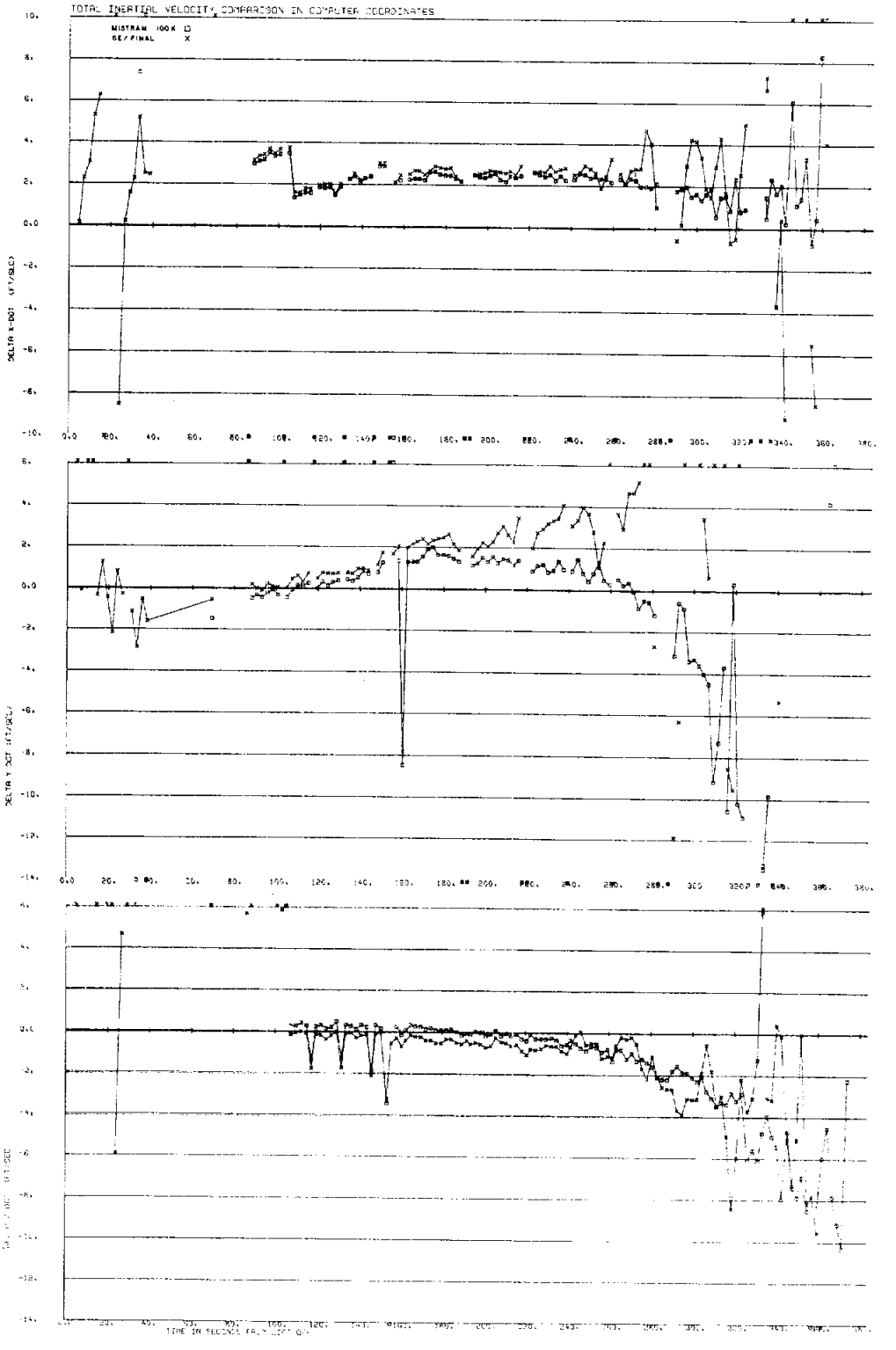

TOTAL INERTIAL VELOCITY COMPARISON IN COMPUTER COORDINATES
MISTRAM 100K D
SE/FINAL X
DELTA X-DOT (FT/SEC)
DELTA Y-DOT (FT/SEC)
TIME IN SECONDS

Figure 2

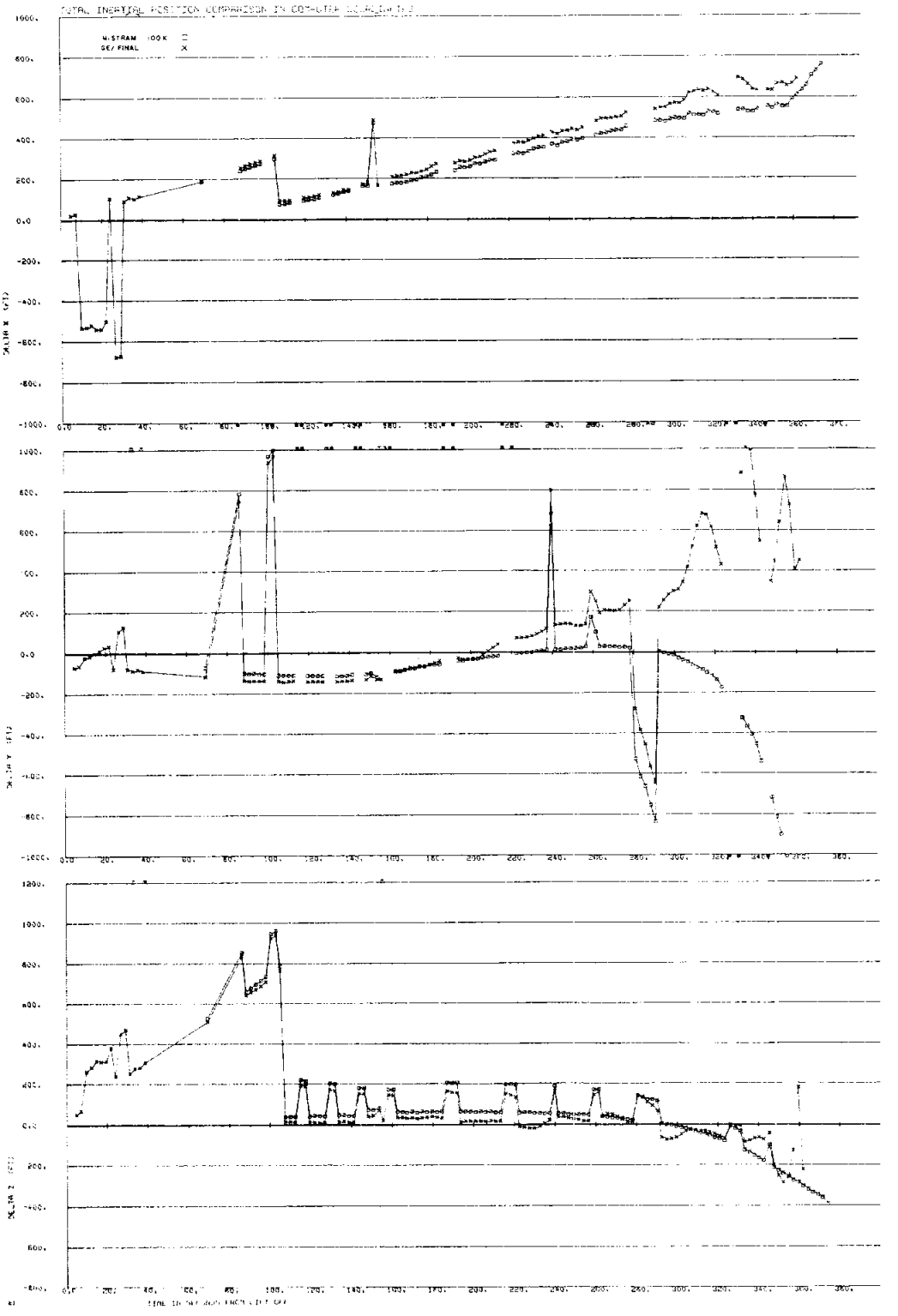


Figure 3

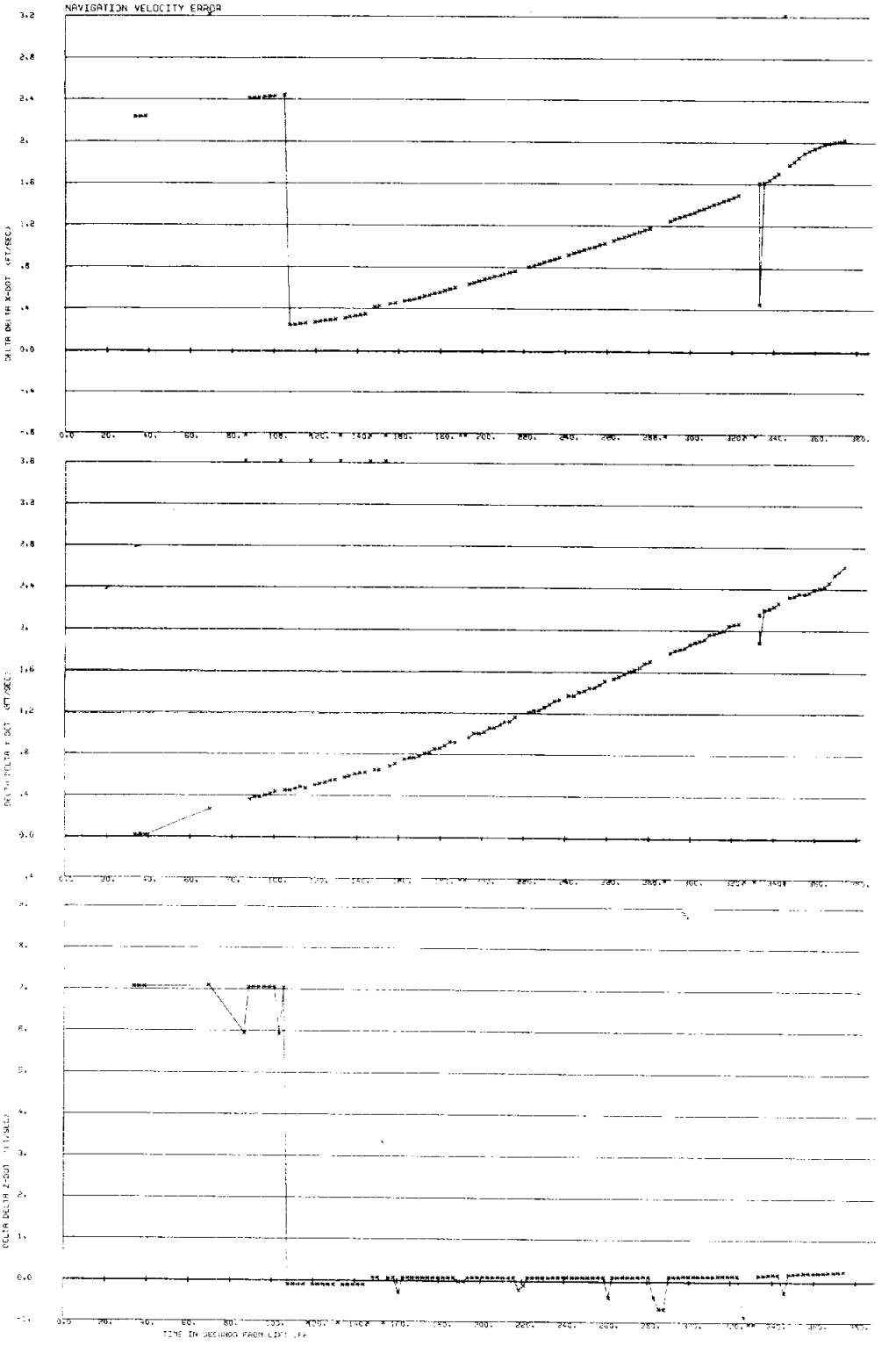

NAVIGATION VELOCITY ERROR
DELTA DELTA X-DOT (FT/SEC)
DELTA DELTA Y-DOT (FT/SEC)
DELTA DELTA Z-DOT (FT/SEC)
TIME IN SECONDS FROM LIFT OFF

Figure 4

Position and velocity comparisons were also made in the external tracking data measurement coordinates. These were made for the purpose of isolating IMU and tracker error coefficients by performing computer regressions on the differences. The reason for regressing in the tracker parameter domain is that the computer programs involved produce the necessary partials and form the normal matrices in the natural tracking system set.

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, and Passive MISTRAM II. An analysis of these data sources is described in Section 5.0.

The plots enclosed are referenced to liftoff time (13 Hr. 59 Min. 59.518 Sec. GMT) which occurred 3.379 seconds after IGS "go inertial".

3.2 Inertial Guidance System Error

The indicated inertial guidance system errors immediately following SECO (336 seconds from liftoff) and equally valid at separation (356 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 and gyro 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 ERROR is the sum of the two and

* 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 1

INERTIAL GUIDANCE ERROR AT SECO

	IMU ERROR	NAVIGATION EQUATION ERRORS	TOTAL GUIDANCE ERROR
$\Delta\dot{x}$ (FPS)	.8 ± .5	1.6 ± .1	2.4 ± .5
$\Delta\dot{y}$ (FPS)	-.5 ± 3.0	2.2 ± .1	1.7 ± 3.0
$\Delta\dot{z}$ (FPS)	-3.9 ± 1.0	.15 ± .1	-3.75 ± 1.0
Δx (FT)	487. ± 20.0	120. ± 5.0	607. ± 21.0
Δy (FT)	115. ± 100.0	232. ± 5.0	347. ± 100.0
Δz (FT)	-100. ± 10.0	-31. ± 1.0	-131. ± 10.0

(THE ± NUMBERS ARE ONE SIGMA ESTIMATES)

TABLE 2

IGS NAVIGATION ERRORS AT SECO

	POSITION (FT)			VELOCITY (FPS)		
	x	y	z	$\dot{x}$	$\dot{y}$	$\dot{z}$
ACTUAL	120	232	-31	1.6	2.2	.15
SIMULATION	169	200	-10	1.9	1.4	.03

represents the total IGS error. These total errors result in velocity magnitude and flight path angle errors at release of the following amounts:

$$\Delta |V| = 2.8 \text{ ft/sec}$$

$$\Delta\gamma = -.008 \text{ degree}$$

Table 2 is a comparison between the navigation errors observed on this flight and those predicted by preflight simulation.** The Table 2 results show reasonable agreement between the actual and simulated navigation errors. The y velocity error difference is due primarily to a gravity integration error of .70 ft/sec resulting from an IGS time drift of 60 PPM (See Section 3.3).

3.3 IMU Analysis

3.3.1 IMU Error

The thrust velocity comparison plots (Figure 1) indicate small x and z velocity errors which increase in magnitude to approximately +2 and 0.2 fps at BECO (157 seconds) and to +1 and -4 fps at SECO respectively. The y axis velocity residuals indicate a discrepancy between the GE/Final and quick look MISTRAM 100K tracking data and show residuals of approximately +6 and -13 at SECO for the respective trackers. The rapid trend of the y axis residuals after 270 seconds of the MISTRAM comparison suggests a MISTRAM P bias error as the most probable cause of the discrepancy; a regression analysis substantiates this conclusion (See Section 3.3.2).

Analyses to recover IMU error coefficients were performed by using the procedures and data processing programs as documented in Reference (1)

** The preflight simulation values were obtained by telephone from IBM.

with the exception that the Recursive Error Modelling Program (REMP) was used for regression analysis (See Section 3.3.3). The regression analysis was performed in the natural measurement coordinates of the external tracking systems which included the following:

TRACKER		OBSERVATION
MISTRAM I	100K	R P Q $\dot{R}$
MISTRAM I	10K	P Q
MISTRAM II		R P Q
GE/FINAL		R A E $\dot{R}$ $\dot{P}$ $\dot{Q}$

[a]

The IMU and tracker error sources recovered in the regression analysis are presented in Table 3. These indicate that there was no single dominant IMU error source and with the exception of z accelerometer bias and scale factor and y gyro input axis unbalance, recovered coefficients were within expected magnitudes. It should be noted that due to the high degree of correlation among many GEMINI IMU error sources, the true error source magnitude may be reflected into another having similar propagation. An example of this is y gyro constant drift rate and input axis unbalance. These have almost identical propagation. The recovered coefficients for this pair are -.2 deg/hr and .6 deg/hr/g respectively. These error sources would cause y velocity of -5.25 and 16.5 at SECO for a net error of 11.25. This net error is equivalent to .4 deg/hr/g of y gyro input axis unbalance.

[a] Paragraph deleted by NASA Gemini V Mission Evaluation Team.

TABLE 3A

ASCENT PHASE RECOVERED ERROR COEFFICIENTS

IMU ERROR SOURCE	RECOVERED COEFFICIENT			UNITS
TIMING ERROR (DT)	.0137	±	.0006	SEC.
IGS TIME SCALE FACTOR (TSF)	- 50.5	±	2.2	PPM
X POS BIAS DUE TO INTEGRATION ERROR (POX)	138.6	±	4.9	FT.
Y POS BIAS DUE TO INTEGRATION ERROR (POY)	- 20.9	±	7.3	FT.
Z POS BIAS DUE TO INTEGRATION ERROR (POZ)	63.1	±	4.5	FT.
X ACCELEROMETER SCALE FACTOR (XSF)	57.7	±	17.4	PPM
Y ACCELEROMETER SCALE FACTOR (YSF)	- 43.	±	160.	PPM
Z ACCELEROMETER SCALE FACTOR (ZSF)	- 440.4	±	31.	PPM
X ACCELEROMETER BIAS (BX)	- 250.	±	37.	PPM
Y ACCELEROMETER BIAS (BY)	- 384.	±	62.	PPM
Z ACCELEROMETER BIAS (BZ)	- 596.	±	64.	PPM
X ACCELEROMETER MISALIGNMENT TOWARD Z (XZMSL)	- 73.8	±	6.6	SEC.
Z ACCELEROMETER MISALIGNMENT TOWARD Y (ZYMSL)	- 8.0	±	34.6	SEC.
X GYRO INPUT AXIS UNBALANCE (XGIAU)	- .28	±	.17	DEG./HR./G
Y GYRO INPUT AXIS UNBALANCE (YGIAU)	.596	±	.082	DEG./HR./G
Z GYRO INPUT AXIS UNBALANCE (ZGIAU)	- .082	±	.053	DEG./HR./G
Y GYRO CONSTANT DRIFT RATE (YGCDR)	- .198	±	.073	DEG./HR.
Z GYRO CONSTANT DRIFT RATE (ZGCDR)	- .176	±	.095	DEG./HR.
X GYRO SPIN AXIS UNBALANCE (XGSAU)	- .13	±	.15	DEG./HR./G
Y GYRO SPIN AXIS UNBALANCE (YGSAU)	.11	±	.20	DEG./HR./G
X GYRO ANISOELASTICITY (XGANI)	.273	±	.068	DEG./HR./G
Y GYRO ANISOELASTICITY (YGANI)	.01	±	.1	DEG./HR./G
Z GYRO ANISOELASTICITY (ZGANI)	.211	±	.042	DEG./HR./G
PLATFORM MISALIGNMENT ABOUT X ACCEL. AXIS (PHIX)	34.8	±	7.8	SEC.
PLATFORM MISALIGNMENT ABOUT Y ACCEL. AXIS (PHIY)	- 117.5	±	11.4	SEC.
PLATFORM MISALIGNMENT ABOUT Z ACCEL. AXIS (PHIZ)	16.6	±	.87	SEC.

THE ± NUMBERS NOTED ABOVE ARE 1σ UNCERTAINTIES

TABLE 3B

ASCENT PHASE RECOVERED ERROR COEFFICIENTS

	TRACKER ERROR SOURCE	RECOVERED COEFFICIENT			UNITS
MISTRAM I,	RANGE BIAS (PRIOR TO 160 SEC.) (CO(1))	14.5	±	4.0	FT.
	RANGE BIAS (AFTER 160 SEC.) (CO(2))	- 8.6	±	4.0	FT.
	10K P BIAS (AO(1))	.176	±	.033	FT.
	10K Q BIAS (BO(1))	- .031	±	.034	FT.
	REFRACTION (C4(1))	-39.8	±	10.7	PPM
	100K P BIAS (AO(2))	2.81	±	.25	FT.
	100K Q BIAS (BO(2))	- .17	±	.32	FT.
MISTRAM II,	RANGE BIAS (CO(3))	123.9	±	8.6	FT.
	P BIAS (AO(3))	1.27	±	.37	FT.
	Q BIAS (BO(3))	- 3.04	±	.14	FT.
	RANGE RATE BIAS (C3(3))	- .062	±	.036	FT./SEC.
	REFRACTION (C4(3))	- 4.2	±	17.	PPM
GE/FINAL,	RANGE BIAS (CO(4))	43.8	±	3.2	FT.
	AZIMUTH BIAS (DO(4))	-28.2	±	8.0	MICRO RADIANS
	ELEVATION BIAS (FO(4))	-22.2	±	22.	MICRO RADIANS
	REFRACTION (C4(4))	.55	±	7.8	PPM

THE ± NUMBERS NOTED ABOVE ARE 1σ UNCERTAINTIES

There is undoubtedly correlation between other error sources or combinations which affect recovered coefficient magnitudes, however, the coefficients presented in Table 3 are representative of the IMU errors of the GT-5 ascent flight. (See Section 3.3.3)

Bias and scale factor timing errors were recovered on this flight as on the GT-4 flight. The bias error which is associated with the synchronization to liftoff was .014 seconds, approximately half that of GT-4 (.032), however, the time drift of 60.5 PPM was twice that of GT-4 (29). The indication for both flights was that the IGS time read high.

The effective magnitudes of the GT-5 timing errors at the time of significant flight events were:

.014 seconds at liftoff (t = 0)
.0045 seconds at BECO (t = 157)
-.0063 seconds at SECO (t = 336)

Reference times used on GT-5 were:

Go Inertial (Platform Release)	13 Hr. 59 Min. 56.139 Sec. (GMT)
Range Time Zero	13 Hr. 59 Min. 59.0 Sec. (GMT)
Liftoff	13 Hr. 59 Min. 59.518 Sec. (GMT)

The position biases noted in Table 3 most likely resulted from errors in the numerical integration of the data across the 29 second T/M dropout interval.

The fit associated with the IMU error coefficients of Table 3 are presented in Figure 1. The residual difference between the fit curve and the data points provides a measure of the tracker error since the curve represents compensations for only IMU errors.

3.3.2 Tracker Errors

Table 3 also presents error source coefficients for the trackers listed above which were used in the ascent phase analysis. Most significant of these were those associated with the MISTRAM trackers. The quick look MISTRAM 100K P Calibration Channel was again inoperative resulting in a P bias of 2.8 feet. This bias accounts for the major portion of the discrepancy between y velocity residuals indicated by the 100K and GE/Final data. The large MISTRAM refraction error also contributed to the discrepancy.

The GE/Final data had small error source coefficients. Velocity comparisons using this data (Figure 1), are therefore most representative of the true IMU error.

3.3.3 Regression Analysis

The regression results given in Table 3 require some explanation. These answers are the product of a TRW Weighted Least Squares regression program (REMP) which uses data from several measurement systems to optimally determine a set of systematic error coefficients for those systems. The REMP program (Recursive Error Modeling Program) orders the various error functions to be fit according to their effect over the trajectory, and proceeds to fit the data expanding the error model from the first error source until the model is full. The following is a table of the ordering selected by REMP along with the RMS fit history as the model expands. Note how the RMS reduction begins to be quite small after the 26th term has been fit. This means that the whole error model was not required to fit the data well.

TABLE 3C

COEFFICIENT ORDERING & RMS HISTORY

(RMS BEFORE FIT = 224.33)

NO.	NAME	RMS
1	DT	62.7
2	POX	29.3
3	POZ	15.2
4	POY	14.8
5	C3(3)	14.5
6	CO(3)	10.1
7	CO(1)	10.1
8	CO(2)	10.1
9	BO(2)	10.1
10	CO(4)	10.0
11	AO(3)	9.9
12	BO(3)	9.9
13	BO(1)	9.8
14	AO(2)	9.5
15	C4(1)	6.8
16	DO(4)	6.8
17	FO(4)	6.8
18	C4(3)	6.7
19	AO(1)	6.6
20	C4(4)	6.5
21	XSF	5.8
22	XZMSL	3.1
23	PHIY	2.3
24	PHIZ	2.3
25	TSF	2.0
26	ZGIAU	1.3
27	YGIAU	1.2
28	PHIX	1.2
29	ZSF	1.2
30	ZGANI	1.2
31	XGIAU	1.2
32	BZ	1.2
33	BY	1.1
34	YGCDR	1.1
35	ZGCDR	1.1
36	BX	1.1
37	XGSAU	1.1
38	XGANI	1.1
39	ZYMSL	1.1
40	YSF	1.1
41	YGSAU	1.1
42	YGANI	1.1

The error model used for this analysis has some obvious disadvantages:

1. Several of the IMU functions are highly correlated - the IMU model is too large;
2. There is evidence of insufficient tracking system modelling - the tracking system model may be too small.

The model was used, however, to allow considerable degrees of freedom in the IMU system per a NASA/MSC request and to allow what TRW considers sufficient degrees of freedom in the tracking system.

After making the regression computer run, a scatter plot (Figure 5) was made to better display the results. This graph is a picture of what one might call "Recoverability vs Significance", i.e., the vertical scale is σ_K/σ_{K_o} (a posteriori standard deviation over an a priori standard deviation) and the horizontal scale is K/σ_{K_o} (the recovered coefficient over the a priori 1σ). It is not hard to see that this is actually a plot of σ_K vs K, normalized by σ_{K_o}. Two somewhat arbitrary lines have been drawn at the .1 σ_K/σ_{K_o} level and at the 2. K/σ_{K_o} level. The horizontal line denotes a ten to one uncertainty improvement level while the vertical line is a 2σ or 90% coefficient level. With these divisions it is easy to see which terms are important, which terms are dubious, and which terms are inconsequential (assuming the validity of the lines drawn). Poorly recovered terms are poorly recovered because of correlation with other terms and because of weak determinacy over the trajectory. As an example, we see that terms which affect the vertical direction (circled on the graph) are generally poorly recovered while most tracking terms are well recovered. This implies strongly that the trackers are well determined, i.e., the geometry is advantageous

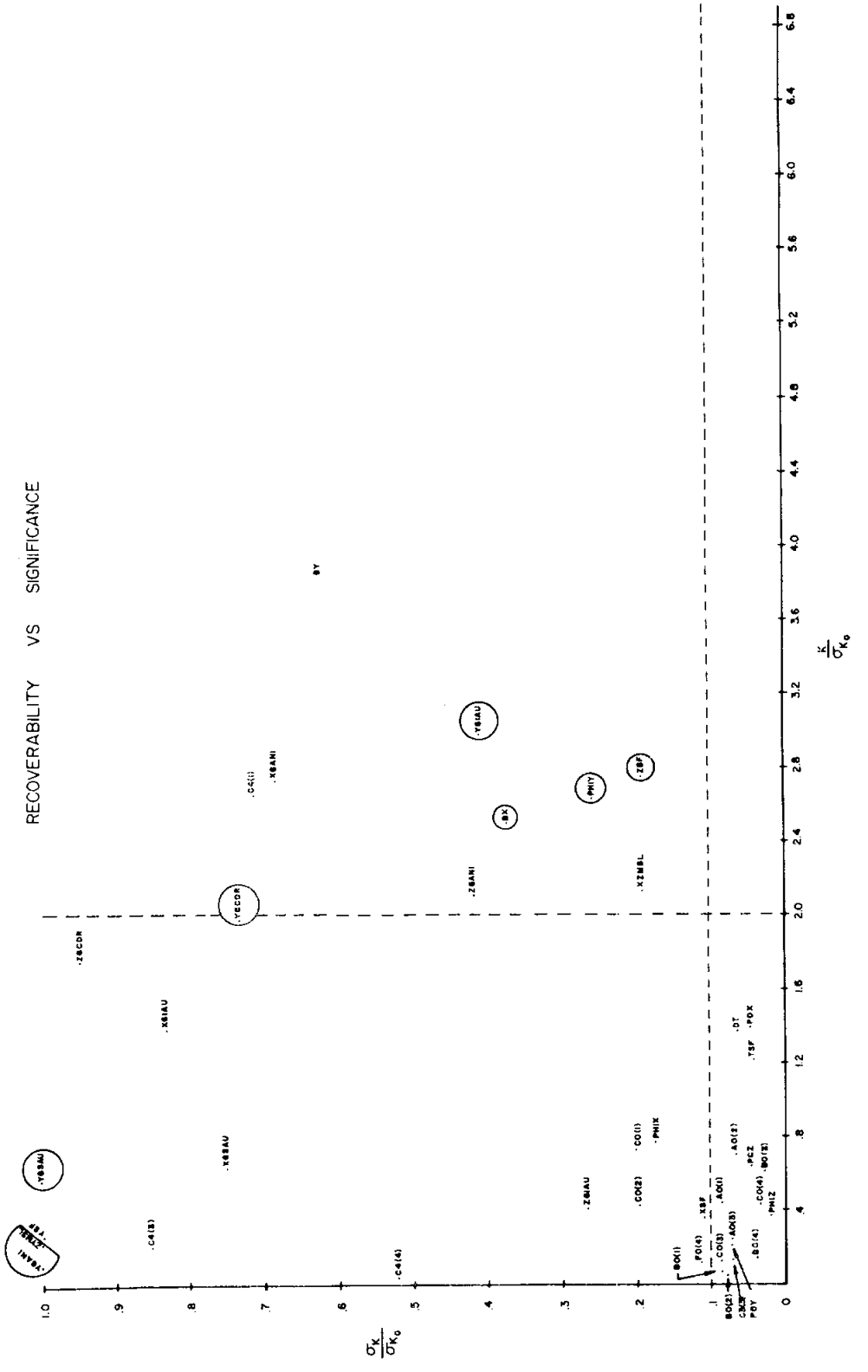

RECOVERABILITY VS SIGNIFICANCE
$\frac{\sigma_K}{\sigma_{K_0}}$
$\frac{\bar{K}}{\sigma_{K_0}}$

FIGURE 5

for tracker analysis while most of the IMU terms are not well determined and many are correlated.

While some of the answers produced by the REMP program seem large, given the input assumptions and the observed data these are the coefficients which best fit the data. It is suggested that because of the apparent error function correlations and possibility of unmodelled tracking system errors, a study be made of the tracking data on all GEMINI flights to try and develop a more suitable set of tracker errors and that the error model for the IMU be reduced to help prevent the problem of correlation among IMU terms.

3.4 Azimuth Update

An azimuth alignment correction is calculated at three separate times by the on-board 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 secs. after liftoff. These are calculated by comparing the crossrange (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 4 summarizes the updates determined by the following methods:

1. Calculated from the telemetry data and simulating the inflight calculations.
2. Calculated from the jumps in the inertial velocity comparisons or the DELTA-DELTA curve.
3. Derived by IBM during their post-flight simulation.

The value indicated at 100 seconds includes those at 0 seconds. The value for zero seconds in the DELTA-DELTA and 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 4

AZIMUTH UPDATE

TIME (SEC. FROM LIFTOFF)	FLIGHT CALCULATION SIMULATION	DELTA-DELTA	IBM	UNITS
0	.0008	.0008	.0008	RADIANS
100	-.0044	-.0056	-.0048	RADIANS
140	-.0003	.0009	.0001	RADIANS
TOTAL	-.0047	-.0047	-.0047	RADIANS
(100 AND 140)	-.2676	-.2672	-.266	DEGREES

The total azimuth correction of -.2676 degrees has been included in all plots contained in this report.

The history of initial alignment error is:

GT-2 r_x = -.29 degrees

GT-3 r_x = -.52 degrees

GT-4 r_x = -.12 degrees

GT-5 r_x = -.27 degrees

Mean Value = -.30 degrees

In all cases this error reflects the basic inability to align the IGS with an outside reference. The 3-sigma design value for alinement is 45 arc minutes and all the values are well within the allowable tolerance. [a]

[a] Paragraph changed by NASA Gemini V Mission Evaluation Team.

4.0 DISCUSSION OF GT-5 RE-ENTRY ANALYSIS AND TRAJECTORY RECONSTRUCTION

4.1 Introduction and Summary

GEMINI GT-5 re-entered the earth's atmosphere approximately 190 hours and 45 minutes from the time of liftoff from Cape Kennedy. Splash-down occurred at about 29.77 degrees North latitude by 69.81 degrees West longitude. The on-board Inertial Navigation System functioned throughout the entire re-entry maneuver (from retro-fire to drogue deployment), and good to poor earth-based radar measurements were available during portions of this period.

Analysis of the IMU performance during re-entry was based primarily upon comparisons with tracking radar measurements originating from the AFETR. Three radars (MILA, PAT, and GBI) tracked the spacecraft for approximately 75 seconds at the time of atmospheric entry. Although the radars were in the skin track mode and the observed elevation angles were generally less than five degrees, by combining all three sets of measurements in a statistical best estimate of trajectory program (TOPS), a segment of position estimates having an estimated RMS error of 2000 feet was achieved.

The lack of extended radar coverage over the actual re-entry portion of the GT-5 flight precluded a complete IMU analysis since no comparisons during high g-loads were obtained. However, since the observed position comparisons just prior to this time were relatively small (Section 4.3), it was concluded that the major contributors to IMU re-entry errors, platform misalignments at retro-fire time, were relatively small for this flight (Section 4.4). The final re-entry RET was obtained from IGS thrust measurements compensated by y and z axis accelerometer biases (Section 6.0). Similar biases were observed during other portions of the GT-5 flight (Section 3.3).

4.2 Initial Platform Alignment and State Vector

The guidance coordinate system during re-entry is defined by the DCS inserted state vector (spacecraft position and velocity) valid at the intended time of retro-fire. The guidance x axis is directed in the tangent plane along the total inertial velocity vector, the y axis is positive downward along the geodetic vertical, and the z axis forms a right-handed set.

The initial state vector used for this analysis was obtained from an ESPOD* program fit to the last orbit tracking data (Reference 2). Table 5 lists this state vector together with the vector supplied to the DCS during the flight.

It should be noted that even though the two vectors agree quite well in position and velocity, the difference in reference longitude (approximately eight degrees) represents an error in the DCS vector. The result of this error was to cause the onboard navigation system to call for a nearly zero lift trajectory in order for the spacecraft to reach the intended impact point. This in turn caused the spacecraft to splash down about 100 miles short.

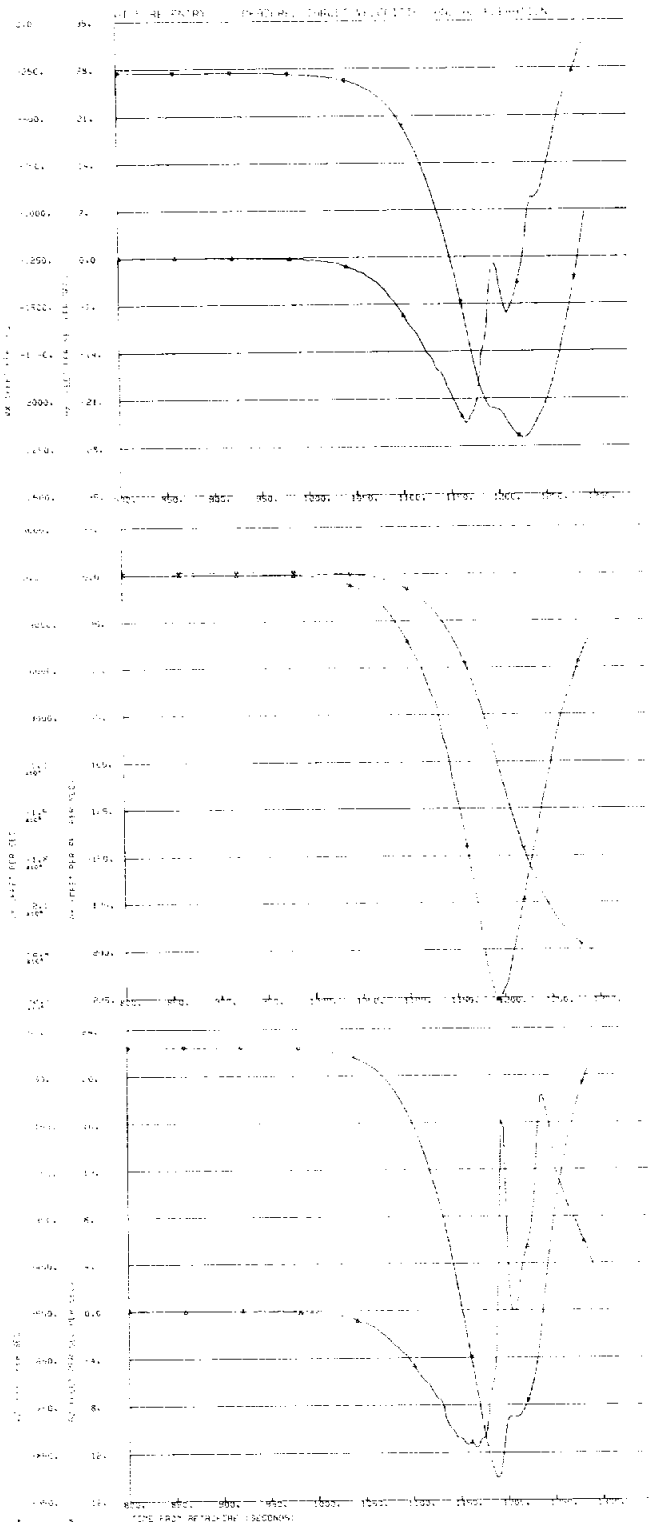
The IMU analysis proceeded on the assumption that, at the time of retro-fire the platform was aligned with the ESPOD vector. Presented in Figure 6 are plots of IMU measured thrust velocity and accelerations from time of retro-fire to drogue deployment. The velocity measurements were initialized with the ESPOD vector and integrated to give total cartesian position and velocity at approximately 2.4 second intervals over this period.

* ESPOD is the name given to the TRW trajectory determination program.

TABLE 5

		TRW VECTOR (ESPOD)		DCS VECTOR (NASA)	
POSITION	x	20,569,453	FEET	20,570,712	FEET
	y	3,884,741	FEET	3,885,588	FEET
	z	6,030,439	FEET	6,030,300	FEET
VELOCITY	$\dot{x}$	-7,607.6	FPS	-7,607.2	FPS
	$\dot{y}$	21,205.9	FPS	21,204.9	FPS
	$\dot{z}$	11,710.9	FPS	11,710.5	FPS
LONGITUDE WITH RESPECT TO GREENWICH DAY OF LAUNCH		195.56	DEG.	203.45	DEG.

NOTE: TIME OF VECTORS: $8^d\ 12^h\ 27^m\ 38^s$ FROM 0^h DAY OF LAUNCH.



Symbols

Δ Acceleration

∇ Velocity [a]

[a] Symbol legend added by NASA Gemini V Mission Evaluation Team.

Figure 6

4.3 External Data Coverage and Processing

Table 6 lists the AFETR radars which tracked the spacecraft. The times of coverage are in units of seconds from time of retro-fire.

TABLE 6

AFETR RADAR COVERAGE

RADAR	LOCATION	COVERAGE (SEC.)
0.18 (PAT)	PATRICK AFB	1076.70 - 1171.55
19.18 (MILA)	MERRIT ISLAND	1090.50 - 1161.00
3.18 (GBI)	GRAND BAHAMA ISLAND	1075.00 - 1160.30

The overlapping coverage permitted the use of a statistical best estimate of trajectory program (TOPS). The final TOPS trajectory extends from t_R + 1093.5 sec. to t_R + 1158.5 sec. The a priori average bias levels used for azimuth, elevation, and range measurements are listed in Table 7. Based upon these values, the estimated a posteriori RMS bias is approximately 1000 feet. The total RMS error (including noise) is estimated at 2000 ft.

TABLE 7

TOPS A PRIORI BIAS LEVELS

MEASUREMENT	A PRIORI BIAS (RMS)	
AZIMUTH	10^{-4}	RADIANS
ELEVATION	4×10^{-4}	RADIANS
RANGE	250	FEET

Figures 7 through 9 are plots of the residuals between the TOPS trajectory and the individual radar measurements. Figure 10 is a plot of estimated standard deviation of the final trajectory. As is evident from these plots, all three radars exhibited extremely high noise levels, due in part to the fact that they were in the skin track mode of operation. Also, Figure 8 shows that Radar 3-18 (GBI) experienced lock-on difficulty until approximately t_R + 1130 seconds, and its data previous to this time contributed very little to the significance of the BET. A range channel jump similar to those seen on flight GT-4 is also apparent at the beginning of the 19.18 radar coverage (Figure 9).

4.4 Inertial Guidance System Analysis

Table 8 lists the differences between the IGS measurements and the TOPS reconstruction in platform coordinates. The indicated discrepancies include total navigational errors in as much as gravity is determined along the IMU derived trajectory. If the errors are small however, it is acceptable as a first order approximation to ascribe the differences to platform (IMU) discrepancies.

Inspection of the average differences in x, y, and z shows a total mean navigation error of about 8,000 feet at t_R + 1130 seconds, with the primary differences occurring in the y and z axes. It was therefore concluded that a large part of these errors arise from y and z accelerometer biases since these had been observed on other portions of the GT-5 flight.

Table 9 lists the y and z accelerometer biases estimated from the mean differences of Table 8. Also included are estimates of these biases based upon an inspection of free-flight thrust data prior to retro-fire. The differences may be attributable to other IMU errors during re-entry, although the platform misalignment at retro-fire necessary to make up this difference would be less than .5 degree.

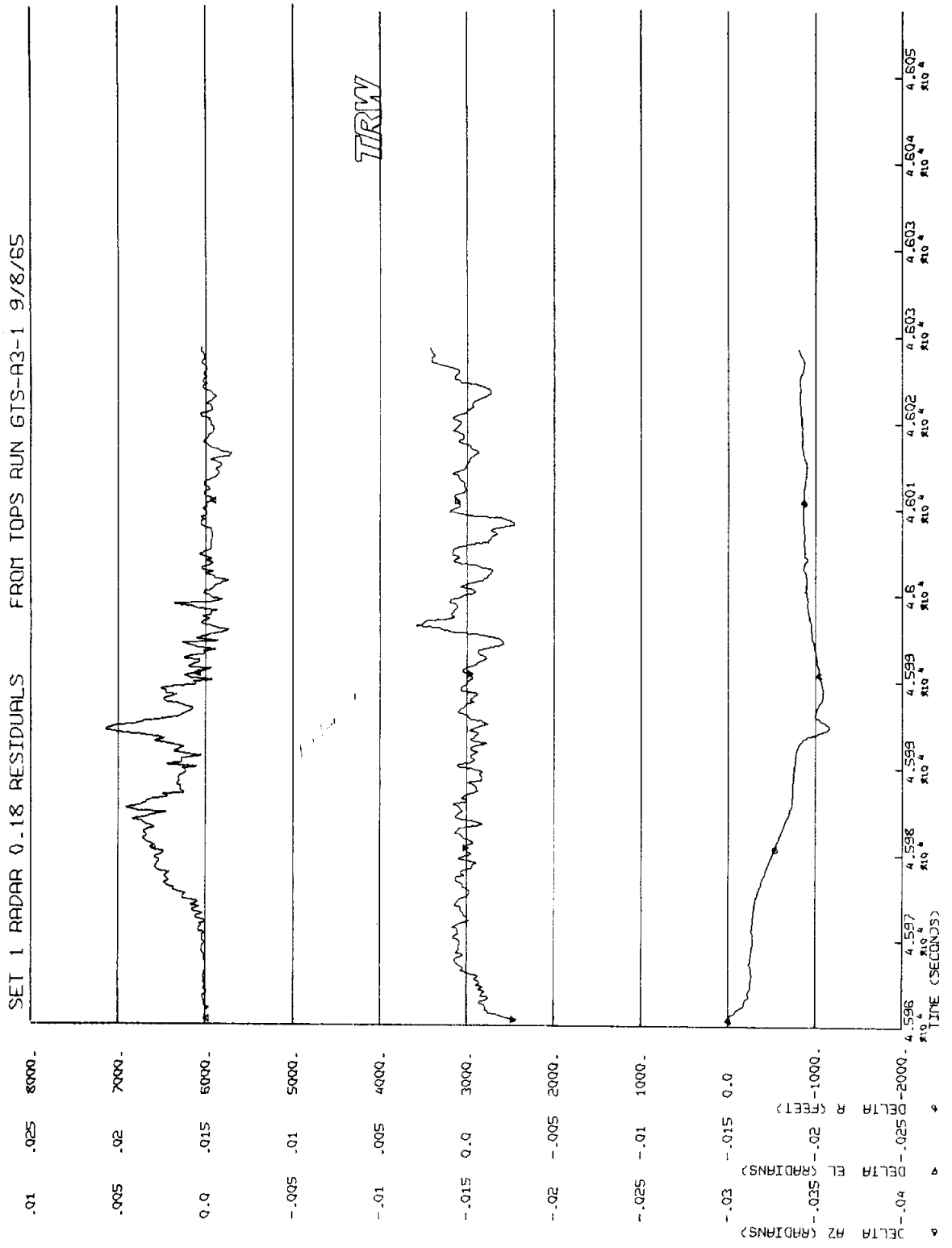

SET 1 RADAR 0.18 RESIDUALS FROM TOPS RUN GTS-A3-1 9/8/65
TRW
DELTA AZ (RADIANS)
DELTA EL (RADIANS)
DELTA R (FEET)
TIME (SECONDS)

Figure 7

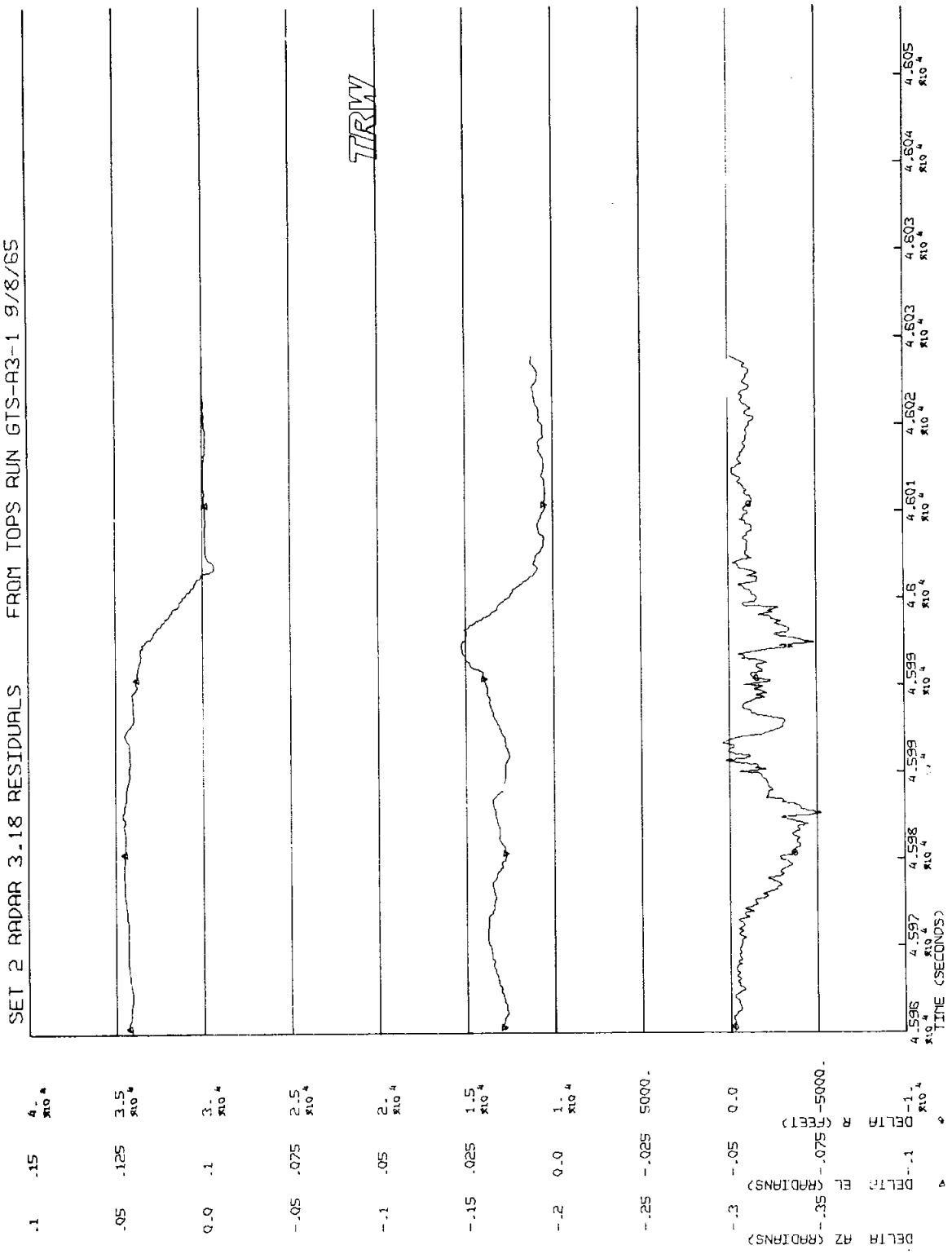

SET 2 RADAR 3.18 RESIDUALS FROM TOPS RUN GTS-A3-1 9/8/65
TRW
TIME (SECONDS)
DELTA AZ (RADIANS)
DELTA EL (RADIANS)
DELTA R (FEET)

Figure 8

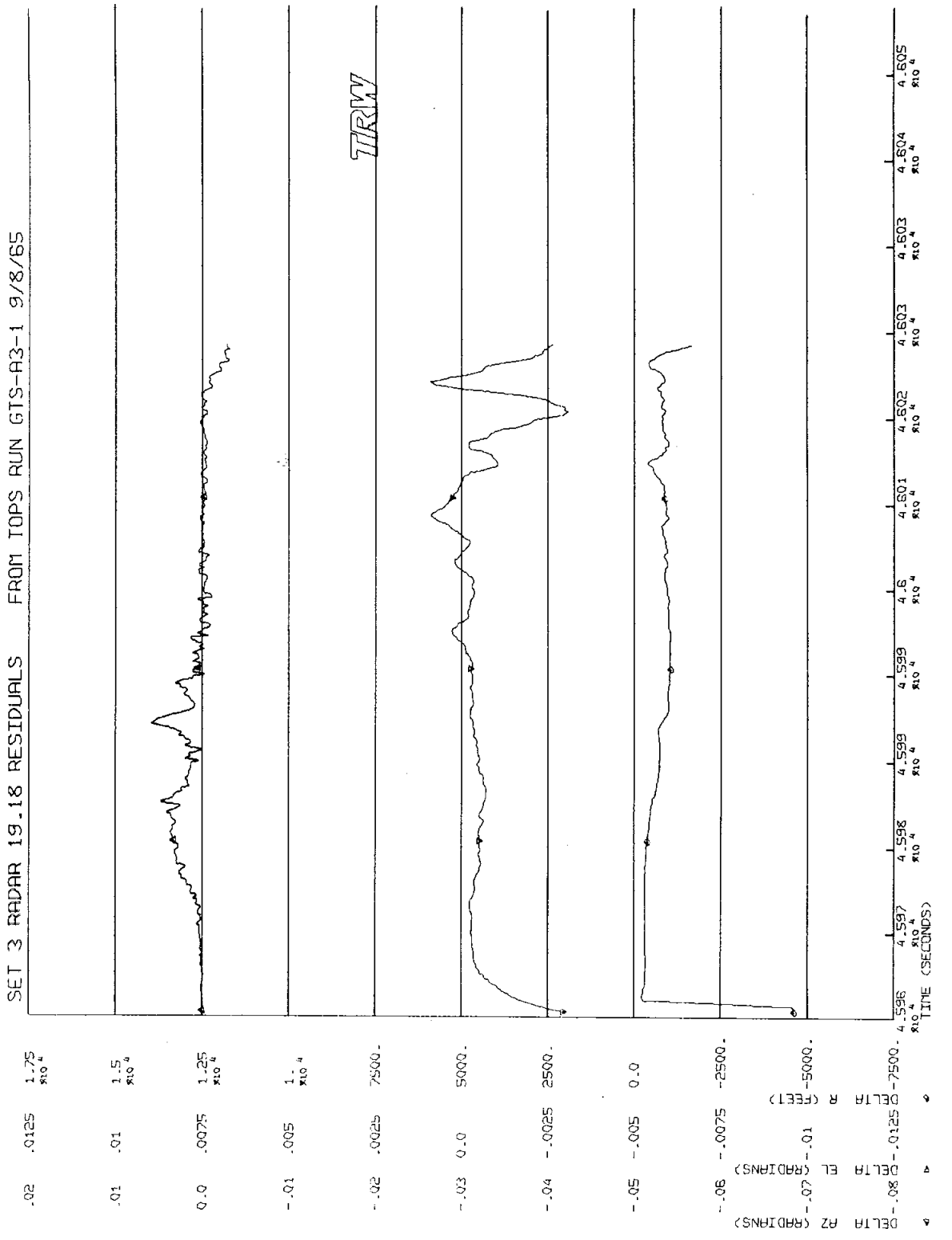

SET 3 RADAR 19.18 RESIDUALS FROM TOPS RUN GTS-A3-1 9/8/65
TRW
TIME (SECONDS)
DELTA R (FEET)
DELTA EL (RADIANS)
DELTA AZ (RADIANS)

Figure 9

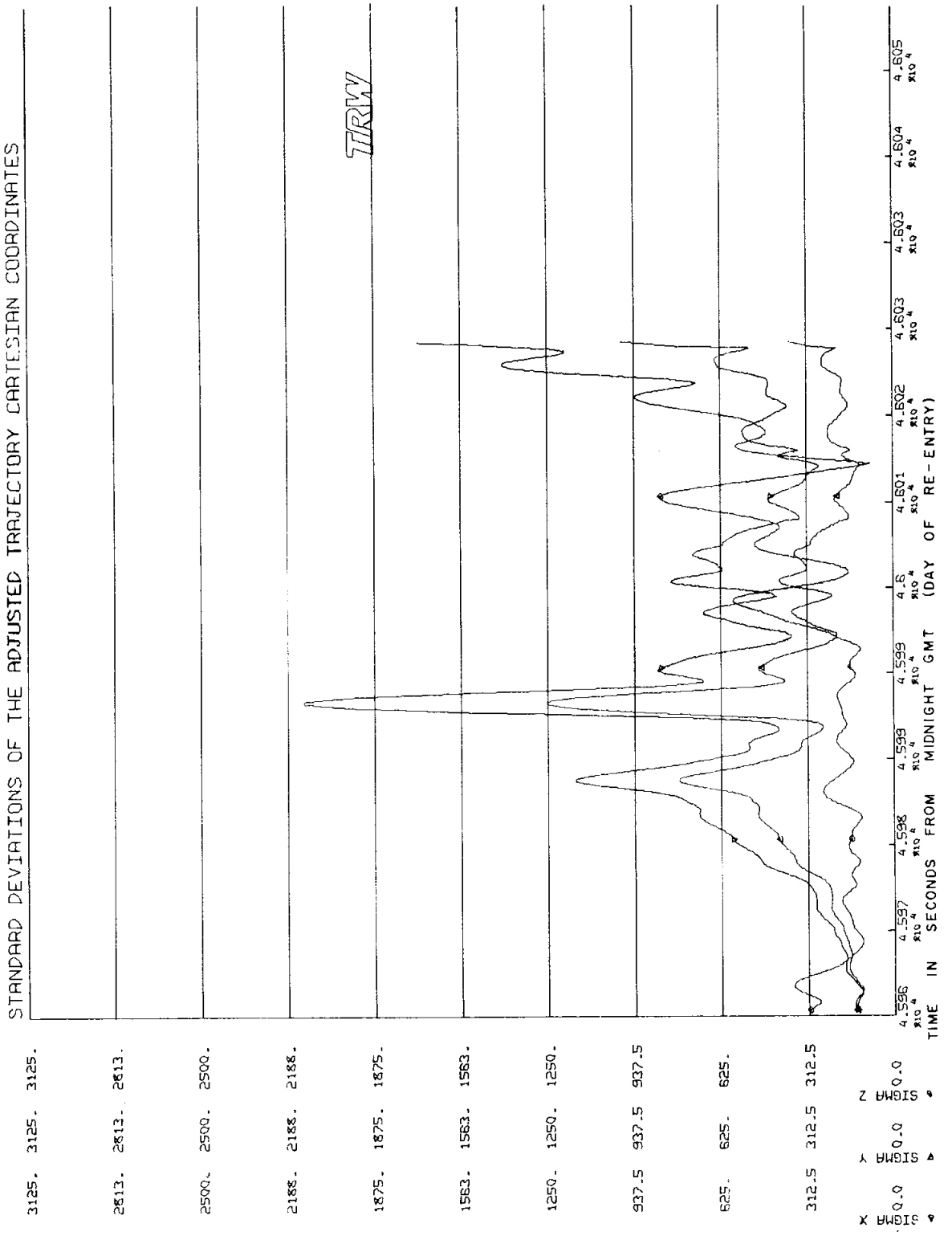

STANDARD DEVIATIONS OF THE ADJUSTED TRAJECTORY CARTESIAN COORDINATES
TRW
3125.
2813.
2500.
2188.
1875.
1563.
1250.
937.5
625.
312.5
0.0
SIGMA X
SIGMA Y
SIGMA Z
4.596 $10^4
4.597 $10^4
4.598 $10^4
4.599 $10^4
4.599 $10^4
4.6 $10^4
4.601 $10^4
4.602 $10^4
4.603 $10^4
4.603 $10^4
4.604 $10^4
4.605 $10^4
TIME IN SECONDS FROM MIDNIGHT GMT (DAY OF RE-ENTRY)

Figure 10

TABLE 8

TOPS/IMU POSITION COMPARISONS IN PLATFORM COORDINATES

TIME FROM RETRO-FIRE (SEC.)	DELTA X (FT.)	DELTA Y (FT.)	DELTA Z (FT.)
1100.467	-1990.00	-9589.56	6066.76
1102.753	-565.00	-10283.40	5966.19
1105.042	-83.25	-10018.40	5560.45
1107.330	-674.50	-9839.50	5723.28
1109.621	-229.00	-8191.44	4099.32
1113.014	12.50	-6256.25	2052.72
1115.304	762.75	-5745.50	949.97
1117.594	278.75	-5015.94	195.04
1119.885	-1680.25	-7279.81	3221.34
1122.178	-1159.50	-8765.12	4520.10
1126.765	1043.50	-8143.25	2352.63
1129.060	7.75	-8738.06	3568.40
1131.357	-2095.50	-8621.50	4628.99
1133.648	1968.75	-10572.50	5081.02
1137.046	-2499.00	-8852.44	5584.97
1139.331	-2998.25	-8000.19	4947.17
1141.616	-489.75	-9006.19	5069.99
1143.900	276.75	-8922.87	4703.45
1146.183	-1143.50	-8116.69	4529.02
1148.465	1389.00	-8948.31	5355.12
1150.744	-1313.50	-8430.00	5513.05
1153.028	-2196.50	-7129.69	4393.47
1155.316	-230.50	-7517.44	4505.82
	AVG. = -598.	AVG. = -7999.	AVG. = 4107.

In summary, therefore, analysis indicates that the Inertial Guidance System exhibited relatively small errors during GT-5 re-entry, and that most of the indicated errors arose from y and z accelerometer biases.* The apparent platform misalignment was less than one degree in all axes.

TABLE 9

ESTIMATED IMU RE-ENTRY ERRORS

	FROM RE-ENTRY ANALYSIS		FREE FLIGHT ESTIMATES	
BY	-207 PPM	±100 PPM	-354 PPM	±50 PPM
BZ	-393 PPM	±100 PPM	-485 PPM	±50 PPM

* It should be noted that these errors do not necessarily represent actual navigation errors since the onboard computer does not use IMU data during free-fall prior to atmospheric entry.

5.0 TRACKING SYSTEM PERFORMANCE

5.1 Introduction

Tracking data available for analysis of the GT-5 IGS performance included the following:

1. GE/Mod III/Burroughs
2. GE/Mod III/Syracuse/Final
3. MISTRAM I Quick Look 10K and 100K
4. MISTRAM Final
5. Passive MISTRAM

Each of the above sets of data were used for position and velocity comparisons as described in Section 3.0. The GE/Mod III/Burroughs data were used for quick look analyses, however, detailed analyses were subsequently accomplished with the GE/Final, Quick Look MISTRAM and Passive MISTRAM data.

For convenience, tracking system velocities were compared with Inertial Guidance data which has been corrected for guidance system errors recovered from analysis (See Section 3). These comparisons are shown in Figures 12 through 33. With the removal of IGS systematic errors, the velocity residuals shown are due to tracker system errors (and IGS random errors) and provide a visual indication of tracker system quality. (Note that the sign sense of comparison is Guidance minus Tracking such that the error shown is the negative of the actual tracker error.)

Discussions of the generation and processing methods for the various tracking systems are contained in References 1 and 3. The following are discussions of the quality of data received for the GT-5 analysis.

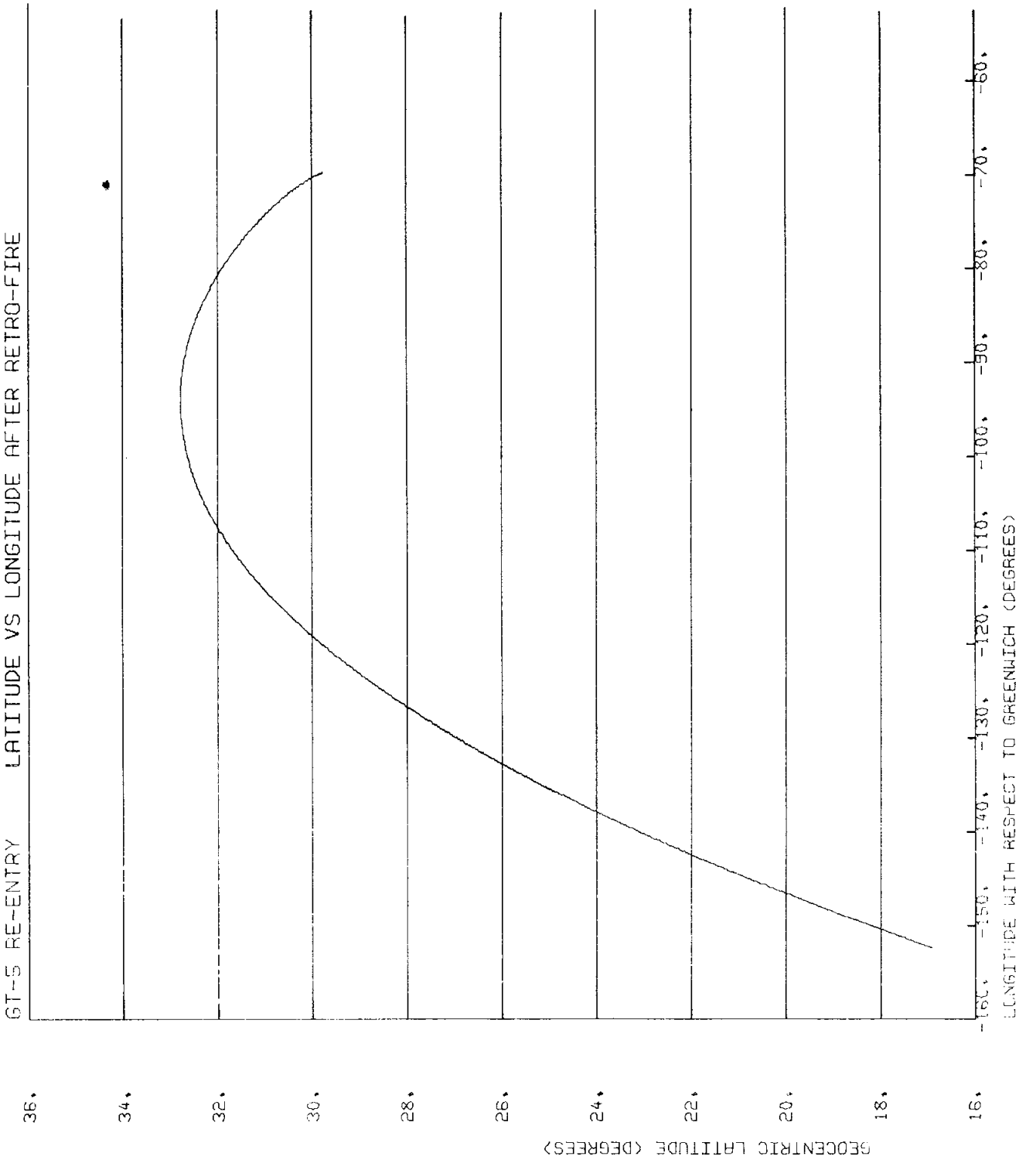

GT-5 RE-ENTRY LATITUDE VS LONGITUDE AFTER RETRO-FIRE
GEOCENTRIC LATITUDE (DEGREES)
36.
34.
32.
30.
28.
26.
24.
22.
20.
18.
16.
-160.
-150.
-140.
-130.
-120.
-110.
-100.
-90.
-80.
-70.
-60.
LONGITUDE WITH RESPECT TO GREENWICH (DEGREES)

Figure 11

5.2 GE/MOD III

Burroughs

The Burroughs raw data, which was recorded at a two per second rate on punched paper tape, was received two days after launch. This data which consists of raw counts was transferred to magnetic tape and processed in the TRW data processing programs.

Figures 12 and 13 present IGS coordinate position and velocity comparisons obtained from the GE/Burroughs and compensated IGS data. (Guidance minus Tracking.) Figures 14 and 15 present comparisons in the Burroughs natural coordinates. The most significant indication of these is a range bias of approximately 150 feet. The azimuth and elevation residuals start at approximately .8 miliradians and decrease to .03 and .05 miliradians respectively. The Burroughs data was excessively noisy on this flight particularly after 300 seconds when the tracking elevation becomes low (less than 10°).

GE/Mod III/Final

The GE/Final data is processed by GE/Syracuse from the ten per second Flight Data Recorder output. The data was available raw and unsmoothed in natural coordinates and as smoothed cartesian xyz data.

The final GE natural coordinate data were used in the computer regression analyses discussed in Section 3.0. Tracker error coefficients recovered

were Range, Azimuth, and Elevation biases of 43.8 ft., -28.2 microradians and -22.2 microradians respectively and an almost negligible refraction error of .5 PPM. The presence of the bias errors are evident in Figures 16 through 19.

The velocity comparisons presented in Figures 1 and 2 were generated with the smoothed final cartesian data. The data noise like that of Burroughs, becomes excessive after 300 seconds corresponding to times of low elevation tracking.

5.3 MISTRAM Data

Quick Look Data

The quick look data received consisted of scaled and corrected, but unsmoothed position data in measurement coordinates. 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}. The data were processed and differentiated in TRW programs to give essentially two sets of tracking data.

The 100K P calibration channel was again inoperative on this flight resulting in the P channel's being in error. The computer regressions performed determined this error to be a bias of approximately 2.8 feet.

Velocity comparisons from 100K and IGS data are presented in Figure 1. The comparisons indicate good agreement between the MISTRAM and GE/Final x and z velocity residuals; however, a significant difference is apparent in the vertical direction where the GE data indicates a positive error trend compared to a large negative trend indicated by the MISTRAM. The major contributors to the indicated difference is the aforementioned

P bias and a MISTRAM I refraction error of -40 PPM. Other MISTRAM I errors recovered from analyses are listed in Table 3 of Section 3.

Comparisons of quick look MISTRAM 10K and 100K and compensated IGS data are presented in Figures 20 through 27. These indicate negligible tracker rate errors; however, there are position biases throughout the flight phase and bias level shifts which occur immediately after BECO. The most significant of these is a -25 ft. jump in the range measurement at this time. The MISTRAM discontinuities are not unusual in that they have been observed on previous flights. These normally result after a temporary loss of track.

MISTRAM Final and Passive MISTRAM

The final MISTRAM is a best estimate trajectory based on all available MISTRAM data (10K, 100K, MISTRAM I and Passive MISTRAM II). Comparisons using these data and the compensated IGS data are presented in Figures 32 and 33. These also show position discontinuities at BECO and a large y velocity error trend as does the quick look MISTRAM data.

Comparisons using the passive MISTRAM data are shown in Figures 28 through 31. These show P and Q biases and negligible rate errors. The passive MISTRAM was also included in the computer regression analysis. The P and Q biases determined were 1.25 ft. and -3.0 ft. Other error sources recovered were: Range bias of 1.24 ft., and a Refraction error of -4.2 PPM.

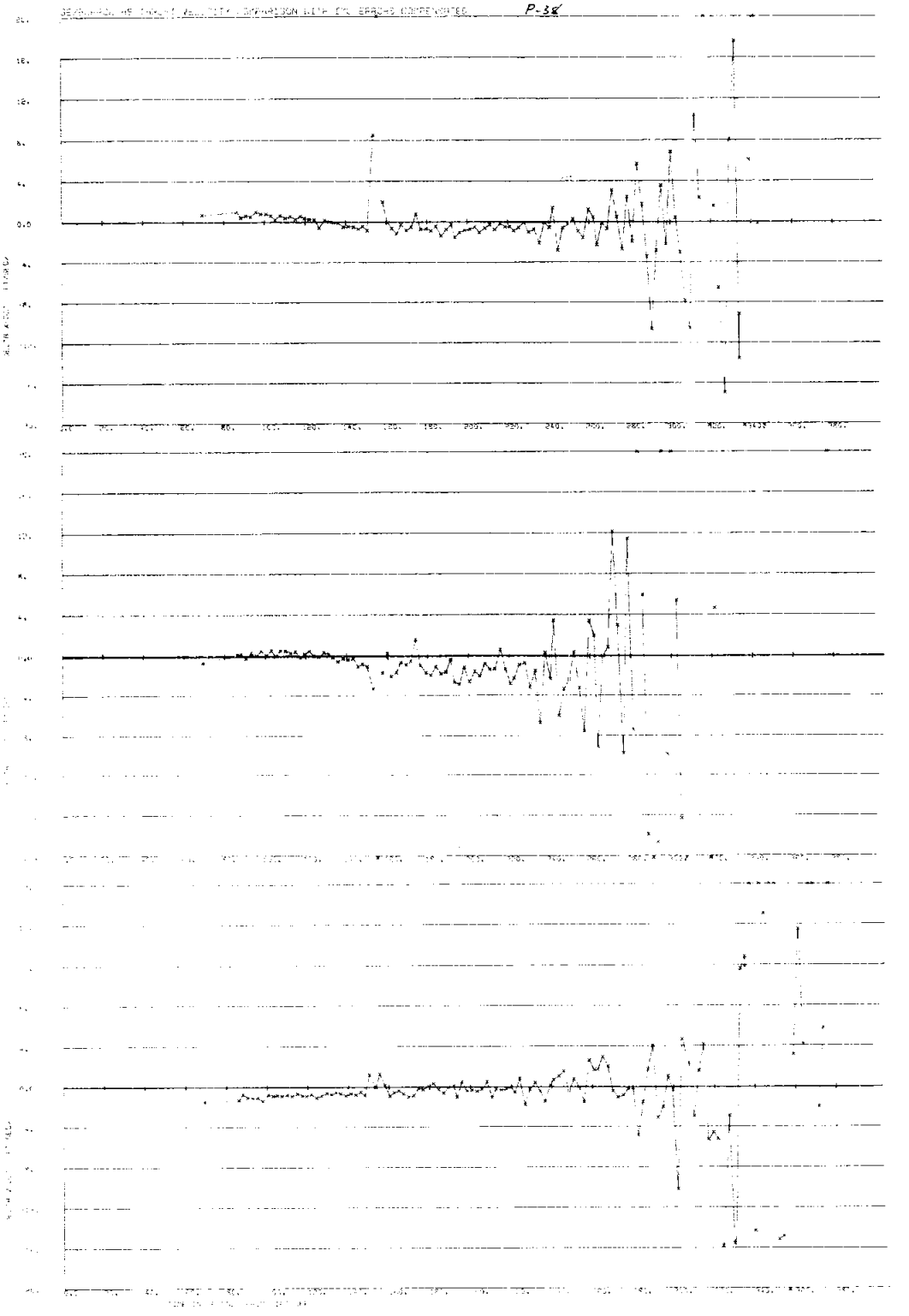
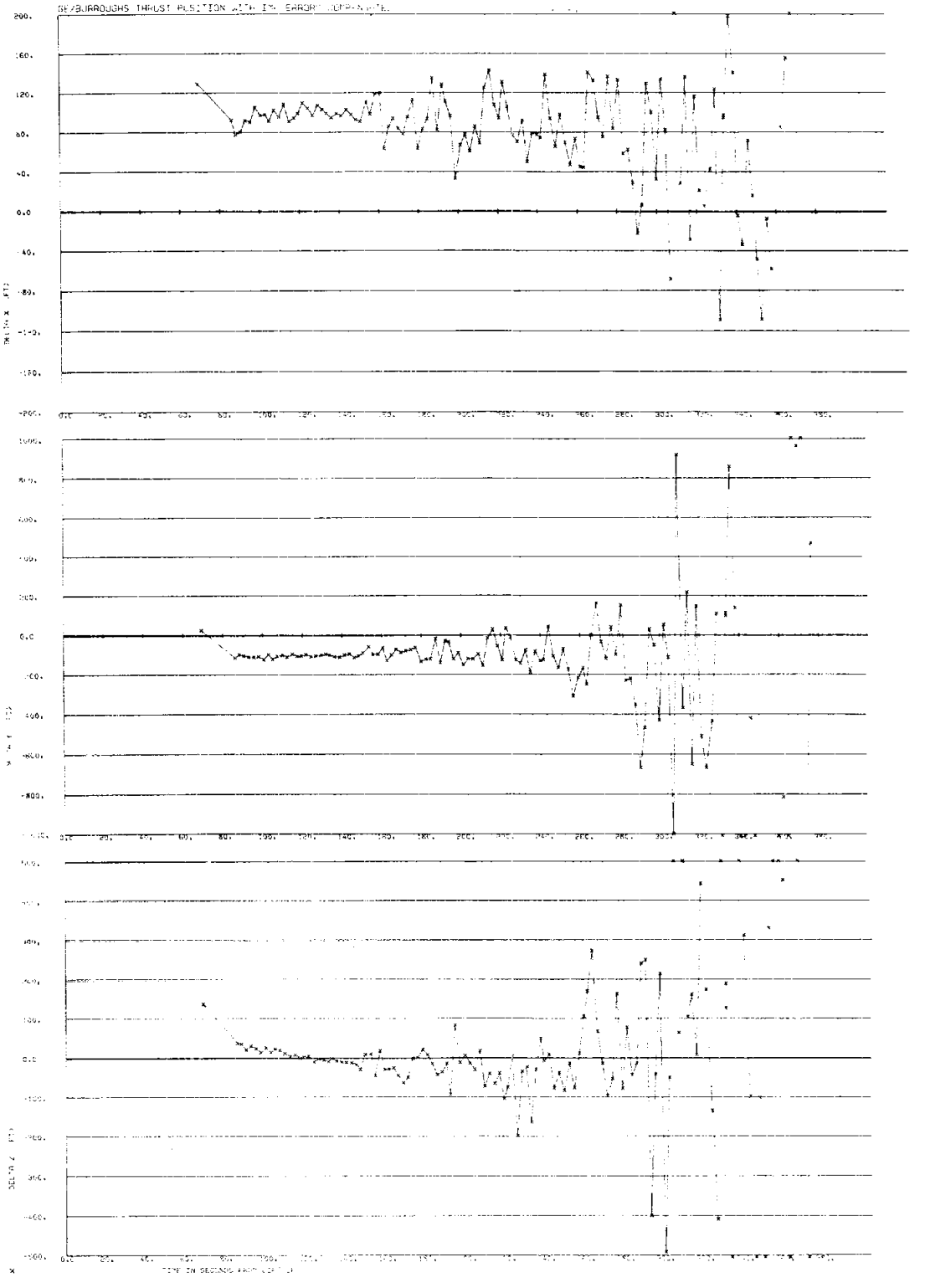


Figure 12



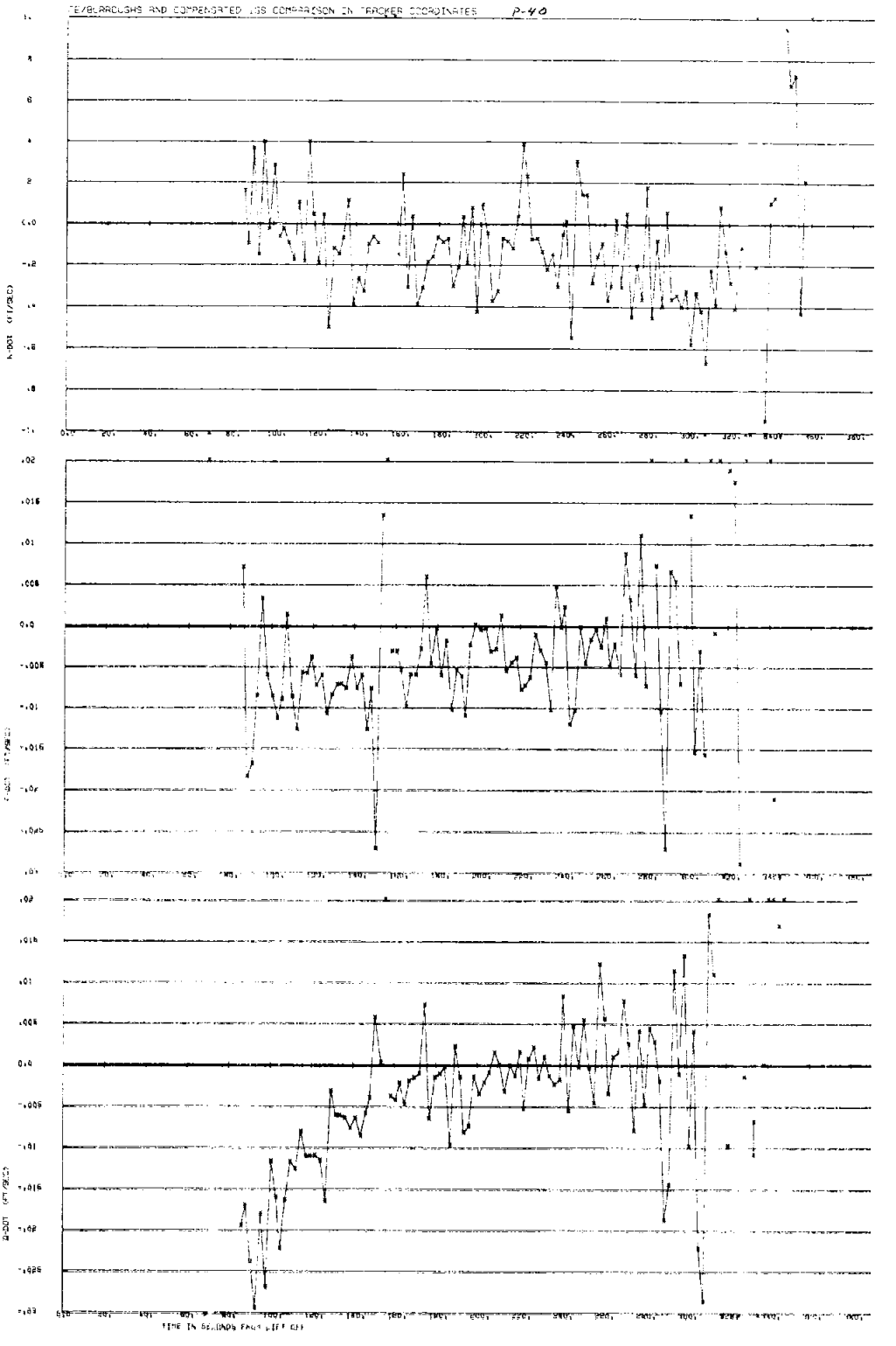
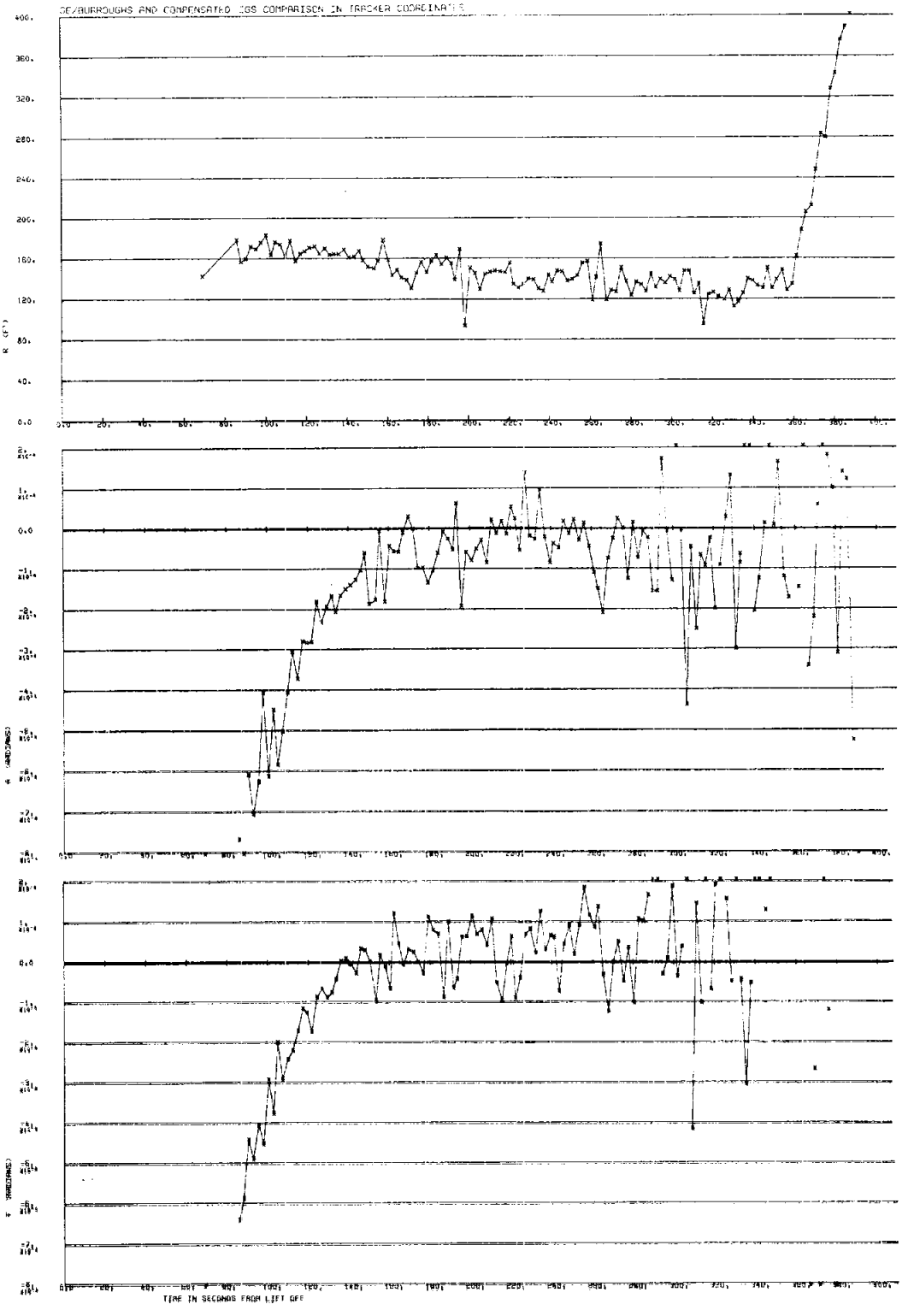
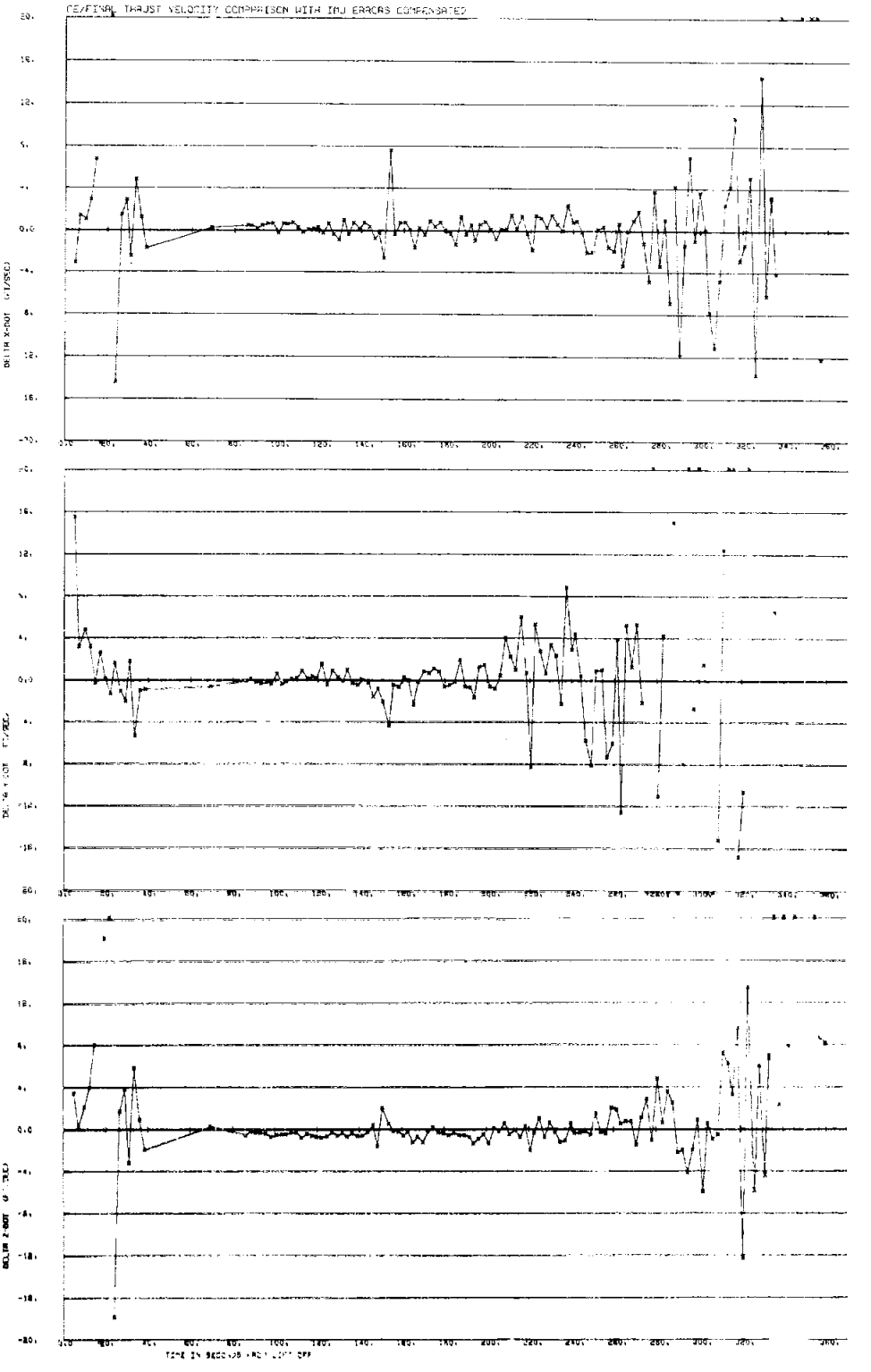

TE/BLRROUGHS AND COMPENSATED LOS COMPARISON IN TRACKER COORDINATES
P-40
TIME IN SECONDS FROM LIFT OFF

Figure 14


TIME IN SECONDS FROM LIFT OFF


CE/FINAL THRUST VELOCITY COMPARISON WITH INU ERRORS COMPENSATED

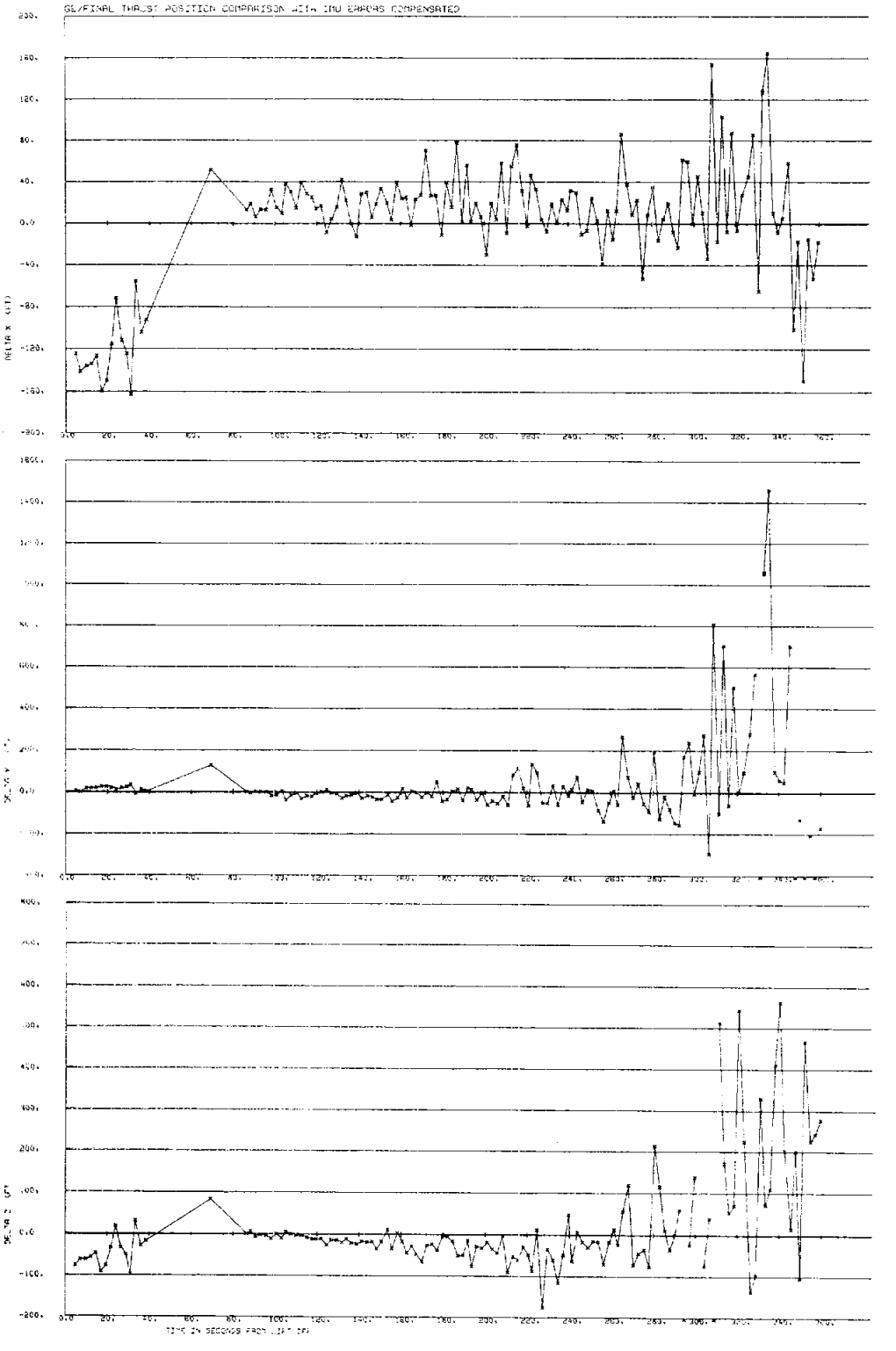

GLXFINAL THRUST POSITION COMPARISON WITH INU ERRORS COMPENSATED

Figure 17

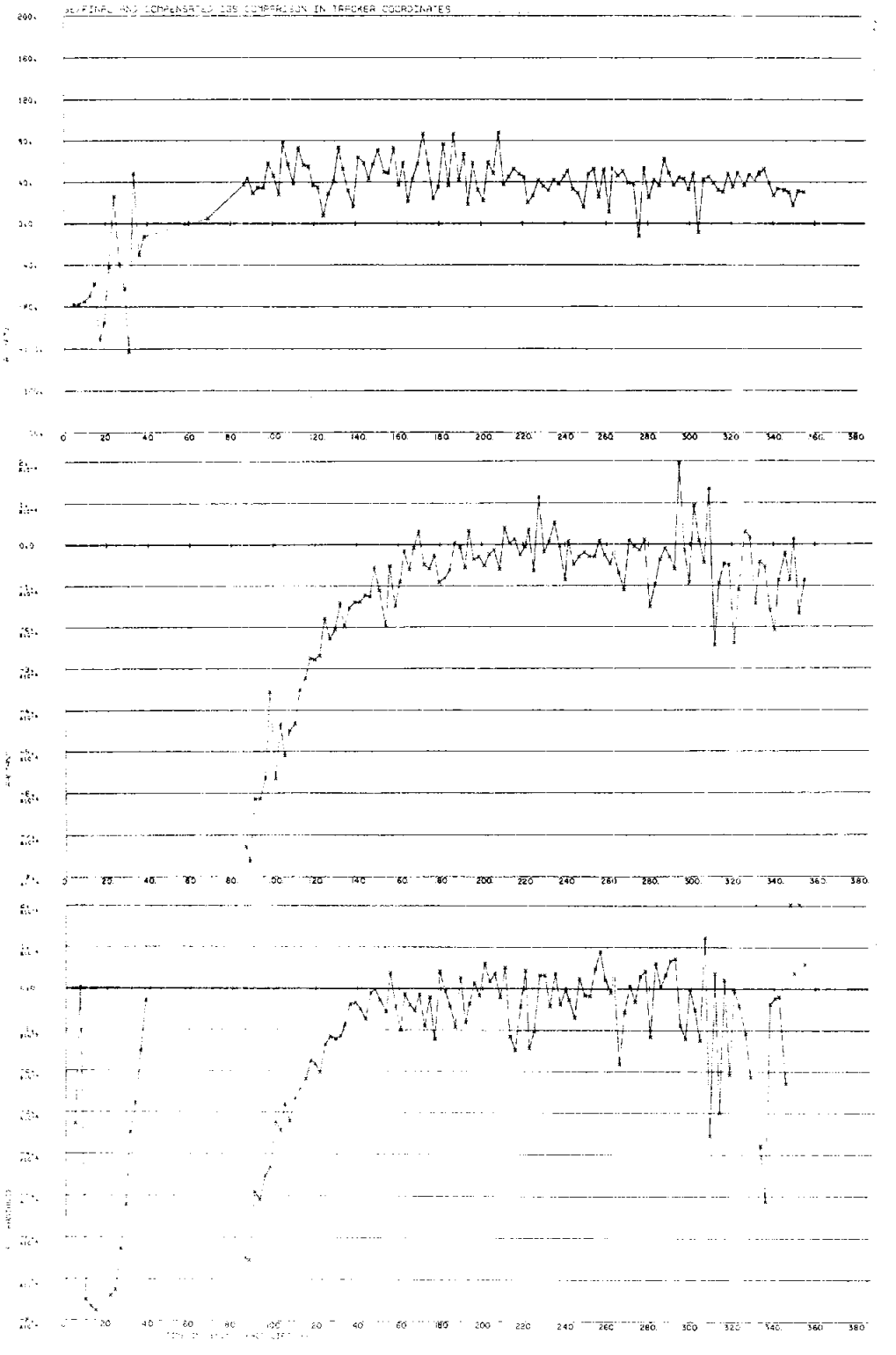


Figure 18

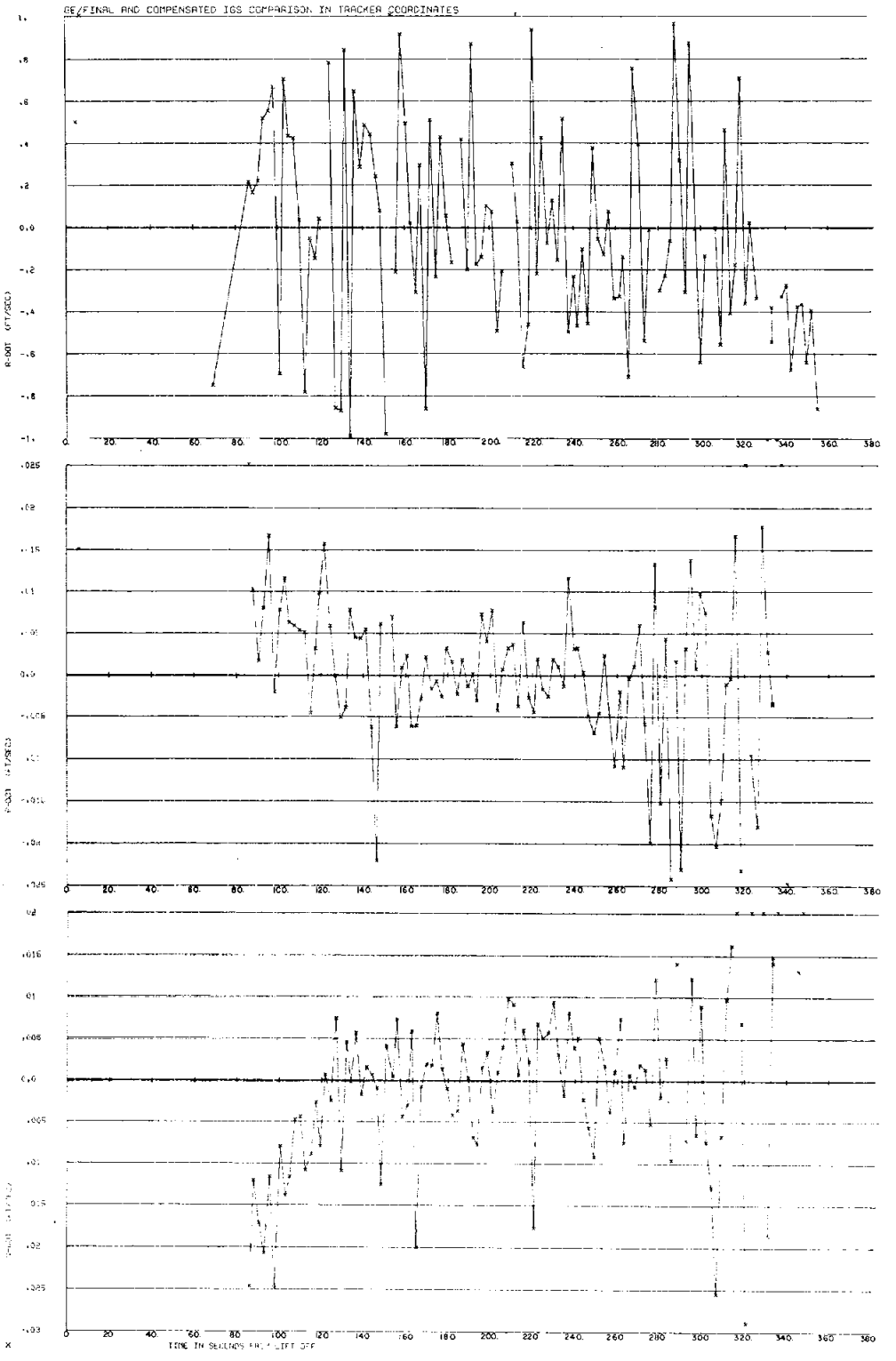

GE/FINAL AND COMPENSATED IGS COMPARISON IN TRACKER COORDINATES
TIME IN SECONDS FROM LIFT OFF

Figure 19

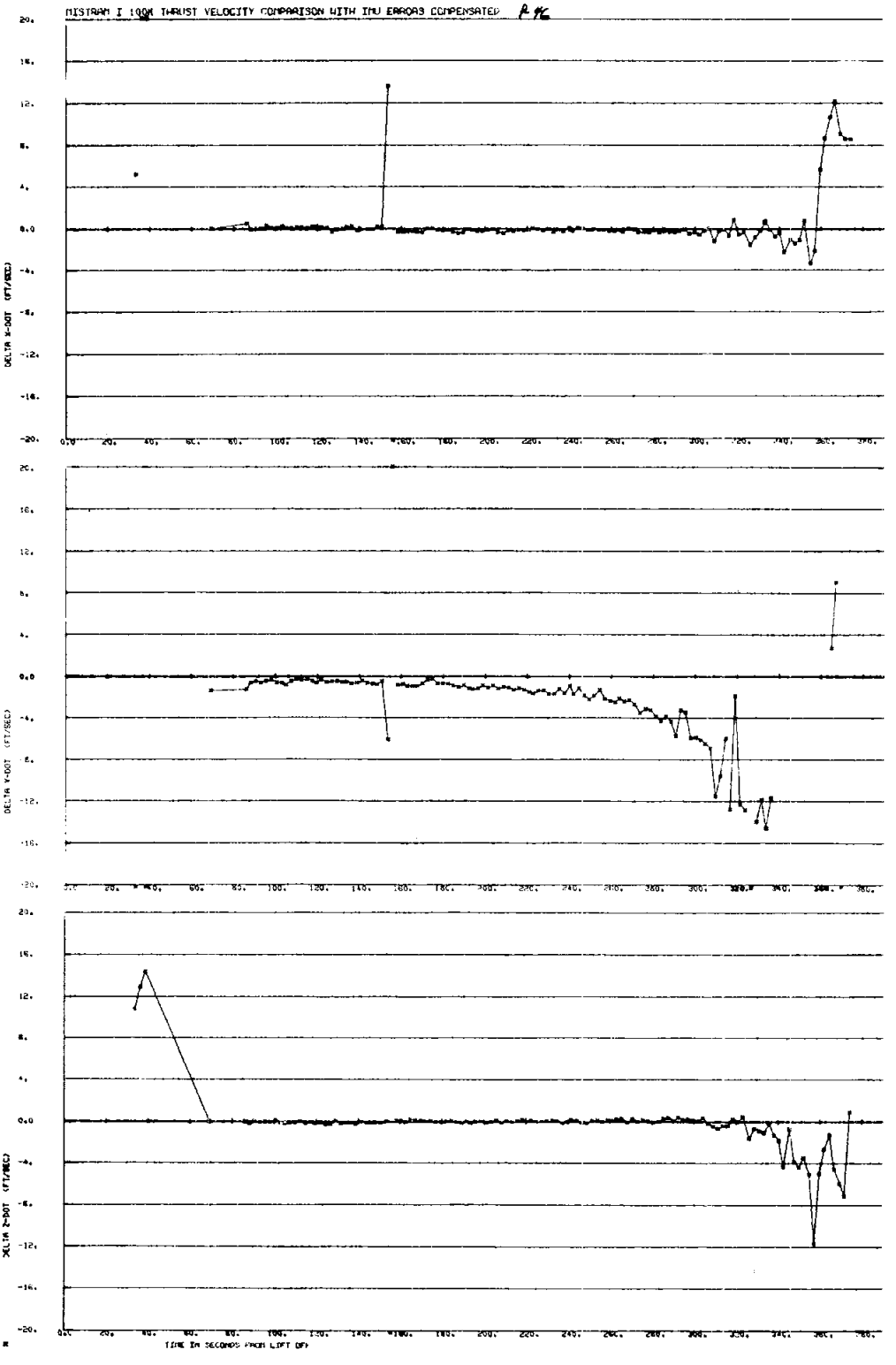

MISTRAM I 100K THRUST VELOCITY COMPARISON WITH IMU ERRORS COMPENSATED
DELTA X-DOT (FT/SEC)
DELTA Y-DOT (FT/SEC)
DELTA Z-DOT (FT/SEC)
TIME IN SECONDS FROM LIFT OFF

Figure 20

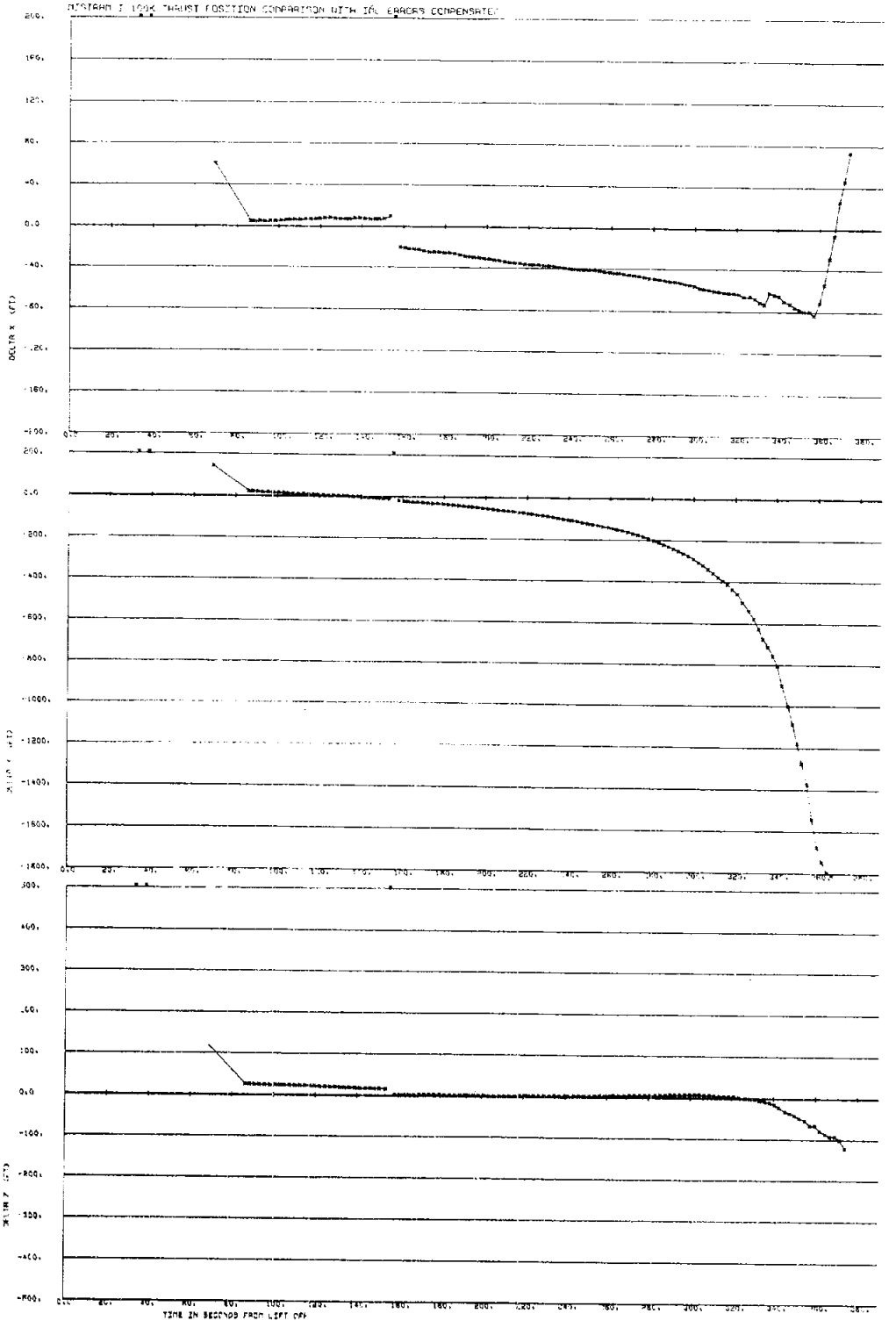


Figure 21

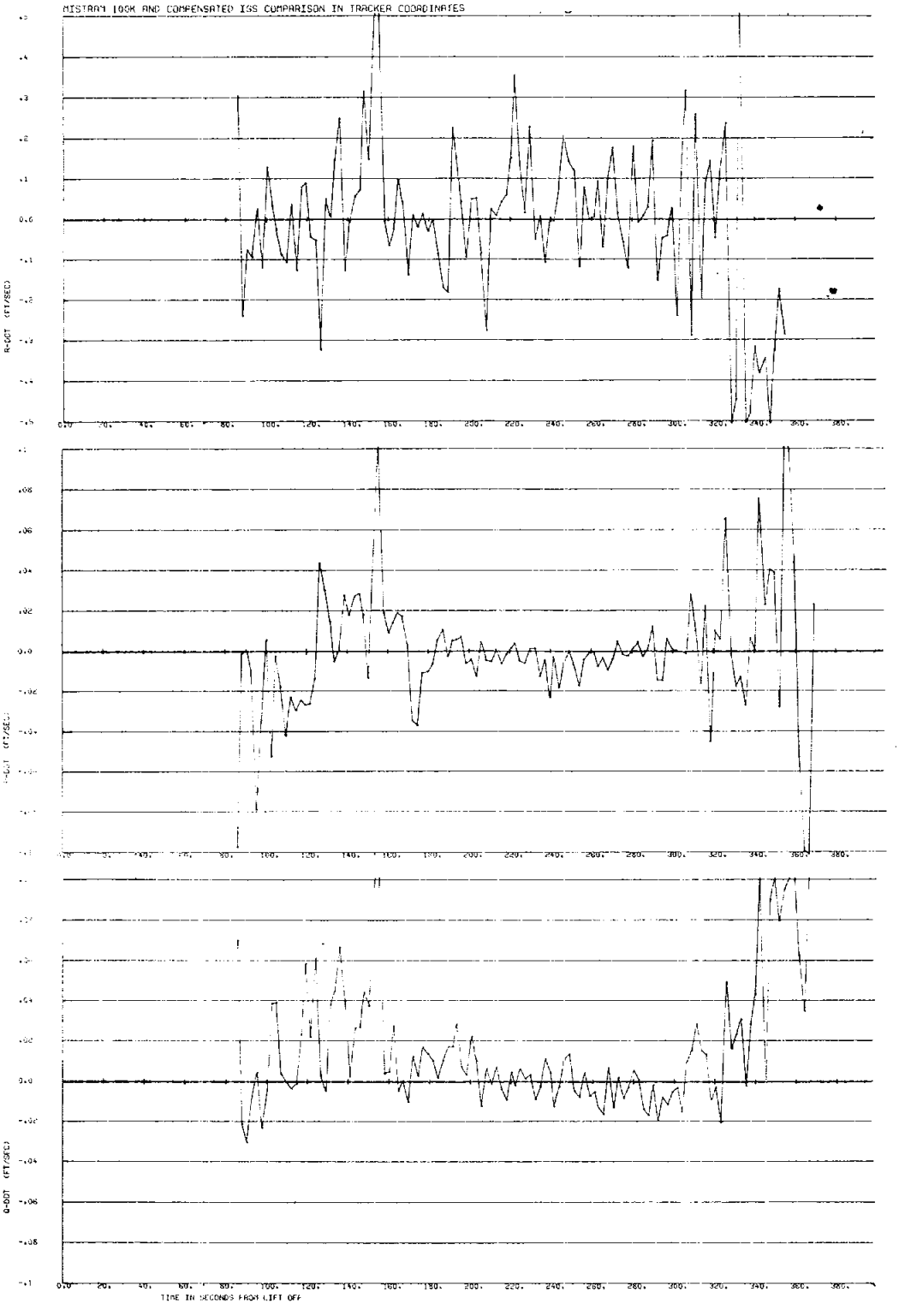

MISTRAM 100K AND COMPENSATED ISS COMPARISON IN TRACKER COORDINATES
R-DOT (FT/SEC)
Q-DOT (FT/SEC)
TIME IN SECONDS FROM LIFT OFF

Figure 22

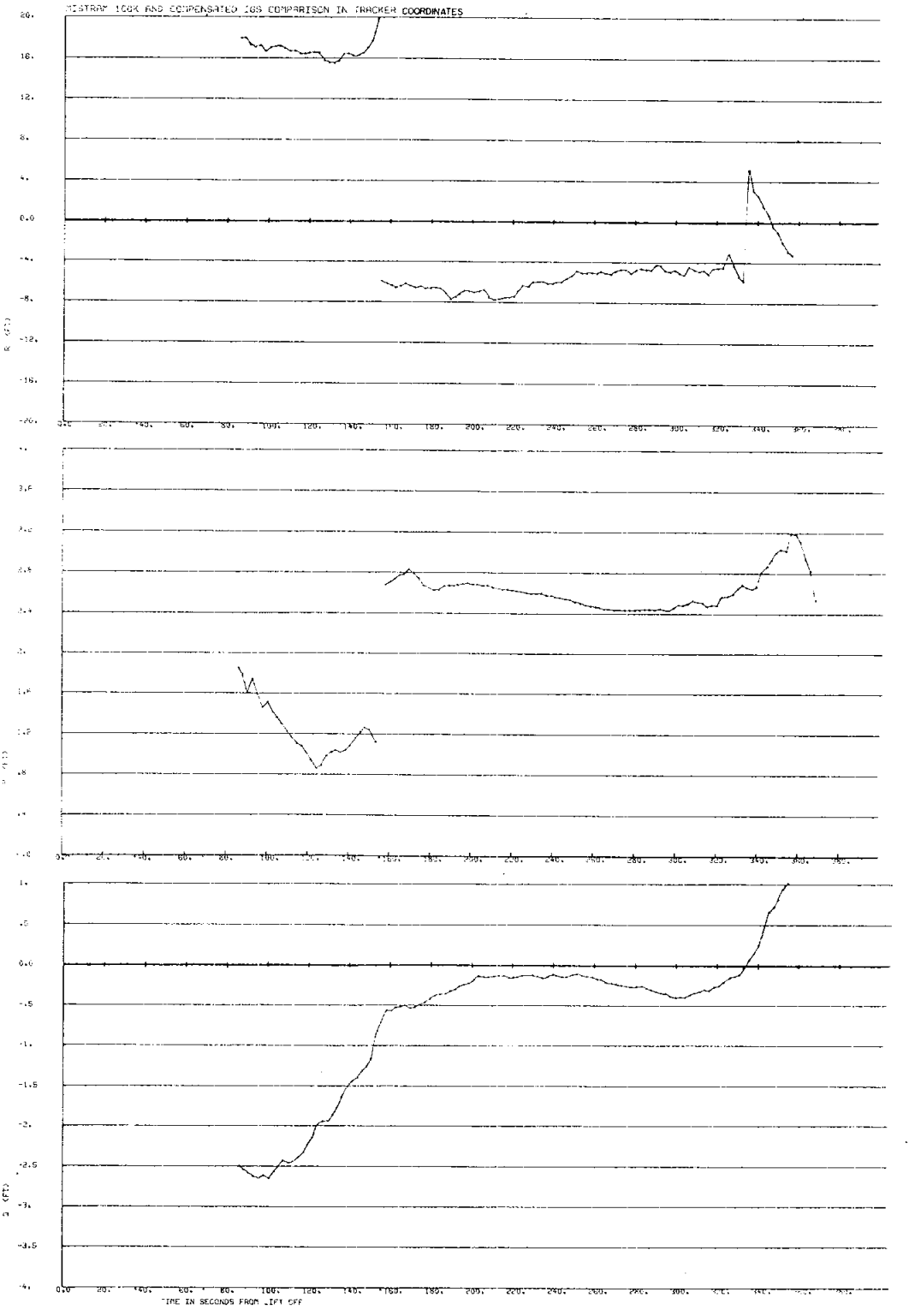

MISTRAM 100K AND COMPENSATED IGS COMPARISON IN TRACKER COORDINATES
TIME IN SECONDS FROM LIFT OFF

Figure 23

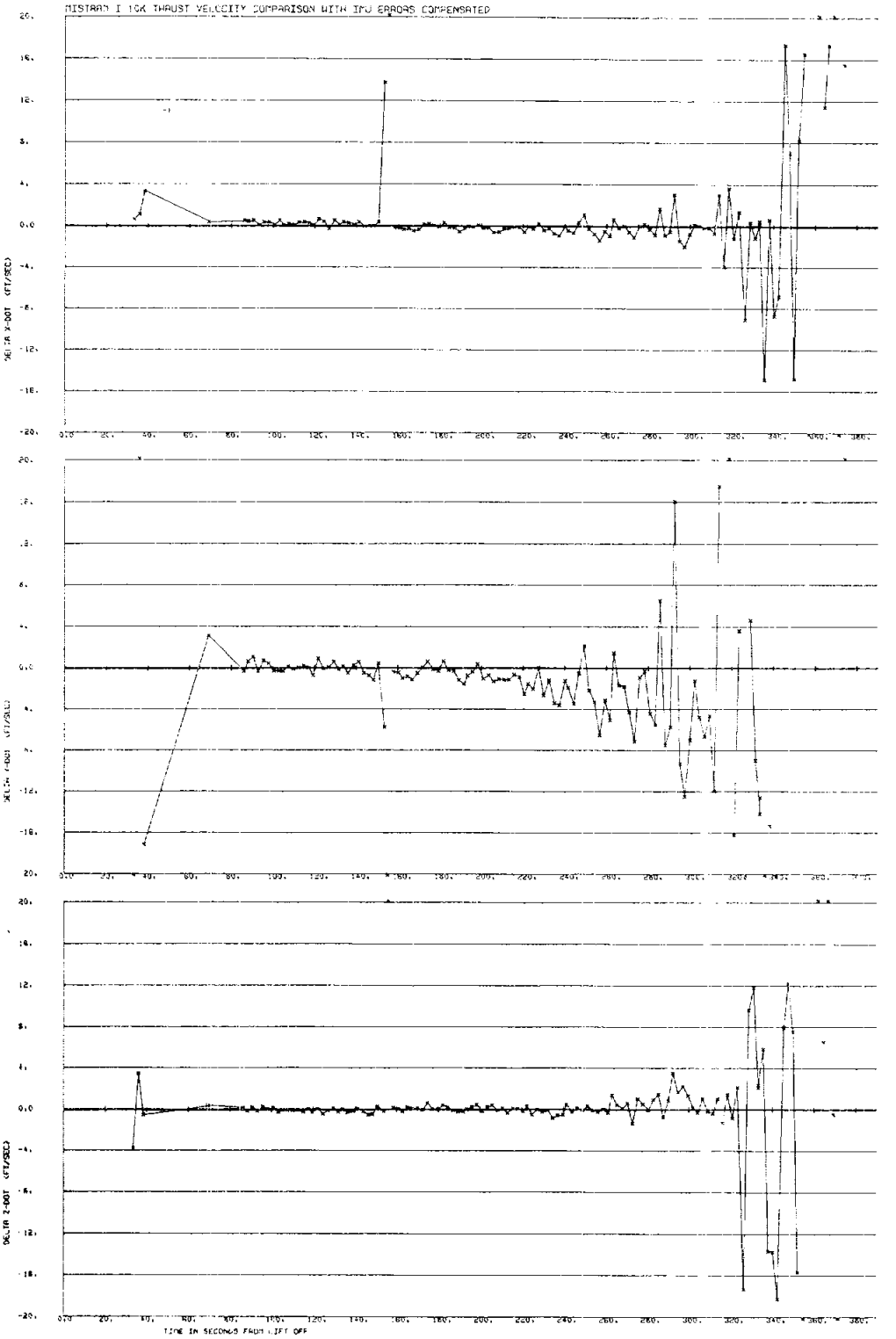

MISTRAN I 10K THRUST VELOCITY COMPARISON WITH IMU ERRORS COMPENSATED
DELTA X-DOT (FT/SEC)
DELTA Y-DOT (FT/SEC)
DELTA Z-DOT (FT/SEC)
TIME IN SECONDS FROM LIFT OFF

Figure 24

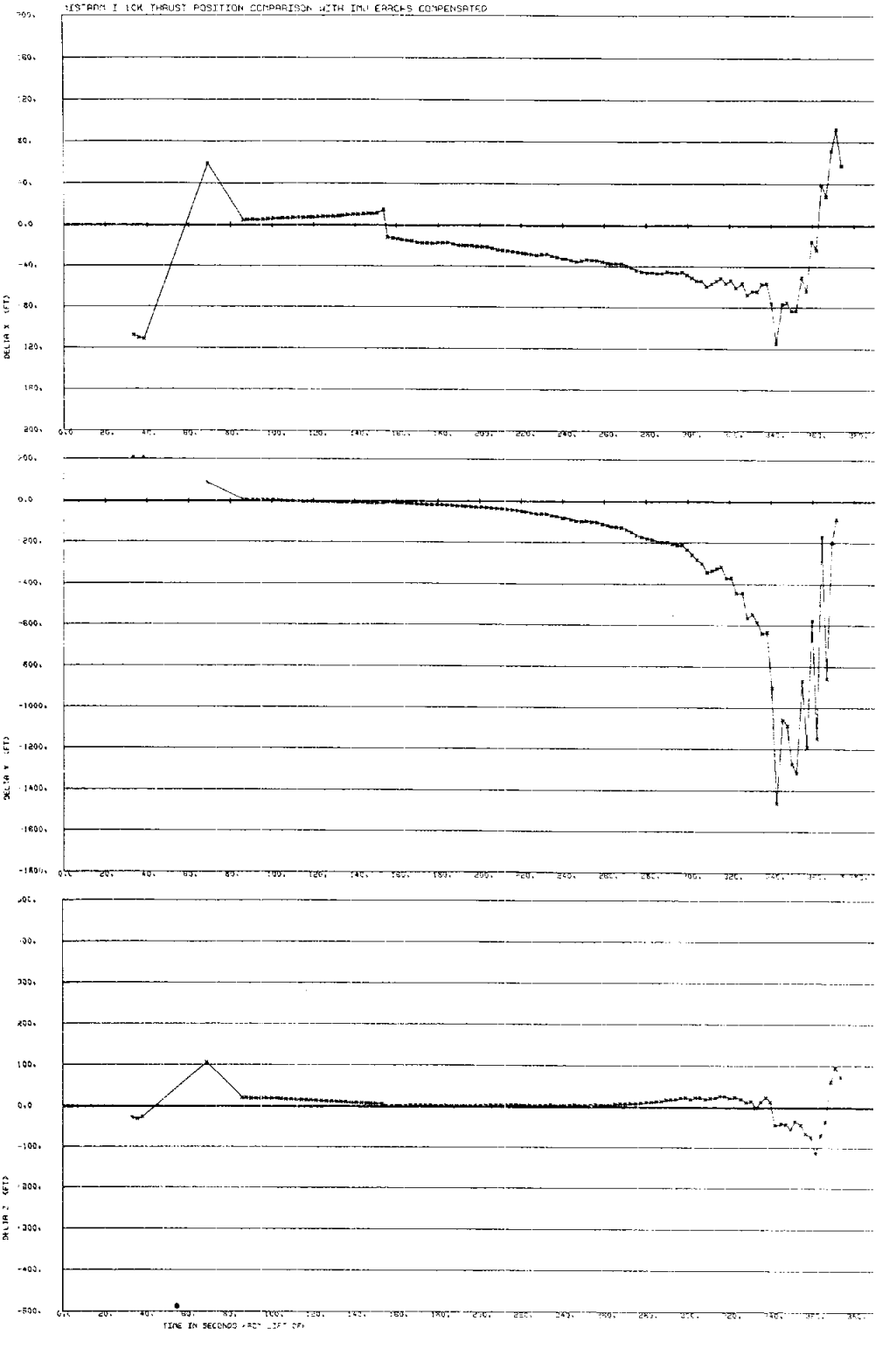
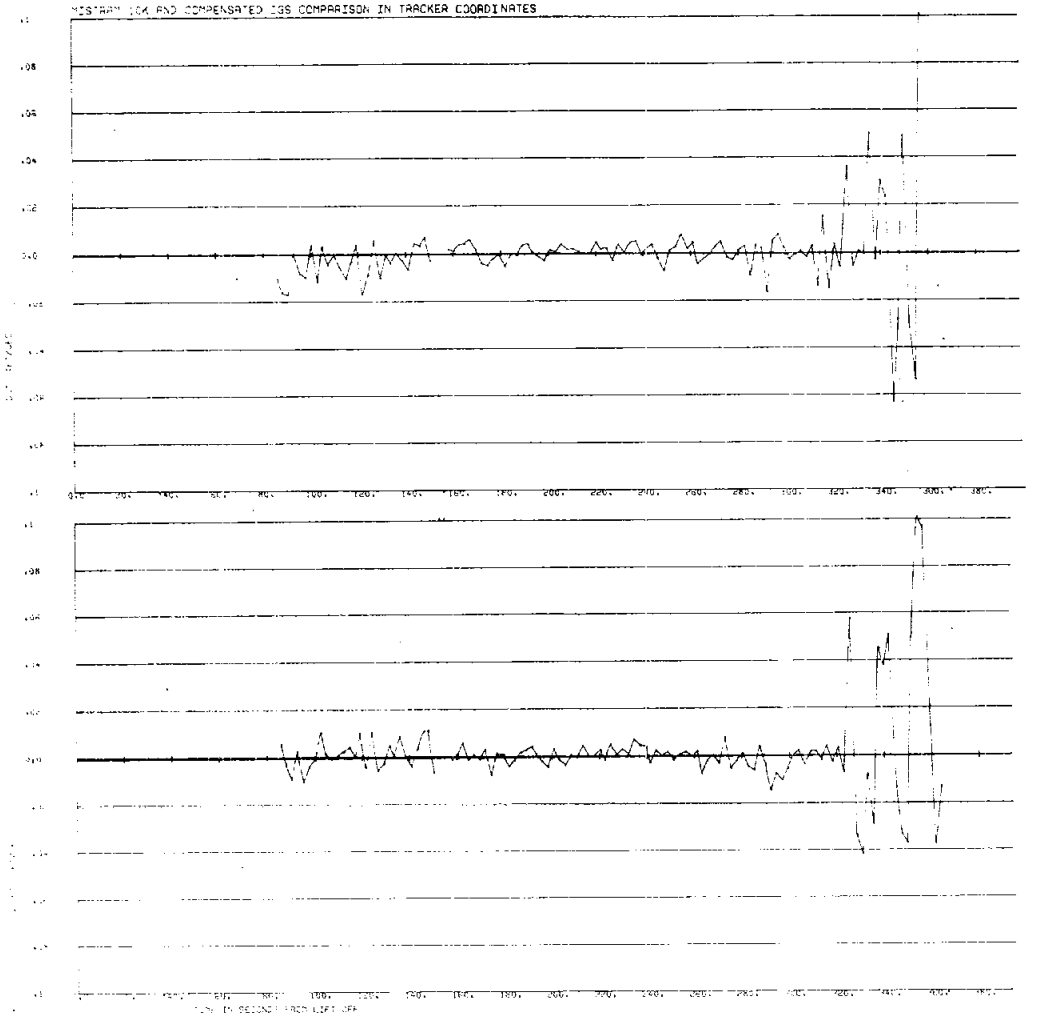


Figure 25


MISTRAM 104 AND COMPENSATED IGS COMPARISON IN TRACKER COORDINATES

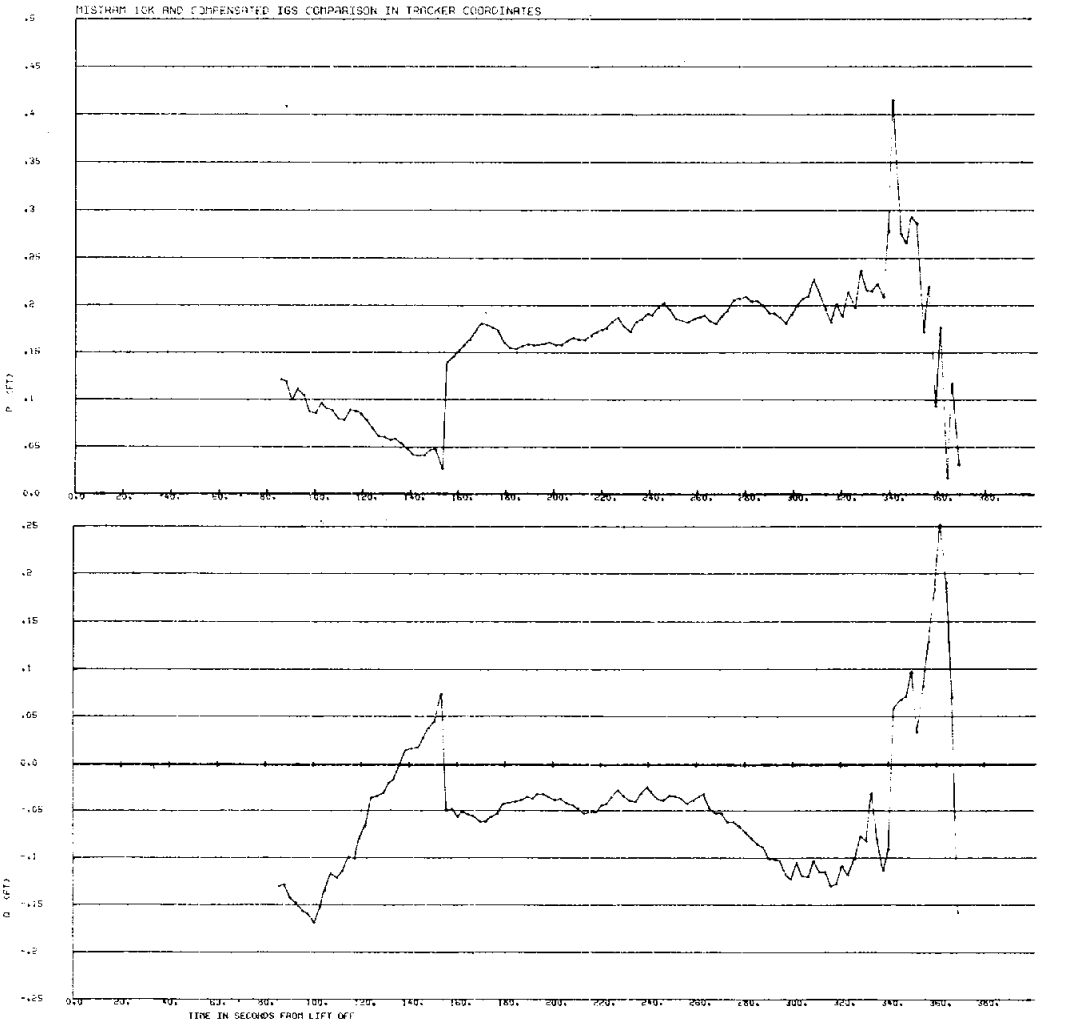

MISTRAM IGK AND COMPENSATED IGS COMPARISON IN TRACKER COORDINATES
P (FT)
Q (FT)
TIME IN SECONDS FROM LIFT OFF

Figure 27

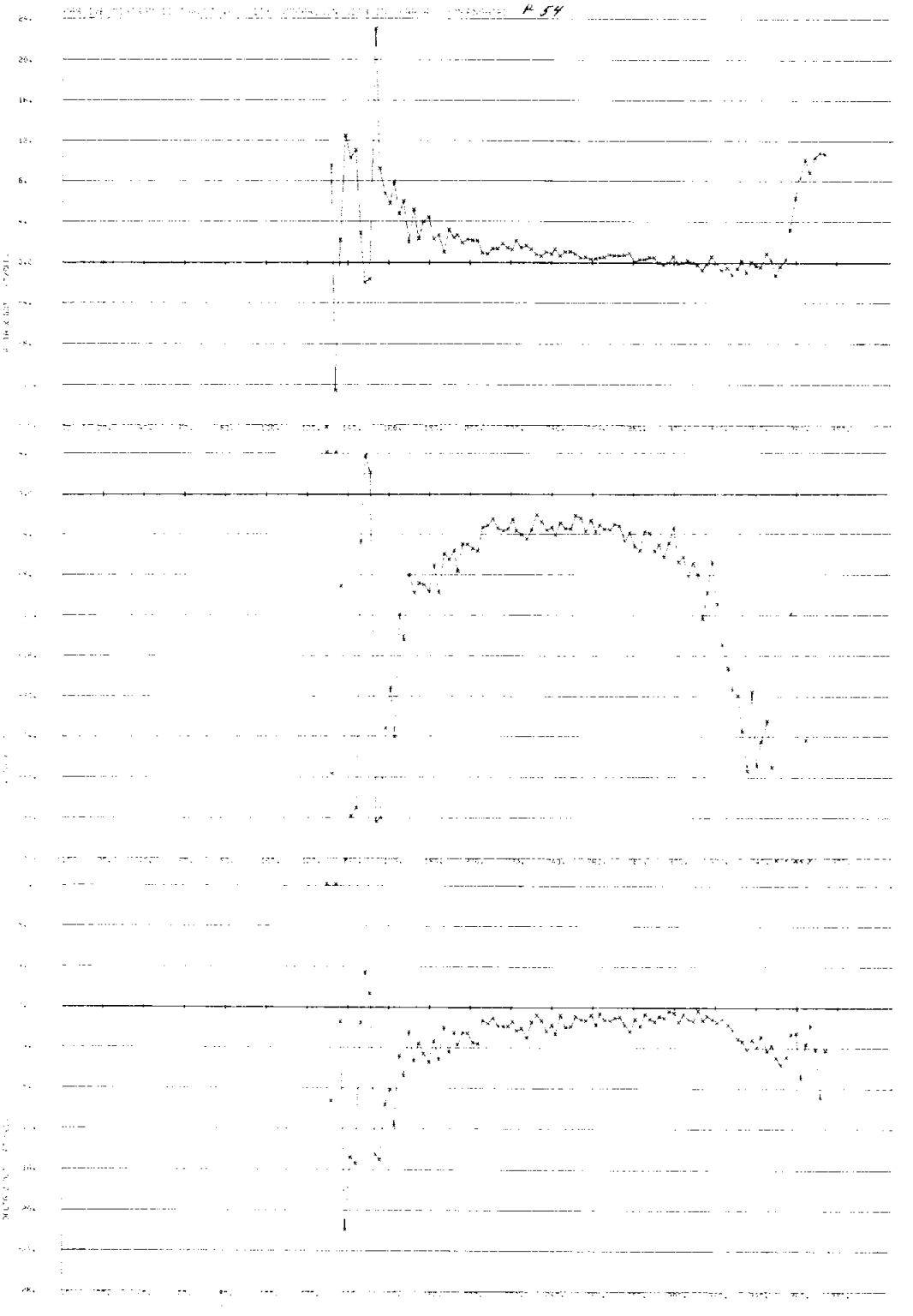


Figure 28

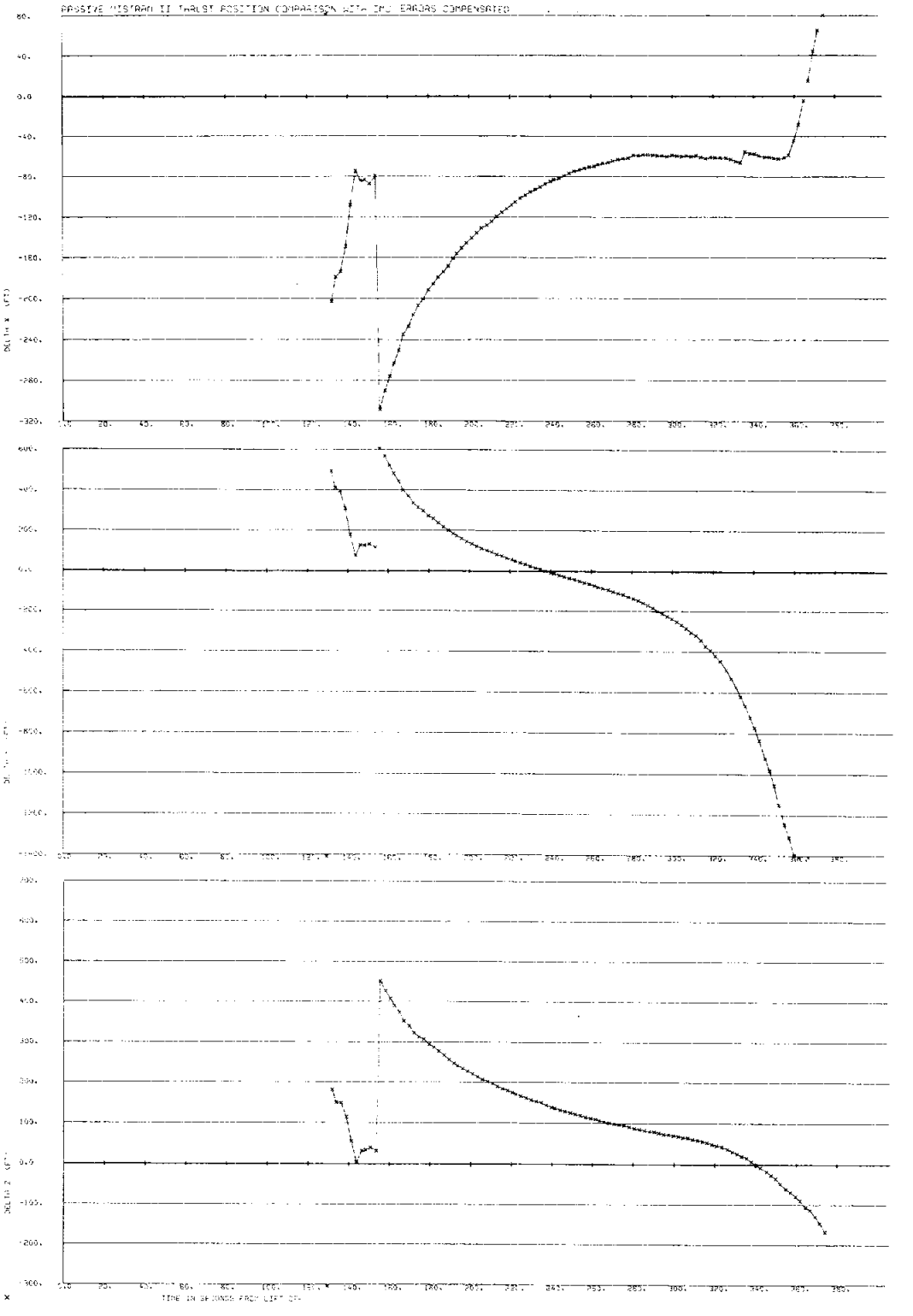

PASSIVE MISTRAM II THRUST POSITION COMPARISON WITH IMU ERRORS COMPENSATED
DELTA X (FT)
DELTA Z (FT)
TIME IN SECONDS FROM LIFT OFF

Figure 29

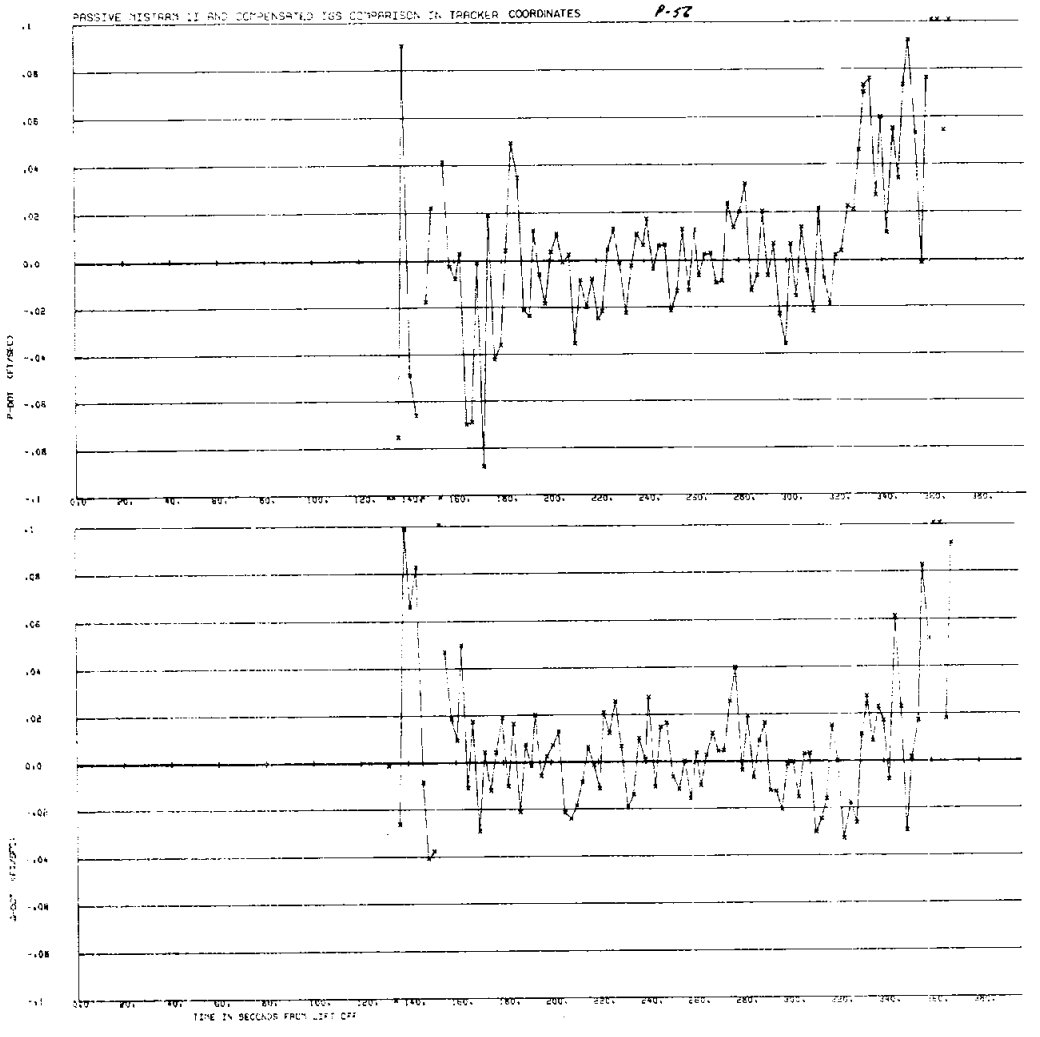

PASSIVE MISTRAM II AND COMPENSATED IGS COMPARISON IN TRACKER COORDINATES
P-58
TIME IN SECONDS FROM LIFT OFF

Figure 30

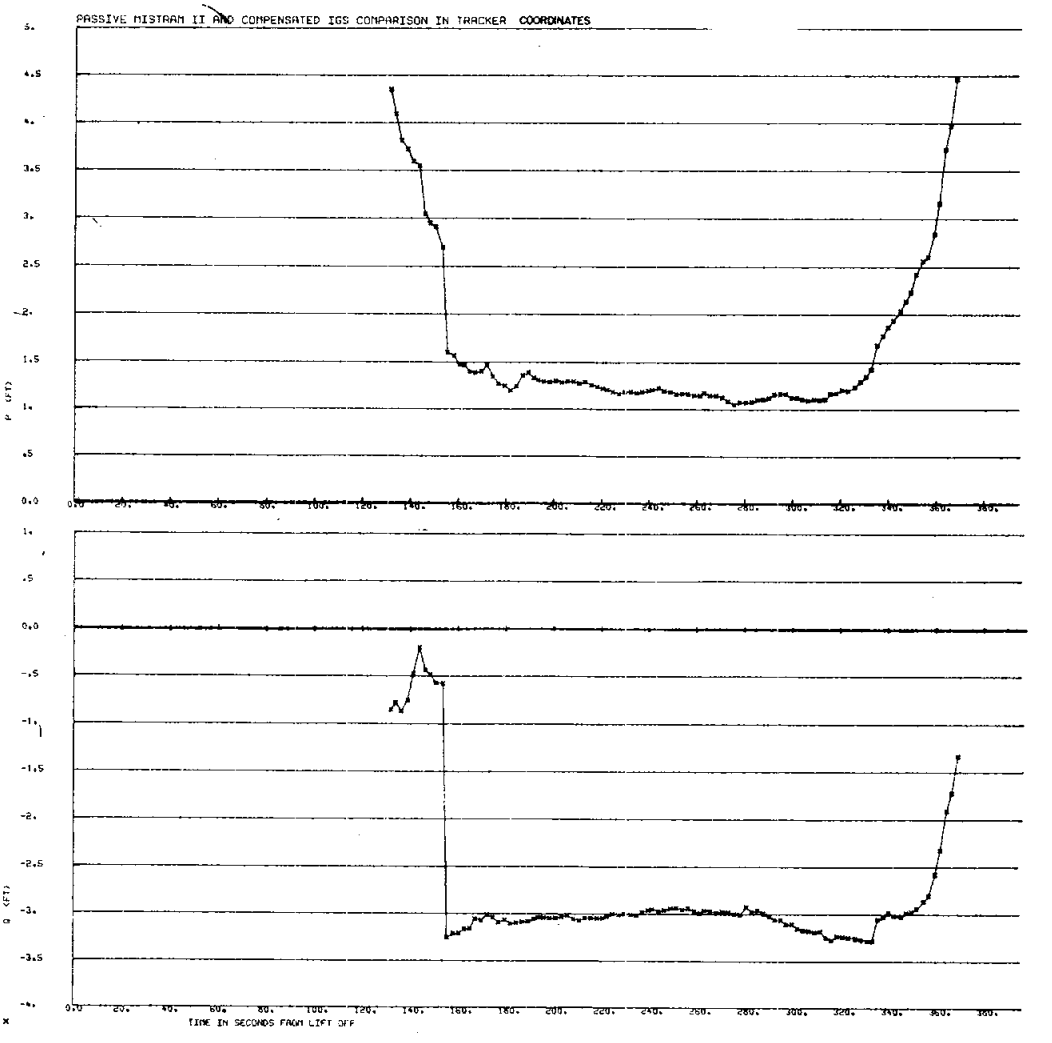

PASSIVE MISTRAM II AND COMPENSATED IGS COMPARISON IN TRACKER COORDINATES
P (FT)
Q (FT)
TIME IN SECONDS FROM LIFT OFF

Figure 31

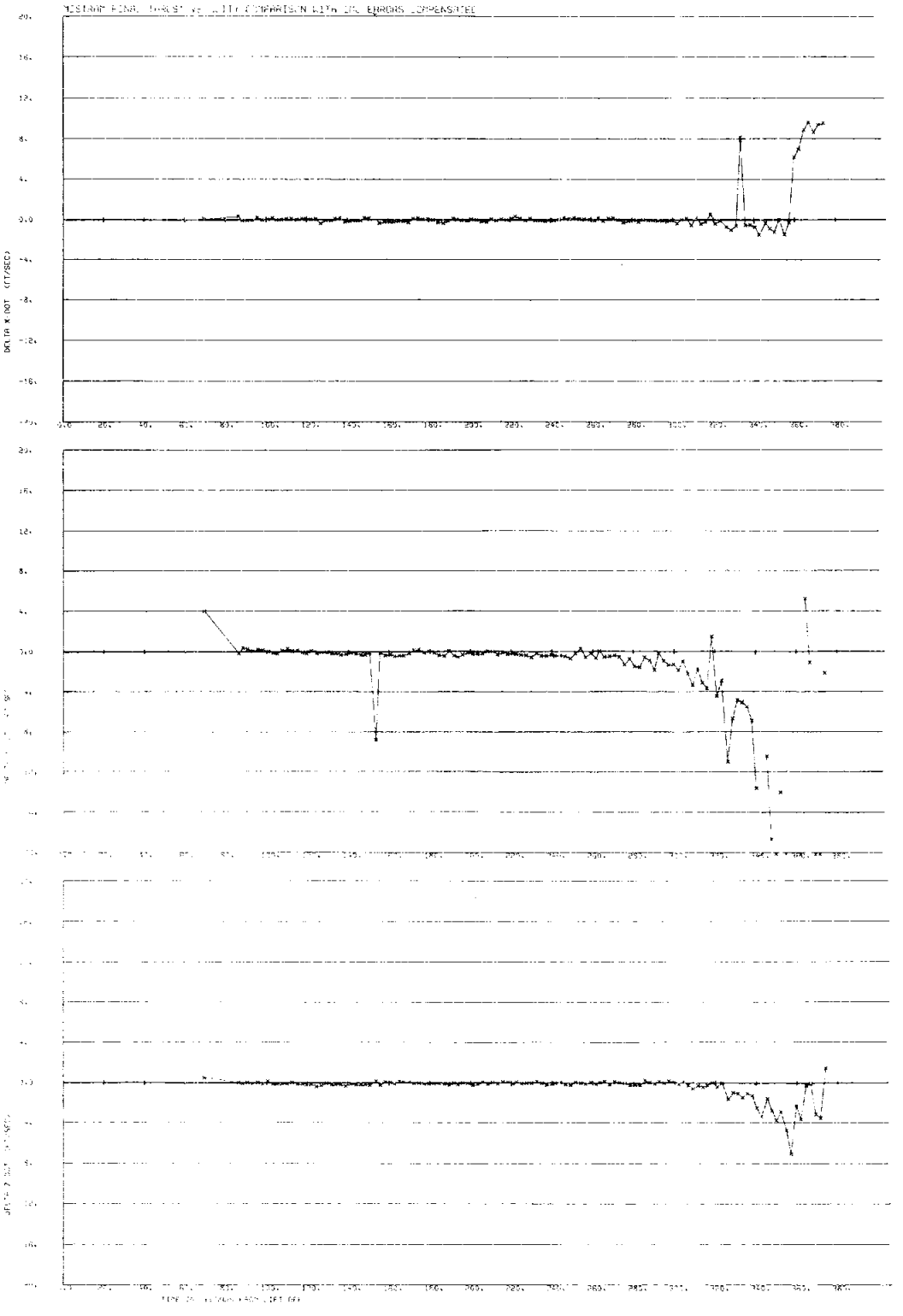


Figure 32

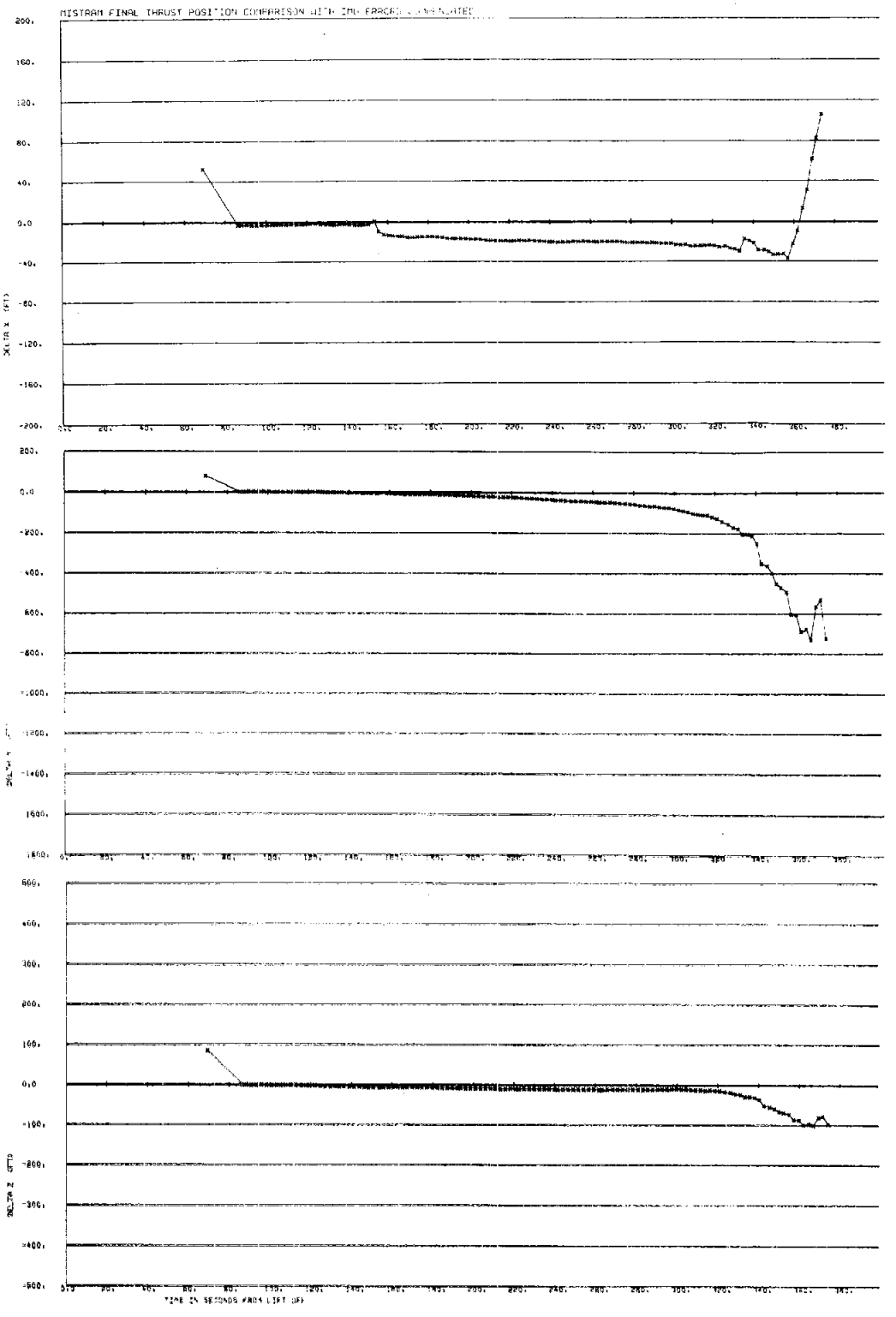

MISTRAM FINAL THRUST POSITION COMPARISON WITH IMU ERRORS COMPENSATED
DELTA X (FT)
DELTA Y (FT)
DELTA Z (FT)
TIME IN SECONDS FROM LIFT OFF

Figure 33

6.0 TRAJECTORY RECONSTRUCTION

This section provides a trajectory reconstruction for the ascent and re-entry flight phases.

The data are provided in an ECIG coordinate system which is a right-handed inertial cartesian system with the origin at the center of the earth. The z axis is the North Polar Axis, the x-y plane is the equatorial plane with the x-z plane containing the Greenwich Meridian at Go-Inertial time.

The ascent reconstruction consists of corrected guidance data. Corrections applied to the ascent data were the IMU error source magnitudes derived from the computer regressions discussed in Section 3.0. Corrections applied to the re-entry data consisted of the accelerometer bias errors listed in Table 9.

ASCENT TRAJECTORY RECONSTRUCTION

GEMINI TRAJECTORY IN ECIG

TIME IN SECONDS FROM LIFTOFF

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
4.732	3030597	-18151550	9927860	1329.835	180.004	22.275
7.064	3033700	-18151155	9927926	1332.951	159.054	33.821
9.835	3037400	-18150750	9928039	1337.029	132.827	48.205
12.185	3040546	-18150465	9928167	1340.557	109.594	60.794
14.550	3043721	-18150234	9928327	1344.369	85.598	74.349
16.943	3046943	-18150060	9928522	1348.201	59.798	88.661
19.336	3050173	-18149948	9928752	1351.918	33.526	103.860
21.729	3053413	-18149901	9929019	1356.268	5.411	119.633
24.078	3056605	-18149922	9929319	1360.909	-23.149	135.985
26.568	3060002	-18150019	9929681	1368.103	-54.628	154.628
29.060	3063423	-18150194	9930091	1379.161	-86.023	175.292
30.959	3066053	-18150380	9930440	1390.208	-110.190	192.243
33.450	3069538	-18150694	9930949	1408.545	-141.405	216.624
35.942	3073076	-18151084	9931522	1431.177	-171.939	243.167
38.433	3076673	-18151550	9932162	1458.232	-202.295	271.699
69.132	3130119	-18163113	9947462	2117.761	-552.825	752.702
86.199	3171736	-18173791	9963293	2811.107	-663.133	1124.426
88.103	3177178	-18175056	9965479	2908.538	-665.565	1172.678
90.596	3184597	-18176717	9968483	3042.804	-667.725	1237.086
93.090	3192357	-18178387	9971652	3181.405	-670.256	1304.648
95.581	3200462	-18180056	9974989	3326.143	-670.141	1374.836
98.072	3208935	-18181725	9978502	3477.206	-669.195	1446.359
100.564	3217792	-18183388	9982199	3634.633	-665.545	1521.171
103.063	3227080	-18185045	9986095	3799.954	-660.039	1597.167
104.963	3234425	-18186294	9989186	3930.291	-654.489	1656.378
107.487	3244571	-18187934	9993469	4109.810	-644.858	1737.146
109.979	3255038	-18189528	9997898	4294.122	-633.792	1819.344
112.470	3265973	-18191089	10002535	4486.641	-619.262	1903.629
114.962	3277403	-18192610	10007386	4687.337	-600.059	1989.884
117.453	3289339	-18194076	10012454	4896.393	-575.988	2079.157
119.357	3298820	-18195152	10016479	5062.305	-553.872	2148.527
121.862	3311782	-18196499	10021977	5288.328	-521.758	2241.457
124.360	3325283	-18197764	10027695	5522.331	-490.502	2337.142
126.855	3339356	-18198948	10033647	5764.197	-459.524	2436.079

GEMINI TRAJECTORY IN ECIG

TIME IN SECONDS FROM LIFTOFF

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
129.351	3354057	-18200057	10039856	6016.223	-428.630	2539.187
131.847	3369399	-18201087	10046326	6278.115	-396.375	2646.239
133.751	3381550	-18201817	10051446	6485.007	-369.929	2731.168
136.249	3398099	-18202695	10058412	6766.483	-333.244	2846.642
138.747	3415366	-18203481	10065671	7059.893	-295.122	2965.995
141.248	3433404	-18204169	10073244	7366.983	-255.031	3090.922
143.744	3452189	-18204754	10081121	7687.329	-212.924	3221.331
146.259	3471942	-18205233	10089393	8025.441	-167.796	3358.619
148.171	3487542	-18205519	10095918	8293.638	-131.597	3467.390
150.668	3508705	-18205786	10104760	8659.227	-81.787	3615.408
153.547	3534268	-18205935	10115424	9101.723	-20.852	3794.272
155.660	3553512	-18205918	10123421	9143.295	35.465	3787.428
158.155	3576434	-18205748	10132881	9230.333	101.453	3795.218
160.654	3599612	-18205411	10142375	9319.362	168.406	3803.429
162.558	3617415	-18205041	10149620	9388.589	219.846	3810.120
165.054	3640965	-18204407	10159143	9481.182	288.329	3819.649
167.273	3662103	-18203699	10167631	9564.875	348.950	3828.501
169.724	3685654	-18202762	10177024	9658.607	416.091	3838.936
172.158	3709284	-18201666	10186383	9754.246	486.369	3848.480
174.607	3733294	-18200379	10195817	9852.562	566.373	3854.572
177.070	3757684	-18198875	10205314	9953.039	655.858	3856.982
179.538	3782371	-18197141	10214833	10055.045	749.684	3857.999
182.010	3807352	-18195170	10224370	10158.633	845.157	3858.932
184.473	3832500	-18192970	10233875	10263.162	941.525	3859.853
186.939	3857937	-18190529	10243394	10369.405	1039.093	3860.726
189.401	3883608	-18187848	10252904	10477.215	1137.837	3861.730
191.863	3909537	-18184925	10262413	10586.617	1237.212	3863.374
193.550	3927455	-18182780	10268929	10662.305	1305.835	3864.245
196.017	3953894	-18179434	10278464	10774.144	1407.128	3866.055
198.481	3980591	-18175840	10287995	10887.784	1509.283	3867.896
200.953	4007645	-18171983	10297558	11003.673	1612.491	3870.230
203.420	4034933	-18167877	10307109	11120.826	1716.561	3872.948
205.883	4062468	-18163520	10316651	11239.456	1821.541	3876.004
208.348	4090320	-18158900	10326208	11360.267	1927.566	3879.054

GEMINI TRAJECTORY IN ECIG

TIME IN SECONDS FROM LIFTOFF

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
210.813	4118472	-18154017	10335774	11483.187	2034.793	3882.936
213.276	4146918	-18148870	10345346	11607.782	2142.833	3886.936
215.739	4175662	-18143458	10354925	11734.401	2252.364	3891.355
218.203	4204732	-18137773	10364519	11863.082	2362.904	3896.205
220.665	4234099	-18131818	10374116	11994.015	2474.867	3901.137
222.369	4254616	-18127534	10380768	12085.857	2552.992	3905.097
224.854	4284810	-18121049	10390476	12221.415	2667.999	3910.625
227.344	4315415	-18114261	10400222	12359.677	2783.967	3917.009
229.836	4346394	-18107177	10409993	12500.860	2900.984	3924.184
232.323	4377664	-18099815	10419763	12643.956	3018.926	3931.646
234.812	4409307	-18092155	10429556	12790.113	3138.419	3939.604
237.299	4441304	-18084198	10439365	12938.732	3259.573	3947.740
239.786	4473675	-18075938	10449195	13090.057	3382.525	3956.569
241.494	4496122	-18070087	10455958	13195.443	3468.595	3962.731
243.982	4529150	-18061299	10465830	13351.571	3595.383	3971.854
246.469	4562544	-18052200	10475717	13510.663	3724.333	3981.139
248.960	4596403	-18042759	10485646	13672.910	3856.152	3990.569
251.452	4630684	-18032981	10495604	13838.282	3990.519	4000.637
253.945	4665394	-18022862	10505591	14006.798	4127.631	4010.669
256.434	4700460	-18012419	10515583	14178.872	4266.832	4021.158
258.922	4735959	-18001625	10525603	14354.265	4408.746	4032.174
261.418	4772012	-17990441	10535682	14534.128	4553.490	4043.698
263.121	4796872	-17982600	10542575	14659.234	4654.079	4051.652
265.611	4833607	-17970825	10552680	14845.183	4803.697	4063.541
268.101	4870797	-17958678	10562810	15035.687	4956.501	4075.688
270.590	4908466	-17946146	10572971	15230.348	5113.018	4088.490
273.079	4946625	-17933221	10583165	15429.602	5272.277	4101.895
275.561	4985164	-17919937	10593361	15633.115	5434.514	4116.114
278.042	5024215	-17906247	10603593	15841.835	5600.281	4130.949
280.524	5063806	-17892135	10613868	16056.331	5769.674	4146.961
283.017	5104095	-17877540	10624223	16276.752	5944.124	4163.060
285.415	5143394	-17863077	10634227	16494.441	6116.817	4179.369
287.772	5182520	-17848460	10644095	16714.477	6289.361	4196.426
290.127	5222156	-17833439	10654001	16940.805	6465.185	4214.814

GEMINI TRAJECTORY IN ECIG

TIME IN SECONDS FROM LIFTOFF

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
292.478	5262248	-17818032	10663931	17172.794	6644.632	4233.740
294.828	5302894	-17802199	10673906	17412.301	6827.946	4254.020
297.185	5344215	-17785889	10683956	17659.579	7015.670	4275.980
299.540	5386110	-17769138	10694054	17914.524	7208.657	4298.345
301.903	5428757	-17751866	10704239	18177.952	7408.840	4320.549
304.261	5471928	-17734158	10714450	18449.271	7616.045	4343.121
306.620	5515786	-17715937	10724725	18729.653	7830.412	4366.280
308.979	5560297	-17697210	10735049	19018.848	8052.116	4389.592
311.343	5605617	-17677903	10745457	19320.442	8281.742	4415.066
313.702	5651566	-17658086	10755906	19631.828	8518.435	4442.195
316.060	5698225	-17637716	10766411	19955.433	8764.641	4470.409
318.418	5745683	-17616746	10776989	20292.407	9019.763	4500.149
320.784	5794112	-17595091	10787675	20644.757	9284.976	4532.918
323.142	5843211	-17572883	10798403	21012.947	9558.254	4568.822
326.242	5909149	-17542670	10812647	21524.465	9934.034	4620.239
328.599	5960349	-17518908	10823584	21934.265	10235.380	4662.031
330.960	6012650	-17494368	10834644	22366.796	10552.607	4706.736
333.278	6065018	-17469527	10845610	22814.381	10879.913	4754.077
333.284	6065146	-17469466	10845637	22815.494	10880.725	4754.195
335.616	6118455	-17443949	10856705	22850.518	10971.234	4728.026
338.068	6174471	-17416966	10868254	22836.142	11036.149	4691.567
340.202	6223183	-17393358	10878231	22821.608	11091.910	4659.594
342.336	6271862	-17369632	10888139	22805.375	11146.321	4627.164
345.467	6343222	-17334611	10902550	22779.171	11225.012	4578.910
347.603	6391853	-17310580	10912294	22760.217	11278.113	4545.550
349.735	6440375	-17286470	10921953	22741.099	11330.918	4512.141
352.072	6493495	-17259923	10932455	22719.877	11388.899	4475.486
354.828	6556072	-17228443	10944729	22694.185	11456.860	4432.284
356.901	6603103	-17204637	10953885	22675.032	11508.396	4399.933
359.637	6665095	-17173063	10965862	22651.686	11577.231	4357.243
361.717	6712193	-17148927	10974891	22632.712	11629.212	4324.533
364.452	6774066	-17117026	10986662	22607.100	11696.457	4281.703
366.525	6820916	-17092722	10995505	22587.789	11748.495	4249.048
369.259	6882622	-17060518	11007060	22561.640	11815.251	4205.639

GEMINI TRAJECTORY IN ECIG

TIME IN SECONDS FROM LIFTOFF

TIME	X	Y	Z	X-DOT	Y-DOT	Z-DOT
371.339	6929531	-17035889	11015774	22541.141	11865.585	4172.801
374.075	6991174	-17003329	11027134	22514.240	11932.356	4129.869
376.150	7037874	-16978515	11035670	22493.228	11982.886	4096.942
378.879	7099209	-16945729	11046788	22465.782	12049.215	4053.276
380.961	7145962	-16920590	11055194	22444.799	12099.038	4020.708
383.689	7207143	-16887499	11066102	22416.936	12164.898	3977.676
385.757	7253487	-16862287	11074295	22395.365	12214.555	3944.805
388.482	7314489	-16828906	11084988	22367.194	12280.032	3901.588
390.549	7360687	-16803479	11093016	22345.715	12329.557	3868.835
393.273	7421531	-16769797	11103498	22316.834	12395.031	3825.383
395.338	7467580	-16744156	11111361	22294.905	12444.765	3792.085

RE-ENTRY TRAJECTORY RECONSTRUCTION

GEMINI GT-5 FREE FLIGHT AND REENTRY RECONSTRUCTION

EARTH CENTERED INERTIAL GREENWICH
COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
23.1719	-18464107.25	-9680881.50	6297604.81	13625.37	-17810.20	11348.59
25.7949	-18428280.50	-9727553.00	6327342.87	13691.55	-17775.51	11325.89
27.7881	-18400941.25	-9762956.00	6349900.06	13741.66	-17748.96	11308.64
35.0371	-18300669.50	-9891265.62	6431646.19	13923.18	-17651.56	11245.05
37.6641	-18264007.75	-9937589.12	6461155.94	13988.87	-17616.22	11221.82
40.2910	-18227173.75	-9983819.12	6490604.44	14054.20	-17580.47	11198.45
42.2861	-18199084.50	-10018867.12	6512929.06	14103.94	-17553.33	11180.82
44.9151	-18161920.75	-10064965.50	6542291.50	14169.27	-17517.06	11157.35
49.5371	-18096165.00	-10145783.25	6593764.94	14283.63	-17453.31	11115.56
52.1621	-18058585.25	-10191550.25	6622912.12	14348.48	-17416.80	11091.81
54.1563	-18029923.75	-10226254.00	6645012.56	14397.43	-17388.82	11073.53
56.7842	-17992003.00	-10271902.25	6674081.56	14462.40	-17352.04	11049.61
59.4043	-17954025.50	-10317318.25	6703001.62	14526.74	-17315.19	11025.77
61.8428	-17918529.50	-10359498.75	6729859.94	14586.48	-17280.54	11003.02
64.2481	-17883374.50	-10401022.12	6756298.56	14645.19	-17246.45	10980.87
66.6543	-17848063.75	-10442480.25	6782694.37	14703.98	-17212.18	10958.48
69.0596	-17812626.00	-10483838.87	6809025.50	14762.56	-17177.82	10936.04
71.4658	-17777033.25	-10525131.50	6835313.25	14821.19	-17143.34	10913.52
73.8711	-17741313.75	-10566324.25	6861536.00	14879.63	-17108.66	10890.87
76.1250	-17707715.00	-10604848.62	6886059.19	14934.29	-17075.93	10869.73
81.0772	-17633461.50	-10689232.50	6939771.37	15054.05	-17003.77	10822.74
83.4805	-17597212.25	-10730056.00	6965754.44	15111.94	-16968.79	10799.90
105.0293	-17266025.75	-11092243.87	7196219.44	15626.31	-16646.77	10590.13
109.9043	-17189567.00	-11173215.25	7247729.50	15741.40	-16572.23	10542.21
121.8545	-16999780.75	-11370153.12	7372990.75	16021.44	-16387.55	10421.67
126.6553	-16922597.50	-11448646.75	7422905.44	16133.01	-16312.83	10372.72
129.0606	-16883726.00	-11487837.87	7447824.87	16188.92	-16274.85	10347.97
131.4668	-16844704.50	-11526953.87	7472695.06	16244.54	-16237.10	10323.36
133.8721	-16805565.25	-11565962.37	7497495.94	16299.99	-16198.70	10298.69

GEMINI GT-5 FREE FLIGHT AND REENTRY RECONSTRUCTION

EARTH CENTERED INERTIAL GREENWICH
COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
136.2764	-16766308.62	-11604863.12	7522227.19	16355.50	-16160.64	10273.88
138.6807	-16726918.87	-11643671.87	7546898.62	16410.65	-16122.26	10248.88
140.1572	-16702662.50	-11667460.12	7562020.44	16444.51	-16098.76	10233.56
143.4785	-16647919.00	-11720840.12	7595951.69	16520.70	-16045.38	10199.02
145.8828	-16608132.37	-11759371.12	7620442.69	16575.52	-16006.49	10173.68
148.2871	-16568214.12	-11797809.25	7644872.75	16630.24	-15967.95	10148.34
150.6914	-16528164.50	-11836153.62	7669242.00	16684.81	-15928.64	10123.08
153.0947	-16488000.12	-11874388.37	7693540.19	16739.33	-15889.62	10097.43
155.4990	-16447688.25	-11912544.62	7717787.00	16793.85	-15850.39	10072.11
157.8906	-16407459.62	-11950405.37	7741844.81	16847.75	-15811.05	10046.49
160.2940	-16366904.00	-11988356.87	7765958.87	16901.89	-15771.53	10020.76
162.6983	-16326201.87	-12026228.75	7790020.75	16955.90	-15731.98	9995.00
165.0264	-16286665.87	-12062809.75	7813261.31	17007.97	-15693.31	9970.06
167.4326	-16245675.50	-12100523.87	7837220.31	17061.94	-15653.49	9943.90
169.8379	-16204572.25	-12138126.62	7861106.75	17115.62	-15613.42	9917.81
172.0918	-16165938.37	-12173275.25	7883433.12	17166.08	-15575.72	9893.49
174.6387	-16122146.87	-12212890.25	7908595.19	17222.39	-15532.96	9865.66
177.0440	-16080658.25	-12250202.50	7932293.25	17275.68	-15492.45	9839.41
179.4502	-16039024.62	-12287432.37	7955937.50	17328.87	-15451.84	9812.98
181.8555	-15997280.37	-12324549.62	7979508.69	17381.71	-15411.33	9786.61
184.2617	-15955392.12	-12361583.75	8003025.62	17434.54	-15370.32	9759.92
186.6670	-15913393.62	-12398504.37	8026469.06	17487.41	-15329.44	9733.44
188.1455	-15887514.37	-12421150.62	8040847.94	17519.62	-15304.33	9716.98
191.4678	-15829188.75	-12471901.00	8073068.87	17592.36	-15247.28	9679.98
193.8711	-15786845.75	-12508495.37	8096300.62	17644.70	-15205.96	9653.09
196.2754	-15744360.00	-12545005.37	8119477.19	17696.89	-15164.61	9626.19
198.6797	-15701748.87	-12581415.25	8142588.94	17748.88	-15122.76	9599.20
201.0840	-15659012.75	-12617724.87	8165635.75	17800.95	-15081.19	9572.15
203.4873	-15616169.25	-12653919.25	8188608.00	17852.65	-15039.16	9544.94

GEMINI GT-5 FREE FLIGHT AND REENTRY RECONSTRUCTION

EARTH CENTERED INERTIAL GREENWICH
COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
205.8789	-15573411.25	-12689837.00	8211403.31	17904.07	-14997.36	9517.86
208.2832	-15530302.75	-12725844.87	8234254.12	17955.56	-14955.60	9490.46
210.6875	-15487070.25	-12761751.50	8257038.94	18007.05	-14913.09	9462.94
213.0908	-15443731.87	-12797541.75	8279748.44	18058.42	-14870.91	9435.50
215.4951	-15400252.75	-12833244.75	8302401.00	18109.44	-14828.41	9407.87
217.8994	-15356651.00	-12868845.25	8324987.19	18160.45	-14785.70	9380.33
220.1514	-15315701.00	-12902097.12	8346082.12	18207.91	-14745.89	9354.45
222.6983	-15269259.25	-12939595.00	8369869.25	18261.70	-14700.28	9325.03
225.0264	-15226686.75	-12973770.75	8391547.62	18310.70	-14658.68	9297.98
227.4317	-15182583.87	-13008977.12	8413878.12	18361.02	-14615.66	9270.01
229.8379	-15138341.75	-13044094.00	8436150.37	18411.67	-14572.42	9242.02
232.2432	-15093996.62	-13079092.50	8458345.87	18461.61	-14529.11	9213.64
234.6494	-15049513.00	-13114000.87	8480482.12	18511.84	-14485.65	9185.38
236.1270	-15022138.25	-13135384.25	8494041.25	18542.67	-14458.80	9168.17
239.4502	-14960402.25	-13183333.87	8524444.00	18611.37	-14398.40	9128.91
241.8565	-14915559.12	-13217927.37	8546376.25	18660.87	-14354.62	9100.46
244.2617	-14870615.12	-13252401.25	8568231.12	18710.38	-14310.60	9071.98
246.6680	-14825533.62	-13286783.25	8590026.25	18759.87	-14266.65	9043.41
249.0723	-14780370.12	-13321031.25	8611734.62	18809.12	-14222.34	9014.63
251.4756	-14735106.75	-13355158.75	8633365.00	18858.33	-14177.97	8985.79
253.8682	-14689928.62	-13389027.75	8654830.12	18906.85	-14133.73	8957.29
256.2725	-14644412.25	-13422955.87	8676331.37	18955.63	-14089.18	8928.35
258.6768	-14598779.12	-13456776.87	8697762.87	19004.10	-14044.60	8899.38
261.0801	-14553047.75	-13490476.62	8719115.87	19052.74	-13999.80	8870.16
263.4844	-14507181.37	-13524082.37	8740407.62	19100.92	-13954.86	8841.21
265.8887	-14461199.00	-13557580.00	8761629.50	19149.23	-13909.98	8812.06
268.1406	-14418025.25	-13588856.87	8781442.75	19194.15	-13867.55	8784.51
270.6875	-14369075.50	-13624114.62	8803776.37	19244.91	-13819.50	8753.54
273.0908	-14322766.62	-13657272.87	8824778.25	19292.52	-13774.22	8723.89

GEMINI GT-5 FREE FLIGHT AND REENTRY RECONSTRUCTION

EARTH CENTERED INERTIAL GREENWICH
COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
275.4951	-14276324.25	-13690335.50	8845717.87	19340.24	-13728.76	8694.60
277.8233	-14231244.37	-13722246.37	8865926.37	19386.11	-13684.55	8665.66
280.2295	-14184539.50	-13755119.62	8886742.87	19433.59	-13638.71	8636.37
282.6348	-14137739.75	-13787869.25	8907479.62	19480.69	-13592.75	8606.42
284.1133	-14108915.75	-13807945.50	8920190.87	19509.73	-13564.65	8588.17
287.4365	-14043972.62	-13852918.25	8948663.12	19574.42	-13500.96	8547.06
289.8428	-13996815.37	-13885349.37	8969193.12	19621.23	-13454.72	8516.80
292.2481	-13949565.00	-13917655.87	8989642.37	19667.84	-13408.29	8486.89
294.6543	-13902183.37	-13949864.00	9010027.75	19714.25	-13362.11	8456.80
297.0596	-13854709.50	-13981947.37	9030332.50	19760.56	-13315.44	8426.74
299.4658	-13807105.00	-14013931.50	9050572.62	19806.82	-13268.81	8396.24
301.8565	-13759700.12	-14045596.62	9070608.87	19852.19	-13222.28	8366.05
304.2617	-13711894.62	-14077343.12	9090695.25	19898.36	-13175.12	8335.91
306.6660	-13663998.25	-14108963.87	9110700.50	19943.97	-13128.45	8305.3[illegible]
309.0703	-13615992.62	-14140471.87	9130632.37	19989.24	-13081.28	8274.78
311.4746	-13567877.62	-14171866.37	9150490.75	20034.89	-13034.07	8244.26
313.8779	-13519673.37	-14203134.50	9170267.37	20079.83	-12986.68	8213.52
316.1299	-13474406.75	-14232329.87	9188731.50	20122.33	-12942.25	8184.80
318.6768	-13423097.25	-14265228.12	9209535.75	20169.75	-12891.91	8152.26
321.0801	-13374569.12	-14296154.25	9229091.00	20214.50	-12844.25	8121.34
323.4844	-13325913.62	-14326978.25	9248579.87	20259.25	-12796.50	8090.36
325.8887	-13277151.25	-14357687.12	9267994.12	20303.44	-12748.54	8059.25
328.2930	-13228282.50	-14388280.75	9287333.50	20347.75	-12700.53	8028.11
330.6211	-13180860.75	-14417795.00	9305988.87	20390.33	-12654.03	7997.95
333.0908	-13130446.25	-14448985.62	9325702.12	20435.70	-12604.30	7965.93
335.4190	-13082820.00	-14478275.50	9344212.37	20478.15	-12557.50	7935.57
337.8242	-13033511.87	-14508421.37	9363261.87	20521.85	-12508.98	7904.23
340.2305	-12984079.00	-14538462.75	9382243.62	20565.25	-12460.47	7872.77
342.6358	-12934561.62	-14568375.12	9401141.87	20608.77	-12411.82	7841.22

GEMINI GT-5 FREE FLIGHT AND REENTRY RECONSTRUCTION

EARTH CENTERED INERTIAL GREENWICH
COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
345.0420	-12884920.00	-14598182.12	9419971.87	20651.75	-12362.85	7809.70
347.4473	-12835194.75	-14627859.50	9438718.12	20695.09	-12314.07	7777.95
349.8399	-12785629.12	-14657263.50	9457289.50	20737.78	-12265.37	7746.26
354.6514	-12685643.75	-14716041.87	9494408.12	20822.98	-12166.94	7682.79
357.0576	-12635487.62	-14745259.25	9512856.37	20865.30	-12117.57	7650.78
359.4629	-12585249.87	-14774346.12	9531220.00	20907.67	-12068.39	7618.66
361.8672	-12534931.00	-14803302.37	9549499.12	20949.77	-12018.76	7586.73
364.1192	-12487708.87	-14830315.62	9566550.37	20989.05	-11972.17	7556.77
366.6660	-12434196.25	-14860740.37	9585753.00	21033.14	-11919.64	7522.59
369.0694	-12383596.75	-14889327.12	9603793.25	21074.91	-11869.74	7490.25
371.4736	-12332876.75	-14917805.37	9621763.37	21116.19	-11819.77	7458.10
373.8779	-12282057.62	-14946163.50	9639655.87	21157.35	-11769.70	7425.65
376.2822	-12231139.37	-14974401.12	9657470.37	21198.74	-11719.61	7393.19
378.6856	-12180143.12	-15002506.62	9675199.37	21239.42	-11669.32	7360.60
380.1631	-12148742.50	-15019725.62	9686060.12	21264.51	-11638.38	7340.55
383.4844	-12078023.50	-15058264.62	9710365.37	21320.79	-11568.85	7295.50
385.8887	-12026713.25	-15086018.75	9727866.62	21361.26	-11518.24	7262.82
388.2168	-11976936.37	-15112777.62	9744738.50	21400.12	-11469.26	7231.09
390.6221	-11925414.87	-15140303.00	9762091.50	21440.35	-11418.25	7198.04
393.0283	-11873775.87	-15167717.00	9779372.12	21480.33	-11367.46	7165.13
395.4336	-11822061.75	-15194997.62	9796566.87	21520.27	-11316.51	7132.36
397.8272	-11770504.75	-15222023.37	9813599.00	21559.64	-11265.53	7099.33
400.2324	-11718600.62	-15249058.50	9830635.00	21598.97	-11214.42	7066.23
402.6387	-11666580.62	-15275981.62	9847598.37	21638.42	-11163.21	7033.17
405.0440	-11614487.25	-15302770.37	9864475.00	21677.58	-11111.82	6999.88
407.4502	-11562278.50	-15329446.00	9881278.50	21716.63	-11060.09	6966.61
409.8555	-11509997.62	-15355986.75	9897994.75	21755.29	-11008.69	6933.09
412.1094	-11460922.25	-15380744.62	9913585.87	21791.69	-10960.18	6901.67
414.6553	-11405390.75	-15408578.50	9931111.75	21832.54	-10905.52	6866.26

GEMINI GT-5 FREE FLIGHT AND REENTRY RECONSTRUCTION

EARTH CENTERED INERTIAL GREENWICH
COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
417.0615	-11352810.25	-15434757.50	9947593.37	21870.71	-10853.64	6832.79
419.4649	-11300202.50	-15460779.75	9963974.37	21908.56	-10801.64	6799.12
421.8692	-11247481.87	-15486687.37	9980280.75	21946.73	-10749.39	6765.28
424.2735	-11194670.25	-15512469.50	9996506.00	21984.36	-10697.32	6731.57
426.6777	-11141768.00	-15538126.25	10012650.25	22022.09	-10645.11	6697.99
428.1543	-11109234.00	-15553820.62	10022525.00	22045.11	-10612.97	6677.19
431.4756	-11035930.37	-15588948.75	10044624.12	22096.56	-10540.30	6630.37
433.8799	-10982758.87	-15614228.00	10060524.37	22133.78	-10488.07	6596.20
436.2832	-10929520.00	-15639370.62	10076336.62	22170.70	-10435.24	6562.48
438.6875	-10876171.12	-15664396.75	10092073.50	22207.20	-10382.56	6528.14
441.0156	-10824428.62	-15688509.25	10107233.37	22242.74	-10331.56	6495.12
443.4219	-10770863.37	-15713305.75	10122821.25	22279.07	-10278.47	6460.99
445.8135	-10717537.25	-15737824.62	10138232.50	22315.35	-10225.73	6426.85
448.2197	-10663797.75	-15762366.37	10153655.75	22351.25	-10172.60	6392.47
450.6250	-10609993.75	-15786770.50	10168990.12	22387.10	-10119.61	6358.17
453.0313	-10556081.75	-15811056.62	10184248.00	22422.86	-10066.23	6323.74
455.4365	-10502105.75	-15835204.37	10199416.75	22458.61	-10012.75	6289.13
457.8428	-10448022.50	-15859233.25	10214508.37	22493.72	-9959.29	6254.53
460.0957	-10397308.50	-15881614.12	10228563.00	22526.71	-9908.99	6222.22
462.6426	-10339888.25	-15906778.62	10244363.25	22564.00	-9852.08	6185.39
465.0479	-10285573.87	-15930411.12	10259199.12	22598.80	-9798.54	6150.75
467.4541	-10231153.87	-15953923.87	10273957.50	22633.41	-9744.47	6115.88
469.8594	-10176672.75	-15977297.12	10288625.87	22667.93	-9690.52	6080.98
472.2637	-10122131.12	-16000531.25	10303204.37	22702.22	-9636.63	6046.10
476.1445	-10033920.25	-16037759.87	10326559.12	22757.25	-9549.15	5989.75
479.4658	-9958259.25	-16069350.87	10346372.25	22803.98	-9474.19	5941.25
481.8701	-9903391.37	-16092064.62	10360614.62	22837.53	-9420.11	5906.15
484.2744	-9848443.12	-16114647.50	10374772.50	22870.86	-9365.40	5871.00
486.6777	-9793437.00	-16137090.25	10388840.12	22904.21	-9311.03	5835.83

GEMINI GT-5 FREE FLIGHT AND REENTRY RECONSTRUCTION

EARTH CENTERED INERTIAL GREENWICH
COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
489.0820	-9738328.62	-16159411.00	10402828.62	22937.32	-9256.28	5800.42
491.4863	-9683141.25	-16181600.12	10416732.12	22970.05	-9201.65	5765.08
493.8770	-9628189.50	-16203532.75	10430472.12	23002.58	-9147.16	5729.84
496.2813	-9572845.37	-16225459.12	10444205.87	23035.12	-9092.17	5694.51
498.6856	-9517423.25	-16247253.25	10457854.37	23067.48	-9037.20	5658.96
501.0137	-9463683.00	-16268231.00	10470989.12	23098.64	-8983.89	5624.49
503.4190	-9408086.00	-16289773.37	10484474.50	23130.65	-8928.78	5588.73
505.8252	-9352389.50	-16311191.62	10497879.62	23162.49	-8873.41	5553.16
508.1543	-9298405.87	-16331796.50	10510773.25	23193.24	-8819.98	5518.61
510.6250	-9241062.50	-16353517.75	10524362.62	23225.43	-8763.03	5481.79
513.0313	-9185138.62	-16374537.00	10537510.00	23256.73	-8707.52	5445.90
515.4365	-9129162.50	-16395414.00	10550565.87	23287.83	-8651.83	5410.13
517.8428	-9073089.12	-16416165.75	10563540.37	23318.59	-8596.40	5373.94
520.2481	-9016964.62	-16436775.12	10576423.25	23349.33	-8540.44	5338.23
522.6543	-8960743.50	-16457258.37	10589224.62	23379.92	-8484.59	5301.89
524.1309	-8926207.75	-16469761.00	10597037.00	23398.58	-8450.17	5279.88
527.4531	-8848402.50	-16497706.87	10614495.50	23440.08	-8373.18	5230.11
529.8565	-8792032.25	-16517762.87	10627021.50	23470.22	-8317.08	5193.84
532.2608	-8735567.12	-16537692.12	10639465.50	23500.02	-8260.91	5157.65
534.6651	-8679030.62	-16557486.25	10651822.50	23529.46	-8204.79	5121.38
537.0694	-8622423.12	-16577145.37	10664092.00	23559.19	-8148.46	5084.97
539.4736	-8565744.87	-16596669.00	10676274.12	23588.26	-8092.19	5048.60
541.8643	-8509319.62	-16615947.25	10688300.00	23617.10	-8036.00	5012.29
544.2676	-8452525.75	-16635192.37	10700302.50	23645.74	-7979.42	4975.96
546.6719	-8395640.00	-16654309.25	10712222.25	23674.42	-7922.83	4939.39
549.0762	-8338685.37	-16673290.00	10724053.87	23702.91	-7866.22	4902.69
551.4805	-8281662.44	-16692134.62	10735797.37	23731.32	-7809.62	4866.12
553.8076	-8226404.44	-16710244.87	10747080.25	23758.54	-7754.63	4830.58
556.1377	-8171013.94	-16728249.25	10758294.50	23785.34	-7699.32	4795.09

GEMINI GT-5 FREE FLIGHT AND REENTRY RECONSTRUCTION

EARTH CENTERED INERTIAL GREENWICH
COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
558.6074	-8112235.50	-16747192.12	10770090.62	23813.85	-7640.70	4757.45
561.0137	-8054900.06	-16765509.00	10781493.62	23841.56	-7583.75	4720.42
563.4190	-7997521.56	-16783681.50	10792803.25	23869.04	-7526.76	4683.59
565.8252	-7940054.06	-16801723.50	10804028.75	23896.14	-7469.27	4646.69
568.2305	-7882544.81	-16819620.25	10815160.75	23923.14	-7412.04	4609.60
570.6367	-7824947.69	-16837386.75	10826208.00	23949.79	-7354.74	4572.59
572.1152	-7789525.31	-16848234.50	10832951.87	23966.35	-7319.26	4549.90
575.4365	-7709865.50	-16872412.25	10847978.37	24002.86	-7239.99	4498.69
577.8418	-7652100.81	-16889757.00	10858754.25	24028.82	-7182.35	4461.47
580.2481	-7594249.81	-16906970.25	10869445.00	24055.15	-7124.69	4424.34
582.6533	-7536359.69	-16924037.75	10880042.00	24080.84	-7067.06	4387.12
585.0576	-7478431.56	-16940959.50	10890545.00	24106.35	-7009.26	4349.79
587.4619	-7420442.00	-16957742.50	10900958.37	24131.91	-6951.57	4312.53
589.8545	-7362674.19	-16974305.50	10911232.12	24157.23	-6893.76	4275.43
592.2588	-7304562.94	-16990810.50	10921466.50	24182.30	-6835.79	4237.99
594.6631	-7246391.75	-17007176.00	10931610.87	24207.02	-6777.83	4200.56
597.0674	-7188161.56	-17023402.25	10941665.00	24231.43	-6719.71	4162.92
599.4707	-7129896.25	-17039482.00	10951624.75	24255.92	-6661.55	4125.37
601.8750	-7071548.37	-17055428.25	10961498.37	24280.41	-6603.31	4087.99
604.1270	-7016844.62	-17070236.75	10970664.75	24302.97	-6548.39	4052.77
606.6738	-6954915.81	-17086836.25	10980935.62	24328.28	-6486.78	4012.75
609.0781	-6896394.87	-17102362.00	10990538.12	24352.00	-6428.33	3975.02
611.4063	-6839673.87	-17117262.00	10999749.87	24374.78	-6371.68	3938.44
613.8125	-6780994.06	-17132523.50	11009181.62	24398.06	-6313.18	3900.91
616.2178	-6722282.19	-17147638.00	11018518.75	24421.21	-6254.57	3862.96
618.6240	-6663491.00	-17162617.25	11027768.50	24444.17	-6195.71	3825.20
620.1016	-6627363.44	-17171745.00	11033403.12	24458.18	-6159.71	3801.72
623.4258	-6546007.25	-17192086.00	11045954.00	24489.37	-6078.39	3749.47
625.8311	-6487076.75	-17206635.50	11054926.75	24511.74	-6019.48	3711.44

GEMINI GT-5 FREE FLIGHT AND REENTRY RECONSTRUCTION

EARTH CENTERED INERTIAL GREENWICH
COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
628.2373	-6428068.81	-17221048.75	11063811.37	24533.81	-5960.38	3673.18
630.6426	-6369032.06	-17235314.00	11072600.87	24555.61	-5901.31	3635.29
633.0488	-6309918.75	-17249443.00	11081302.37	24577.53	-5842.22	3597.15
635.4531	-6250801.19	-17263418.25	11089905.12	24599.09	-5783.07	3558.98
637.8457	-6191920.50	-17277184.25	11098374.75	24620.35	-5724.16	3520.96
640.2500	-6132700.56	-17290875.25	11106794.25	24641.42	-5664.64	3482.79
642.6533	-6073454.00	-17304418.00	11115118.75	24662.49	-5605.44	3444.70
645.0576	-6014133.06	-17317823.75	11123354.87	24683.26	-5546.05	3406.38
647.4619	-5954762.69	-17331087.00	11131498.50	24703.66	-5486.80	3367.92
649.8662	-5895343.06	-17344207.25	11139550.12	24724.17	-5427.23	3329.71
652.1182	-5839644.19	-17356366.50	11147008.00	24743.04	-5371.56	3293.79
654.6651	-5776600.06	-17369966.50	11155344.87	24763.97	-5308.23	3252.93
657.0684	-5717060.25	-17382652.00	11163116.62	24784.01	-5248.54	3214.66
659.4727	-5657448.94	-17395199.25	11170799.37	24803.31	-5188.69	3176.17
661.8770	-5597791.31	-17407602.75	11178389.37	24822.52	-5129.10	3137.48
664.2051	-5539979.69	-17419476.75	11185650.37	24841.19	-5071.30	3100.20
666.6104	-5480206.94	-17431602.25	11193060.87	24860.21	-5011.16	3061.64
668.0889	-5443442.12	-17438984.00	11197569.87	24871.82	-4974.18	3037.78
671.4121	-5360744.37	-17455376.75	11207576.37	24897.51	-4891.37	2984.37
673.8184	-5300812.69	-17467074.50	11214711.12	24915.84	-4831.49	2945.74
676.2236	-5240861.19	-17478623.25	11221749.75	24934.19	-4771.22	2906.98
678.6299	-5180842.00	-17490031.50	11228697.87	24951.90	-4710.94	2868.11
681.0352	-5120804.50	-17501290.00	11235550.12	24969.65	-4650.71	2829.49
683.4414	-5060699.94	-17512408.25	11242311.50	24987.40	-4590.41	2790.37
685.8350	-5000870.75	-17523323.75	11248944.25	25004.51	-4530.33	2751.86
688.2402	-4940707.25	-17534147.75	11255516.37	25021.85	-4469.85	2712.86
690.6465	-4880478.06	-17544830.75	11261997.50	25038.75	-4409.56	2674.09
693.0508	-4820257.44	-17555360.00	11268379.62	25055.41	-4349.04	2634.84
695.4541	-4760021.25	-17565739.25	11274665.37	25072.08	-4288.47	2596.01

GEMINI GT-5 FREE FLIGHT AND REENTRY RECONSTRUCTION

EARTH CENTERED INERTIAL GREENWICH
COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
697.8584	-4699721.06	-17575977.25	11280860.25	25088.26	-4227.87	2557.17
700.1104	-4643206.25	-17585434.25	11286577.37	25103.56	-4171.11	2520.34
702.6592	-4579200.25	-17595983.75	11292948.50	25120.29	-4106.93	2478.84
705.0625	-4518809.25	-17605781.00	11298859.12	25136.02	-4046.13	2439.88
707.4668	-4458356.12	-17615436.00	11304678.37	25151.55	-3985.26	2400.87
709.8711	-4397866.31	-17624944.75	11310403.75	25166.57	-3924.49	2361.70
712.2754	-4337340.06	-17634307.00	11316034.62	25181.85	-3863.55	2322.41
714.6835	-4278696.75	-17643233.25	11321397.25	25196.29	-3804.57	2284.39
716.1572	-4239541.50	-17649114.00	11324926.87	25205.93	-3765.34	2259.09
719.4033	-4157689.28	-17661202.75	11332174.12	25225.29	-3682.82	2206.14
721.8096	-4096973.56	-17669991.25	11337435.37	25239.71	-3621.93	2166.77
724.2149	-4036248.00	-17678629.25	11342599.75	25253.98	-3560.63	2127.50
726.6211	-3975464.06	-17687123.25	11347671.62	25267.74	-3499.42	2088.05
729.0264	-3914671.66	-17695467.25	11352646.37	25281.53	-3438.48	2048.53
731.4326	-3853821.75	-17703667.25	11357528.25	25295.02	-3377.16	2009.13
733.8252	-3793285.97	-17711674.25	11362288.37	25307.95	-3316.09	1969.89
736.2305	-3732397.59	-17719576.75	11366979.00	25321.11	-3254.96	1930.38
738.6367	-3671453.00	-17727335.25	11371576.25	25334.15	-3193.49	1890.76
741.0420	-3610502.59	-17734942.50	11376076.75	25346.49	-3132.03	1851.39
743.4463	-3549547.03	-17742399.00	11380480.50	25359.03	-3070.75	1811.91
745.8506	-3488561.81	-17749708.00	11384789.12	25371.16	-3009.20	1772.13
748.1026	-3431414.47	-17756419.75	11388738.12	25382.42	-2951.54	1735.09
750.6485	-3366777.47	-17763851.00	11393102.12	25394.93	-2886.33	1693.19
753.0527	-3305706.44	-17770716.75	11397125.50	25406.64	-2824.90	1653.61
755.4570	-3244607.81	-17777434.50	11401053.75	25417.90	-2763.14	1614.06
757.8604	-3183506.94	-17784000.75	11404885.00	25429.15	-2701.28	1574.21
760.2647	-3122354.75	-17790421.50	11408621.87	25439.95	-2639.78	1534.35
762.6690	-3061176.47	-17796694.25	11412263.50	25450.82	-2578.04	1494.93
764.1455	-3023591.81	-17800472.75	11414452.75	25457.49	-2540.14	1470.28

GEMINI GT-5 FREE FLIGHT AND REENTRY RECONSTRUCTION

EARTH CENTERED INERTIAL GREENWICH
COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
767.4668	-2939016.56	-17808767.50	11419245.00	25471.68	-2454.76	1415.51
769.8711	-2877763.12	-17814595.25	11422600.50	25481.64	-2393.01	1375.74
772.1992	-2818427.28	-17820096.50	11425758.62	25491.43	-2332.91	1337.26
774.6045	-2757101.78	-17825633.75	11428927.00	25501.12	-2271.20	1297.28
777.0108	-2695728.37	-17831024.00	11432000.37	25510.54	-2209.07	1257.26
779.4160	-2634357.56	-17836263.00	11434976.62	25519.67	-2147.11	1217.48
781.8086	-2573288.62	-17841326.25	11437842.25	25528.99	-2085.37	1177.94
784.2149	-2511849.12	-17846269.50	11440628.25	25537.60	-2023.33	1137.76
786.6201	-2450413.62	-17851061.50	11443316.87	25546.41	-1961.27	1097.79
789.0264	-2388932.25	-17855706.00	11445910.62	25554.98	-1899.17	1058.03
791.4317	-2327455.97	-17860199.25	11448407.25	25562.95	-1836.95	1017.97
793.8379	-2265935.44	-17864544.50	11450808.62	25570.99	-1774.69	978.00
796.0908	-2208317.53	-17868477.25	11452969.75	25578.32	-1716.43	940.48
798.6377	-2143162.34	-17872765.00	11455311.12	25586.49	-1650.67	898.14
801.0430	-2081611.11	-17876660.25	11457423.12	25593.76	-1588.37	858.03
803.4473	-2020067.48	-17880404.25	11459438.12	25600.94	-1525.99	818.10
805.8516	-1958507.05	-17883998.50	11461356.75	25607.74	-1463.83	777.96
808.2549	-1896955.25	-17887441.50	11463178.12	25614.56	-1401.30	737.71
810.6592	-1835362.45	-17890736.00	11464903.75	25621.04	-1339.18	697.71
812.1358	-1797528.48	-17892685.00	11465915.87	25624.95	-1300.77	673.22
815.4580	-1712381.39	-17896863.00	11468060.12	25633.50	-1214.43	617.64
817.8623	-1650743.95	-17899707.75	11469497.00	25639.24	-1151.98	577.68
820.2656	-1589117.70	-17902401.50	11470837.25	25645.03	-1089.70	537.58
822.5938	-1529406.89	-17904868.25	11472043.37	25650.16	-1029.39	498.53
825.0000	-1467679.64	-17907269.75	11473194.75	25655.61	-966.60	458.47
827.4053	-1405964.92	-17909519.25	11474248.75	25660.56	-904.01	417.95
829.7988	-1344539.06	-17911608.75	11475201.25	25665.49	-841.89	377.97
832.2041	-1282801.14	-17913558.25	11476062.12	25669.98	-779.16	337.83
834.6104	-1221027.42	-17915357.75	11476826.50	25674.40	-716.52	297.52

GEMINI GT-5 FREE FLIGHT AND REENTRY RECONSTRUCTION

EARTH CENTERED INERTIAL GREENWICH
COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
837.0156	-1159268.62	-17917006.00	11477493.87	25678.43	-653.92	257.35
839.4219	-1097474.97	-17918504.25	11478064.62	25682.52	-591.38	217.11
841.8272	-1035697.12	-17919851.25	11478538.37	25686.16	-528.67	176.75
844.1572	-975842.15	-17921012.25	11478904.37	25689.77	-467.96	137.45
846.6279	-912366.31	-17922089.00	11479193.12	25693.04	-403.52	96.22
849.0332	-850563.77	-17922984.00	11479376.00	25696.16	-340.79	55.86
851.4395	-788728.87	-17923728.50	11479461.87	25699.08	-277.96	15.55
853.8428	-726962.52	-17924321.25	11479450.75	25701.77	-215.24	-24.80
856.2471	-665165.03	-17924763.00	11479342.75	25704.11	-152.35	-65.03
858.6514	-603361.87	-17925054.00	11479138.00	25706.47	-89.72	-105.32
860.1279	-565403.71	-17925158.00	11478964.12	25707.76	-51.16	-130.13
863.2637	-484787.46	-17925190.25	11478473.37	25709.90	30.65	-182.87
865.3184	-431960.02	-17925072.00	11478062.25	25711.48	84.52	-217.29
867.3711	-379179.91	-17924843.50	11477580.75	25712.73	138.11	-251.88
870.4102	-301035.22	-17924303.00	11476737.75	25714.11	217.47	-302.93
872.4707	-248049.23	-17923799.50	11476077.87	25714.94	271.22	-337.50
874.5293	-195112.00	-17923185.75	11475347.50	25715.54	325.26	-372.14
877.5820	-116607.95	-17922070.75	11474133.37	25716.42	405.17	-423.31
879.6416	-63643.14	-17921180.75	11473225.62	25716.45	459.06	-458.08
881.7012	-10678.18	-17920180.00	11472246.62	25716.57	512.83	-492.66
884.7539	67827.55	-17918492.25	11470664.37	25716.49	592.77	-543.96
886.8125	120767.07	-17917216.75	11469509.00	25716.21	646.54	-578.53
889.8565	199044.79	-17915127.25	11467670.12	25715.55	726.28	-629.69
891.9190	252082.16	-17913573.50	11466335.50	25714.63	780.34	-664.45
893.9776	305017.45	-17911911.75	11464932.00	25713.96	834.21	-699.09
897.0235	383337.15	-17909249.25	11462724.25	25712.38	914.07	-750.56
899.0889	436442.81	-17907305.50	11461138.37	25710.97	968.08	-785.05
901.1465	489344.92	-17905258.00	11459487.50	25709.78	1022.11	-819.67
904.1924	567650.74	-17902023.25	11456913.12	25707.44	1101.90	-870.74

GEMINI GT-5 FREE FLIGHT AND REENTRY RECONSTRUCTION

EARTH CENTERED INERTIAL GREENWICH
COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
906.2549	620670.53	-17899695.00	11455081.25	25705.68	1155.88	-905.56
908.3145	673610.91	-17897258.75	11453180.50	25703.46	1209.79	-940.22
911.3623	751946.33	-17893449.50	11450236.62	25700.23	1289.86	-991.57
913.4248	804950.63	-17890733.75	11448155.62	25697.88	1343.68	-1026.41
915.4727	857573.56	-17887927.00	11446018.50	25695.42	1397.46	-1060.74
918.5195	935858.02	-17883547.50	11442708.25	25691.30	1477.18	-1112.10
920.5820	988843.11	-17880445.00	11440378.87	25688.19	1531.52	-1146.79
922.6406	1041721.47	-17877236.75	11437982.62	25685.09	1585.30	-1181.24
925.6895	1120023.45	-17872281.50	11434302.75	25680.21	1665.36	-1232.70
927.7500	1172935.05	-17868794.25	11431726.87	25676.64	1719.40	-1267.43
929.8096	1225814.02	-17865197.50	11429081.00	25672.88	1773.36	-1301.99
932.8594	1304102.28	-17859667.25	11425031.87	25666.97	1853.25	-1353.33
934.9092	1356710.48	-17855813.50	11422222.25	25663.00	1906.87	-1388.03
936.9678	1409535.62	-17851832.25	11419329.25	25658.58	1960.95	-1422.66
940.0195	1487828.97	-17845725.50	11414909.37	25651.74	2041.14	-1473.95
942.0811	1540705.47	-17841462.00	11411834.87	25646.74	2095.10	-1508.74
944.1406	1593521.77	-17837091.50	11408691.75	25641.90	2149.11	-1543.44
947.1934	1671788.06	-17830409.00	11403901.87	25634.29	2229.00	-1594.66
949.2529	1724577.72	-17825762.50	11400581.62	25628.51	2283.02	-1629.60
951.3145	1777405.87	-17821000.50	11397186.37	25623.06	2336.91	-1664.34
954.3643	1855537.73	-17813751.50	11392032.25	25614.22	2416.75	-1715.63
956.4238	1908285.81	-17808718.25	11388462.87	25608.18	2470.87	-1750.51
958.4824	1960996.00	-17803576.50	11384823.75	25601.72	2524.58	-1785.01
961.5235	2038836.70	-17795777.75	11379317.50	25592.17	2604.52	-1836.36
963.5840	2091563.64	-17790355.75	11375497.87	25585.44	2658.19	-1870.95
966.6319	2169528.47	-17782132.25	11369717.12	25575.08	2737.98	-1922.43
968.6963	2222319.34	-17776424.50	11365712.50	25567.66	2791.80	-1957.11
970.7549	2274945.09	-17770621.75	11361647.75	25560.19	2845.75	-1991.99
973.8057	2352906.16	-17761819.00	11355492.37	25548.73	2925.10	-2043.31

GEMINI GT-5 FREE FLIGHT AND REENTRY RECONSTRUCTION

EARTH CENTERED INERTIAL GREENWICH
COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
975.8692	2405617.34	-17755727.25	11351240.25	25540.95	2979.12	-2078.00
977.9277	2458187.03	-17749539.25	11346926.62	25532.45	3032.96	-2112.86
980.9756	2535987.22	-17740174.75	11340408.62	25520.03	3112.08	-2164.19
983.0401	2588663.03	-17733694.50	11335904.75	25511.21	3165.80	-2199.04
985.0986	2641171.06	-17727122.25	11331342.12	25502.29	3219.53	-2233.77
988.1465	2718877.19	-17717188.75	11324455.62	25488.46	3298.67	-2285.16
990.2110	2771486.91	-17710323.50	11319702.12	25478.78	3352.36	-2319.87
992.2695	2823927.03	-17703367.50	11314890.87	25468.75	3405.64	-2354.42
995.3174	2901528.28	-17692867.50	11307636.75	25453.18	3484.52	-2405.75
997.3809	2954039.09	-17685622.00	11302637.00	25442.29	3537.99	-2440.19
999.5606	3009482.25	-17677849.00	11297278.12	25430.29	3594.20	-2476.96
1001.8594	3067927.25	-17669518.00	11291539.62	25417.34	3653.84	-2515.59
1004.1582	3126341.69	-17661050.75	11285712.50	25403.74	3712.86	-2554.04
1006.4570	3184724.84	-17652447.50	11279797.25	25390.08	3771.93	-2592.30
1008.7549	3243050.91	-17643712.25	11273796.25	25375.68	3830.99	-2630.77
1012.1641	3329522.53	-17630504.00	11264730.87	25353.02	3917.70	-2687.45
1014.4629	3387786.47	-17621430.50	11258509.12	25337.10	3976.24	-2725.58
1016.7627	3446037.62	-17612219.00	11252196.75	25320.37	4034.52	-2763.90
1019.0635	3504274.56	-17602869.75	11245793.25	25303.26	4092.57	-2802.42
1021.3623	3562421.81	-17593395.00	11239307.37	25285.33	4150.55	-2840.41
1023.6582	3620453.47	-17583799.25	11232741.87	25267.14	4208.48	-2878.84
1025.9580	3678541.00	-17574054.00	11226077.37	25248.05	4266.27	-2916.93
1028.2559	3736534.81	-17564184.50	11219330.62	25228.50	4323.89	-2955.27
1030.5547	3794507.31	-17554178.75	11212493.37	25208.07	4381.34	-2993.15
1032.8535	3852432.19	-17544041.25	11205569.00	25187.07	4438.28	-3031.16
1035.1524	3910306.06	-17533773.75	11198557.62	25163.67	4494.60	-3068.76
1038.5606	3996006.59	-17518313.25	11188003.25	25127.08	4577.90	-3124.79
1040.8604	4053764.19	-17507721.00	11180773.62	25101.15	4633.48	-3162.37
1043.1592	4111436.34	-17497006.00	11173460.62	25074.12	4688.75	-3199.97

GEMINI GT-5 FREE FLIGHT AND REENTRY RECONSTRUCTION

EARTH CENTERED INERTIAL GREENWICH
COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
1045.4580	4169045.31	-17486164.00	11166061.00	25046.17	4743.88	-3237.83
1047.7569	4226588.56	-17475195.50	11158574.25	25016.98	4798.81	-3275.67
1050.0557	4284063.06	-17464101.00	11151000.75	24986.33	4853.40	-3313.28
1052.3545	4341465.12	-17452882.25	11143341.62	24953.94	4907.10	-3350.31
1054.6533	4398790.87	-17441539.75	11135596.50	24919.98	4960.83	-3387.93
1056.9522	4456037.06	-17430074.75	11127765.37	24884.65	5013.90	-3425.24
1059.2490	4513152.06	-17418498.25	11119855.62	24848.12	5066.39	-3462.16
1062.6543	4597667.69	-17401115.50	11107972.62	24789.97	5142.82	-3517.05
1064.9522	4654582.62	-17389239.75	11099848.50	24747.56	5193.72	-3553.97
1067.2510	4711422.31	-17377242.75	11091636.00	24703.50	5243.83	-3590.97
1069.5508	4768182.12	-17365126.00	11083335.25	24657.03	5293.24	-3627.73
1071.8447	4824688.00	-17352927.75	11074971.12	24608.18	5342.05	-3664.56
1074.1397	4881103.44	-17340613.25	11066519.50	24557.27	5389.84	-3700.95
1076.4356	4937421.81	-17328185.00	11057980.62	24502.77	5436.62	-3737.38
1078.7295	4993564.25	-17315661.00	11049365.75	24445.59	5482.52	-3773.58
1081.0225	5049547.69	-17303038.50	11040671.75	24384.94	5527.28	-3809.60
1083.3164	5105412.75	-17290309.00	11031891.37	24321.59	5571.06	-3845.69
1085.6084	5161079.56	-17277491.00	11023036.50	24253.46	5613.89	-3881.13
1089.0049	5243272.69	-17258320.00	11009766.12	24145.46	5674.89	-3933.05
1091.2969	5298524.37	-17245268.25	11000711.87	24067.36	5714.08	-3967.74
1093.5899	5353616.25	-17232121.75	10991574.87	23985.54	5752.73	-4001.81
1095.8828	5408515.44	-17218888.75	10982359.87	23899.24	5789.49	-4035.82
1098.1748	5463188.62	-17205578.25	10973071.25	23808.77	5825.31	-4069.42
1100.4668	5517648.12	-17192188.50	10963706.12	23712.80	5858.74	-4102.63
1102.7529	5571742.69	-17178757.50	10954289.25	23611.28	5891.07	-4135.57
1105.0420	5625668.44	-17165238.00	10944785.62	23504.69	5921.22	-4168.01
1107.3301	5679320.81	-17151657.00	10935212.12	23392.50	5949.80	-4200.11
1109.6211	5732779.87	-17137995.00	10925553.50	23275.95	5976.86	-4231.67
1113.0137	5811436.31	-17117655.75	10911119.75	23093.76	6013.55	-4277.34

GEMINI GT-5 FREE FLIGHT AND REENTRY RECONSTRUCTION

EARTH CENTERED INERTIAL GREENWICH
COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
1115.3037	5864174.12	-17103858.75	10901289.87	22964.66	6035.97	-4307.48
1117.5938	5916607.50	-17090013.25	10891392.75	22827.91	6055.95	-4336.23
1119.8848	5968742.56	-17076118.50	10881426.37	22684.68	6074.00	-4364.17
1122.1777	6020585.19	-17062173.75	10871387.50	22534.12	6089.08	-4392.03
1124.4707	6072073.56	-17048196.75	10861286.87	22375.65	6102.10	-4418.05
1126.7647	6123212.44	-17034187.25	10851122.12	22210.30	6112.05	-4444.16
1129.0596	6173988.81	-17020150.25	10840894.50	22040.80	6121.04	-4469.16
1131.3574	6224435.62	-17006076.75	10830597.37	21867.02	6128.41	-4493.19
1133.6485	6274316.19	-16992036.00	10820278.00	21677.47	6128.81	-4515.36
1137.0459	6347439.75	-16971232.50	10804887.37	21368.54	6117.69	-4544.72
1139.3311	6396022.31	-16957267.00	10794482.75	21151.57	6104.93	-4561.54
1141.6162	6444100.69	-16943333.75	10784041.12	20927.27	6089.68	-4577.17
1143.9004	6491634.75	-16929446.00	10773570.62	20693.01	6070.28	-4590.65
1146.1826	6538573.94	-16915622.00	10763082.00	20441.52	6044.27	-4600.84
1148.4649	6584925.31	-16901862.50	10752572.75	20177.94	6013.61	-4608.89
1150.7442	6630608.44	-16888193.75	10742061.50	19907.32	5980.36	-4614.28
1153.0283	6675754.69	-16874576.75	10731518.25	19622.16	5942.39	-4617.26
1155.3164	6720312.75	-16861029.00	10720952.50	19325.73	5899.74	-4618.21
1157.6055	6764198.37	-16847577.50	10710382.75	19018.03	5853.04	-4616.82
1160.9961	6827865.81	-16827865.00	10694743.12	18536.97	5774.54	-4608.43
1163.2861	6869922.81	-16814710.50	10684202.50	18193.40	5714.06	-4597.12
1165.5752	6911159.00	-16801706.75	10673695.75	17835.47	5647.43	-4582.83
1167.8643	6951562.31	-16788861.50	10663224.75	17465.75	5575.71	-4565.89
1170.1455	6990974.31	-16776231.37	10652833.87	17087.24	5497.43	-4543.97
1172.4307	7029572.94	-16763765.87	10642482.37	16694.79	5412.53	-4515.83
1174.7178	7067291.94	-16751493.12	10632191.75	16289.19	5319.58	-4482.89
1177.0059	7104081.19	-16739438.37	10621980.25	15868.08	5217.43	-4443.00
1179.2949	7139902.69	-16727623.87	10611865.50	15429.87	5105.15	-4394.38
1181.5860	7174739.69	-16716071.87	10601871.12	14981.97	4979.41	-4330.47

GEMINI GT-5 FREE FLIGHT AND REENTRY RECONSTRUCTION

EARTH CENTERED INERTIAL GREENWICH
COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
1184.9815	7224460.75	-16699500.00	10587346.87	14304.42	4781.68	-4224.53
1187.2744	7256723.69	-16688695.87	10577749.75	13836.30	4642.00	-4146.36
1189.5674	7287908.06	-16676220.00	10568348.87	13363.73	4495.43	-4053.39
1191.8613	7318019.87	-16668079.62	10559182.37	12889.56	4345.48	-3938.50
1194.1494	7346972.69	-16658297.62	10550324.87	12417.89	4204.97	-3803.84
1196.4395	7374870.25	-16648826.62	10541774.12	11946.39	4066.45	-3663.87
1198.7305	7401704.69	-16639671.87	10533530.75	11479.39	3925.43	-3532.42
1201.0244	7427505.12	-16630835.25	10525554.87	11014.99	3778.90	-3421.41
1203.3154	7452208.44	-16622344.37	10517828.37	10550.43	3633.36	-3323.71
1205.6074	7475867.87	-16614177.62	10510319.25	10094.85	3493.02	-3228.68
1209.0059	7509056.00	-16602633.75	10499558.75	9436.54	3300.61	-3103.97
1211.2988	7530203.00	-16595205.00	10492536.75	9008.56	3178.96	-3020.87
1213.5928	7550389.37	-16588046.50	10485702.87	8591.14	3062.30	-2937.28
1215.8887	7569647.62	-16581142.12	10479055.37	8185.10	2952.27	-2853.54
1218.1846	7587987.75	-16574485.75	10472599.50	7791.28	2846.19	-2770.30
1220.4795	7605433.50	-16568068.12	10466334.75	7412.50	2746.69	-2689.27
1222.7754	7622031.44	-16561872.87	10460252.87	7046.32	2650.16	-2608.80
1225.0703	7637799.12	-16555895.50	10454357.75	6695.00	2559.02	-2528.72
1227.3662	7652782.31	-16550118.25	10448643.37	6357.16	2473.66	-2449.26
1229.6602	7666991.00	-16544540.50	10443119.50	6030.83	2389.33	-2366.77
1231.9522	7680458.12	-16539155.75	10437796.50	5720.64	2309.40	-2278.04
1235.3457	7699130.37	-16531499.50	10430310.62	5283.89	2202.82	-2133.78
1237.6377	7710920.19	-16526525.75	10425527.50	5003.96	2137.35	-2039.96
1239.9287	7722080.50	-16521693.37	10420955.75	4738.72	2081.20	-1951.04
1242.2178	7732635.19	-16516992.75	10416586.37	4483.15	2025.81	-1866.65
1244.5069	7742618.19	-16512412.62	10412404.25	4239.17	1975.98	-1787.33
1246.7949	7752050.50	-16507947.00	10408401.25	4005.55	1927.32	-1711.63
1249.0840	7760964.75	-16503590.62	10404563.87	3783.00	1878.98	-1641.14
1251.3731	7769384.81	-16499342.12	10400882.87	3573.74	1832.97	-1575.05

GEMINI GT-5 FREE FLIGHT AND REENTRY RECONSTRUCTION

EARTH CENTERED INERTIAL GREENWICH
COORDINATE SYSTEM

TIME (SEC)	X (FT)	Y (FT)	Z (FT)	XDOT (FT/SEC)	YDOT (FT/SEC)	ZDOT (FT/SEC)
1253.6611	7777337.25	-16495198.00	10397348.75	3377.46	1789.39	-1514.13
1255.9522	7784862.00	-16491146.00	10393947.25	3191.48	1747.91	-1455.33
1259.3428	7795254.12	-16485317.87	10389152.00	2938.43	1689.86	-1373.20
1261.6348	7801809.00	-16481487.50	10386064.37	2781.36	1652.54	-1321.01
1263.9248	7808008.75	-16477745.37	10383096.75	2633.15	1615.65	-1270.80
1266.2119	7813871.81	-16474090.75	10380245.12	2493.92	1580.21	-1222.76
1268.5000	7819429.19	-16470513.87	10377500.12	2363.73	1546.30	-1176.69
1270.7871	7824694.44	-16467015.75	10374859.87	2240.59	1512.75	-1132.08
1273.0752	7829687.81	-16463591.50	10372318.75	2124.05	1480.31	-1089.16
1275.2949	7834285.25	-16460338.75	10369944.87	2018.32	1450.53	-1049.67
1278.4854	7840503.37	-16455775.75	10366680.25	1879.68	1409.88	-996.86
1280.6416	7844465.56	-16452763.12	10364566.12	1795.35	1384.45	-964.08
1282.7969	7848250.81	-16449805.00	10362521.75	1717.20	1360.55	-933.01
1284.9522	7851873.62	-16446898.50	10360543.25	1644.63	1336.57	-902.99
1288.1436	7856968.75	-16442685.87	10357725.87	1548.39	1303.39	-862.55
1290.3037	7860250.06	-16439895.87	10355891.12	1489.65	1279.76	-836.25
1292.4590	7863402.50	-16437161.00	10354115.12	1435.68	1258.06	-811.81

RE-ENTRY TRAJECTORY RECONSTRUCTION

SPECIAL PARAMETERS

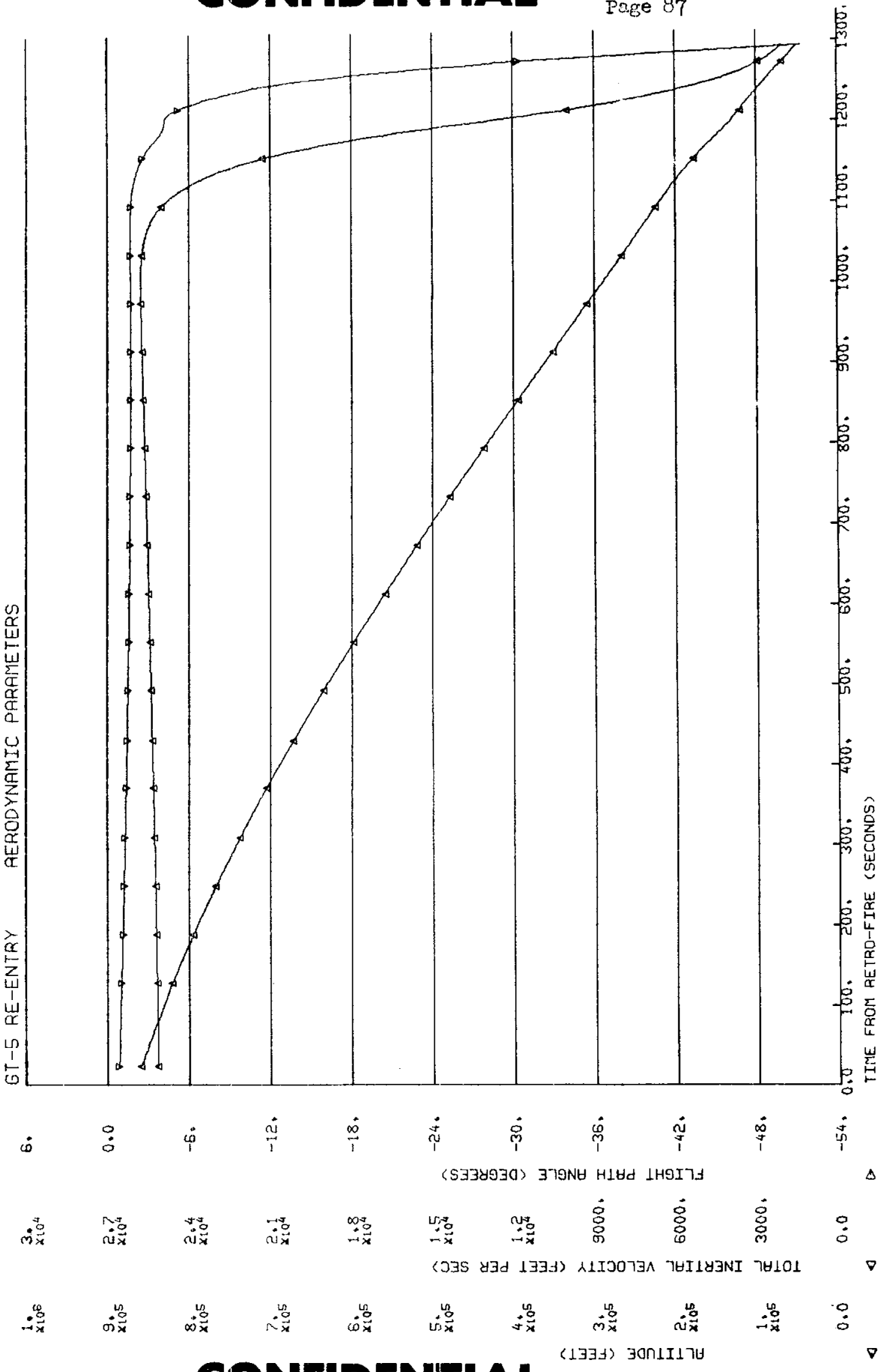

GT-5 RE-ENTRY AERODYNAMIC PARAMETERS
TIME FROM RETRO-FIRE (SECONDS)
0.0
100.
200.
300.
400.
500.
600.
700.
800.
900.
1000.
1100.
1200.
1300.
FLIGHT PATH ANGLE (DEGREES)
6.
0.0
-6.
-12.
-18.
-24.
-30.
-36.
-42.
-48.
-54.
TOTAL INERTIAL VELOCITY (FEET PER SEC)
3. x10^4
2.7 x10^4
2.4 x10^4
2.1 x10^4
1.8 x10^4
1.5 x10^4
1.2 x10^4
9000.
6000.
3000.
0.0
ALTITUDE (FEET)
1. x10^6
9. x10^5
8. x10^5
7. x10^5
6. x10^5
5. x10^5
4. x10^5
3. x10^5
2. x10^5
1. x10^5
0.0

Figure 34

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)
685686.172	25132.5	23806.7	7.500	61.576	858639.5	16.915	-152.428
685688.789	25133.7	23807.9	7.520	61.622	857766.7	16.998	-152.280
685690.781	25134.5	23808.7	7.536	61.658	857100.2	17.061	-152.167
685698.031	25137.3	23811.5	7.590	61.788	854651.5	17.289	-151.756
685700.664	25138.6	23812.8	7.609	61.836	853755.0	17.372	-151.606
685703.289	25139.6	23813.8	7.628	61.884	852853.7	17.454	-151.457
685705.281	25140.6	23814.9	7.642	61.920	852166.2	17.517	-151.343
685707.914	25141.6	23815.9	7.661	61.968	851255.7	17.599	-151.193
685712.531	25143.5	23817.8	7.692	62.054	849643.2	17.743	-150.929
685715.156	25144.6	23818.9	7.710	62.103	848720.5	17.825	-150.779
685717.156	25145.2	23819.5	7.723	62.141	848017.2	17.887	-150.665
685719.781	25146.5	23820.8	7.740	62.190	847085.2	17.969	-150.515
685722.398	25147.8	23822.1	7.757	62.239	846151.2	18.050	-150.364
685724.836	25148.5	23822.9	7.772	62.286	845277.2	18.125	-150.224
685727.242	25149.6	23823.9	7.787	62.332	844411.7	18.200	-150.086
685729.648	25150.6	23825.0	7.802	62.379	843542.0	18.274	-149.948
685732.055	25151.7	23826.1	7.816	62.425	842668.2	18.348	-149.809
685734.461	25152.9	23827.3	7.830	62.472	841791.0	18.422	-149.670
685736.867	25153.9	23828.4	7.844	62.519	840909.2	18.496	-149.532
685739.125	25155.0	23829.4	7.857	62.563	840080.0	18.566	-149.401
685744.070	25157.2	23831.7	7.884	62.661	838245.0	18.717	-149.115
685746.477	25158.5	23833.0	7.897	62.709	837348.5	18.791	-148.976
685768.023	25168.4	23843.0	8.001	63.148	829137.2	19.444	-147.721
685772.898	25170.8	23845.5	8.021	63.249	827236.2	19.591	-147.435
685784.852	25176.4	23851.1	8.067	63.504	822508.2	19.948	-146.733
685789.648	25178.9	23853.7	8.084	63.608	820582.5	20.090	-146.450
685792.055	25180.0	23854.8	8.092	63.660	819612.0	20.152	-146.308
685794.461	25181.4	23856.2	8.099	63.713	818637.5	20.233	-146.165

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)
685796.867	25182.4	23857.2	8.107	63.765	817659.5	20.304	-146.023
685799.273	25183.7	23858.6	8.114	63.818	816678.2	20.374	-145.880
685801.680	25184.8	23859.7	8.121	63.871	815693.2	20.445	-145.737
685803.156	25185.7	23860.6	8.125	63.904	815086.2	20.489	-145.650
685806.477	25187.5	23862.4	8.134	63.977	813716.0	20.586	-145.452
685808.883	25188.5	23863.4	8.140	64.031	812719.7	20.656	-145.309
685811.281	25189.9	23864.8	8.146	64.086	811719.5	20.726	-145.166
685813.687	25190.9	23865.9	8.152	64.139	810716.0	20.797	-145.022
685816.094	25192.1	23867.1	8.157	64.194	809708.7	20.866	-144.879
685818.492	25193.6	23868.6	8.162	64.249	808697.5	20.936	-144.735
685820.891	25194.6	23869.7	8.167	64.304	807687.7	21.006	-144.592
685823.289	25195.8	23870.9	8.171	64.359	806669.0	21.075	-144.448
685825.695	25197.2	23872.3	8.175	64.414	805646.2	21.144	-144.304
685828.023	25198.3	23873.4	8.179	64.468	804652.7	21.212	-144.164
685830.430	25199.7	23874.8	8.183	64.524	803622.2	21.281	-144.019
685832.836	25200.9	23876.1	8.186	64.580	802588.0	21.350	-143.874
685835.086	25202.4	23877.5	8.189	64.633	801615.5	21.414	-143.739
685837.633	25203.5	23878.7	8.192	64.693	800512.5	21.487	-143.585
685840.039	25204.7	23880.0	8.195	64.750	799467.0	21.556	-143.440
685842.445	25206.0	23881.3	8.198	64.807	798417.5	21.624	-143.294
685844.852	25207.4	23882.6	8.200	64.864	797365.0	21.693	-143.149
685847.258	25208.4	23883.8	8.202	64.922	796308.7	21.761	-143.003
685849.664	25209.9	23885.3	8.203	64.979	795249.2	21.829	-142.857
685851.141	25210.7	23886.0	8.204	65.015	794596.0	21.871	-142.767
685854.461	25212.5	23887.9	8.205	65.095	793123.7	21.964	-142.565
685856.867	25213.9	23889.3	8.206	65.154	792053.7	22.032	-142.419
685859.273	25215.2	23890.7	8.207	65.213	790980.0	22.099	-142.272
685861.680	25216.4	23891.8	8.207	65.271	789902.5	22.167	-142.126

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)
685864.078	25217.9	23893.4	8.207	65.330	788821.5	22.234	-141.979
685866.484	25219.0	23894.5	8.207	65.390	787737.0	22.301	-141.832
685868.875	25220.4	23895.9	8.206	65.449	786654.0	22.368	-141.686
685871.281	25221.8	23897.4	8.205	65.509	785562.5	22.434	-141.538
685873.687	25223.0	23898.6	8.204	65.569	784466.7	22.501	-141.391
685876.086	25224.6	23900.2	8.203	65.629	783368.0	22.567	-141.243
685878.492	25225.8	23901.4	8.201	65.690	782265.0	22.634	-141.095
685880.898	25227.2	23902.8	8.200	65.750	781159.0	22.700	-140.947
685883.148	25228.5	23904.2	8.198	65.807	780119.5	22.762	-140.809
685885.695	25229.8	23905.6	8.195	65.872	778940.5	22.831	-140.652
685888.023	25231.2	23906.9	8.193	65.931	777859.0	22.895	-140.508
685890.430	25232.5	23908.3	8.190	65.993	776738.7	22.961	-140.359
685892.836	25234.1	23909.9	8.186	66.055	775614.0	23.026	-140.210
685895.242	25235.2	23911.1	8.183	66.118	774486.5	23.091	-140.061
685897.648	25236.7	23912.6	8.179	66.180	773354.7	23.157	-139.912
685899.125	25237.7	23913.6	8.177	66.218	772658.0	23.196	-139.820
685902.445	25239.5	23915.5	8.171	66.305	771085.7	23.286	-139.613
685904.852	25240.9	23916.8	8.166	66.368	769943.7	23.351	-139.464
685907.258	25242.3	23918.3	8.161	66.432	768798.7	23.415	-139.314
685909.664	25243.9	23919.9	8.156	66.495	767649.7	23.480	-139.164
685912.070	25245.2	23921.3	8.151	66.559	766498.0	23.544	-139.013
685914.469	25246.7	23922.8	8.145	66.623	765343.0	23.608	-138.863
685916.867	25248.1	23924.2	8.140	66.687	764189.5	23.671	-138.713
685919.266	25249.5	23925.6	8.133	66.751	763027.0	23.735	-138.563
685921.672	25250.9	23927.0	8.127	66.816	761861.5	23.799	-138.412
685924.078	25252.3	23928.5	8.120	66.881	760693.0	23.862	-138.261
685926.484	25253.7	23930.0	8.113	66.946	759520.2	23.925	-138.109
685928.883	25255.4	23931.6	8.106	67.011	758344.5	23.988	-137.958

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)
685931.141	25256.5	23932.8	8.099	67.073	757240.0	24.047	-137.816
685933.687	25258.1	23934.4	8.091	67.142	755987.2	24.114	-137.655
685936.086	25259.4	23935.7	8.083	67.209	754801.5	24.176	-137.503
685938.492	25261.0	23937.4	8.075	67.275	753611.7	24.238	-137.351
685940.820	25262.3	23938.7	8.066	67.340	752457.0	24.299	-137.204
685943.227	25263.9	23940.4	8.058	67.406	751260.0	24.361	-137.051
685945.633	25265.2	23941.7	8.048	67.473	750059.5	24.423	-136.899
685947.109	25266.3	23942.8	8.043	67.515	749320.2	24.461	-136.805
685950.430	25268.3	23944.8	8.030	67.607	747653.7	24.546	-136.593
685952.836	25269.7	23946.3	8.020	67.676	746443.2	24.607	-136.440
685955.242	25271.2	23947.8	8.010	67.743	745229.7	24.669	-136.287
685957.648	25272.8	23949.5	7.999	67.812	744012.5	24.730	-136.133
685960.055	25274.3	23951.0	7.989	67.880	742793.0	24.791	-135.979
685962.461	25275.8	23952.6	7.977	67.949	741569.2	24.851	-135.825
685964.852	25277.0	23953.8	7.966	68.018	740350.2	24.911	-135.672
685967.258	25278.8	23955.6	7.955	68.086	739120.5	24.972	-135.518
685969.664	25280.4	23957.2	7.943	68.156	737887.7	25.032	-135.363
685972.070	25281.6	23958.5	7.931	68.225	736652.5	25.092	-135.209
685974.469	25283.4	23960.3	7.919	68.295	735413.5	25.152	-135.054
685976.875	25284.7	23961.6	7.907	68.365	734172.0	25.211	-134.899
685979.125	25286.4	23963.4	7.895	68.431	733005.5	25.267	-134.754
685981.672	25287.9	23965.0	7.881	68.505	731682.7	25.330	-134.589
685984.078	25289.5	23966.5	7.868	68.576	730431.5	25.389	-134.434
685986.484	25291.1	23968.2	7.854	68.647	729176.5	25.448	-134.278
685988.885	25292.4	23969.6	7.840	68.718	727918.0	25.507	-134.122
685991.289	25294.0	23971.1	7.826	68.790	726656.7	25.565	-133.966
685993.617	25295.4	23972.6	7.812	68.859	725432.5	25.622	-133.815
685996.086	25297.1	23974.3	7.798	68.933	724130.2	25.682	-133.655

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)
685998.414	25298.6	23975.9	7.783	69.003	722899.2	25.738	-133.503
686000.820	25300.2	23977.5	7.768	69.075	721624.5	25.796	-133.346
686003.227	25301.6	23979.0	7.753	69.148	720346.0	25.854	-133.189
686005.633	25303.4	23980.8	7.737	69.220	719065.2	25.911	-133.032
686008.039	25304.7	23982.1	7.721	69.293	717780.5	25.968	-132.874
686010.445	25306.5	23984.0	7.705	69.367	716493.2	26.026	-132.717
686012.836	25308.1	23985.6	7.689	69.440	715209.5	26.082	-132.560
686017.648	25311.2	23988.8	7.656	69.587	712618.7	26.196	-132.244
686020.055	25312.7	23990.3	7.638	69.662	711319.0	26.252	-132.086
686022.461	25314.4	23992.1	7.621	69.737	710016.2	26.308	-131.927
686024.867	25316.0	23993.8	7.603	69.811	708711.0	26.364	-131.769
686027.117	25317.5	23995.3	7.587	69.881	707486.0	26.416	-131.620
686029.664	25319.2	23997.0	7.567	69.960	706097.2	26.475	-131.452
686032.062	25320.9	23998.7	7.549	70.036	704783.5	26.531	-131.293
686034.469	25322.4	24000.3	7.531	70.111	703466.0	26.586	-131.133
686036.875	25323.9	24001.8	7.512	70.187	702146.0	26.641	-130.974
686039.281	25325.8	24003.8	7.492	70.263	700823.0	26.696	-130.814
686041.680	25327.1	24005.2	7.473	70.339	699497.0	26.750	-130.654
686043.156	25328.1	24006.2	7.461	70.386	698680.5	26.784	-130.556
686046.484	25330.6	24008.7	7.434	70.492	696840.7	26.859	-130.335
686048.883	25332.2	24010.4	7.414	70.569	695505.5	26.913	-130.174
686051.211	25333.7	24011.9	7.394	70.643	694210.2	26.965	-130.019
686053.617	25335.3	24013.6	7.373	70.721	692868.2	27.019	-129.858
686056.023	25337.0	24015.3	7.352	70.799	691523.0	27.072	-129.697
686058.430	25338.8	24017.2	7.331	70.876	690175.5	27.125	-129.536
686060.820	25340.3	24018.7	7.310	70.954	688831.5	27.178	-129.375
686063.227	25341.9	24020.3	7.288	71.032	687478.0	27.231	-129.214
686065.633	25343.7	24022.2	7.267	71.110	686121.2	27.284	-129.052

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)
686068.039	25345.4	24023.9	7.244	71.189	684762.2	27.336	-128.890
686070.445	25347.0	24025.6	7.222	71.268	683399.5	27.388	-128.728
686072.852	25348.6	24027.2	7.200	71.347	682034.7	27.440	-128.566
686075.109	25350.3	24029.0	7.178	71.422	680752.7	27.489	-128.413
686077.648	25352.2	24031.0	7.154	71.506	679301.7	27.544	-128.241
686080.055	25353.8	24032.6	7.130	71.586	677927.5	27.595	-128.078
686082.461	25355.2	24034.1	7.107	71.666	676552.5	27.646	-127.915
686084.867	25357.0	24035.9	7.083	71.746	675173.5	27.697	-127.752
686087.273	25358.6	24037.5	7.059	71.827	673791.7	27.748	-127.589
686089.672	25360.5	24039.5	7.035	71.907	672407.5	27.798	-127.425
686091.148	25361.5	24040.5	7.020	71.957	671555.7	27.829	-127.325
686094.469	25363.7	24042.8	6.986	72.068	669636.0	27.899	-127.099
686096.875	25365.6	24044.7	6.961	72.151	668242.7	27.949	-126.935
686099.281	25367.3	24046.5	6.936	72.231	666847.7	27.998	-126.770
686101.687	25368.8	24048.0	6.910	72.314	665449.0	28.048	-126.606
686104.016	25370.6	24049.9	6.886	72.393	664092.2	28.095	-126.447
686106.422	25372.2	24051.5	6.860	72.475	662687.5	28.145	-126.282
686108.812	25374.1	24053.5	6.834	72.557	661288.2	28.193	-126.118
686111.219	25375.6	24055.1	6.808	72.640	659877.7	28.242	-125.952
686113.625	25377.5	24056.9	6.781	72.723	658465.5	28.290	-125.787
686116.031	25379.2	24058.7	6.754	72.806	657050.0	28.338	-125.621
686118.430	25381.0	24060.6	6.727	72.889	655632.5	28.386	-125.456
686120.836	25382.5	24062.2	6.700	72.973	654211.5	28.434	-125.290
686123.094	25384.2	24063.9	6.674	73.051	652878.7	28.479	-125.134
686125.641	25386.1	24065.9	6.645	73.140	651368.7	28.529	-124.958
686128.047	25388.0	24067.8	6.617	73.224	649940.0	28.576	-124.792
686130.453	25389.6	24069.4	6.589	73.308	648508.7	28.623	-124.625
686132.859	25391.3	24071.2	6.561	73.393	647074.7	28.670	-124.458

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)
686135.258	25393.1	24073.1	6.532	73.478	645639.2	28.716	-124.291
686139.141	25396.0	24076.0	6.486	73.615	643316.0	28.790	-124.021
686142.461	25398.4	24078.6	6.445	73.733	641322.5	28.854	-123.790
686144.867	25400.3	24080.5	6.416	73.819	639876.5	28.899	-123.622
686147.273	25401.9	24082.1	6.386	73.904	638428.0	28.945	-123.454
686149.672	25403.8	24084.2	6.357	73.990	636977.7	28.990	-123.287
686152.078	25405.6	24086.0	6.326	74.076	635524.0	29.034	-123.118
686154.484	25407.3	24087.7	6.296	74.163	634067.7	29.079	-122.950
686156.875	25409.1	24089.5	6.266	74.249	632617.2	29.123	-122.782
686159.281	25410.9	24091.4	6.235	74.336	631156.0	29.167	-122.614
686161.680	25412.7	24093.3	6.204	74.423	629692.2	29.211	-122.445
686164.008	25414.4	24095.1	6.174	74.507	628272.2	29.253	-122.281
686166.414	25416.2	24096.9	6.143	74.595	626802.7	29.297	-122.112
686168.820	25418.0	24098.8	6.111	74.683	625330.0	29.340	-121.942
686171.148	25419.9	24100.8	6.080	74.768	623902.5	29.382	-121.778
686173.625	25421.7	24102.6	6.048	74.858	622385.5	29.426	-121.603
686176.031	25423.5	24104.5	6.015	74.947	620905.5	29.468	-121.433
686178.430	25425.3	24106.3	5.983	75.035	619423.7	29.511	-121.263
686180.836	25427.0	24108.1	5.950	75.124	617939.2	29.553	-121.093
686183.242	25428.9	24110.0	5.918	75.213	616453.0	29.594	-120.922
686185.648	25430.7	24111.9	5.885	75.302	614963.2	29.636	-120.751
686187.125	25431.8	24113.0	5.864	75.357	614048.0	29.661	-120.646
686190.453	25434.3	24115.6	5.818	75.480	611985.7	29.718	-120.410
686192.852	25436.2	24117.6	5.785	75.570	610491.2	29.759	-120.239
686195.258	25438.1	24119.5	5.751	75.660	608993.5	29.800	-120.068
686197.664	25439.8	24121.3	5.717	75.750	607493.7	29.840	-119.896
686200.062	25441.9	24123.5	5.683	75.840	605991.2	29.880	-119.725
686202.469	25443.6	24125.3	5.649	75.931	604486.5	29.920	-119.553

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)
686204.859	25445.4	24127.1	5.614	76.021	602988.2	29.959	-119.382
686207.266	25447.0	24128.8	5.580	76.111	601479.5	29.999	-119.210
686209.672	25448.9	24130.7	5.545	76.203	599968.0	30.038	-119.037
686212.070	25450.8	24132.7	5.509	76.294	598454.0	30.077	-118.865
686214.477	25452.8	24134.8	5.474	76.386	596938.0	30.115	-118.692
686216.805	25454.6	24136.6	5.440	76.474	595468.5	30.152	-118.525
686219.133	25456.1	24138.2	5.405	76.563	593995.2	30.189	-118.357
686221.602	25458.1	24140.2	5.369	76.657	592431.0	30.228	-118.179
686224.008	25460.1	24142.3	5.332	76.750	590904.7	30.266	-118.006
686226.414	25462.1	24144.4	5.296	76.842	589376.7	30.303	-117.832
686228.820	25463.8	24146.2	5.260	76.935	587846.0	30.340	-117.658
686231.227	25465.7	24148.2	5.223	77.028	586313.5	30.377	-117.484
686233.633	25467.5	24150.0	5.186	77.121	584778.7	30.414	-117.310
686235.109	25468.8	24151.3	5.164	77.177	583834.2	30.436	-117.203
686238.430	25471.4	24154.0	5.113	77.306	581709.7	30.486	-116.962
686240.836	25473.0	24155.7	5.075	77.400	580168.5	30.522	-116.788
686243.242	25475.2	24158.0	5.038	77.494	578625.2	30.558	-116.613
686245.648	25477.0	24159.8	5.000	77.587	577079.7	30.593	-116.438
686248.055	25478.7	24161.7	4.962	77.682	575533.2	30.628	-116.263
686250.461	25480.8	24163.8	4.924	77.776	573984.7	30.663	-116.088
686252.852	25482.8	24165.9	4.886	77.869	572441.5	30.697	-115.913
686255.258	25484.7	24167.9	4.848	77.964	570888.5	30.732	-115.738
686257.656	25486.5	24169.7	4.810	78.059	569333.2	30.766	-115.562
686260.062	25488.2	24171.4	4.771	78.154	567776.7	30.800	-115.387
686262.469	25490.1	24173.4	4.732	78.249	566218.5	30.833	-115.211
686264.875	25492.2	24175.6	4.693	78.344	564657.2	30.866	-115.035
686267.125	25493.9	24177.4	4.657	78.433	563193.0	30.897	-114.870
686269.672	25496.0	24179.5	4.615	78.535	561535.0	30.932	-114.683

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)
686272.078	25497.9	24181.5	4.575	78.630	559967.5	30.964	-114.506
686274.406	25499.8	24183.5	4.537	78.723	558448.0	30.996	-114.335
686276.812	25501.7	24185.5	4.497	78.819	556875.7	31.028	-114.158
686279.211	25503.7	24187.5	4.457	78.916	555302.7	31.059	-113.981
686281.617	25505.6	24189.5	4.417	79.012	553726.5	31.091	-113.804
686283.102	25506.8	24190.8	4.392	79.072	552758.0	31.110	-113.695
686286.422	25509.5	24193.6	4.337	79.205	550576.0	31.153	-113.449
686288.826	25511.5	24195.6	4.296	79.302	548995.2	31.183	-113.272
686291.234	25513.3	24197.5	4.255	79.399	547411.7	31.214	-113.094
686293.641	25515.1	24199.4	4.215	79.496	545827.0	31.244	-112.916
686296.047	25517.2	24201.5	4.174	79.594	544239.5	31.274	-112.738
686298.453	25519.1	24203.6	4.132	79.691	542651.2	31.303	-112.559
686300.844	25521.1	24205.6	4.091	79.789	541069.2	31.332	-112.382
686303.250	25522.9	24207.5	4.050	79.886	539477.0	31.361	-112.204
686305.648	25525.0	24209.7	4.009	79.984	537884.0	31.390	-112.025
686308.055	25527.0	24211.7	3.967	80.082	536288.5	31.419	-111.846
686310.461	25528.8	24213.6	3.925	80.181	534691.2	31.447	-111.667
686312.859	25530.9	24215.8	3.883	80.279	533092.2	31.475	-111.488
686315.117	25532.7	24217.7	3.844	80.372	531593.5	31.501	-111.320
686317.664	25534.5	24219.6	3.799	80.476	529896.2	31.530	-111.130
686320.062	25536.8	24221.9	3.757	80.575	528292.2	31.557	-110.951
686322.469	25538.5	24223.7	3.714	80.674	526686.0	31.583	-110.771
686324.875	25540.3	24225.6	3.671	80.774	525078.2	31.610	-110.592
686327.203	25542.4	24227.8	3.630	80.870	523520.2	31.635	-110.418
686329.609	25544.4	24229.8	3.587	80.969	521908.7	31.661	-110.237
686331.086	25545.6	24231.1	3.560	81.030	520917.0	31.677	-110.127
686334.406	25548.3	24234.0	3.501	81.168	518685.5	31.712	-109.878
686336.812	25550.3	24236.0	3.458	81.268	517068.0	31.738	-109.697

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)
686339.219	25552.5	24238.2	3.414	81.368	515450.2	31.763	-109.516
686341.625	25554.2	24240.0	3.371	81.469	513829.5	31.787	-109.336
686344.031	25556.2	24242.1	3.327	81.569	512208.0	31.811	-109.155
686346.437	25558.3	24244.3	3.283	81.670	510584.2	31.835	-108.974
686348.828	25560.2	24246.3	3.240	81.770	508967.2	31.859	-108.793
686351.234	25562.3	24248.5	3.195	81.870	507340.7	31.883	-108.612
686353.641	25564.3	24250.6	3.152	81.971	505712.0	31.906	-108.431
686356.047	25566.2	24252.5	3.107	82.073	504083.5	31.929	-108.249
686358.453	25568.3	24254.8	3.063	82.173	502453.7	31.951	-108.068
686360.852	25570.2	24256.7	3.019	82.274	500821.7	31.974	-107.886
686363.109	25572.2	24258.8	2.977	82.370	499292.0	31.994	-107.716
686365.656	25574.2	24260.9	2.929	82.478	497558.5	32.017	-107.523
686368.062	25576.2	24263.0	2.884	82.579	495923.0	32.039	-107.341
686370.461	25578.2	24265.1	2.840	82.680	494284.7	32.060	-107.159
686372.867	25580.0	24266.9	2.795	82.782	492645.7	32.081	-106.977
686375.273	25582.1	24269.2	2.750	82.884	491004.5	32.101	-106.794
686377.602	25584.1	24271.2	2.706	82.983	489414.2	32.121	-106.617
686379.156	25585.5	24272.7	2.677	83.050	488352.2	32.134	-106.499
686382.398	25588.0	24275.3	2.615	83.187	486131.5	32.161	-106.253
686384.805	25590.2	24277.5	2.570	83.290	484483.7	32.180	-106.070
686387.211	25592.3	24279.8	2.524	83.392	482835.2	32.199	-105.887
686389.617	25594.2	24281.8	2.479	83.495	481184.5	32.218	-105.703
686392.023	25596.4	24284.0	2.433	83.599	479533.2	32.237	-105.520
686394.430	25598.4	24286.1	2.387	83.702	477880.0	32.255	-105.337
686396.820	25600.2	24288.0	2.341	83.804	476235.0	32.273	-105.154
686399.227	25602.3	24290.2	2.295	83.907	474579.5	32.291	-104.971
686401.633	25604.5	24292.5	2.249	84.011	472922.2	32.308	-104.787
686404.039	25606.3	24294.4	2.203	84.114	471264.5	32.325	-104.603

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)
686406.445	25608.5	24296.6	2.157	84.217	469606.0	32.342	-104.419
686408.844	25610.4	24298.6	2.110	84.321	467946.7	32.359	-104.236
686411.102	25612.3	24300.6	2.067	84.418	466391.0	32.374	-104.063
686413.648	25614.5	24302.9	2.017	84.528	464630.7	32.391	-103.868
686416.047	25616.6	24305.1	1.971	84.632	462967.2	32.406	-103.684
686418.453	25618.5	24307.2	1.924	84.735	461303.0	32.422	-103.500
686420.859	25620.6	24309.3	1.877	84.839	459637.2	32.437	-103.315
686423.258	25622.5	24311.3	1.830	84.944	457969.7	32.452	-103.131
686425.664	25624.7	24313.6	1.784	85.048	456301.2	32.466	-102.946
686427.141	25626.1	24315.1	1.755	85.112	455276.0	32.475	-102.833
686430.461	25628.8	24317.9	1.690	85.256	452968.2	32.494	-102.578
686432.867	25630.7	24319.9	1.643	85.361	451296.5	32.507	-102.393
686435.195	25632.9	24322.1	1.597	85.462	449676.7	32.520	-102.214
686437.602	25634.9	24324.2	1.550	85.567	448002.0	32.533	-102.029
686440.008	25636.9	24326.3	1.502	85.672	446325.5	32.546	-101.843
686442.414	25638.8	24328.3	1.455	85.776	444648.5	32.558	-101.658
686444.805	25641.1	24330.7	1.408	85.880	442979.5	32.570	-101.474
686447.211	25642.9	24332.6	1.360	85.986	441299.7	32.582	-101.288
686449.617	25645.1	24334.9	1.313	86.091	439619.5	32.594	-101.103
686452.023	25647.3	24337.2	1.266	86.196	437937.7	32.605	-100.917
686454.430	25649.1	24339.1	1.218	86.301	436255.5	32.616	-100.731
686456.836	25651.2	24341.3	1.170	86.407	434572.0	32.626	-100.545
686459.086	25653.1	24343.3	1.125	86.505	432994.7	32.636	-100.371
686461.633	25555.4	24345.7	1.075	86.617	431210.7	32.646	-100.175
686464.039	25657.3	24347.7	1.027	86.723	429525.0	32.656	-99.989
686466.445	25659.4	24349.9	.979	86.828	427839.0	32.665	-99.803
686468.852	25661.3	24351.9	.931	86.934	426152.0	32.674	-99.617
686471.250	25663.5	24354.1	.883	87.040	424464.7	32.683	-99.431

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)
686473.656	25665.5	24356.3	.835	87.145	422775.7	32.691	-99.244
686475.133	25666.8	24357.6	.806	87.210	421738.0	32.697	-99.130
686478.453	25669.7	24360.7	.739	87.356	419402.0	32.707	-98.872
686480.859	25671.6	24362.7	.691	87.462	417710.2	32.715	-98.686
686483.266	25673.8	24365.0	.643	87.568	416018.7	32.722	-98.500
686485.594	25675.7	24366.9	.597	87.671	414379.5	32.729	-98.319
686488.000	25677.9	24369.3	.549	87.777	412684.7	32.735	-98.132
686490.398	25679.9	24371.4	.500	87.883	410989.0	32.742	-97.946
686492.797	25682.1	24373.6	.452	87.989	409301.2	32.748	-97.760
686495.203	25684.0	24375.7	.404	88.095	407604.0	32.753	-97.573
686497.609	25686.1	24377.9	.355	88.201	405905.5	32.759	-97.386
686500.016	25688.0	24379.9	.307	88.308	404207.2	32.764	-97.199
686502.422	25690.2	24382.2	.259	88.414	402507.5	32.769	-97.012
686504.820	25692.2	24384.3	.210	88.521	400808.0	32.773	-96.825
686507.156	25694.4	24386.6	.163	88.624	399160.7	32.777	-96.644
686509.625	25696.4	24388.7	.114	88.733	397413.5	32.781	-96.452
686512.031	25698.5	24390.9	.065	88.840	395711.5	32.785	-96.264
686514.437	25700.6	24393.1	.017	88.947	394008.2	32.788	-96.077
686516.836	25702.7	24395.3	-.032	89.053	392306.7	32.791	-95.890
686519.242	25704.6	24397.3	-.080	89.159	390603.2	32.793	-95.703
686521.648	25706.8	24399.6	-.128	89.266	388899.7	32.796	-95.515
686523.125	25708.1	24401.0	-.158	89.332	387853.5	32.797	-95.400
686526.258	25710.6	24403.6	-.222	89.471	385630.2	32.799	-95.156
686528.312	25712.5	24405.6	-.263	89.562	384173.0	32.800	-94.996
686530.367	25714.3	24407.5	-.305	89.653	382716.5	32.801	-94.836
686533.406	25716.8	24410.1	-.366	89.788	380559.5	32.802	-94.599
686535.469	25718.6	24412.0	-.407	89.880	379096.7	32.803	-94.438
686537.523	25720.3	24413.8	-.449	89.971	377635.2	32.803	-94.278

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)
686540.578	25723.1	24416.7	-.510	90.107	375466.5	32.803	-94.039
686542.641	25724.6	24418.3	-.552	90.198	374002.5	32.802	-93.879
686544.695	25726.4	24420.2	-.593	90.290	372539.0	32.802	-93.718
686547.750	25729.1	24423.0	-.655	90.426	370368.2	32.800	-93.480
686549.812	25730.8	24424.8	-.696	90.517	368904.7	32.799	-93.319
686552.852	25733.5	24427.6	-.758	90.652	366739.5	32.797	-93.081
686554.914	25735.0	24429.3	-.799	90.744	365271.7	32.795	-92.920
686556.977	25737.0	24431.3	-.841	90.836	363807.0	32.793	-92.760
686560.023	25739.6	24434.0	-.902	90.971	361638.2	32.790	-92.522
686562.086	25741.2	24435.7	-.944	91.063	360167.5	32.788	-92.360
686564.141	25743.1	24437.8	-.985	91.154	358702.2	32.785	-92.200
686567.187	25745.8	24440.6	-1.046	91.289	356532.5	32.780	-91.962
686569.250	25747.6	24442.5	-1.088	91.381	355063.2	32.777	-91.800
686571.312	25749.1	24444.1	-1.129	91.473	353595.5	32.773	-91.640
686574.359	25751.7	24446.8	-1.190	91.608	351423.2	32.768	-91.401
686576.422	25753.4	24448.6	-1.232	91.700	349952.7	32.763	-91.240
686578.469	25755.2	24450.5	-1.273	91.791	348492.7	32.759	-91.080
686581.516	25757.7	24453.2	-1.334	91.927	346320.2	32.752	-90.842
686583.578	25759.3	24454.9	-1.375	92.018	344849.2	32.747	-90.681
686585.641	25761.1	24456.7	-1.416	92.109	343380.7	32.742	-90.520
686588.687	25763.7	24459.4	-1.477	92.245	341205.7	32.734	-90.282
686590.750	25765.3	24461.2	-1.519	92.337	339735.2	32.728	-90.121
686592.805	25767.0	24462.9	-1.560	92.428	338265.2	32.722	-89.960
686595.859	25769.3	24465.4	-1.620	92.563	336088.5	32.713	-89.721
686597.906	25771.2	24467.3	-1.661	92.655	334625.5	32.707	-89.561
686599.961	25772.7	24469.0	-1.702	92.746	333155.7	32.700	-89.400
686603.016	25775.0	24471.4	-1.763	92.881	330976.2	32.689	-89.162
686605.078	25776.4	24472.9	-1.804	92.973	329503.7	32.682	-89.001

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)
686607.141	25778.1	24474.7	-1.845	93.064	328032.7	32.675	-88.840
686610.187	25780.4	24477.1	-1.906	93.200	325851.7	32.663	-88.601
686612.250	25781.5	24478.4	-1.947	93.291	324380.5	32.655	-88.440
686614.312	25783.2	24480.1	-1.988	93.383	322907.2	32.646	-88.279
686617.359	25785.1	24482.2	-2.048	93.518	320727.7	32.634	-88.041
686619.422	25786.6	24483.8	-2.089	93.610	319255.5	32.625	-87.880
686621.477	25787.7	24485.0	-2.130	93.701	317784.0	32.615	-87.719
686624.523	25789.8	24487.2	-2.190	93.836	315609.7	32.602	-87.482
686626.578	25791.1	24488.6	-2.230	93.927	314136.5	32.592	-87.321
686629.625	25793.0	24490.6	-2.291	94.062	311956.7	32.577	-87.083
686631.695	25794.0	24491.7	-2.331	94.154	310480.7	32.567	-86.921
686633.750	25795.2	24493.0	-2.372	94.245	309008.2	32.556	-86.761
686636.805	25796.7	24494.7	-2.432	94.381	306826.0	32.540	-86.523
686638.867	25797.9	24496.0	-2.472	94.472	305350.5	32.529	-86.362
686640.922	25798.6	24496.8	-2.513	94.563	303878.0	32.518	-86.201
686643.969	25800.0	24498.4	-2.573	94.698	301697.7	32.500	-85.963
686646.039	25800.8	24499.2	-2.613	94.790	300221.0	32.489	-85.802
686648.094	25801.6	24500.1	-2.653	94.881	298748.7	32.476	-85.642
686651.141	25802.4	24501.1	-2.713	95.017	296568.5	32.458	-85.404
686653.211	25802.9	24501.7	-2.753	95.108	295092.2	32.445	-85.243
686655.266	25803.1	24502.0	-2.793	95.199	293620.0	32.432	-85.083
686658.312	25803.0	24502.0	-2.852	95.334	291441.2	32.413	-84.845
686660.375	25802.8	24501.9	-2.892	95.425	289966.0	32.399	-84.685
686662.555	25802.2	24501.5	-2.935	95.522	288408.2	32.385	-84.515
686664.859	25801.5	24500.9	-2.979	95.624	286765.0	32.369	-84.336
686667.156	25800.4	24499.9	-3.024	95.725	285122.2	32.353	-84.157
686669.453	25799.3	24498.9	-3.068	95.827	283480.5	32.337	-83.978
686671.750	25797.7	24497.5	-3.112	95.928	281839.5	32.321	-83.799

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)
686675.164	25794.3	24494.2	-3.177	96.079	279407.5	32.296	-83.535
686677.461	25791.6	24491.6	-3.221	96.181	277769.0	32.278	-83.356
686679.758	25788.3	24488.5	-3.265	96.283	276131.2	32.261	-83.177
686682.062	25784.8	24485.1	-3.310	96.386	274494.0	32.243	-82.999
686684.359	25780.7	24481.0	-3.353	96.487	272859.2	32.225	-82.820
686686.656	25776.5	24477.0	-3.398	96.589	271227.5	32.207	-82.642
686688.953	25771.6	24472.2	-3.441	96.691	269594.2	32.188	-82.464
686691.250	25766.4	24467.1	-3.486	96.794	267963.0	32.170	-82.286
686693.555	25760.5	24461.3	-3.529	96.895	266332.0	32.150	-82.108
686695.852	25754.1	24455.1	-3.573	96.998	264702.7	32.131	-81.931
686698.148	25745.5	24446.6	-3.617	97.100	263075.5	32.111	-81.753
686701.555	25731.1	24432.4	-3.682	97.252	260666.0	32.081	-81.490
686703.859	25720.4	24421.8	-3.725	97.355	259042.2	32.061	-81.312
686706.156	25708.7	24410.2	-3.769	97.459	257421.2	32.040	-81.135
686708.453	25696.3	24397.9	-3.814	97.562	255802.0	32.019	-80.958
686710.750	25682.8	24384.6	-3.858	97.666	254183.7	31.998	-80.781
686713.055	25668.1	24370.0	-3.902	97.770	252566.5	31.977	-80.604
686715.352	25651.6	24353.6	-3.946	97.873	250951.0	31.955	-80.428
686717.648	25633.8	24336.0	-3.991	97.978	249336.2	31.933	-80.251
686719.945	25614.8	24317.1	-4.035	98.082	247722.2	31.910	-80.075
686722.242	25594.6	24297.1	-4.079	98.187	246111.0	31.888	-79.900
686725.648	25560.9	24263.6	-4.145	98.343	243724.2	31.854	-79.640
686727.945	25535.2	24238.0	-4.190	98.449	242115.2	31.831	-79.464
686730.250	25508.0	24210.9	-4.236	98.556	240505.7	31.807	-79.289
686732.547	25478.4	24181.5	-4.281	98.663	238896.0	31.783	-79.115
686734.844	25446.6	24149.9	-4.327	98.770	237290.7	31.759	-78.941
686737.133	25412.7	24116.2	-4.373	98.878	235684.2	31.735	-78.767
686739.430	25375.4	24079.0	-4.420	98.987	234076.7	31.710	-78.593

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)
686741.727	25335.4	24039.2	-4.467	99.097	232470.2	31.685	-78.420
686744.016	25292.1	23996.1	-4.514	99.207	230863.5	31.660	-78.248
686746.312	25246.1	23950.3	-4.562	99.319	229254.2	31.635	-78.076
686748.602	25195.4	23899.8	-4.610	99.430	227644.2	31.609	-77.904
686752.000	25113.3	23817.9	-4.682	99.596	225253.0	31.571	-77.651
686754.297	25052.6	23757.4	-4.731	99.710	223635.0	31.545	-77.480
686756.586	24988.3	23693.3	-4.780	99.824	222012.5	31.518	-77.310
686758.883	24919.5	23624.7	-4.831	99.939	220384.7	31.492	-77.141
686761.172	24846.6	23552.1	-4.881	100.055	218752.5	31.465	-76.972
686763.461	24769.0	23473.7	-4.933	100.172	217113.2	31.437	-76.804
686765.750	24684.0	23390.0	-4.986	100.290	215470.0	31.410	-76.637
686768.039	24594.8	23301.0	-5.039	100.410	213816.0	31.383	-76.471
686770.328	24500.0	23206.5	-5.094	100.531	212152.7	31.355	-76.306
686772.617	24400.8	23107.6	-5.149	100.653	210476.0	31.327	-76.141
686776.008	24244.2	22951.4	-5.232	100.836	207970.7	31.285	-75.898
686778.297	24132.2	22839.8	-5.289	100.961	206263.0	31.256	-75.735
686780.594	24012.3	22720.2	-5.347	101.086	204540.7	31.228	-75.573
686782.883	23885.9	22594.1	-5.405	101.213	202802.2	31.199	-75.413
686785.172	23751.9	22460.5	-5.466	101.343	201045.0	31.170	-75.253
686787.469	23609.8	22318.8	-5.527	101.472	199268.7	31.141	-75.094
686789.758	23460.7	22170.1	-5.591	101.606	197471.5	31.111	-74.936
686792.055	23307.5	22017.2	-5.654	101.739	195651.7	31.082	-74.779
686794.352	23149.8	21860.0	-5.719	101.873	193805.5	31.052	-74.624
686796.648	22975.3	21685.9	-5.786	102.012	191940.7	31.022	-74.470
686800.039	22686.9	21398.3	-5.890	102.229	189133.5	30.978	-74.244
686802.328	22482.6	21194.5	-5.961	102.377	187218.5	30.948	-74.094
686804.609	22270.7	20983.3	-6.033	102.527	185281.7	30.918	-73.946
686806.898	22048.2	20761.3	-6.107	102.679	183323.5	30.888	-73.800

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)
686809.180	21807.3	20521.0	-6.183	102.835	181344.0	30.858	-73.655
686811.461	21553.5	20268.0	-6.261	102.995	179340.5	30.828	-73.513
686813.742	21292.2	20007.3	-6.340	103.153	177314.5	30.797	-73.372
686816.023	21015.7	19731.6	-6.422	103.316	175256.5	30.767	-73.233
686818.312	20727.2	19443.9	-6.508	103.483	173165.5	30.737	-73.096
686820.602	20426.9	19144.4	-6.596	103.654	171041.7	30.707	-72.961
686823.992	19955.0	18673.8	-6.731	103.912	167834.0	30.663	-72.766
686826.281	19615.9	18335.7	-6.825	104.089	165623.5	30.633	-72.637
686828.570	19261.4	17982.2	-6.924	104.273	163379.0	30.603	-72.511
686830.859	18894.1	17616.1	-7.027	104.463	161097.5	30.574	-72.387
686833.141	18516.0	17239.1	-7.130	104.656	158790.2	30.544	-72.267
686835.430	18121.9	16846.2	-7.234	104.850	156448.2	30.515	-72.149
686837.711	17712.5	16438.1	-7.342	105.051	154078.5	30.487	-72.034
686840.000	17284.6	16011.6	-7.451	105.259	151688.0	30.458	-71.922
686842.289	16836.1	15564.5	-7.560	105.469	149285.2	30.430	-71.813
686844.586	16370.9	15100.7	-7.656	105.669	146888.7	30.402	-71.707
686847.977	15662.9	14394.8	-7.798	105.971	143388.2	30.362	-71.557
686850.273	15171.8	13905.2	-7.896	106.178	141064.2	30.335	-71.460
686852.562	14670.7	13405.4	-7.976	106.362	138785.0	30.309	-71.366
686854.859	14161.1	12896.8	-8.024	106.488	136572.5	30.283	-71.276
686857.148	13651.2	12387.2	-8.033	106.526	134446.2	30.259	-71.190
686859.437	13140.6	11876.8	-8.032	106.537	132398.7	30.235	-71.107
686861.727	12635.8	11372.4	-8.048	106.581	130426.7	30.212	-71.028
686864.023	12137.4	10875.2	-8.110	106.717	128517.0	30.190	-70.952
686866.312	11643.0	10382.6	-8.209	106.910	126655.5	30.168	-70.880
686868.602	11159.4	9900.9	-8.315	107.109	124823.0	30.147	-70.811
686872.000	10467.9	9213.0	-8.516	107.446	122124.0	30.118	-70.715
686874.297	10019.3	8766.8	-8.655	107.665	120297.0	30.098	-70.654

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)
686876.586	9581.9	8332.1	-8.796	107.875	118458.5	30.080	-70.597
686878.883	9157.2	7910.0	-8.938	108.071	116603.7	30.062	-70.542
686881.180	8745.2	7500.9	-9.082	108.262	114731.0	30.044	-70.491
686883.477	8350.0	7108.5	-9.231	108.445	112838.7	30.027	-70.442
686885.773	7967.4	6729.2	-9.381	108.625	110924.2	30.011	-70.396
686888.070	7600.4	6365.4	-9.529	108.789	108989.5	29.996	-70.353
686890.359	7247.8	6016.1	-9.676	108.932	107032.0	29.981	-70.312
686892.656	6905.2	5676.8	-9.811	109.052	105058.2	29.966	-70.274
686894.945	6576.4	5350.8	-9.912	109.100	103077.7	29.953	-70.238
686898.344	6109.4	4886.8	-9.990	108.990	100149.0	29.933	-70.189
686900.633	5811.1	4590.6	-10.038	108.879	98172.7	29.921	-70.158
686902.922	5531.1	4312.8	-10.083	108.727	96190.5	29.910	-70.130
686905.211	5261.8	4046.2	-10.138	108.581	94198.0	29.899	-70.103
686907.500	5007.0	3794.5	-10.199	108.418	92189.7	29.889	-70.078
686909.789	4763.3	3554.5	-10.265	108.251	90164.5	29.880	-70.055
686912.078	4531.6	3327.4	-10.344	108.104	88121.7	29.871	-70.033
686914.367	4314.2	3115.2	-10.426	107.957	86064.0	29.863	-70.013
686916.656	4111.2	2918.1	-10.516	107.818	83993.0	29.855	-69.994
686918.945	3919.0	2732.5	-10.602	107.659	81906.2	29.847	-69.977
686922.336	3657.3	2481.5	-10.718	107.398	78799.7	29.837	-69.954
686924.633	3494.6	2326.8	-10.790	107.209	76692.0	29.830	-69.940
686926.922	3340.5	2181.5	-10.858	107.013	74584.2	29.824	-69.927
686929.211	3195.6	2046.2	-10.920	106.804	72480.2	29.819	-69.915
686931.500	3059.9	1920.7	-10.974	106.579	70378.7	29.813	-69.904
686933.781	2930.9	1802.9	-11.021	106.342	68284.5	29.808	-69.894
686936.070	2808.8	1692.9	-11.064	106.090	66198.2	29.803	-69.884
686938.289	2698.0	1595.0	-11.100	105.834	64183.2	29.799	-69.876
686941.484	2552.4	1469.1	-11.142	105.459	61306.2	29.793	-69.866

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)
686943.641	2463.6	1394.4	-11.163	105.202	59375.0	29.790	-69.859
686945.797	2381.3	1326.6	-11.176	104.934	57456.5	29.786	-69.854
686947.945	2303.6	1263.9	-11.181	104.665	55551.2	29.783	-69.848
686951.141	2200.1	1183.1	-11.181	104.281	52758.5	29.778	-69.842
686953.297	2134.5	1132.8	-11.173	104.038	50891.0	29.775	-69.838
686955.453	2074.3	1088.1	-11.160	103.793	49048.0	29.773	-69.834

7.0 REFERENCES

1. 4160-6009-TV000, "Preliminary GEMINI G and C Data Reduction and Analysis Plan", by F. B. Lavenhar, dated 30 October 1964 (U)

2. GEMINI GT-5 Post-flight Orbit and Re-Entry Trajectory Reconstruction (To be Published)

3. 4160-6047-TC000, "GEMINI GT-3 Inertial Guidance System Evaluation Trajectory Reconstruction (U)," by P. M. Jackson and W. R. Anders, dated 17 May 1965. (C)

Appendix I

ASCENT THRUST PROFILE

Guidance thrust, position, velocity, and acceleration quantities during ascent are listed along with plots of the thrust accelerations and the inertial flight path angle.

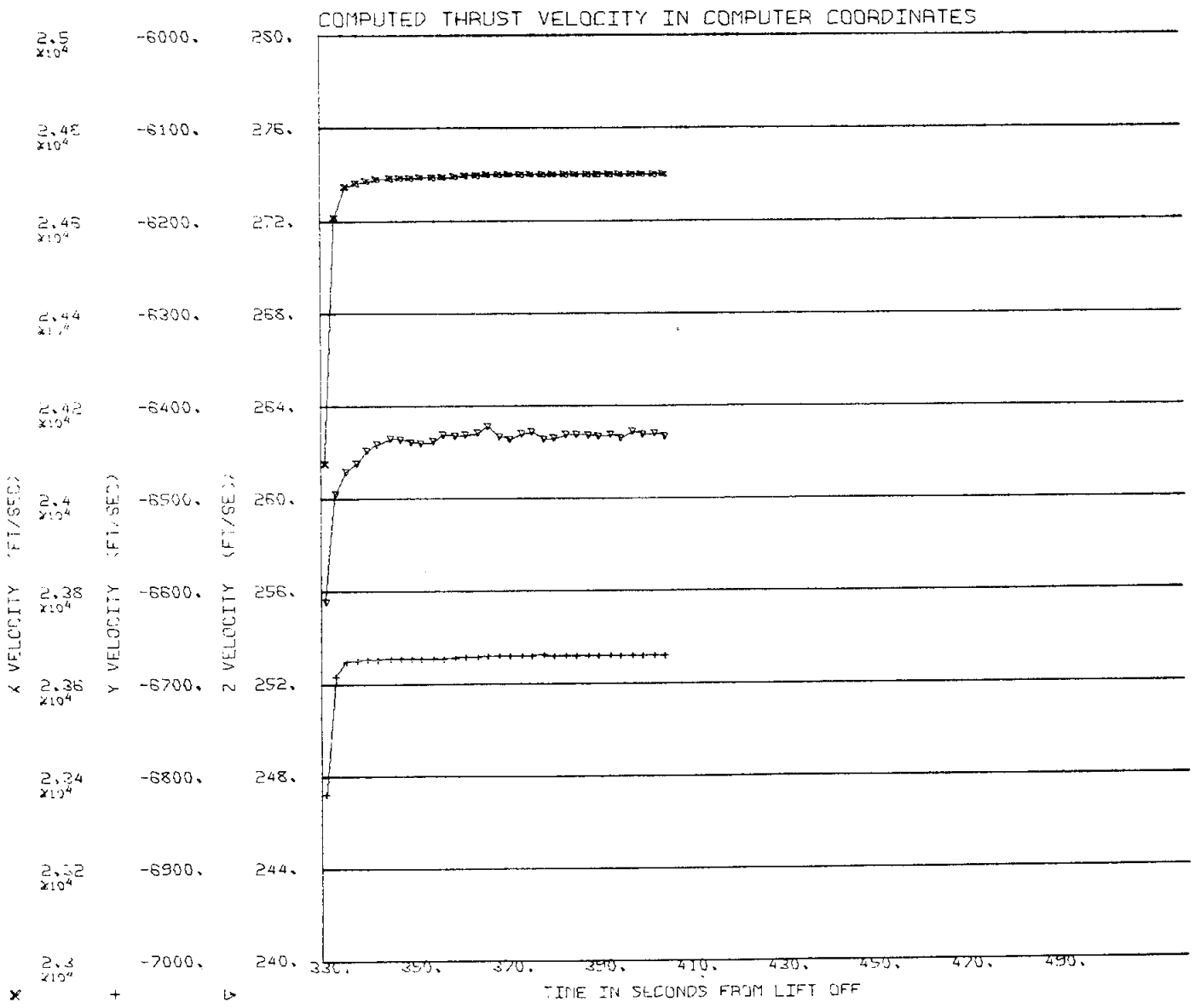

COMPUTED THRUST VELOCITY IN COMPUTER COORDINATES
X VELOCITY (FT/SEC)
Y VELOCITY (FT/SEC)
Z VELOCITY (FT/SEC)
2.5 ×10⁴
2.48 ×10⁴
2.46 ×10⁴
2.44 ×10⁴
2.42 ×10⁴
2.4 ×10⁴
2.38 ×10⁴
2.36 ×10⁴
2.34 ×10⁴
2.32 ×10⁴
2.3 ×10⁴
-6000.
-6100.
-6200.
-6300.
-6400.
-6500.
-6600.
-6700.
-6800.
-6900.
-7000.
280.
276.
272.
268.
264.
260.
256.
252.
248.
244.
240.
330.
350.
370.
390.
410.
430.
450.
470.
490.
TIME IN SECONDS FROM LIFT OFF
X
+
Δ

Figure 35

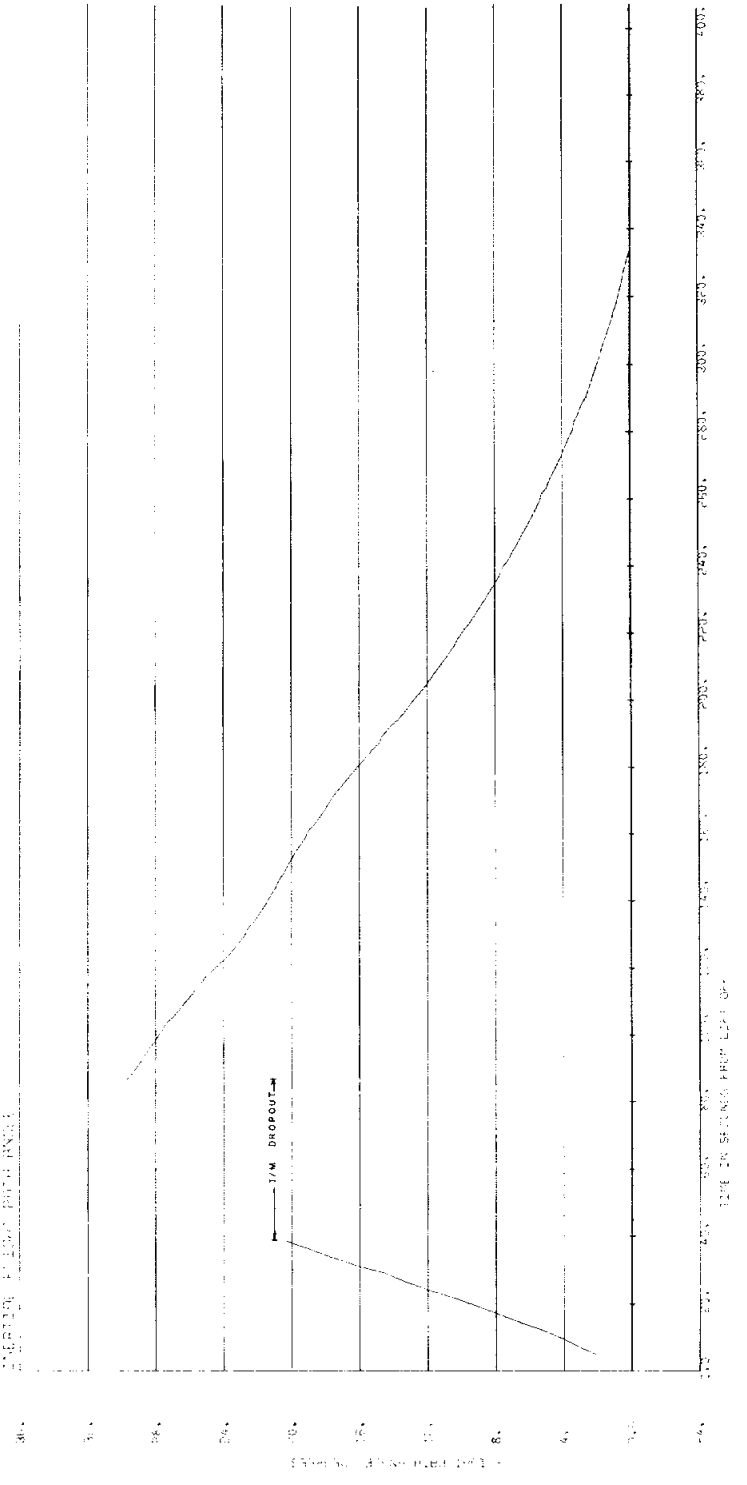


Figure 36

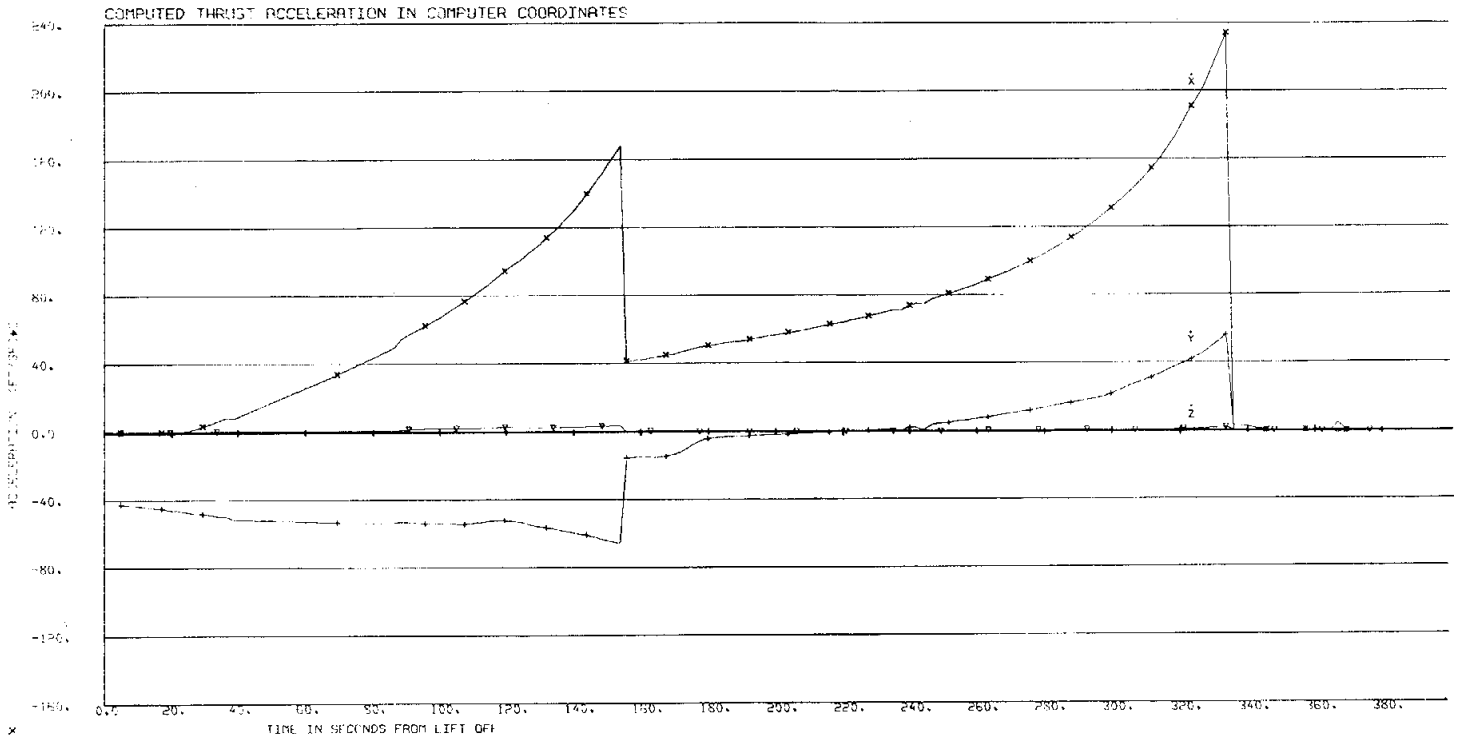

COMPUTED THRUST ACCELERATION IN COMPUTER COORDINATES
240.
200.
160.
120.
80.
40.
0.0
-40.
-80.
-120.
-160.
0.0
20.
40.
60.
80.
100.
120.
140.
160.
180.
200.
220.
240.
260.
280.
300.
320.
340.
360.
380.
TIME IN SECONDS FROM LIFT OFF
X
Y
Z

Figure 37

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)
4.732	-1	-1169	-	-.63	-308.24	-.02	-.13	-42.51	-.01
7.064	-3	-2003	-	-.97	-407.45	.02	-.13	-42.87	-.02
9.835	-6	-3298	-	-1.24	-526.91	-.06	-.10	-43.33	-.01
12.185	-10	-4656	-1	-1.58	-629.24	-.22	-.10	-43.81	.01
14.550	-13	-6267	-1	-1.63	-733.24	.01	-.11	-44.29	.09
16.943	-18	-8150	-1	-1.98	-840.08	.13	-.10	-44.84	.15
19.336	-23	-10288	1	-2.33	-947.70	.86	-.08	-45.43	.17
21.729	-28	-12686	3	-2.48	-1057.28	1.08	.16	-46.07	.16
24.078	-34	-15298	6	-2.33	-1166.17	1.51	.77	-46.74	.14
26.568	-38	-18348	10	-.08	-1283.58	1.73	1.85	-47.41	.16
29.060	-31	-21693	15	6.29	-1402.46	2.25	3.42	-48.05	.23
30.959	-13	-24444	19	13.81	-1494.25	2.59	4.77	-48.47	.33
33.450	38	-28318	27	27.92	-1615.78	3.60	6.60	-49.01	.47
35.942	131	-32497	38	46.76	-1738.40	5.10	8.39	-49.47	.55
38.433	275	-36980	53	70.22	-1862.39	6.71	7.93	-51.34	.55
69.132	10691	-118512	706	701.38	-3477.64	23.52	34.06	-53.37	.61
86.199	28127	-185828	1076	1405.92	-4397.94	33.19	49.58	-54.03	.77
88.103	30899	-194294	1143	1507.76	-4498.07	36.47	54.23	-53.25	1.40
90.596	34832	-205672	1238	1647.87	-4629.86	39.74	57.14	-53.27	1.63
93.090	39121	-217387	1342	1792.71	-4764.11	43.89	59.68	-53.67	1.72
95.581	43775	-229422	1458	1944.68	-4898.07	49.02	62.32	-53.95	1.92
98.072	48815	-241792	1585	2103.10	-5032.82	53.27	65.20	-54.04	1.98
100.564	54260	-254498	1725	2269.05	-5167.68	59.00	68.14	-54.11	1.95
103.063	60146	-267581	1878	2443.15	-5302.84	63.54	71.19	-54.13	1.94
104.963	64919	-277756	2002	2580.59	-5405.77	67.02	73.58	-54.18	1.89
107.487	71671	-291574	2177	2770.28	-5542.43	71.95	76.81	-54.23	1.95
109.979	78814	-305551	2363	2965.20	-5678.11	76.89	80.22	-54.06	2.03
112.470	86453	-319865	2561	3169.27	-5812.93	81.92	83.87	-53.66	2.22
114.962	94615	-334517	2771	3382.80	-5945.80	87.45	87.75	-52.96	2.48
117.453	103319	-349494	2998	3606.29	-6077.02	94.35	91.77	-52.20	2.69
119.357	110355	-361160	3182	3784.16	-6175.50	99.80	94.76	-52.05	2.72
121.862	120135	-376790	3441	4026.66	-6304.31	106.71	98.45	-52.34	2.57
124.360	130505	-392702	3715	4276.99	-6436.06	112.63	102.05	-53.35	2.36

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)
126.855	141493	-408922	4003	4535.37	-6570.56	118.24	105.82	-54.54	2.23
129.351	153147	-425494	4305	4804.21	-6708.60	123.56	109.92	-55.56	2.27
131.847	165485	-442414	4620	5083.60	-6848.71	129.07	114.42	-56.39	2.47
133.751	175375	-455558	4871	5304.71	-6956.54	134.12	118.08	-57.00	2.59
136.249	189000	-473114	5215	5605.72	-7099.62	141.21	123.09	-57.80	2.72
138.747	203392	-491031	5576	5919.20	-7244.96	147.70	128.55	-58.79	2.76
141.248	218603	-509335	5954	6247.36	-7393.26	154.59	134.28	-59.85	2.85
143.744	234621	-527977	6349	6589.79	-7544.13	161.97	140.59	-60.97	3.02
146.259	251643	-547142	6765	6951.33	-7698.74	169.74	147.40	-62.10	3.18
148.171	265208	-561976	7096	7238.20	-7818.31	175.96	152.98	-63.04	3.31
150.668	283766	-581697	7546	7629.30	-7977.27	184.41	160.27	-64.27	3.47
153.547	306409	-604932	8091	8102.79	-8164.35	194.66	168.66	-65.69	3.65
155.660	323555	-622194	8505	8157.00	-8184.64	195.77	41.64	-15.55	.15
158.155	344036	-642663	8994	8260.53	-8222.34	196.20	42.23	-15.24	.19
160.654	364811	-663257	9484	8366.38	-8259.75	196.63	42.82	-14.93	.21
162.556	380813	-679005	9859	8448.60	-8288.23	196.98	43.58	-14.97	.23
165.054	402039	-699740	10352	8558.67	-8325.26	197.81	44.36	-15.02	.25
167.273	421147	-718256	10791	8657.89	-8358.75	198.24	45.14	-14.83	.24
169.724	442496	-738782	11278	8768.96	-8395.97	198.87	46.18	-13.75	.21
172.158	463982	-759266	11763	8882.55	-8429.77	199.31	47.44	-11.45	.19
174.607	485881	-779945	12251	9000.69	-8454.29	199.74	48.76	-8.53	.15
177.070	508198	-800787	12744	9122.75	-8469.51	200.08	49.88	-6.02	.15
179.538	530865	-821702	13238	9247.24	-8480.62	200.42	50.77	-4.52	.14
182.010	553877	-842675	13734	9373.74	-8490.57	200.76	51.52	-3.86	.12
184.473	577120	-863598	14228	9501.45	-8499.54	201.10	52.26	-3.49	.10
186.939	600709	-884567	14725	9631.17	-8507.72	201.25	53.04	-3.20	.09
189.401	624591	-905529	15220	9762.80	-8515.03	201.39	53.78	-2.92	.07
191.863	648790	-926502	15717	9896.34	-8522.25	201.73	54.49	-2.71	.09
193.550	665558	-940878	16057	9988.65	-8526.67	201.69	55.04	-2.58	.08
196.017	690366	-961920	16555	10125.22	-8532.71	202.03	55.84	-2.35	.05
198.481	715493	-982958	17053	10263.79	-8538.17	202.07	56.65	-2.18	.06
200.953	741036	-1004068	17552	10404.98	-8543.44	202.12	57.49	-1.99	.07
203.420	766879	-1025149	18051	10547.78	-8548.12	202.36	58.34	-1.78	.07

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)
205.883	793035	-1046207	18550	10692.39	-8552.22	202.70	59.23	-1.56	.08
208.348	819570	-1067292	19050	10839.41	-8555.74	202.64	60.15	-1.36	.07
210.813	846472	-1088384	19550	10989.05	-8558.86	202.98	61.11	-1.13	.08
213.276	873734	-1109476	20050	11140.60	-8561.51	203.12	62.07	-.90	.11
215.739	901361	-1130564	20550	11294.67	-8563.27	203.46	63.05	-.63	.11
218.203	929382	-1151665	21052	11451.15	-8564.64	203.80	64.05	-.29	.12
220.665	957769	-1172750	21554	11610.25	-8565.04	203.94	64.99	-.10	.11
222.369	977649	-1187346	21902	11721.88	-8565.19	204.30	65.84	-.00	.11
224.854	1006974	-1208625	22410	11886.51	-8564.52	204.44	66.83	.16	.10
227.344	1036783	-1229952	22919	12054.25	-8563.95	204.68	67.99	.30	.08
229.836	1067037	-1251294	23429	12225.32	-8563.30	204.91	69.18	.43	.07
232.323	1097660	-1272592	23939	12398.60	-8562.05	205.05	70.40	.68	.04
234.812	1128730	-1293895	24450	12575.40	-8560.13	205.09	71.65	1.00	.03
237.299	1160232	-1315183	24960	12755.12	-8557.13	205.03	71.65	.17	-.03
239.786	1192185	-1336462	25470	12938.16	-8553.26	205.27	74.18	1.93	.09
241.494	1214392	-1351068	25821	13065.78	-8549.42	205.63	75.33	2.35	.11
243.982	1247138	-1372334	26333	13254.66	-8543.01	205.86	74.99	.95	.17
246.469	1280331	-1393565	26845	13447.05	-8535.14	206.00	78.11	3.53	.12
248.960	1314075	-1414816	27358	13643.38	-8525.42	206.24	79.60	4.20	.16
251.452	1348325	-1436050	27873	13843.62	-8514.23	206.87	81.16	4.85	.19
253.945	1383093	-1457261	28389	14047.69	-8501.09	207.41	82.80	5.51	.23
256.434	1418306	-1478396	28906	14255.89	-8486.69	207.84	84.51	6.12	.23
258.922	1454042	-1499494	29424	14468.21	-8470.62	208.57	86.13	6.65	.24
261.418	1490426	-1520616	29945	14685.76	-8453.20	209.21	87.93	7.41	.25
263.121	1515567	-1535002	30302	14837.03	-8440.09	209.56	89.49	7.89	.23
265.611	1552793	-1555994	30825	15061.93	-8419.25	210.19	91.54	8.77	.25
268.101	1590572	-1576924	31348	15292.16	-8396.37	210.62	93.54	9.62	.28
270.590	1628930	-1597794	31874	15527.63	-8371.14	211.56	95.72	10.40	.34
273.079	1667881	-1618599	32401	15768.42	-8344.45	212.39	97.99	11.16	.40
275.561	1707313	-1639270	32930	16014.35	-8315.91	213.51	100.42	11.90	.45
278.042	1747363	-1659868	33461	16266.42	-8285.32	214.64	102.94	12.76	.51
280.524	1788063	-1680396	33996	16525.32	-8252.99	216.06	105.54	13.75	.57
283.017	1829578	-1700920	34536	16791.38	-8217.43	217.39	108.26	14.75	.63

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)
285.415	1870165	-1720585	35059	17054.31	-8180.20	219.21	111.11	15.63	.66
287.772	1910663	-1739817	35578	17319.56	-8142.49	220.73	114.39	16.58	.67
290.127	1951779	-1758951	36099	17592.05	-8103.42	222.35	117.31	17.11	.63
292.478	1993456	-1777950	36624	17871.09	-8062.11	223.77	120.64	17.87	.63
294.828	2035800	-1796851	37151	18158.67	-8019.15	225.10	124.17	18.77	.60
297.185	2078938	-1815695	37684	18455.31	-7974.44	226.72	127.86	19.94	.54
299.540	2122767	-1834423	38219	18760.80	-7926.41	227.94	131.73	21.54	.49
301.903	2167475	-1853094	38759	19076.36	-7873.51	228.77	135.85	23.46	.43
304.261	2212827	-1871588	39299	19401.48	-7815.63	229.80	140.17	25.52	.40
306.620	2258997	-1889955	39843	19737.36	-7753.16	230.83	144.89	27.49	.43
308.979	2305951	-1908161	40388	20083.71	-7685.62	231.66	149.91	29.36	.50
311.343	2353859	-1926248	40937	20444.55	-7614.19	232.88	155.37	31.32	.63
313.702	2402532	-1944125	41489	20817.06	-7538.66	234.70	161.28	33.38	.75
316.060	2452059	-1961802	42045	21204.06	-7457.09	236.72	167.60	35.54	.89
318.418	2502539	-1979288	42605	21606.55	-7370.45	238.63	174.58	37.61	1.01
320.784	2554158	-1996620	43173	22027.16	-7278.94	241.44	183.25	39.77	1.11
323.142	2606598	-2013668	43745	22465.67	-7183.94	244.24	191.75	42.10	1.25
326.242	2677189	-2035740	44508	23073.69	-7050.71	247.91	201.39	45.10	1.37
328.599	2732130	-2052226	45096	23560.69	-6940.12	251.50	212.23	48.87	1.60
330.960	2788365	-2068474	45695	24074.26	-6820.56	255.49	223.53	52.60	1.88
333.278	2844789	-2084142	46292	24605.34	-6694.37	260.17	234.62	56.26	2.16
333.284	2844927	-2084180	46294	24606.66	-6694.06	260.18	234.65	56.27	2.16
335.616	2902456	-2099757	46903	24671.23	-6678.50	261.12	2.66	.10	.17
338.068	2962964	-2116132	47544	24679.37	-6677.02	261.48	2.28	.21	.16
340.202	3015630	-2130378	48102	24684.49	-6675.93	262.04	1.94	.31	.15
342.336	3068305	-2144623	48662	24687.71	-6675.53	262.31	1.28	.16	.11
345.467	3145603	-2165522	49484	24690.01	-6675.21	262.56	.57	.10	.04
347.603	3198335	-2179778	50044	24690.51	-6675.10	262.53	.25	.09	-.00
349.735	3250996	-2194015	50604	24690.91	-6675.08	262.41	.20	.03	-.02
352.072	3308697	-2209614	51217	24691.30	-6674.87	262.38	.17	.04	.02
354.828	3376743	-2228009	51940	24691.30	-6674.84	262.44	.32	.13	.03
356.901	3427934	-2241847	52485	24691.79	-6674.53	262.71	.49	.21	.04
359.637	3495479	-2260103	53203	24694.70	-6673.63	262.67	.61	.23	.03

GEMINI EDIT PROGRAM

TIME IN SECONDS FROM LIFTOFF

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361.717	3546847	-2273984	53750	24695.81	-6672.93	262.74	.58	.25	.04
364.452	3614400	-2292238	54468	24696.60	-6672.91	262.80	.24	.24	.01
366.525	3665603	-2306071	55014	24697.71	-6671.82	263.07	4.42	-1.72	.17
369.259	3733113	-2324307	55732	24698.20	-6671.70	262.64	.37	.07	-.03
371.339	3784487	-2338185	56278	24698.10	-6671.98	262.51	.07	-.01	-.01
374.075	3852070	-2356442	56997	24698.49	-6671.95	262.77	.01	.04	.00
376.150	3903324	-2370287	57542	24698.29	-6671.74	262.84	.01	.03	-.01
378.879	3970713	-2388490	58259	24698.28	-6671.33	262.51	-.00	-.02	-.01
380.961	4022136	-2402381	58805	24698.37	-6672.00	262.58	.00	-.07	-.00
383.689	4089502	-2420579	59522	24698.47	-6672.07	262.74	-.02	-.08	.02
385.757	4140587	-2434380	60065	24698.16	-6672.15	262.71	-.01	-.03	.00
388.482	4207904	-2452565	60781	24698.25	-6672.23	262.67	-.03	-.01	-.01
390.549	4258941	-2466353	61324	24698.35	-6672.31	262.64	.01	.01	-.01
393.273	4326234	-2484532	62040	24698.24	-6672.19	262.70	-.01	.02	.01
395.338	4377222	-2498306	62582	24698.34	-6672.07	262.58	.01	.01	.01
398.064	4444539	-2516492	63298	24698.23	-6672.15	262.84	.00	.00	.01
400.130	4495576	-2530279	63841	24698.43	-6672.13	262.71	-.00	-.00	.00
402.863	4563087	-2548517	64559	24698.22	-6672.11	262.77	-.01	.01	.00
404.927	4614051	-2562284	65101	24698.21	-6672.09	262.65	-.00	.01	.01
407.652	4681368	-2580470	65818	24698.21	-6672.07	262.90	.01	.02	.00
409.717	4732356	-2594244	66360	24698.40	-6672.05	262.78	.02	.00	-.00
412.481	4800639	-2612689	67087	24698.29	-6671.93	262.74	-.11	-.00	-.02
414.672	4854738	-2627304	67662	24698.29	-6672.11	262.71	-.02	-.01	.00
416.836	4908187	-2641743	68231	24698.18	-6671.99	262.68	.11	-.05	.01
419.589	4976179	-2660111	68954	24698.18	-6672.17	262.84	-.02	.00	.03
421.661	5027361	-2673937	69499	24698.27	-6672.05	262.81	.01	-.00	.03
424.388	5094702	-2692129	70216	24698.16	-6672.13	262.97	.02	.01	-.01