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Supplemental Report 5

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

GEMINI GT-6A POST FLIGHT ANALYSIS REPORT,
GEMINI GT-6 RENDEZVOUS AND CATCH-UP POST FLIGHT REPORT,
AND GT-7/6 RE-ENTRY MISSION RECONSTRUCTION REPORT

Issued as: Supplemental Report 5
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Gemini VI-A
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By: Gemini VI-A Mission Evaluation Team
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Manned Spacecraft Center
Houston, Texas

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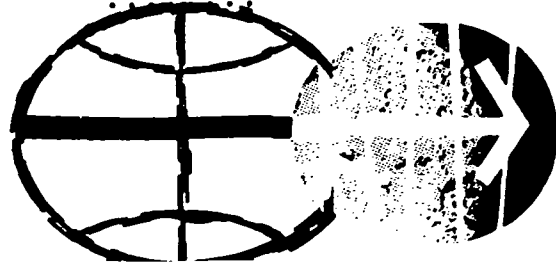
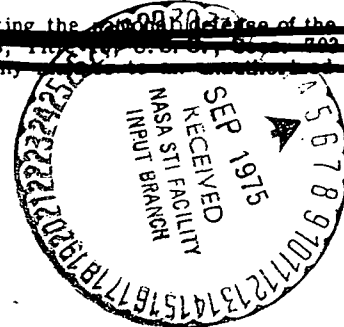
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REPORT

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ABSTRACT

This report presents an analysis of the Ascent portion of the GT-6A flight. IGS system performance during the Ascent phase of the mission was near perfect. The results of the analysis indicate that the in-plane system navigation components were within 1σ of ideal performance. With the exception of Stage II guidance initiation, the maximum IGS pitch and yaw attitude errors seen during flight were less than 1.5° and -2.0° , respectively.

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1.0 INTRODUCTION

This report presents the results of the analysis of the performance of the on-board computer during the Ascent phase of the GT-6B flight.

The purpose of this study was to verify that no anomalies occurred in the computer or its program during the Prelaunch and Ascent phases of the flight. The study was made using the Operational Program interpretive simulation which executes a Gemini computer program tape (magnetic) on the 7090 DPS. The simulation uses fixed point arithmetic and Gemini computer word length. Also, several associated simulation runs were made using the FORTRAN model of the GDC Ascent mode. The implementation of the study is discussed in detail in Reference 1. The results obtained from the analysis of the GT-6B flight are discussed in the sections to follow.

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2.0 DISCUSSION OF ASCENT FLIGHT RECONSTRUCTION

Appendix A contains a tabulation of the DAS data obtained from the GT-6B flight. The data was obtained from one telemetry station and, therefore, has several discrete areas where data is incorrect or missing. However, the DAS parameter time histories are sufficiently complete to allow comparison with the flight reconstruction data which is included in graphical form in Appendix B. The data presented in Appendix B was derived using the GT-6B Operational Program as simulated on the 7090 DPS. This simulation performs all the Gemini arithmetic and logic operations in a manner identical to the GDC including fixed point arithmetic and parameter scaling. Additional details on the operation of this simulation as well as suggested improvements to the techniques used are described in Reference 1. These improvements have as yet not been implemented since authorization to do so has not been obtained.

The remainder of this section describes and explains the various data obtained from the flight and through mission reconstruction. It is divided into the following general areas of interest:

- 2.1 Gimbal Angle and Attitude Error Behavior
- 2.2 Position and Velocity Comparisons
- 2.3 Platform Azimuth Alignment
- 2.4 IGS Injection Conditions
- 2.5 Navigation Accuracy
- 2.6 IVAR and IVI Operation
- 2.7 IGS Discrettes and Lift-off Synchronization

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2.1 Gimbal Angle and Attitude Error Behavior

Figures 1 through 3 present the Inertial Guidance System Attitude errors obtained from post flight reconstruction. Inspection of the IGS attitude errors from lift-off through SECO revealed no unusual or unexpected behavior. However, the nature of the errors was somewhat different than seen on previous flights because of the biased azimuth launch technique employed for this flight.

During Stage I guidance the IGS attitude error signals reached the following maximum values:

Pitch	+1.87°	@ 87 seconds*
Yaw	-2.14°	@ 114 seconds
Roll	+1.27°	@ 17 seconds**

- * The maximum pitch error command on telemetry was 1.45° at 87 seconds.
- ** The maximum roll error command on telemetry was 0.72° at lift-off.

The behavior of the pitch command as shown in Figure 1 is attributed to pitch program start time differences between the primary and back-up systems and primary pitch programmer drift. This is expected since the Inertial Guidance System can initiate a pitch step up to 1/2 computation cycle early. A primary pitch programmer pitch rate error of approximately +23°/hour (pitch up) is evident in the graph.

The roll error signal reached a value of 0.72° immediately following lift-off, corresponding directly to a 0.72° increase in the roll gimbal angle at this time. The roll error subsequently decreased through Stage I, reaching a value of -.2° just before staging. After staging, this signal changed abruptly to -1.5°, reflecting the Stage II engine thrust alignment. The signal remained at this approximate level until SECO.

Inspection of the roll gimbal angle data indicates that the launch vehicle rolled 3.53° during the roll program as compared with 3.54° which was desired.

2.1 (Continued)

The pitch error signal reached a maximum value of 1.4° at 90 seconds during Stage I. This error signal reached $+2.7^\circ$ at the initiation of Stage II guidance and is similar to characteristics seen in previous flights. The error signal slowly decreases as the primary system pitches the vehicle down and becomes null at about 210 seconds. The signal remains less than 0.5° until SECO is reached.

During Stage I, the yaw attitude error reaches a maximum positive value of 1.2° at about 80 seconds and a largest negative value of -2.1° at 114 seconds. Examination of the yaw gimbal angle behavior during Stage I indicates that the error signal variations are correlated with the vehicle yaw attitude commanded by the RGS as measured by the IGS yaw gimbal angle readings. Although the error signal and gimbal angle behavior are not as "smooth" as noted in earlier flights, no anomalies are noted. At staging, the yaw attitude error signal shows a shift of $+3^\circ$, which is approximately twice the shift noted on the GT-7 flight.

When Stage II guidance is initiated at approximately 168 seconds, the yaw attitude error signal reaches a maximum negative value of -5° . It remains constant at this value for several seconds until the primary system starts to yaw the vehicle to the desired Stage II yaw attitude. The error then decreases and reaches null at about 210 seconds. The Stage II yaw error signal behavior is thus similar to the Stage II pitch error signal behavior and is attributable to the smoothing of data performed in the RGS. The yaw signal remains less than 0.5° until just before SECO, when it becomes more negative and reaches about -1° . This reflects the yaw right maneuver of the vehicle required by the IGS to null its measured out-of-plane velocity.

The attitude error characteristics after SECO reflect the vehicle attitude changes during the thrust tail-off period.

At about 358 seconds the rendezvous equations are entered as evidenced by the sudden shifts in IGS attitude error. The roll error signal reaches $+92.3^\circ$ corresponding to the counter clockwise rotation required to put the astronauts in a heads-up-orientation. The pitch attitude error signal is -2° reflecting the pitch up maneuver required to put the spacecraft in a horizontal attitude. The yaw attitude error reaches -19° reflecting the yaw right rotation of the vehicle required to correct the IGS out-of-plane velocity when forward thrusting is applied. The attitude error signals generated for the spacecraft at SECO +20 seconds for the orbit adjustment (IVAR) are listed in Table 4, IVAR and IVI operation.

2.1 (Continued)

Figures 12 and 13 represent the measured and commanded pitch and yaw attitudes as well as the pitch and yaw attitude commands as generated during post flight reconstruction. These plots show that following the Stage II guidance initiate transients, the RGS has steered the vehicle to the attitude desired by the back-up system. This excellent agreement between the two guidance systems results in the back-up system attitude error commands being very near zero for the duration of Stage II flight. The yaw error command deviates from zero near SECO because of the out-of-plane velocity residual measured by the back-up system. The noise appearing in these plots is caused by the linear interpolation used in reconstructing the mission and has been reported in previous Gemini post flight analysis documents.

2.2 Position and Velocity Comparisons

Table 1 compares the in-flight DAS navigation data with similar data derived from mission reconstruction using the FORTRAN and Operational Program simulations. Inspection of this data indicates that a bit-for-bit comparison was not obtained in either reconstruction simulation, nor is it immediately obvious that one simulation provides a better reproduction of the flight than the other.

The largest position difference between the flight results and those obtained through reconstruction is seen in the X component of the Operational Program Run (400 feet at 340 seconds). The major contributor to the 400 foot difference appears to be linear interpolation of data between DAS frames at SECO.

The reconstructed velocities are within 0.5 fps of the flight values. The velocity differences which exist at the end of the reconstruction are attributable to several factors. These are linear interpolation of data between DAS data frames, differences caused by the fixed point vs. floating point arithmetic of the simulations and different navigation error growth characteristics between the FORTRAN and Operational Programs. These factors have been discussed in detail in previous post flight analysis reports. Since the velocity and position differences for this flight reconstruction are so small, a detailed analysis to precisely isolate the various error contributions did not seem warranted.

TABLE I - POSITION AND VELOCITY COMPARISON

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	Position (Feet)			Velocity (fps)		
	X	Y	Z	VX	VY	VZ
Prior to Platform Release	-4792 -4788 -4790	-20909920 -20909917 -20909917	-58600 -58593 -58598	1337.492 1337.495 1337.493	0 0 0	-109.309 -109.306 -109.306
After Platform Release	-4508 -4506 -4508	-20909920 -20909917 -20909917	-58624 -58616 -58621	1337.977 1338.079 1338.086	.195 .204 .204	-107.715 -107.785 -107.737
After Lift-off 3.977	5044 5045 5044	-20909992 -20909985 -20909987	-59392 -59384 -59386	1338.051 1338.147 1338.160	-35.148 -35.172 -35.167	-106.859 -106.935 -106.876
Before Update 99.985	187008 187038 187042	-20980524 -20980331 -20980351	-6200 -6204 -66199	3499.531 3499.551 3499.633	-1626.672 -1626.768 -1626.689	49.520 49.375 49.602
Between Updates 131.287	334116 334163 334170	-21040588 -21040672 -21040694	-63044 -63091 -63072	6134.742 6134.721 6134.830	-2201.398 -2201.490 -2201.386	278.270 277.972 278.305
Following Updates 155.100	514664 514732 514740	-21099544 -21099628 -21099652	-53504 -53548 -53534	9244.828 9244.782 9244.901	-2783.402 -2783.529 -2783.405	535.785 535.507 535.827

Flight - DAS Flight Data
 Fortran - Fortran Flight Reconstruction Results
 Op. Pgm. - Operational Program Flight Reconstruction Results

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TABLE 1 (Continued)

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		Position (Feet)			Velocity (fps)		
	<u>X</u>	<u>Y</u>	<u>Z</u>	<u>VX</u>	<u>VY</u>	<u>VZ</u>	
After	777012	-21168800	-38316	10580.367	-2415.637	596.082	
Stage II	776714	-21168749	-38374	10580.316	-2415.780	596.790	
Initiate	776725	-21168774	-38352	10580.451	-2415.643	596.135	
181.336							
Prior to	3003440	-21224096	12108	22808.086	2828.793	-77.406	
SECO	3003510	-21223912	11980	22808.005	2828.624	-77.767	
325.575	3003214	-21224023	12080	22808.231	2828.810	-77.357	
After	3352820	-21174488	9876	25380.723	4014.879	-225.602	
SECO	3352711	-21174353	9750	25380.699	4014.706	-225.965	
340.047	3352420	-21174464	9856	25380.941	4014.897	-225.562	
Near	3822068	-21094908	5692	25307.539	4579.844	-226.695	
SECO +20	3821958	-21094775	5559	25307.384	4579.653	-227.063	
358.557	3821672	-21094888	5669	25307.650	4579.856	-226.647	
Near	3955712	-21070288	4492	25281.621	4739.965	-227.086	
SECO +25	3955616	-21070152	4358	25281.487	4739.791	-227.455	
363.841	3955332	-21070265	4471	25281.759	4739.996	-227.039	

Flight - DAS Flight Data
 Fortran - Fortran Flight Reconstruction Results
 Op. Pgm. - Operational Program Flight Reconstruction Results

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2.3 Platform Azimuth Alignment

Reconstruction of the in-flight DAS data indicated that the platform roll gimbal angle at the time of platform release was within two quanta ($.072^\circ$) of the value desired by the IGS. The value read by the GDC was 90.252 degrees (2507 quanta) and the commanded roll gimbal angle was 90.189 degrees.

The in-flight results indicated that both azimuth updates were received and properly used by the GDC. Table 2 lists the platform azimuth alignment values obtained from the flight reconstruction runs. The difference in misalignment estimates after the 140 second update is less than 8.5 $\widehat{\text{sec}}$ and would contribute less than 1.0 ft/sec out-of-plane velocity difference at SECO.

2.4 IGS Injection Conditions

Table 3 presents the IGS measured injection conditions obtained during the flight and those obtained from the post flight reconstruction simulations. Column 4 of the table lists the IGS navigation errors as measured by STL. These errors have been combined with the X, Y, and Z velocity and position data from the flight, to derive the actual X, Y, and Z velocity and position achieved in the flight, which is given in Column 5. The insertion parameters quoted in Column 5 were computed from the corrected X, Y, Z data and should thus represent the actual insertion conditions achieved in the flight (V_1 may be in error by 1 to 2 fps since the reconstruction value for platform misalignment had to be used in its computation). The indicated IGS navigation errors in terms of the insertion parameters are thus 3.1 fps in total velocity, -10.7 fps in radial velocity, -1.7 fps in out-of-plane velocity and -662 feet in altitude.

The IGS targeting quantities were biased to account for anticipated navigation errors of 1.9 fps in X velocity, 0.9 fps in Y velocity, and -0.2 in Z velocity. It is noted that the velocity errors realized exceeded the anticipated errors by 11.1 fps in Y and 2.6 fps in Z velocity and the X velocity error was smaller by 0.9 fps. It is concluded that had a switchover to the IGS been made early in the flight, the IGS would have achieved the desired insertion conditions within the specified tolerances.

2.5 Navigation Accuracy

Table 3 lists the IGS velocity and position errors as obtained from STL. The relatively large Y velocity error suggest a bias or scale factor error on that axis. However, the navigation errors are within 1 σ of nominal performance.

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TABLE 2

PLATFORM AZIMUTH ALIGNMENT

<u>Time</u>	<u>Fortran Results (Degrees)</u>	<u>Operational Program Results (Degrees)</u>
Platform Release	.06077	.06315
105 seconds	-.55018	-.54551
145 seconds	-.52757	-.52521

Values of V_{ZG} received by the IGS via DCS from the Burroughs system were .68. 5 at 105 seconds and 425.25 at 145 seconds.

Differences between the final Fortran and Operational Program results above is approximately 8.5 $\overline{\text{sec}}$ or equivalently a 1.0 ft/sec out-of-plane velocity error at SECO.

IGS INJECTION CONDITIONS
(At Approximately SECO +20:358.557)

	IGS Flight Values (1)	FORTAN Reconstruction (3)	Operational Program Reconstruction (3)	IGS Navigation Error (4)	Corrected IGS Flight Value (5)
VX	25307.539 fps	25307.384	25307.650	1.0	25306.539
VY	4579.844 fps	4579.653	4579.856	12.0	4567.844
VZ	-226.695 fps	-227.063	-226.647	-2.8	-223.895
X	3822068 ft	3821958	3821672	627	3821441
Y	-21094908 ft	-21094775	-21094888	786	-21095694
Z	5692 ft	5559	5669	-394	6086
V	25719.601 fps	25719.417	25719.699		25716.459
R	21438362 ft	21438211	21438266		21439024
VR	5.339 fps	5.400	4.880		16.057
V _l	9.417 fps	9.050	8.422		11.156
Γ	.0119 deg	.0120	.0109		.0358

- (1) IGS parameters listed were obtained from in-flight DAS data.
- (2) Out-of-plane velocity was calculated using platform misalignment obtained from flight reconstruction data.
- (3) FORTAN and Operational Program results were obtained from reconstruction of the flight using DAS accelerometer and gimbal angle data.
- (4) IGS navigation data obtained from STL, error defined as IGS minus tracking data.
- (5) IGS flight values corrected for navigation errors.

2.6 IVAR and IVI Operation

Table 4 lists the IVI and FDI readings following SECO +20. These readings were obtained from the post flight reconstruction simulation. The roll attitude error is saturated (unlimited value is 92°), indicating the spacecraft should be rolled upright to the heads-up orientation. The pitch attitude error is -2.2° initially, indicating a desired pitch-up to a local horizontal attitude. The yaw attitude error is -18.9° indicating a yaw right command. This signal is large because the out-of-plane correction, 9.4 fps, is large relative to the in-plane correction, 20.4 fps.

The total velocity computed by the IGS indicates that the astronaut simultaneously rolled upright and thrusts to gain approximately 10 fps following separation. This is indicated as the X IVI is reduced from 21 to 12 fps and the roll signal decreased from 92.3° to 7° in the time interval from 359 to 373 seconds. When the heads-up orientation is achieved at 378 seconds ($\Delta\theta_b = -.2^\circ$), the indicated in-plane correction is 12 fps forward, 1 fps down and the out-of-plane correction is 4 fps. The indicated pitch attitude is to pitch down 2.6° (which would cause the total in-plane correction to appear on the FWD/AFT channel) and to yaw right 19.8° . These indications correspond to the IGS calculated V_{ga} (in-plane velocity correction required to reach apogee) of 11 fps and the out-of-plane velocity error of 6 fps.

TABLE 4
IVAR AND IVI OPERATION

<u>Time</u> <u>sec</u>	<u>IVI-X</u> <u>ft/sec</u>	<u>IVI-Y</u> <u>ft/sec</u>	<u>IVI-Z</u> <u>ft/sec</u>	<u>$\Delta\theta_b$</u> <u>deg</u>	<u>$\Delta\Psi_b$</u> <u>deg</u>	<u>$\Delta\phi_b$</u> <u>deg</u>
359.7	21	-1	-7	-2.2	-18.9	92.3
361.8	19	-1	-7	-2.0	-19.3	92.5
363.8	18	0	-6	-.9	-18.4	86.0
366.6	16	+3	-5	-.3	-19.9	62.9
368.6	15	5	-2	+.4	-19.3	25.7
371.3	13	5	-1	+1.0	-20.3	14.3
373.4	12	4	0	1.5	-20.0	7.2
376.2	12	4	0	2.1	-19.7	2.1
378.4	12	4	1	2.6	-19.8	-.2
380.4	12	4	1	3.3	-19.2	.1
383.2	12	4	1	3.9	-18.2	.1

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2.7 IGS Discrettes and Lift-off Synchronization

Detailed analysis of IGS time since lift-off, "tDAS" and comparison with range time provides an estimate of lift-off synchronization (See Reference 1, Section IV.G). On this flight the analysis indicated the IGS was 21 ± 15 milliseconds late in the determination of lift-off. An error of 9 milliseconds is known to exist in a program constant used in lift-off determination (See IBM Report #65-554-0042, Reference 3). This error results in an apparent delay in IGS lift-off synchronization. The synchronization accuracy obtained from this flight is reasonable.

Table 5 presents a list of various discrete events issued or controlled by the IGS.

It was determined that the IGS SECO discrete was issued at a tDAS time of $338.739 \pm .003$ seconds. The tDAS time is lagging real time by 0.021 ± 0.015 seconds at lift-off but the analysis indicates that the clock is running fast at about 95 ppm. Therefore, at the time the SECO discrete is issued, about 0.032 seconds have been gained and the corrected time for delivery of the IGS SECO discrete is 338.728 ± 0.015 seconds after lift-off. A preliminary value quoted by Aerospace for RGS SECO time is 338.737 seconds.

Analysis of the IGS velocity data in the area near SECO provides an estimate of 78 ± 5 fps for the Stage II engine cut-off impulse.

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IGS DISCRETE EVENTS

<u>Time (1)</u> <u>(sec)</u>	<u>Event</u>	<u>Comment</u>
-3.82/-3.37	Platform Release	Based on reconstruction of the IGS position and velocity data in the time period prior to platform release through lift-off.
0	Lift-off	IGS lift-off sync was late by <u>21</u> + 15 m seconds.
17.753	Roll Program Initiate	
20.587	Roll Program Termination	
23.133	Start Pitch Step 1	
88.062	Start Pitch Step 2	
107.501	Receipt of First Update (Value 68.5 FPS)	Time quoted is DAS time in mode when update is seen on telemetry.
109.804	Gain Change	
118.752	Start Pitch Step 3	
145.681	Receipt of Second Update (Value 425.25 FPS)	Time quoted is DAS time in mode when update is seen on telemetry.
162.560	Start Pitch Step 4	

(1) All times are quoted based on GDC clock readings. The times are not corrected for lift-off sync errors.

SECRET

TABLE 5 (Continued)

<u>Time (1)</u> <u>(sec)</u>	<u>Event</u>	<u>Comment</u>
168.192	Time Stage II Guidance Initiate	Time quoted is the time at which attitude error signals, generated by the IGS Stage II equations, are first sent to the autopilot.
338.728	IGS SECO (Uncertainty <u>+3.0 msec</u>)	Lift-off time synchronization error and clock drift are accounted for in quoted time.
360.187 ⁽¹⁾	IVAR Initiation	Time is again quoted to reflect the time at which IVAR attitude errors are first displayed.

(1) All times are quoted based on GDC clock readings. The times are not corrected for lift-off sync errors.

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CONCLUSIONS

The following conclusions are formed based on the analysis performed and documented in this report:

1. IGS system performance during the Ascent portion of this mission was near perfect.
2. IGS navigation errors at SECO +20 were approximately +1.0, +12.0 and -2.8 fps on the X, Y and Z axes, respectively. This resulted in IGS errors of approximately 3.1 fps in velocity magnitude, -1.7 fps in the out-of-plane direction and -10.7 fps in radial velocity.
3. IMU performance was within 1 σ of nominal.
4. With the exception of the attitude errors seen at Stage II guidance initiation, the maximum IGS pitch and yaw attitude errors seen during flight were less than 1.5 $^{\circ}$ and -2.0 $^{\circ}$, respectively.
5. IGS was successful in accepting airborne azimuth updates and reducing what could have been a potential 230 fps out-of-plane velocity error to one less than 1 fps. The calculated platform misalignment on this flight was on the order of -.53 $^{\circ}$.
6. IGS lift-off synchronization was established late by 21 ± 15 milliseconds.

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4.0 RECOMMENDATIONS

The analysis performed did not result in any recommendations in the GDC analytic equation area. Several recommendations were made as a result of the analysis of the GT-4 flight (Reference 2). These were as follows:

1. Sequence η_X , VZG, SF_X, SF_Y, SF_Z and time of IGS SECO by multiplexing the DAS word position now allotted to VZG.
2. Add IGS SECO discrete to Martin telemetry to be sampled at 400 cps rate.
3. Use "START COMP" button in Ascent mode to eliminate undesirable entry into the Ascent mode after Ascent guidance is completed.

Of these recommendations, the first and third have been implemented in Math Flow 7, Modules II and V. The third recommendation was implemented using a time test instead of the "START COMP" button.

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APPENDIX A

GT-6B FLIGHT DATA

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GT6 REV 1

ASCENT

TIME	PITCH	YAW	ROLL	SFXP	SFYP	SFZP	VELX	VELY	VELZ	PERR
3232.327	89.86	-0.18	90.25	5937.00	-1151.00	-1010106.00	1337.49	0.	-109.31	99999.000
3235.111	89.86	-0.18	90.22	5940.00	-1152.00	-1010975.00	1337.49	0.	-109.31	99999.000
3237.455	89.86	-0.10	90.25	5946.00	-1154.00	-1011707.00	1337.49	0.	-109.31	99999.000
3239.799	89.86	-0.18	90.25	5949.00	-1154.00	-1012439.98	1337.49	-0.	-109.31	-0.181
3242.142	89.86	-0.18	90.25	5955.00	-1155.00	-1013169.99	1337.49	-0.	-109.31	-0.145
3244.485	89.86	-0.22	90.25	5960.00	-1157.00	-1013902.99	1337.49	-0.	-109.31	-0.145
3246.830	89.86	-0.18	90.22	5964.00	-1155.00	-1014636.99	1337.49	-0.	-109.31	-0.181
3249.176	89.86	-0.18	90.25	5966.00	-1158.00	-1015370.99	1337.49	-0.	-109.31	-0.181
3251.519	89.86	-0.18	90.25	5971.00	-1158.00	-1016103.99	1337.49	-0.	-109.31	-0.181
3254.303	89.86	-0.18	90.25	5976.00	-1159.00	-1016970.99	1337.49	-0.	-109.31	-0.145
3256.646	89.82	-0.22	90.22	5982.00	-1159.00	-1017702.99	1337.49	-0.	-109.31	-0.145
3258.989	89.82	-0.22	90.25	5986.00	-1160.00	-1018436.99	1337.49	-0.	-109.31	-0.181
3261.333	89.82	-0.22	90.25	5989.00	-1160.00	-1019169.99	1337.49	-0.	-109.31	-0.181
3263.678	89.86	-0.18	90.25	5993.00	-1162.00	-1019899.99	1337.49	-0.	-109.31	-0.181
3268.367	89.86	-0.18	90.22	6000.00	-1163.00	-1021366.98	1337.49	-0.	-109.31	-0.181
3270.712	89.82	-0.18	90.25	6006.00	-1164.00	-1022098.99	1337.49	-0.	-109.31	-0.145
3273.496	89.86	-0.18	90.25	6013.00	-1167.00	-1022969.99	1337.49	-0.	-109.31	-0.145
3275.839	89.82	-0.18	90.25	6015.00	-1167.00	-1023701.99	1337.49	-0.	-109.31	-0.181
3278.182	89.82	-0.18	90.25	6022.00	-1167.00	-1024434.99	1337.49	-0.	-109.31	-0.181
3280.524	89.86	-0.18	90.22	6024.00	-1168.00	-1025164.99	1337.49	-0.	-109.31	-0.145
3282.869	89.86	-0.18	90.25	6028.00	-1168.00	-1025898.99	1337.49	-0.	-109.31	-0.145
3285.214	89.82	-0.22	90.22	6033.00	-1170.00	-1026629.99	1337.49	-0.	-109.31	-0.145
3287.559	89.86	-0.18	90.25	6037.00	-1171.00	-1027365.98	1337.49	-0.	-109.31	-0.145
3289.903	89.82	-0.18	90.22	6042.00	-1171.00	-1028096.99	1337.49	-0.	-109.31	-0.145
3292.246	89.86	-0.18	90.25	6046.00	-1172.00	-1028828.99	1337.49	-0.	-109.31	-0.145
3295.030	89.86	-0.18	90.22	6053.00	-1172.00	-1029697.99	1337.49	-0.	-109.31	-0.145
3297.374	89.86	-0.18	90.25	6055.00	-1175.00	-1030431.99	1337.49	-0.	-109.31	-0.145
3299.717	89.86	-0.18	90.25	6062.00	-1175.00	-1031162.99	1337.49	-0.	-109.31	-0.145
3302.061	89.86	-0.22	90.22	6064.00	-1175.00	-1031896.99	1337.49	-0.	-109.31	-0.145
3304.405	89.86	-0.18	90.25	6068.00	-1176.00	-1032630.99	1337.49	-0.	-109.31	-0.181
3306.751	89.82	-0.18	90.25	6075.00	-1178.00	-1033361.99	1337.49	-0.	-109.31	-0.145
3309.097	89.86	-0.18	90.25	6077.00	-1177.00	-1034093.99	1337.49	-0.	-109.31	-0.145
3311.439	89.86	-0.22	90.22	6083.00	-1179.00	-1034828.99	1337.49	-0.	-109.31	-0.145
3313.994	89.66	-0.19	90.25	6088.00	-1181.00	-1035624.99	1337.98	0.20	-107.71	-0.181

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ASCENT

TIME	YAWER	RERRR	ZVUPDT	PITRTE	VEL(R)	X (POS)	Y (POS)	Z (POS)	TTSECO	ELAP T
3232.327	-0.18	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	0.
3235.111	-0.18	0.02	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-82.464
3237.455	-0.18	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-80.065
3239.799	-0.18	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-77.663
3242.142	-0.22	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-75.265
3244.485	-0.22	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-72.865
3246.830	-0.18	0.02	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-70.464
3249.176	-0.18	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-68.066
3251.519	-0.18	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-65.666
3254.303	-0.22	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-63.265
3256.646	-0.22	0.02	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-60.867
3258.989	-0.22	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-58.466
3261.333	-0.18	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-56.067
3263.678	-0.18	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-53.666
3268.367	-0.18	0.02	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-51.265
3270.712	-0.18	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-48.867
3273.496	-0.18	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-46.466
3275.839	-0.18	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-44.066
3278.182	-0.22	0.02	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-41.666
3280.524	-0.18	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-39.265
3282.869	-0.18	0.02	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-36.866
3285.214	-0.18	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-34.466
3287.559	-0.22	0.02	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-32.066
3289.903	99999.00	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-29.666
3292.246	-0.18	0.02	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-27.265
3295.030	-0.22	0.02	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-24.866
3297.374	-0.22	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-22.466
3299.717	-0.22	0.02	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-20.066
3302.061	-0.18	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-17.666
3304.405	-0.18	0.02	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-15.265
3306.751	-0.18	0.06	99999.00	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-12.866
3309.097	-0.18	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-10.466
3311.439	-0.22	0.06	0.	-0.52	-1307.48	-4.79	-20909.92	-58.60	175.00	-8.066
3313.994	-0.18	0.06	0.	-0.52	-1307.48	-4.51	-20909.92	-58.62	175.00	-5.666

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ASCENT

TIME	PITCH	YAW	ROLL	SFXP	SFYP	SFPZ	VELX	VELY	VELZ	PERR
1.640	89.82	-0.33	90.97	6096.00	-1184.00	-1037257.00	1337.90	-14.47	-107.38	-0.222
4.021	89.79	-0.28	90.97	6102.00	-1189.00	-1038203.00	1338.05	-35.15	-106.86	-0.216
6.400	89.72	-0.32	91.00	6107.00	-1191.00	-1039158.00	1338.08	-56.76	-106.65	-0.254
8.781	89.74	-0.36	91.01	6114.00	-1198.00	-1040122.99	1338.31	-79.40	-105.93	-0.261
11.161	89.75	-0.36	91.04	6124.00	-1207.00	-1041092.99	1338.83	-102.58	-180.51	-0.287
13.536	89.72	-0.36	91.05	6131.00	-1213.00	-1042071.99	1339.03	-126.86	-104.41	-0.297
15.913	89.71	-0.36	91.07	6140.00	-1222.00	-1043060.99	1339.43	-152.06	-103.50	-0.295
21.136	89.68	-0.40	94.60	6162.00	-1238.00	-1045276.99	1340.59	-211.85	-102.08	-0.389
28.192	86.30	-0.47	94.58	6268.00	-1259.00	-1048372.99	1349.54	-303.36	-99.73	-0.138
32.582	83.11	-0.69	94.50	6480.00	-1279.00	-1046796.97	1369.93	-366.00	-97.73	-0.244
35.074	81.26	-0.58	94.41	6654.00	-1284.00	-1045653.00	1386.93	-403.54	-97.23	-0.317
37.565	79.40	-0.82	94.42	6873.00	-1294.00	-1044497.99	1408.47	-442.22	-96.73	-0.366
40.055	77.61	-1.04	94.40	7133.00	-1309.00	-1043331.99	1434.16	-482.12	-94.73	-0.410
47.523	72.26	-1.22	94.25	8185.00	-1364.00	-1039774.00	1538.53	99999.00	-89.03	-0.550
49.427	70.81	-1.17	94.11	8520.00	-1378.00	-1038852.99	1572.13	-641.59	-87.86	-0.567
51.923	68.97	-1.01	93.97	9001.00	-1383.00	-1037641.99	1620.16	-685.95	-87.37	-0.610
54.420	67.21	-1.15	93.99	9532.00	-1389.00	-99999.00	1673.24	-730.93	-86.79	-0.594
56.914	65.84	-1.36	94.00	10102.00	-1398.00	-1035194.99	1730.26	-777.34	-85.91	-0.240
59.408	64.19	-1.68	93.96	10705.00	-1418.00	-1033953.99	1790.61	-824.91	-83.93	-0.130
61.900	62.50	-1.98	94.00	11359.00	-1455.00	-1032711.99	1856.17	-872.26	-80.37	-0.106
71.291	56.05	-2.35	93.69	14219.00	-1652.00	-1028043.99	2142.88	-1051.54	-60.63	0.160
76.271	53.32	-2.34	93.54	15988.00	-1761.00	-1025552.99	2319.98	-1148.11	-49.42	0.927
80.663	49.70	-1.79	93.44	16724.00	-1779.00	-1024598.99	2394.33	-1185.33	-48.00	0.770
83.155	48.32	-3.26	93.30	17758.00	-1766.00	-1023364.99	2498.21	-1232.45	-49.35	0.505
85.648	47.15	-3.96	93.40	18843.00	-1816.00	-1022119.99	2607.24	-1280.72	-44.39	0.783
90.636	44.21	-4.00	93.06	22398.00	-2236.00	-1018322.99	2720.80	-1329.92	-32.11	1.355
93.132	42.88	-3.96	92.99	23705.00	-2378.00	-1017037.99	2964.59	-1431.89	-2.45	1.441
95.036	41.76	-3.83	92.93	24755.00	-2482.00	-1016059.99	3095.65	-1484.45	12.14	1.332
97.533	40.28	-3.83	92.83	26197.00	-2619.00	-1014781.99	3201.62	-1523.98	22.10	1.220
100.029	38.91	-3.86	92.71	27716.00	-2757.00	-1013510.99	3466.69	-1575.67	35.76	1.075
102.530	37.43	-3.88	92.63	29319.00	-2902.00	-1012243.99	3499.53	-1626.67	49.52	0.973
105.024	36.03	-3.78	92.52	31001.00	-3045.00	-1010991.99	3660.85	-1677.16	63.98	0.789
107.545	34.71	-3.74	92.45	32785.00	-3188.00	-1009735.99	3830.15	-1726.35	78.23	0.681
109.449	33.69	-3.82	92.34	3487.00	-3300.00	-1009735.99	4007.34	-1775.04	71.35	0.660
111.946	32.55	-4.62	92.24	36093.00	-3467.00	-1008791.99	4149.74	-1811.53	89.51	0.652
114.442	31.07	-5.38	92.11	38080.00	-3687.00	-1007561.99	4341.65	-1858.49	106.16	0.754
116.937	29.51	-5.13	91.99	40164.00	-3916.00	-1005150.99	4541.73	-1904.36	128.11	0.542
119.433	27.87	-4.97	91.81	42345.00	-4136.00	-1003979.99	4751.60	-1947.57	151.17	0.275
121.936	27.11	-4.93	91.73	44624.00	-4361.00	-1002822.99	4971.26	-1988.61	172.92	-0.305
123.840	26.95	-4.88	91.70	46410.00	-4535.00	-1001924.99	5200.03	-2027.15	195.25	-0.411
126.338	26.78	-4.69	91.72	48222.00	-4760.00	-1000718.99	5380.71	-2059.87	212.71	-0.172
128.836	26.37	-4.48	91.70	51315.00	-4982.00	-999490.00	5623.65	-2104.55	235.14	0.254
131.331	25.94	-4.20	91.63	53896.00	-5193.00	-998236.99	5874.76	-2151.66	257.26	0.431
133.826	25.43	-4.31	91.58	56580.00	-5412.00	-996959.00	6134.74	-2201.40	278.27	0.619
							6405.11	-2253.71	300.07	0.701

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GT6 REV 1

ASCENT

TIME	PITCH	YAW	ROLL	SFXP	SFYP	SFZP	VELX	VELY	VELZ	PERR
136.322	24.84	-4.43	91.55	59373.00	-5644.00	995665.99	6685.32	-2307.87	323.10	0.664
136.227	24.38	-4.46	91.49	61579.00	-6832.00	994665.99	6908.69	-2350.16	341.87	0.694
140.731	23.77	-4.44	91.44	64588.00	-6083.00	993332.99	7211.83	-2407.98	366.84	0.681
143.231	23.20	-4.43	91.41	67716.00	-6346.00	991986.99	7526.97	-2467.22	393.00	0.686
148.246	22.03	-4.54	91.26	74430.00	-6910.00	989220.99	8202.44	-2593.32	449.39	0.703
152.648	20.99	-4.51	91.19	80867.00	-7450.00	986715.99	8852.18	-2712.30	503.28	0.667
160.138	19.33	-1.72	89.80	88949.00	-8102.00	983753.99	9664.29	-2780.88	568.14	0.847
162.639	18.87	-2.10	89.75	89963.00	99999.00	983407.99	9764.49	-2737.62	571.42	0.908
165.136	18.86	-2.12	89.75	90998.00	-8173.00	983056.99	9866.42	-2695.10	99999.00	0.911
167.358	18.86	-2.12	89.75	91935.00	-8210.00	982741.99	9959.27	-2657.56	578.87	0.878
169.823	18.66	-2.12	89.75	92995.00	-8248.00	982383.99	10063.91	-2616.86	582.64	2.626
172.288	17.72	-2.09	89.71	94074.00	-8288.00	982035.00	10169.83	-2575.41	586.73	2.382
173.975	17.29	-1.86	89.71	94824.00	-8313.00	981798.99	10244.40	-2546.59	589.07	2.230
176.439	16.67	-1.46	89.71	95940.00	99999.00	99999.00	10354.50	-2504.03	592.41	2.004
178.906	15.96	-1.02	89.71	97074.00	-8369.00	981134.99	10466.32	-2460.17	594.55	1.895
181.380	15.26	-0.53	89.71	98231.00	-8385.00	980813.99	10580.37	-2415.64	596.08	1.805
183.844	14.58	-0.07	89.71	99405.00	-8387.00	980505.99	10696.06	-2370.16	596.21	1.597
188.693	13.24	0.86	89.71	101770.00	-8366.00	979924.99	10929.01	-2278.16	593.93	1.350
191.115	12.56	1.25	89.74	102983.00	-8338.00	979647.99	11048.44	-2230.96	591.04	1.132
193.536	11.93	1.55	89.78	104213.00	-8307.00	979383.99	11169.50	-2182.48	587.83	1.006
195.960	11.31	1.83	89.76	105466.00	-8263.00	979128.99	11292.80	-2133.05	583.31	0.929
198.382	10.67	2.07	89.80	106734.00	-8218.00	978884.99	11417.53	-2082.61	578.70	0.730
200.810	10.07	2.28	89.82	108025.00	-8163.00	978649.99	11544.48	-2031.08	573.07	0.559
203.231	9.43	2.47	89.85	109338.00	-8105.00	978426.99	11673.58	-1978.57	567.13	0.531
205.652	8.83	2.59	89.86	110668.00	-8042.00	978212.99	11804.31	-1925.20	560.70	0.543
208.074	8.26	2.69	89.89	112019.00	-7976.00	978011.99	11937.06	-1870.53	553.95	0.297
210.495	7.70	2.74	89.93	113391.00	-7907.00	977817.99	12071.85	-1815.19	546.90	0.061
212.917	7.13	2.83	89.96	114788.00	-7835.00	977638.99	12209.07	-1758.36	539.54	0.126
215.338	6.59	2.88	90.00	116206.00	-7762.00	977466.99	12348.31	-1700.85	532.08	0.084
217.761	6.04	2.95	90.00	117647.00	-7684.00	977307.99	12489.79	-1642.03	524.11	-0.037
220.180	5.50	2.99	90.07	119109.00	-7603.00	977159.99	12633.29	-1582.20	515.84	-0.067
222.606	4.98	2.95	90.11	120598.00	-7521.00	977024.99	12779.42	-1520.87	507.46	-0.205
225.026	4.44	2.99	90.07	122110.00	-7440.00	976900.99	12927.78	-1458.66	499.18	-0.289
227.446	3.96	3.06	90.14	123645.00	-7354.00	976788.00	13078.05	-1395.86	490.61	-0.174
229.866	3.49	3.06	90.14	125205.00	-7267.00	976683.99	13231.74	-1331.09	481.40	-0.363
232.287	2.99	3.10	90.22	126792.00	-7177.00	976594.99	13387.00	-1265.70	472.21	-0.470
234.712	2.56	3.10	90.22	128410.00	-7084.00	976512.99	13545.80	-1198.92	462.90	-0.520
237.138	2.13	3.06	90.22	130057.00	-6992.00	976445.99	13706.17	-1131.24	453.36	-0.329
239.560	1.79	3.03	90.24	131798.00	-6929.00	976404.99	13819.04	-1083.86	446.94	-0.268
241.981	1.33	2.97	90.28	132897.00	-6834.00	976353.99	13985.60	-1014.07	437.23	-0.362
243.658	0.90	2.97	90.31	134619.00	-6741.00	976317.99	14154.38	-942.94	427.71	-0.405
246.085	0.49	2.97	90.35	136376.00	-6645.00	976294.99	14326.60	-870.52	417.88	-0.373
248.511	0.09	3.00	90.36	138165.00	-6546.00	976285.99	14501.94	-796.70	407.75	-0.320
253.404	-0.81	3.06	90.39	141869.00	-6341.00	976299.99	14864.94	-644.66	386.77	-0.159
255.854	-1.32	3.06	90.40	143778.00	-6236.00	976334.99	15052.02	-565.76	376.03	-0.166

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GT6 REV 1

ASCENT

TIME	PITCH	YAW	ROLL	SFPX	SFPY	SFPZ	VELX	VELY	VELZ	PERR
258.300	-1.83	3.06	90.45	145720.00	-6129.00	976384.99	15242.33	-485.44	365.08	-0.199
260.750	-2.32	3.06	90.50	147703.00	-6016.00	976449.99	15436.66	-403.48	353.52	-0.242
263.203	-2.79	3.06	90.54	149732.00	-5900.00	976538.99	15635.51	-319.01	341.66	-0.214
265.653	-3.27	3.12	90.54	151798.00	-5783.00	976644.99	15838.00	-232.93	329.70	-0.225
268.100	-3.78	3.10	90.54	153905.00	-5660.00	976767.99	16044.51	-145.25	317.13	-0.258
270.548	-4.26	3.10	90.57	156056.00	-5538.00	976916.99	16255.35	-54.89	304.66	-0.254
272.994	-4.74	3.10	90.61	158253.00	-5413.00	977081.99	16470.72	37.00	291.88	-0.274
275.442	-5.22	3.10	90.61	160503.00	-5286.00	977273.99	16691.04	131.90	279.20	-0.330
277.887	-5.65	3.06	90.68	162798.00	-5155.00	977488.99	16916.76	99999.00	265.72	-0.415
280.334	-6.08	3.06	90.68	165147.00	-5024.00	977721.99	99999.00	327.08	251.97	-0.392
282.013	-6.39	3.06	90.68	166790.00	-4930.00	977898.99	17307.86	396.95	242.54	-0.234
284.458	-6.82	3.06	90.71	169232.00	-4793.00	978174.99	17547.41	500.07	228.54	-0.115
286.901	-7.22	3.06	90.75	171733.00	-4652.00	978471.99	17792.80	605.24	214.15	-0.033
289.349	-7.67	3.06	90.73	174300.00	-4507.00	978800.99	18044.72	713.78	199.35	-0.012
291.705	-8.18	3.06	90.74	176837.00	-4366.00	979145.99	18293.76	821.16	184.95	-0.043
294.019	-8.73	3.06	90.78	179390.00	-4222.00	979514.99	18544.44	929.66	170.26	-0.013
297.062	-9.39	3.02	90.83	182842.00	-4026.00	980054.99	18882.86	1077.89	150.51	-0.180
299.379	-9.81	3.02	90.86	185552.00	-3875.00	980504.99	19149.72	1194.84	134.88	-0.171
301.705	-10.30	3.02	90.90	188346.00	-3719.00	980990.99	19424.32	1315.63	118.98	-0.154
304.023	-10.75	3.02	90.90	191211.00	-3559.00	981511.99	19705.99	1439.79	102.67	-0.150
306.341	-11.18	3.02	90.93	194159.00	-3394.00	982071.99	19995.93	1567.85	85.87	-0.154
308.656	-11.62	3.02	90.94	197188.00	-3224.00	982670.99	20293.95	1699.86	68.55	-0.152
310.980	-12.08	3.02	90.96	200326.00	-3047.00	983316.99	20602.82	1836.91	50.54	-0.142
313.295	-12.58	3.05	90.95	203549.00	-2863.00	984007.99	20920.20	1978.30	31.82	-0.210
316.338	-13.28	3.02	90.97	207950.00	-2615.00	985004.99	21353.33	2172.88	6.78	-0.291
318.655	-13.68	2.99	91.01	211431.00	-2423.00	985821.99	21695.70	2327.42	-12.93	-0.387
320.981	-14.06	3.02	91.01	215053.00	-2218.00	986703.99	22054.20	2488.82	-33.74	-0.393
323.300	-14.45	3.03	91.01	218799.00	-2008.00	987641.99	22423.88	2655.58	-55.07	-0.340
325.619	-14.80	3.02	91.04	222690.00	-1788.00	988642.99	22808.09	2828.79	99999.00	99999.000
327.936	-15.12	3.05	91.02	226744.00	-1561.00	989708.99	23208.66	99999.00	-100.45	-0.134
330.252	-15.51	3.06	91.03	230963.00	-1323.00	990847.98	23625.78	3195.82	-124.59	-0.145
332.575	-15.85	3.03	91.05	235385.00	-1072.00	992071.99	24063.27	3392.00	-150.04	-0.085
342.403	-15.12	0.28	92.14	248825.00	-323.00	995943.99	25378.16	4087.40	-226.14	1.484
344.526	-12.69	-2.73	91.16	248879.00	-327.00	995955.99	25372.85	4152.82	-225.87	3.785
346.658	-12.11	-2.47	90.58	248921.00	-329.00	995965.99	25366.11	4218.30	-225.87	4.404
348.936	-11.75	-1.35	89.90	248948.00	-329.00	995972.99	25356.91	4287.85	-225.94	4.742
352.302	-11.61	1.41	89.80	248965.00	-329.00	995973.99	25340.22	4389.07	-226.50	99999.000
354.406	-11.99	2.20	90.62	248973.00	-328.00	995975.99	25330.03	4453.33	-226.36	4.535
356.503	-12.17	3.19	91.18	248976.00	-329.00	995974.99	25318.77	4516.48	-226.37	4.430
358.601	-12.45	4.27	91.96	248981.00	-327.00	995975.99	25307.54	4579.84	-226.70	4.148
363.885	-12.49	6.08	92.48	249008.00	-327.00	995980.99	25291.95	4677.42	-226.87	-2.046
366.603	-11.56	7.92	86.00	249024.00	-326.00	995984.99	25281.62	4739.96	-227.09	-0.925
368.661	-11.04	7.26	52.05	249047.00	-323.00	995993.99	25267.98	4822.71	-227.53	-0.227
371.379	-10.58	8.60	25.70	249065.00	-317.00	995997.99	25257.53	4885.06	-228.24	0.378
371.379	-10.06	9.51	13.76	249090.00	-314.00	995992.99	25243.63	4966.25	-228.68	1.084

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ASCENT

TIME	PITCH	YAW	ROLL	SFXP	SFYP	SFZP	VELX	VELY	VELZ	PERR
373.436	-9.76	9.32	7.24	249102.00	-310.00	995996.99	25232.23	5028.48	-229.19	1.533
376.259	-9.28	9.05	0.65	249106.00	-312.00	995996.99	25215.20	5112.87	-228.94	2.202
380.487	-8.46	9.50	-0.11	249114.00	-315.00	995997.00	99999.00	5240.17	-229.04	3.311
383.212	-7.99	7.62	-0.04	249119.00	-312.00	995996.00	25171.88	5321.77	-229.47	3.973
385.423	-8.71	7.74	-0.07	249124.00	-313.00	995994.59	25157.88	5387.91	-229.47	3.400
388.219	-9.50	7.33	-0.04	249127.00	-312.00	995995.99	25139.58	5471.73	-229.70	2.756
390.276	-10.91	6.23	-0.04	249131.00	-314.00	995997.99	25126.11	5533.52	-229.59	1.538
392.992	-12.20	4.55	-0.20	249134.00	-315.00	995996.99	25107.88	5614.63	-229.62	0.418
395.050	-13.25	3.17	0.29	249140.00	-313.00	995996.99	25094.27	5676.12	-229.91	-0.476
397.759	-14.10	1.42	0.71	249145.00	-314.00	995996.00	25075.81	5756.94	-229.92	-1.134
399.815	-14.58	0.00	1.04	249145.00	-314.00	995997.99	25061.25	5818.52	-230.01	-1.477
404.591	-14.29	-2.56	1.80	249154.00	-315.00	995998.99	25027.75	5961.02	-230.11	-0.861
407.302	-13.47	-3.25	1.65	249159.00	-316.00	995997.99	25008.36	6041.67	-230.12	0.142
409.355	-12.02	-2.33	1.15	249167.00	-315.00	995997.00	99999.00	6102.78	-230.20	1.735
412.071	-8.91	-0.54	0.26	249167.00	-315.00	995998.00	24973.52	6183.60	-230.40	5.035
414.127	-6.84	-0.54	0.25	249172.00	-317.00	995998.99	24958.41	6244.81	-230.28	7.246
416.842	-3.90	-0.51	0.12	249176.00	-314.00	995998.99	24937.56	6325.46	-230.68	10.373
418.897	-1.91	-0.43	0.11	249179.00	-316.00	995999.99	24922.32	6386.53	-230.55	12.509
421.618	-0.18	-0.44	0.06	249184.00	-317.00	996000.99	24901.46	6467.35	-230.55	14.426

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GT6 REV 1

ASCENT

TIME	YAWER	RERROR	ZVUPDT	PITRTE	VEL(R)	X(POS)	Y(POS)	Z(POS)	TTSECO	ELAP T
1.640	-0.32	0.72	0.	-0.52	-1307.48	1.86	-20909.93	-59.13	175.00	1.426
4.021	-0.28	0.72	0.	-0.52	-1307.48	5.04	-20909.99	-59.39	175.00	3.826
6.400	-0.35	0.75	0.	-0.52	-1307.48	8.23	-20910.10	-59.64	175.00	6.228
8.781	-0.36	0.76	0.	-0.52	-1307.48	11.41	-20910.26	-59.90	175.00	8.627
11.161	-0.36	0.79	0.	-0.52	-1307.48	14.60	-20910.48	-60.15	175.00	11.028
13.536	-0.35	0.80	0.	-0.52	-1307.48	17.78	-20910.75	-60.40	175.00	13.426
15.913	-0.35	0.79	0.	-0.52	-1307.48	20.96	-20911.08	-60.64	175.00	15.825
18.136	-0.37	0.79	0.	-0.52	-1307.48	27.95	-20912.02	-61.18	175.00	20.625
28.192	-0.22	0.76	0.	-0.74	-1307.48	37.44	-20913.84	-61.89	175.00	30.123
32.582	-0.22	0.71	0.	-0.71	-1307.48	43.40	-20915.30	-62.32	175.00	32.625
35.074	-0.03	0.66	0.	-0.71	-1307.48	46.84	-20916.26	-62.57	175.00	35.123
37.565	-0.09	0.69	0.	-0.71	-1307.48	50.32	-20917.31	-62.81	175.00	37.524
40.055	-0.21	0.70	0.	-0.71	-1307.48	53.86	-20918.46	-63.04	175.00	39.923
47.523	-0.06	0.61	0.	-0.71	-1307.48	64.92	-20922.53	-63.73	175.00	49.322
49.427	0.11	0.52	0.	-0.71	-1307.48	67.89	-20923.72	-63.90	175.00	49.522
51.923	0.37	0.46	0.	-0.71	-1307.48	71.88	-20925.38	-64.12	175.00	56.522
54.420	0.36	0.49	0.	-0.71	-1307.48	75.98	-20927.14	-64.34	175.00	56.722
56.914	0.21	0.53	0.	-0.71	-1307.48	80.23	-20929.02	-64.55	175.00	59.122
59.408	-0.05	0.55	0.	-0.71	-1307.48	84.60	-20931.02	-64.76	175.00	61.523
61.900	-0.22	0.63	0.	-0.71	-1307.48	89.16	-20933.14	99999.00	175.00	71.019
71.291	-0.19	0.51	0.	-0.71	-1307.48	107.88	-20942.18	-65.63	175.00	75.820
76.271	-0.08	0.49	0.	-0.71	-1307.48	118.98	-20947.65	-65.90	175.00	78.221
78.172	0.54	0.47	0.	-0.71	-1307.48	123.47	-20949.87	-66.00	175.00	80.620
80.663	1.11	0.47	0.	-0.71	-1307.48	129.56	-20952.88	-66.12	175.00	83.017
83.155	-0.67	0.56	0.	-0.71	-1307.48	135.92	-20956.01	-66.24	175.00	85.419
85.648	-1.43	0.52	0.	-0.71	-1307.48	142.56	-20959.26	-66.33	175.00	90.218
90.636	-1.32	0.39	99999.00	99999.00	99999.00	99999.00	-20966.14	-66.42	175.00	92.618
93.132	-1.15	0.38	0.	-0.49	-1307.48	164.27	-20969.79	-66.41	175.00	95.118
95.036	-0.99	0.38	0.	-0.52	-1307.48	170.29	-20972.66	-66.38	175.00	97.519
97.533	-0.93	0.36	0.	-0.52	-1307.48	178.46	-20976.53	-66.30	175.00	99.916
100.029	-0.90	0.32	0.	-0.52	-1307.48	187.01	-20980.52	-66.20	175.00	102.316
102.530	-0.84	0.31	0.	-0.52	-1307.48	195.96	-20984.66	-66.06	175.00	104.716
105.024	-0.71	0.32	0.	-0.52	-1307.48	205.26	-20988.88	-65.88	175.00	107.117
107.545	-0.66	0.25	68.50	-0.52	-1307.48	215.01	-20993.31	-67.78	175.00	109.516
109.449	-0.67	0.21	68.50	-0.52	-1307.48	222.82	-20996.73	-67.03	175.00	111.918
111.946	-1.39	0.16	68.50	-0.52	-1307.48	233.42	-21001.31	-66.78	175.00	114.314
114.442	-2.09	0.12	68.50	-0.52	-1307.48	244.51	-21006.01	-66.49	175.00	116.715
116.937	-1.86	0.11	68.50	-0.52	-1307.48	256.10	-21010.81	-66.44	175.00	119.118
119.433	-1.57	0.08	68.50	-0.13	-1307.48	268.23	-21015.73	99999.00	175.00	121.516
121.936	-1.58	-0.02	68.50	-0.28	99999.00	280.91	-21020.73	-65.28	175.00	123.914
123.840	-1.48	-0.04	68.50	-0.24	-1307.48	291.04	-21024.64	-64.89	175.00	126.316
126.338	-1.28	-0.03	68.50	-0.24	-1307.48	304.78	-21029.84	-63.72	175.00	128.612
128.836	-1.05	-0.01	68.50	-0.24	-1307.48	319.14	-21035.16	-63.04	175.00	131.012
131.331	-0.78	-0.04	68.50	-0.24	-1307.48	334.12	-21040.59	-63.04	175.00	133.412
133.826	-0.84	-0.05	68.50	-0.24	-1307.48	349.76	-21046.15	-62.32	175.00	

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ASCENT

TIME	YAWR	ERROR	ZVUPDT	PITRTE	VEL(R)	X(POS)	Y(POS)	Z(POS)	TTSECD	ELAP T
136.322	-0.97	-0.06	68.50	-0.24	-1307.48	366.05	-21051.82	-61.55	175.00	135.914
138.227	-0.97	-0.09	68.50	-0.24	-1307.48	379.04	-21056.28	-60.91	175.00	138.314
140.731	-0.95	-0.10	68.50	-0.24	-1307.48	396.73	-21062.24	-60.02	175.00	140.712
143.231	-0.96	-0.13	68.50	-0.24	-1307.48	415.14	-21068.32	-59.08	175.00	143.111
148.246	-1.01	-0.14	425.25	-0.24	-1307.48	454.51	-21081.00	-56.88	175.00	147.911
152.648	-0.99	-0.17	425.25	-0.24	-1307.48	492.08	-21092.68	-54.80	175.00	152.711
160.138	1.86	-1.40	425.25	-0.24	-1307.48	562.24	-21113.57	-50.71	175.00	159.910
162.639	1.57	-1.46	425.25	0.07	-1307.48	586.47	-21120.46	-49.29	175.00	162.313
165.136	1.49	-1.46	425.25	-0.03	-1307.48	610.99	-21127.24	-47.85	175.00	164.709
167.358	1.53	-1.46	425.25	-0.	4619.61	633.09	-21133.20	-46.57	175.00	167.110
169.823	-4.52	-1.41	425.25	-0.32	1514.28	657.72	-21139.70	-45.14	177.23	169.509
172.288	-5.02	-1.43	425.25	99999.00	99999.00	682.60	-21146.08	-43.70	171.35	171.912
173.975	-4.80	-1.40	425.25	-0.19	2882.82	699.92	-21150.42	-42.71	169.93	174.308
176.439	-4.44	99999.00	425.25	-0.19	2856.16	725.29	-21156.64	-41.25	166.53	176.608
178.906	-3.98	-1.38	425.25	-0.19	2828.67	750.98	-21162.77	-39.79	163.26	179.008
181.380	-3.54	-1.39	425.25	-0.19	2801.02	777.01	-21168.80	-38.32	161.47	181.509
183.844	-3.16	-1.41	425.25	-0.19	2772.86	803.22	-21174.69	-36.84	157.13	183.907
188.693	-2.25	-1.40	425.25	-0.19	2716.39	855.66	-21185.97	-33.96	153.40	188.706
191.115	-1.90	-1.40	425.25	-0.19	2687.70	882.26	-21191.43	-32.52	150.39	191.108
193.536	-1.61	-1.36	425.25	-0.19	2658.24	909.16	-21196.77	-31.10	148.01	193.507
195.960	-1.32	-1.35	425.25	-0.19	2628.41	936.38	-21202.00	-29.68	146.00	195.906
198.382	-0.93	-1.37	425.25	-0.19	2598.09	963.88	-21207.11	-28.27	141.55	198.306
203.231	-0.78	-1.34	425.25	-0.19	2567.49	991.76	-21212.10	-26.87	139.74	200.706
205.652	-0.65	-1.32	425.25	-0.19	2536.05	1019.87	-21216.96	-25.49	138.95	203.106
208.074	-0.51	-1.33	425.25	-0.19	2504.48	1048.29	-21221.68	-24.12	136.34	205.507
210.495	-0.46	-1.30	425.25	-0.19	2472.73	1077.04	-21226.28	-22.78	131.30	207.906
212.917	-0.34	-1.31	425.25	-0.19	2440.34	1106.11	-21230.74	-21.44	128.66	210.307
215.338	-0.29	-1.33	425.25	-0.19	2406.95	1135.50	-21235.07	-20.13	128.37	212.707
217.761	-0.26	-1.29	425.25	-0.19	2374.34	1165.24	-21239.26	-18.83	125.38	215.104
220.180	-0.29	-1.30	425.25	-0.19	2340.61	1195.32	-21243.31	-17.55	122.86	217.503
222.606	-0.27	-1.30	425.25	-0.19	2306.79	1225.71	-21247.21	-16.29	120.24	219.906
225.026	-0.20	-1.29	425.25	-0.19	2272.46	1256.47	-21250.96	-15.06	117.59	222.306
227.446	-0.19	-1.27	425.25	-0.19	2237.44	1287.67	-21254.58	-13.83	114.98	224.704
229.866	-0.16	-1.26	425.25	-0.20	2202.74	1319.09	-21258.03	99999.00	113.87	227.102
232.287	-0.10	-1.28	425.25	-0.20	2167.26	1350.94	-21261.33	-11.46	109.44	229.502
234.712	-0.13	-1.28	425.25	-0.20	2131.72	1383.13	-21264.47	-10.30	107.23	231.903
237.138	-0.24	-1.26	425.25	-0.19	2095.83	1415.79	-21267.46	-9.17	104.30	234.303
241.231	-0.23	-1.26	425.25	-0.19	2059.84	1448.75	-21270.27	-8.06	103.39	236.701
243.658	-0.26	-1.27	425.25	-0.20	1998.67	1471.74	-21272.13	-7.31	101.38	239.101
246.085	-0.24	-1.27	425.25	-0.19	1961.97	1505.55	-21274.68	-6.24	98.28	241.501
248.511	-0.25	-1.27	425.25	-0.20	1925.06	1539.70	-21277.05	-5.19	96.36	243.901
253.404	-0.19	-1.29	425.25	-0.20	1887.84	1574.25	-21279.25	-4.16	93.79	246.302
255.854	-0.18	-1.31	425.25	-0.20	1813.02	1681.07	-21284.81	-1.22	86.02	248.700
					1774.61	1717.70	-21286.29	-0.28	83.71	255.899

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TIME	YAWR	RERRR	ZVUPDT	PIIRATE	VEL(R)	X(POS)	Y(POS)	Z(POS)	TTSECO	ELAP T
258.300	-0.15	-1.31	425.25	-0.20	1736.00	1754.75	-21287.58	0.63	81.41	258.300
260.750	-0.20	-1.30	425.25	-0.20	1697.14	1792.34	-21288.67	1.51	78.81	260.700
263.203	-0.16	-1.29	425.25	-0.19	1657.27	1830.46	-21289.55	2.36	76.70	263.099
265.653	-0.11	-1.28	425.25	-0.20	1617.26	1869.01	-21290.23	3.18	73.80	265.501
268.100	-0.10	-1.27	425.25	-0.20	1576.72	1908.01	-21290.69	3.97	71.55	267.900
270.548	-0.13	-1.25	425.25	-0.20	1535.69	1947.55	-21290.94	4.73	68.92	270.300
272.994	-0.17	-1.28	425.25	-0.20	1494.03	1987.50	-21290.96	5.46	66.43	272.699
275.442	-0.14	-1.31	425.25	-0.20	1451.73	2028.15	-21290.75	6.16	63.99	275.099
277.887	-0.14	-1.26	425.25	-0.21	1409.23	2069.27	-21290.32	6.83	61.05	277.497
280.334	-0.13	-1.28	425.25	-0.20	1366.14	2110.71	-21289.64	7.46	58.92	11.875
282.013	-0.16	-1.30	425.25	-0.20	1336.07	2139.84	-21289.03	7.88	57.45	284.498
284.458	-0.17	-1.31	425.25	-0.20	1292.22	2182.46	-21287.93	8.45	54.99	284.698
286.901	-0.15	-1.29	425.25	-0.20	1248.37	2225.63	-21286.58	8.99	52.40	287.096
289.349	-0.13	-1.31	425.25	-0.20	1203.47	2269.48	-21284.97	9.50	50.07	289.497
291.705	-0.13	-1.34	425.25	-0.20	1159.61	2312.29	-21283.16	9.95	47.61	291.897
294.019	-0.16	-1.32	425.25	-0.20	1115.68	2354.90	-21281.14	10.36	45.07	294.296
297.062	-0.17	-1.29	425.25	-0.20	1055.68	2411.75	-21278.09	10.85	42.44	296.696
299.379	-0.17	-1.31	425.25	-0.20	1009.39	2455.92	-21275.45	11.18	40.10	299.095
301.705	-0.20	-1.30	425.25	-0.19	961.38	2500.78	-21272.53	11.48	37.54	301.495
304.023	-0.24	-1.32	425.25	-0.19	912.69	99999.00	-21269.34	11.73	35.29	303.895
306.341	99999.00	-1.32	425.25	-0.19	863.14	2592.13	-21265.86	11.95	32.91	306.295
308.656	-0.19	-1.35	425.25	-0.19	812.57	2638.78	-21262.07	12.13	30.58	308.695
310.980	-0.18	-1.35	425.25	-0.19	760.57	2686.29	-21257.96	12.27	28.18	311.094
313.295	-0.21	-1.36	425.25	-0.19	707.34	2734.35	-21253.55	12.36	25.94	313.495
316.338	-0.26	-1.34	425.25	-0.19	634.22	2798.61	-21247.24	12.42	22.75	315.894
318.655	-0.24	-1.36	425.25	-0.19	99999.00	2848.44	-21242.03	12.42	20.63	318.295
320.981	-0.25	-1.35	425.25	-0.19	517.57	2899.43	-21236.42	12.36	18.18	320.693
323.300	-0.30	-1.40	425.25	-0.18	456.65	2951.00	-21230.46	12.26	15.83	323.093
325.619	99999.00	-1.43	425.25	-0.18	395.07	3003.44	-21224.10	12.11	13.54	325.493
327.936	-0.27	-1.42	425.25	-0.18	331.55	3056.74	-21217.34	11.90	11.17	327.893
330.252	-0.31	-1.43	425.25	-0.18	266.53	3110.96	-21210.15	11.64	8.90	330.292
332.575	-0.42	-1.46	425.25	-0.18	199.30	3166.36	-21202.50	11.32	6.56	332.692
342.403	-3.62	-0.38	425.25	-0.17	-2.91	3411.50	-21165.12	9.36	1.98	342.291
344.526	-6.51	-1.15	425.25	-0.17	3.05	3465.36	-21156.38	8.88	1.98	344.691
346.658	-6.34	-1.75	425.25	-0.17	3.10	3519.45	-21147.45	8.39	1.98	347.090
348.936	-5.22	-2.37	425.25	-0.17	3.26	3577.22	-21137.76	7.88	1.98	349.492
352.302	-2.43	-2.45	425.25	-0.17	4.33	3662.38	-21123.19	7.11	1.98	351.891
354.406	-1.65	-1.66	425.25	-0.17	4.37	3715.87	-21113.85	6.64	1.98	354.290
356.503	-0.67	-1.12	425.25	-0.17	4.96	3768.96	-21104.45	6.16	1.98	356.690
358.601	0.40	-0.40	425.25	-0.17	5.34	3822.07	-21094.91	5.69	1.98	359.090
361.821	-15.16	92.48	425.25	-0.17	5.94	3886.93	-21083.07	5.11	1.98	361.491
363.885	-15.37	86.00	425.25	-0.17	6.21	3955.71	-21070.29	4.49	1.98	363.889
366.603	-16.93	52.05	425.25	-0.17	5.88	4024.42	-21057.29	3.87	1.98	366.289
368.661	-15.52	25.70	425.25	-0.17	6.63	4076.42	-21047.30	3.40	1.98	368.689
371.379	-15.20	13.76	425.25	-0.17	8.18	4145.02	-21033.92	2.78	1.98	371.091

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TIME	YANER	ERROR	ZVUPDT	PITRTE	VEL(R)	X(POS)	Y(POS)	Z(POS)	TTSECO	ELAP T
373.436	-15.74	7.24	425.25	-0.17	8.43	4196.94	-21023.64	2.31	1.98	373.489
376.259	95599.00	0.65	425.25	-0.17	9.30	4268.03	-21009.34	1.66	1.98	375.889
380.487	-14.99	-0.11	425.25	-0.17	10.13	4374.73	-20987.43	0.70	1.98	380.689
383.212	-15.14	-0.04	425.25	-0.17	10.89	4443.34	-20973.04	0.07	1.98	383.089
385.423	-14.23	-0.07	425.25	-0.17	11.55	4498.98	-20961.20	-0.44	1.98	385.488
388.219	-14.34	-0.04	425.25	-0.17	11.87	4552.79	-20949.60	99999.00	1.98	387.890
390.276	-14.17	-0.04	425.25	99999.00	99999.00	99999.00	-20934.70	-1.55	1.98	390.287
392.992	-14.18	-0.20	425.25	-0.17	13.37	4689.22	-20919.56	-2.18	1.98	392.688
395.050	-14.96	0.29	425.25	-0.17	13.66	4740.86	-20907.94	-2.65	1.98	394.989
397.759	-16.10	0.71	425.25	-0.17	14.27	4808.82	-20892.46	-3.27	1.98	397.386
399.815	-16.23	1.04	425.25	-0.17	14.63	4860.37	-20880.55	-3.74	1.98	399.786
404.591	-17.45	1.80	425.25	-0.17	14.63	4979.96	-20852.43	-4.84	1.98	404.586
407.302	-17.36	1.65	425.25	-0.17	16.66	5047.78	-20836.16	-5.47	1.98	406.986
409.355	-15.86	1.15	425.25	-0.17	16.96	5099.11	-20823.70	-5.94	1.98	409.386
412.071	-12.66	0.26	425.25	-0.17	17.59	5166.99	-20807.00	-6.56	1.98	411.785
414.127	-11.27	0.25	425.25	-0.17	18.02	5218.32	-20794.23	-7.04	1.98	414.185
416.842	-11.27	0.12	425.25	-0.17	18.65	5286.05	-20777.16	-7.66	1.98	416.585
418.897	-9.86	0.11	425.25	-0.17	19.03	5337.26	-20764.11	-8.14	1.98	418.985
421.618	-8.83	0.06	425.25	-0.17	19.59	5405.06	-20746.62	-8.76	1.98	421.384

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APPENDIX B

FLIGHT RECONSTRUCTION GRAPHS

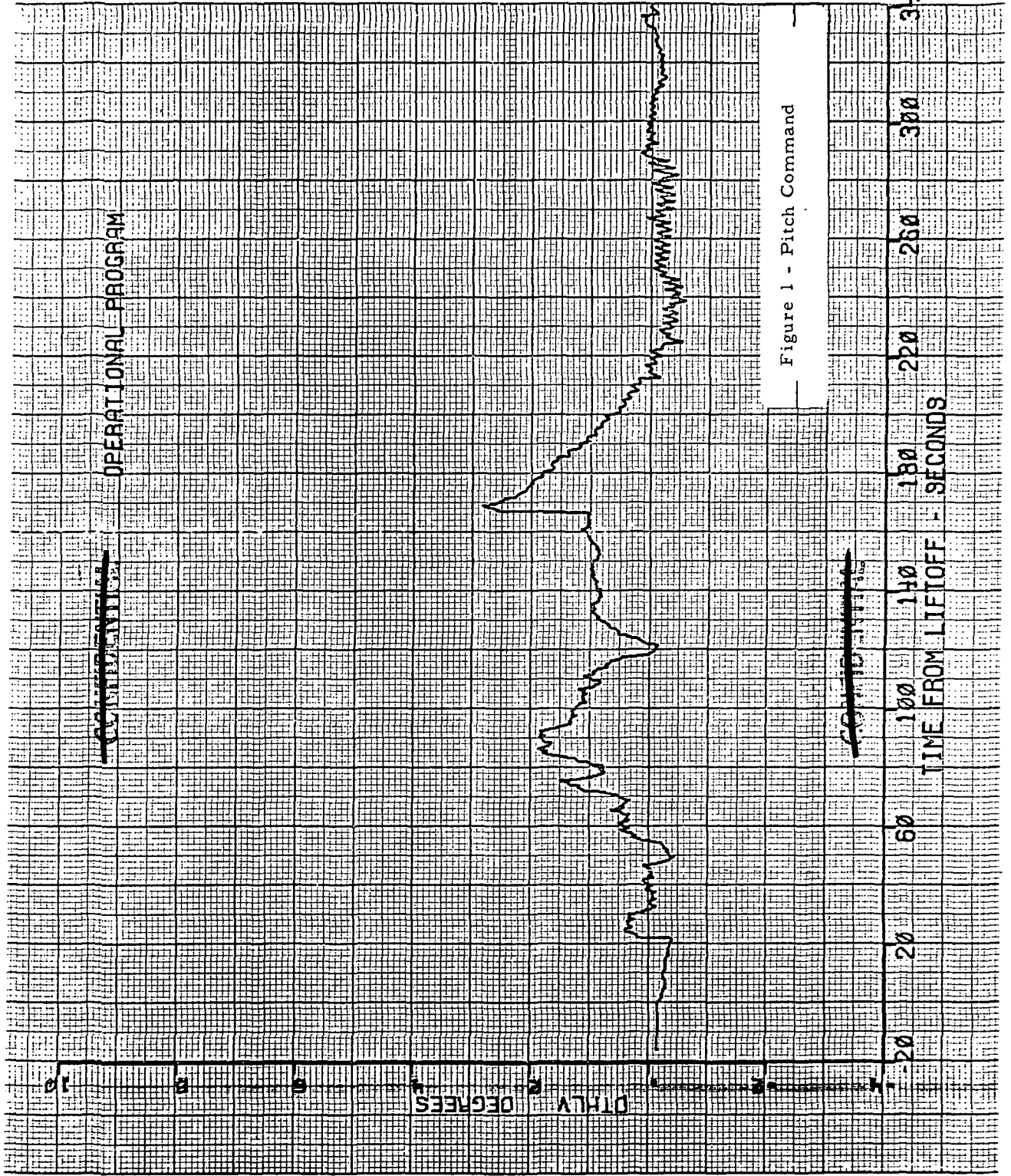


Figure 1 - Pitch Command

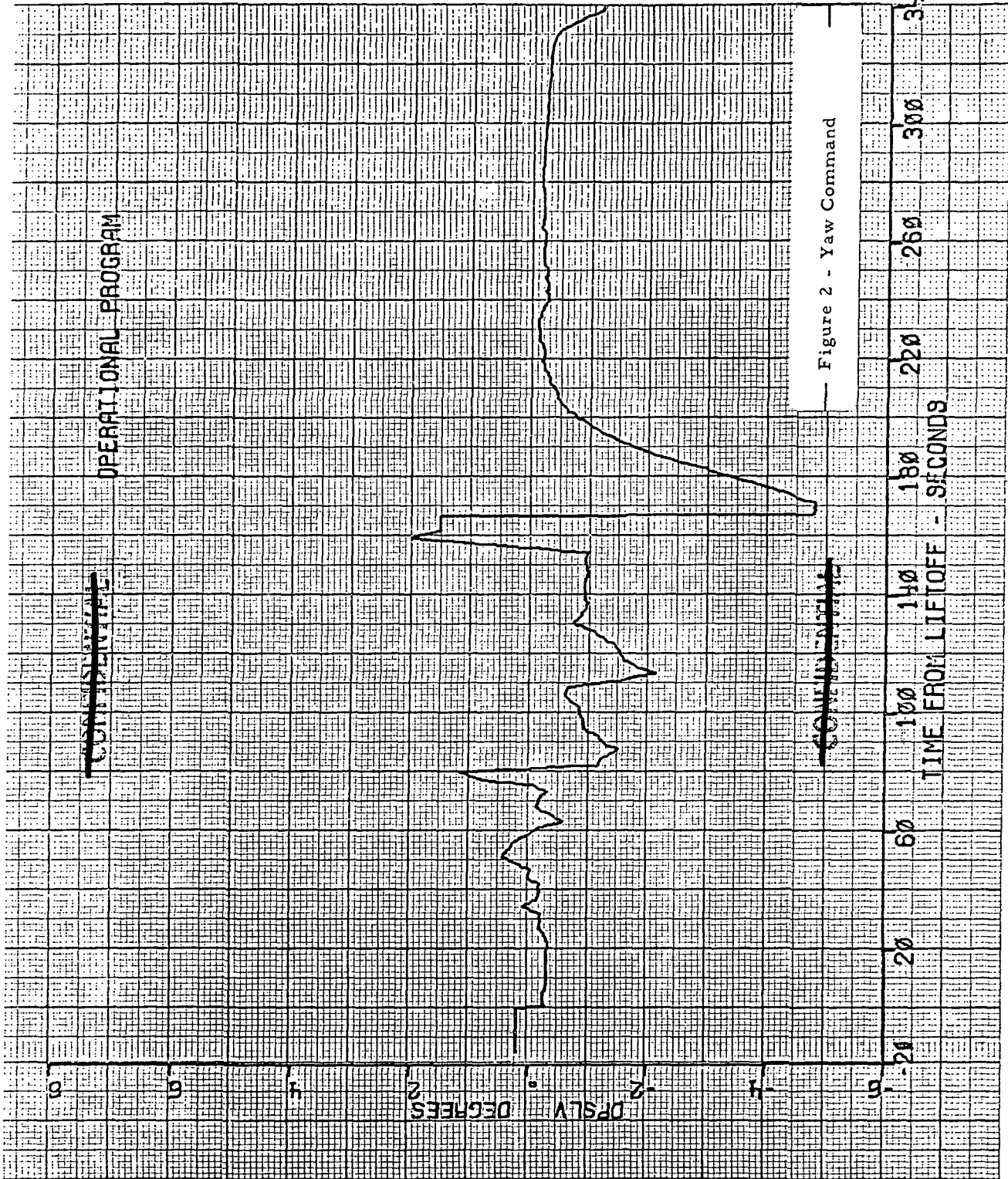
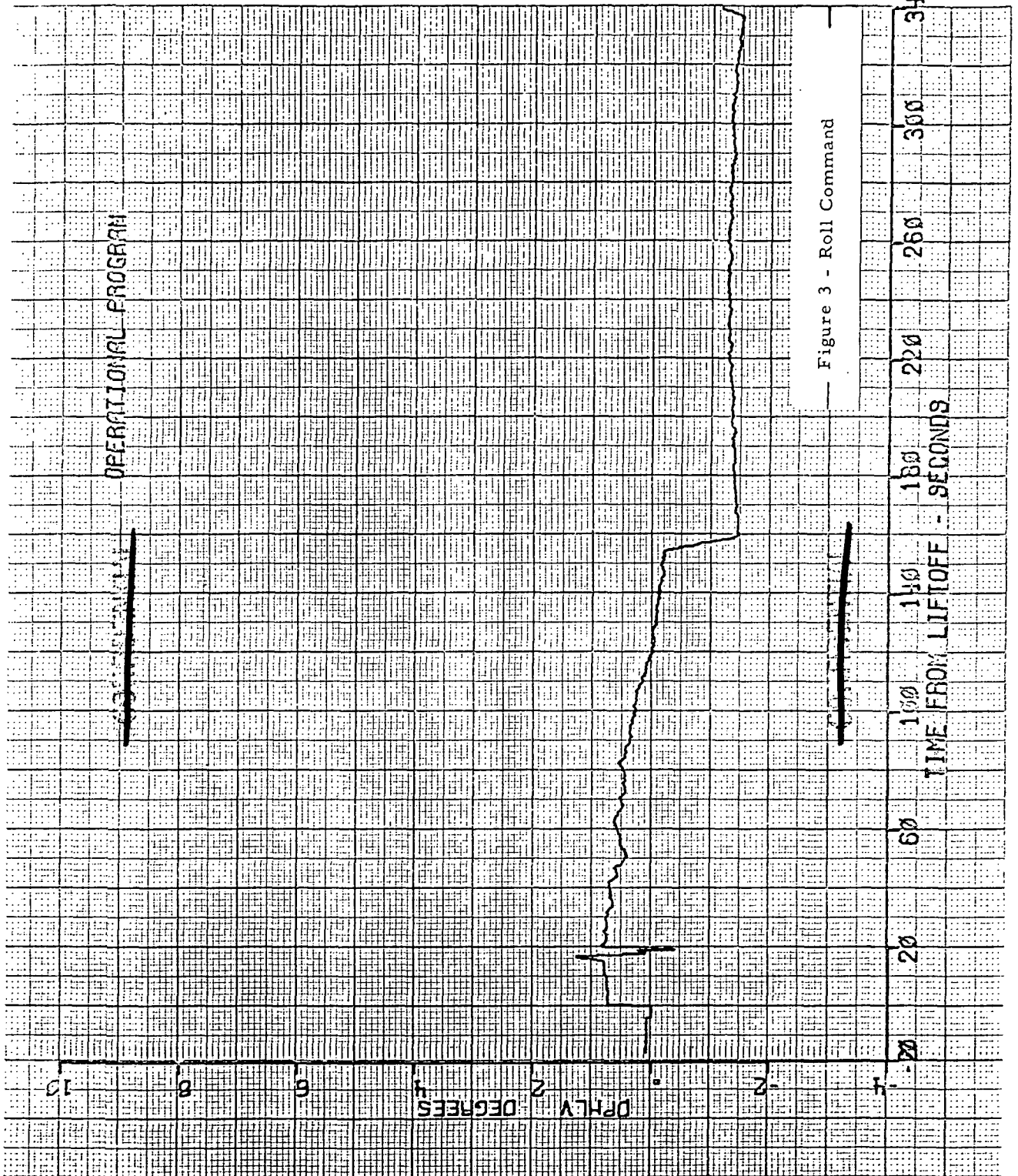
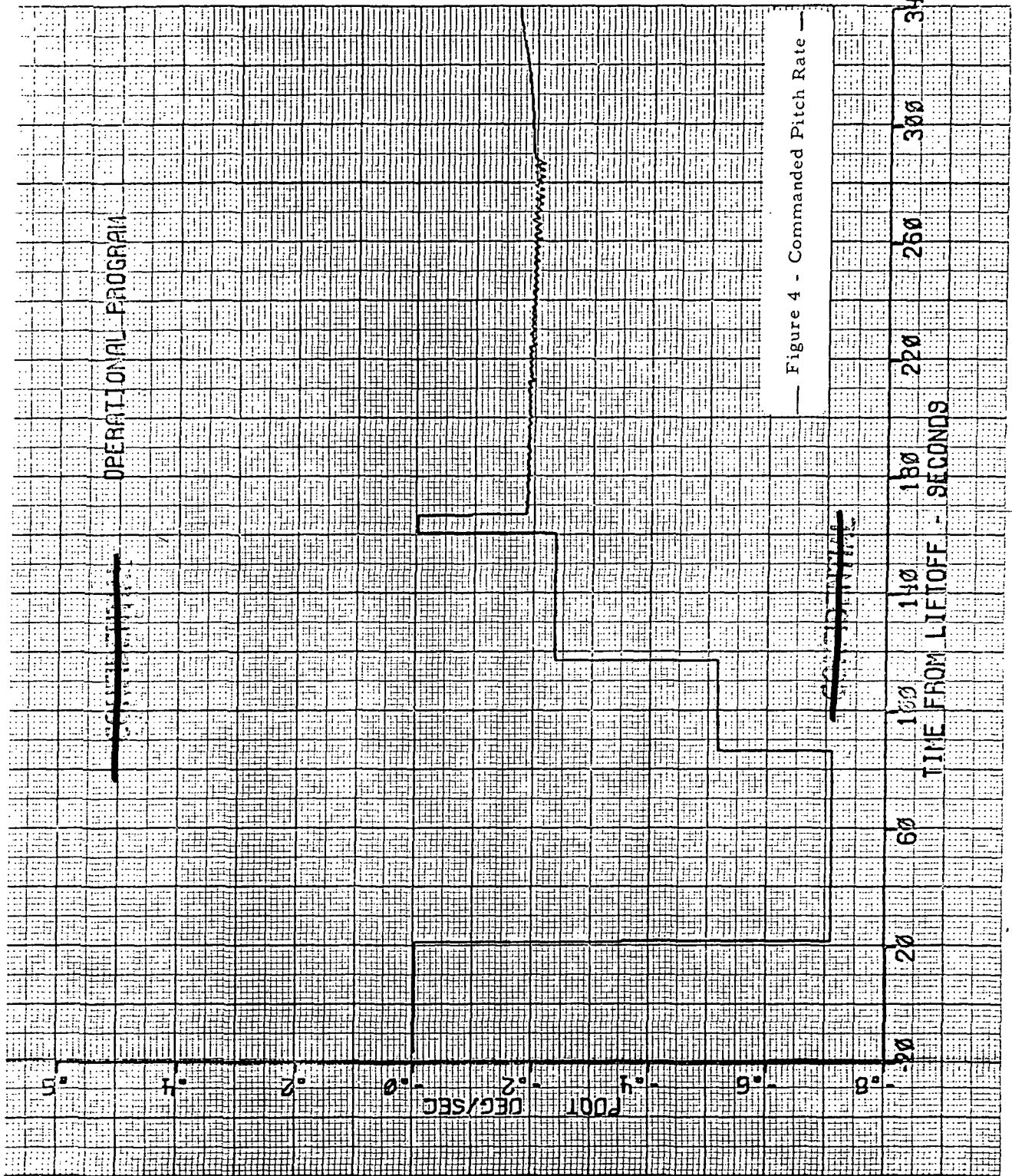
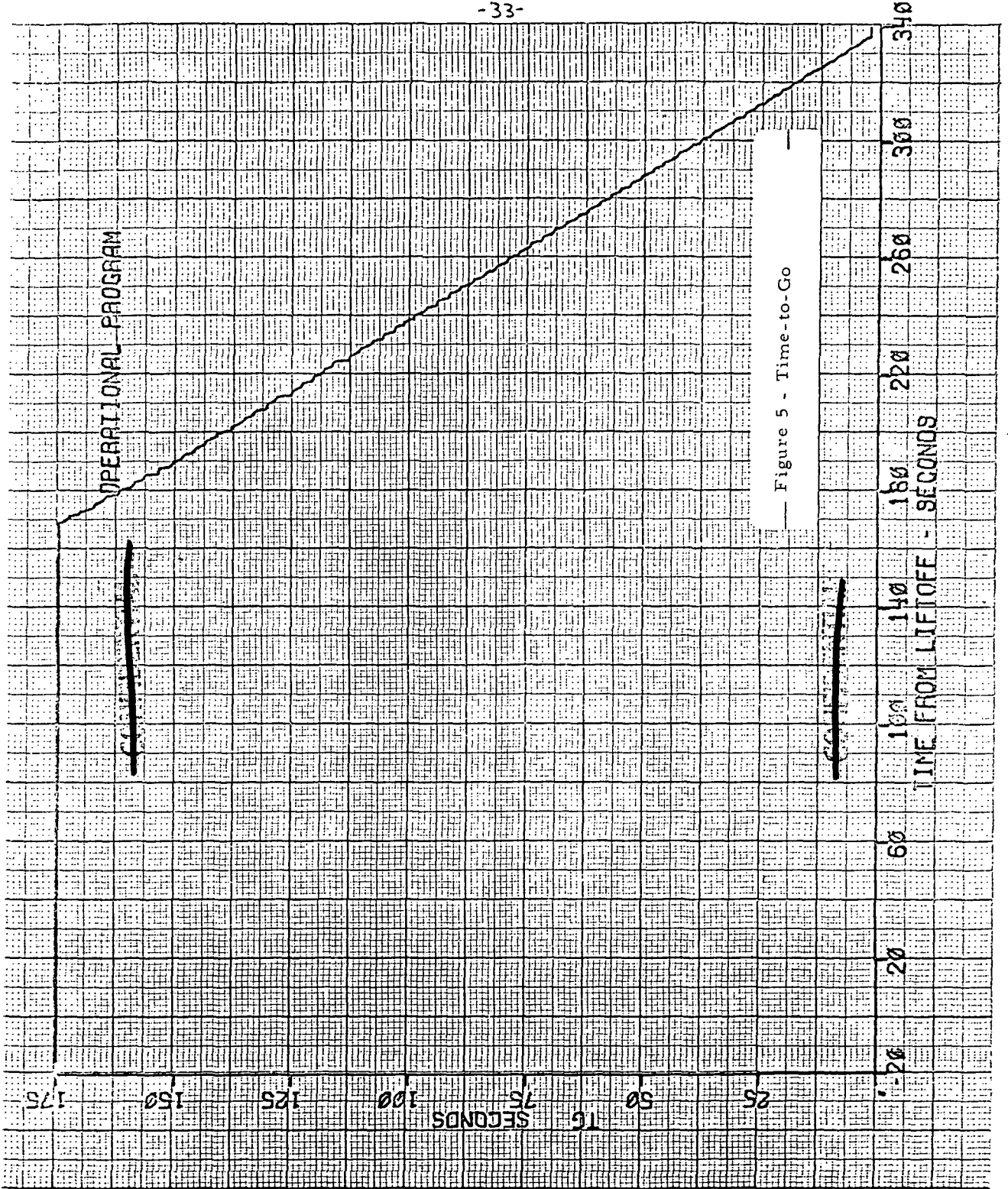


Figure 2 - Yaw Command







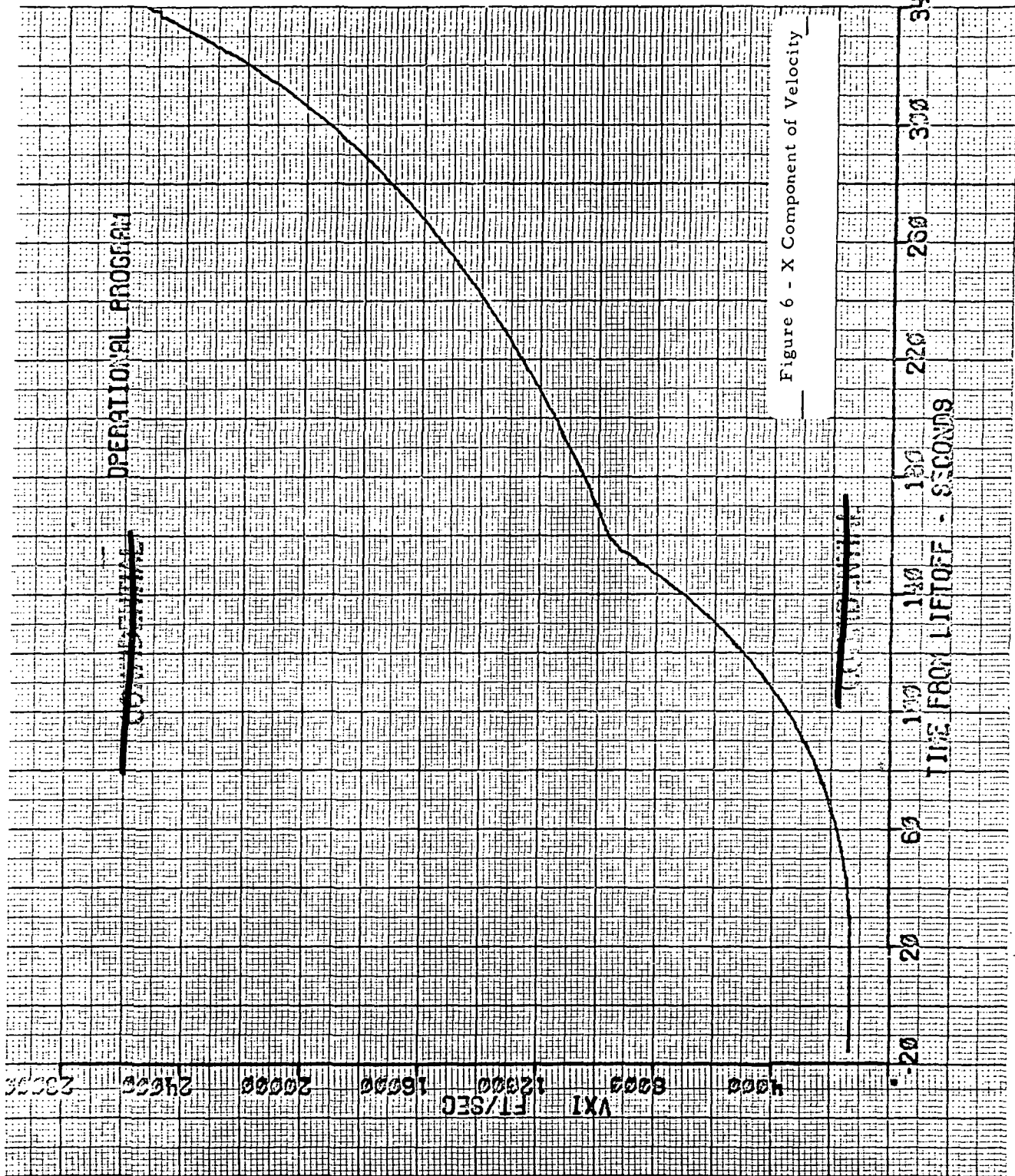


Figure 6 - X Component of Velocity

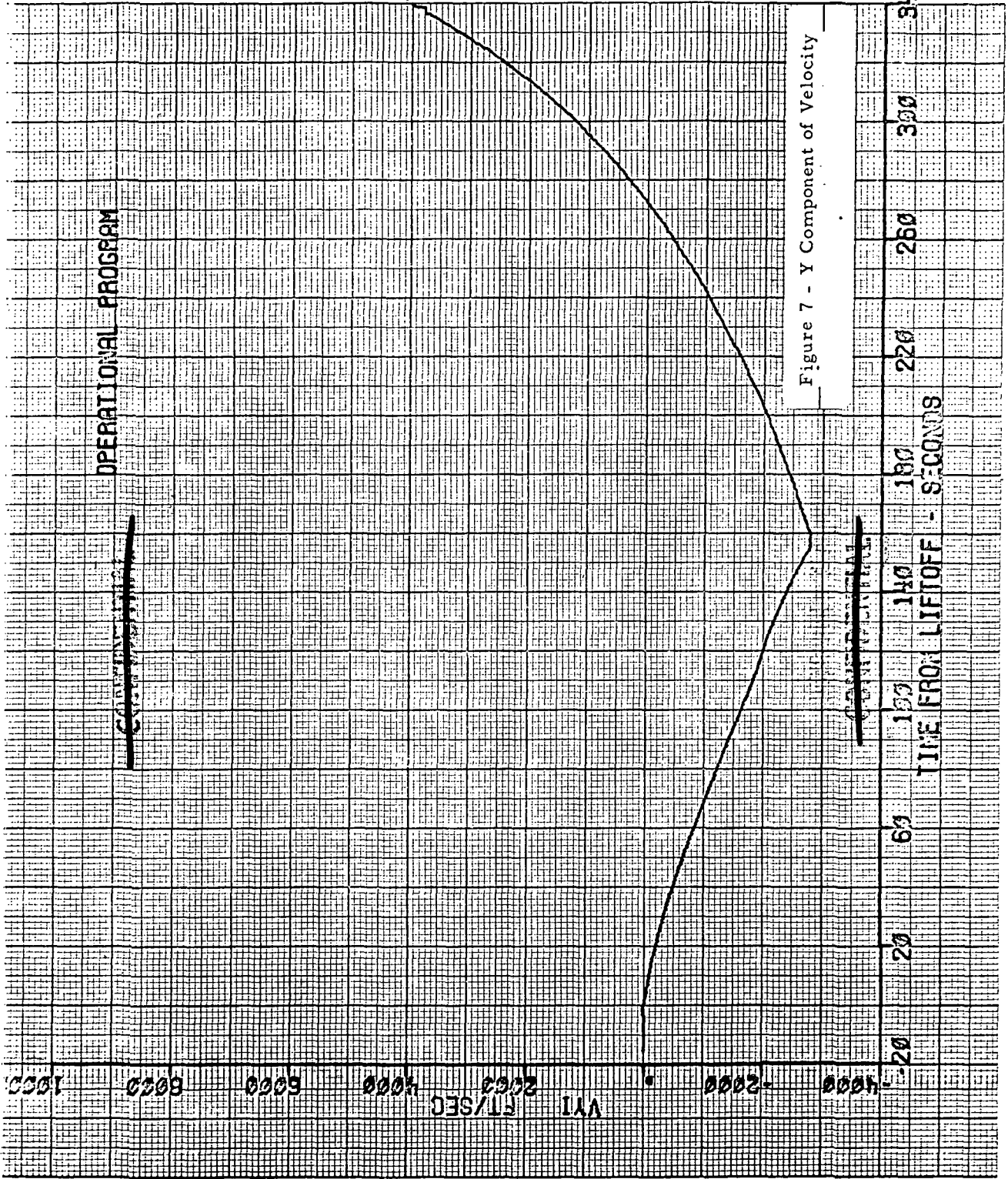


Figure 7 - Y Component of Velocity

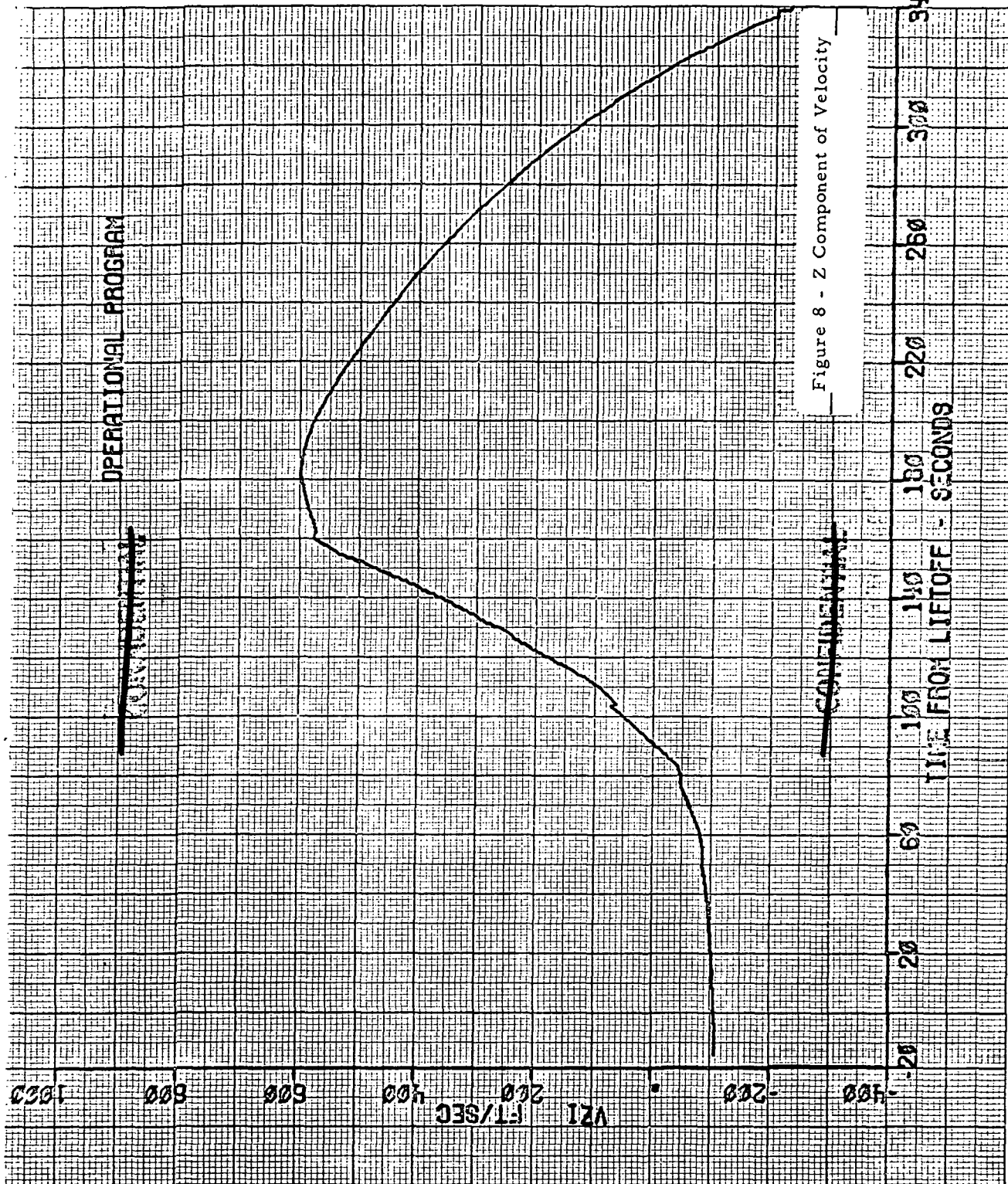


Figure 8 - Z Component of Velocity

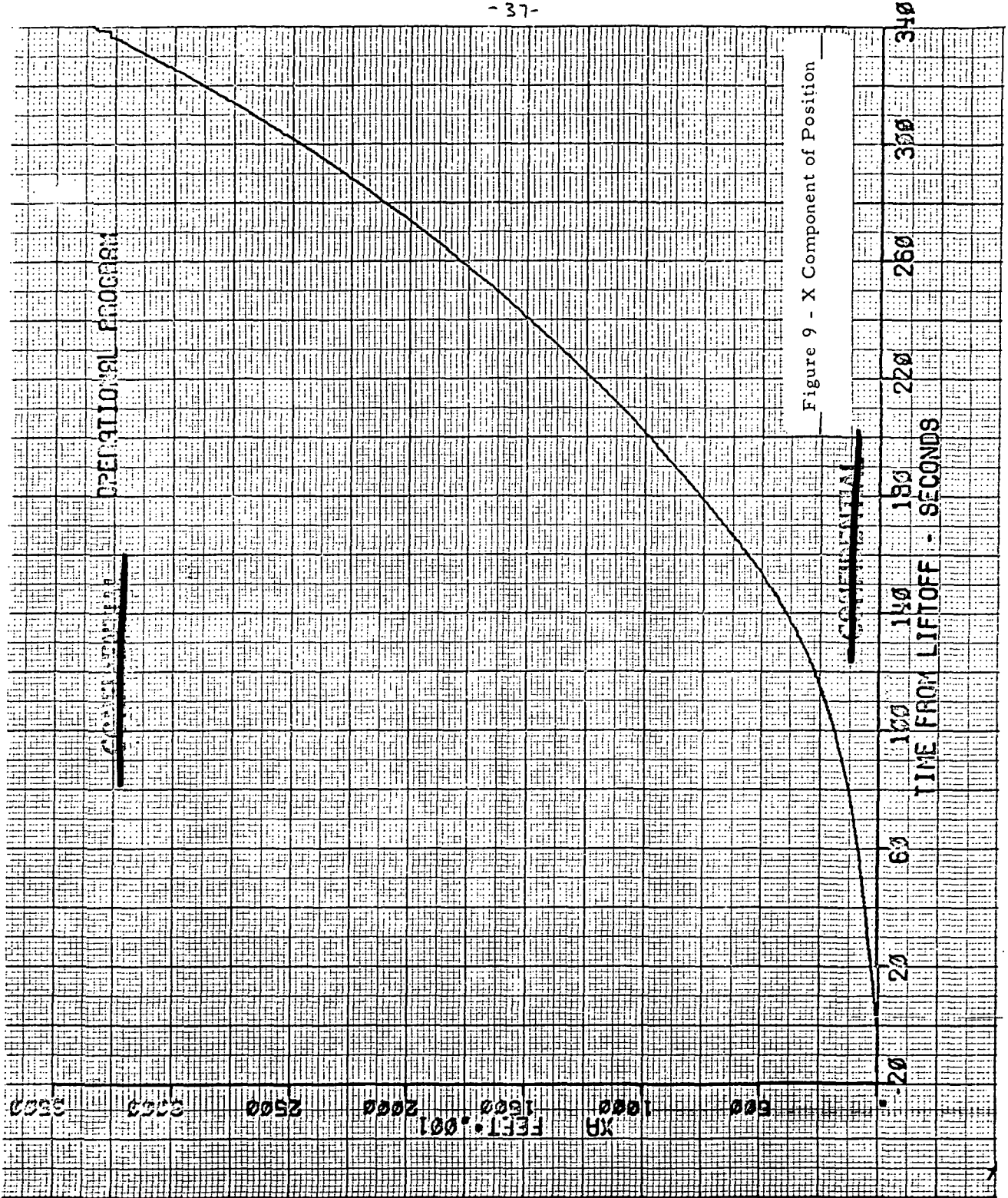


Figure 9 - X Component of Position

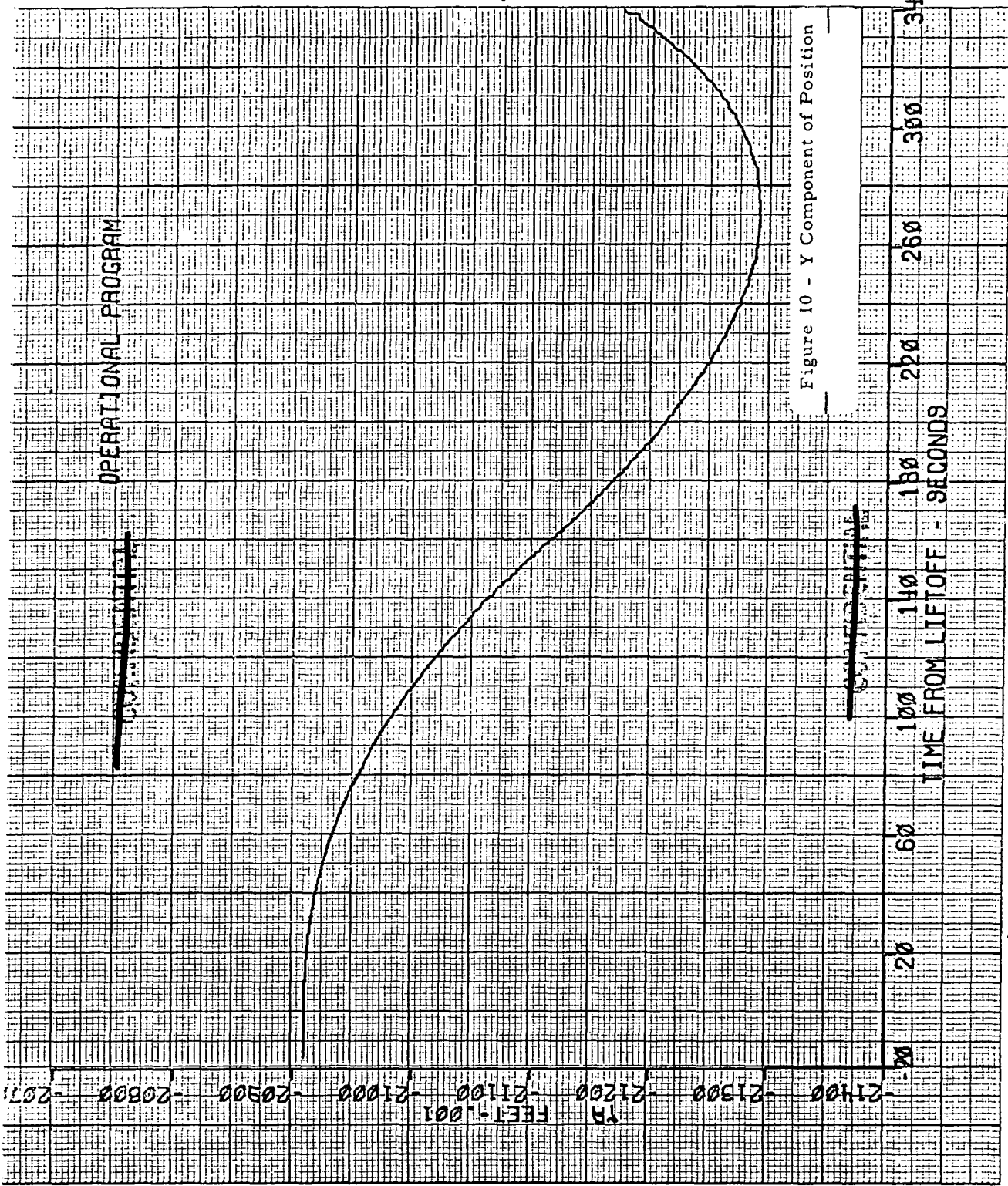


Figure 10 - Y Component of Position

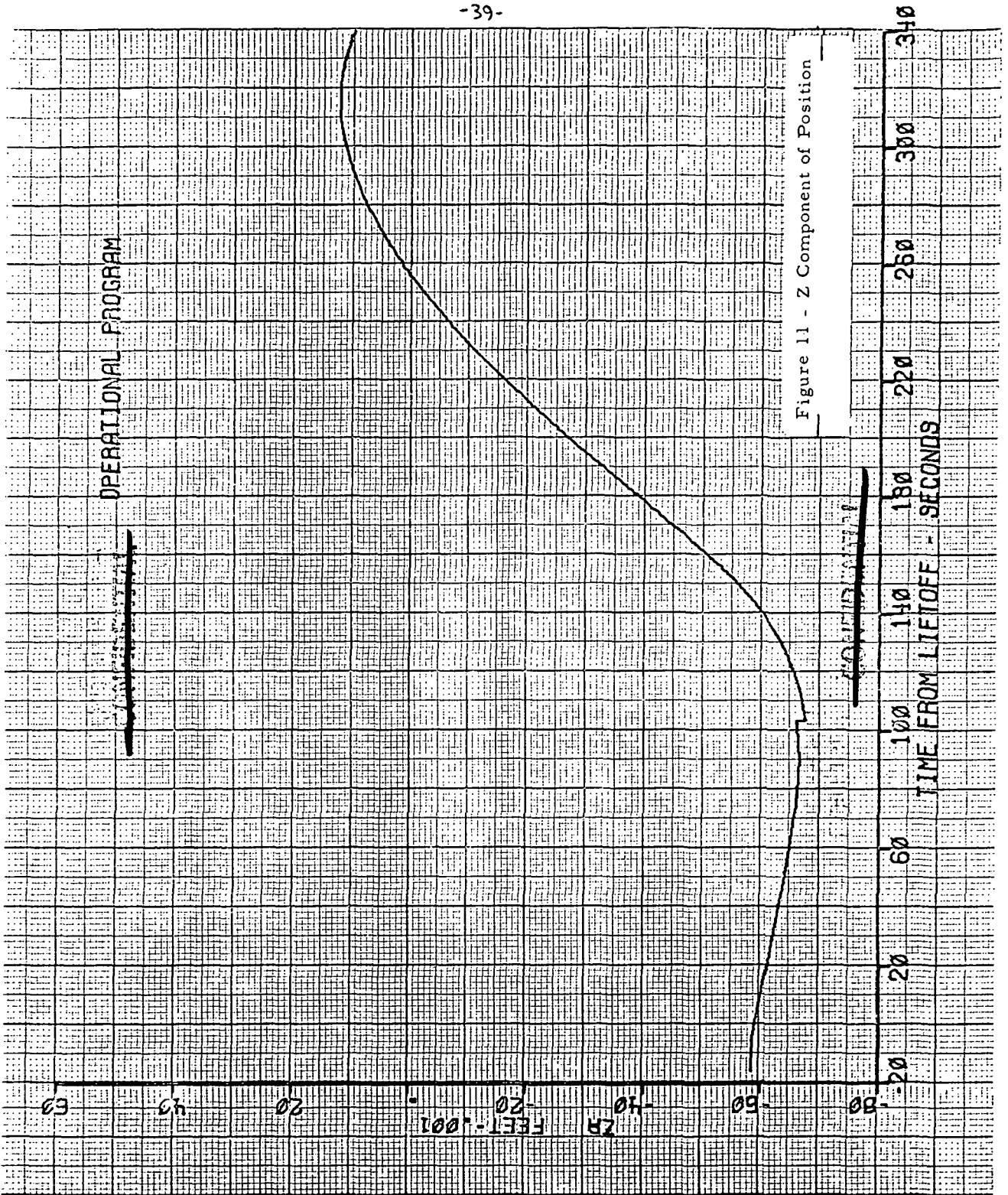


Figure 11 - Z Component of Position

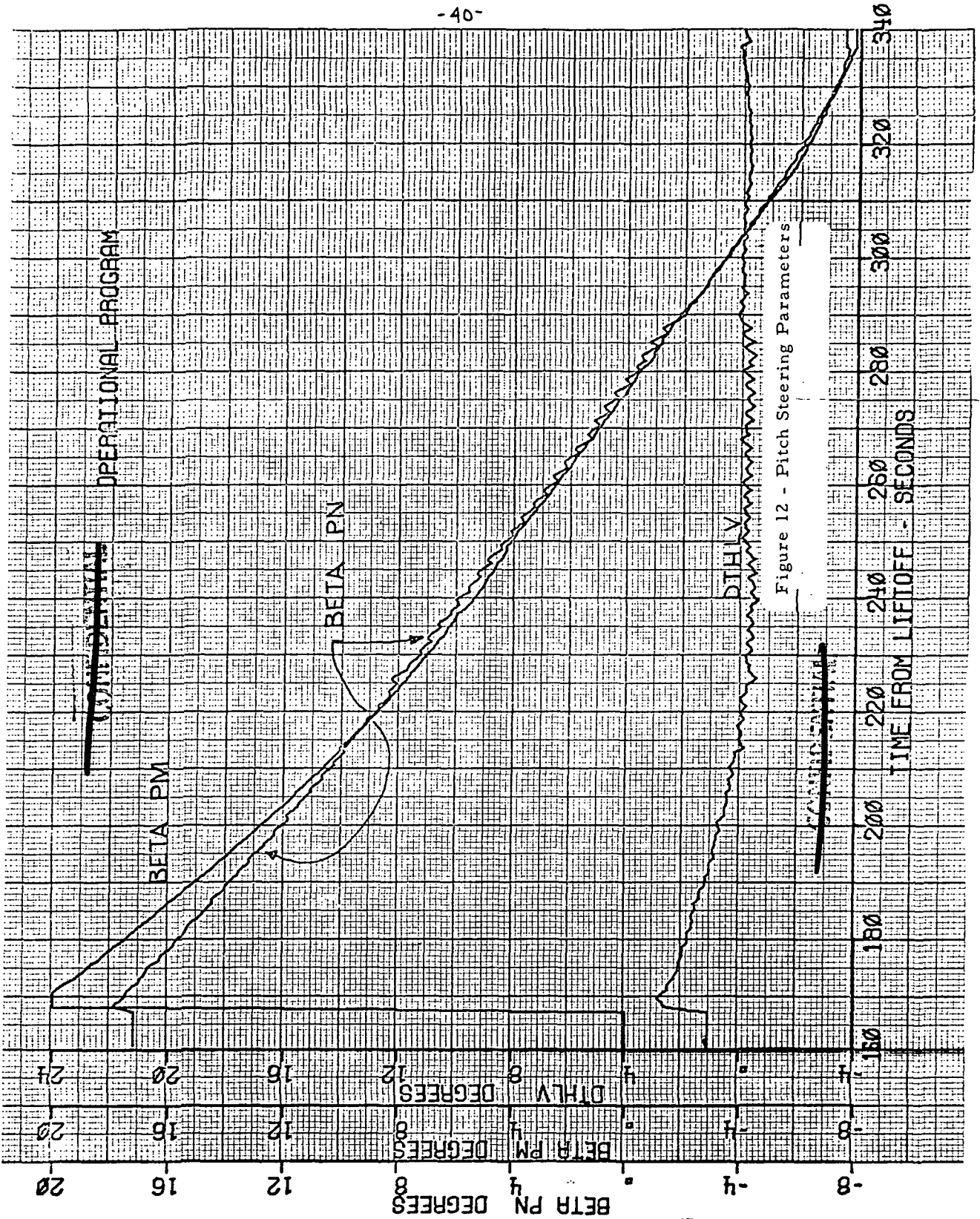


Figure 12 - Pitch Steering Parameters

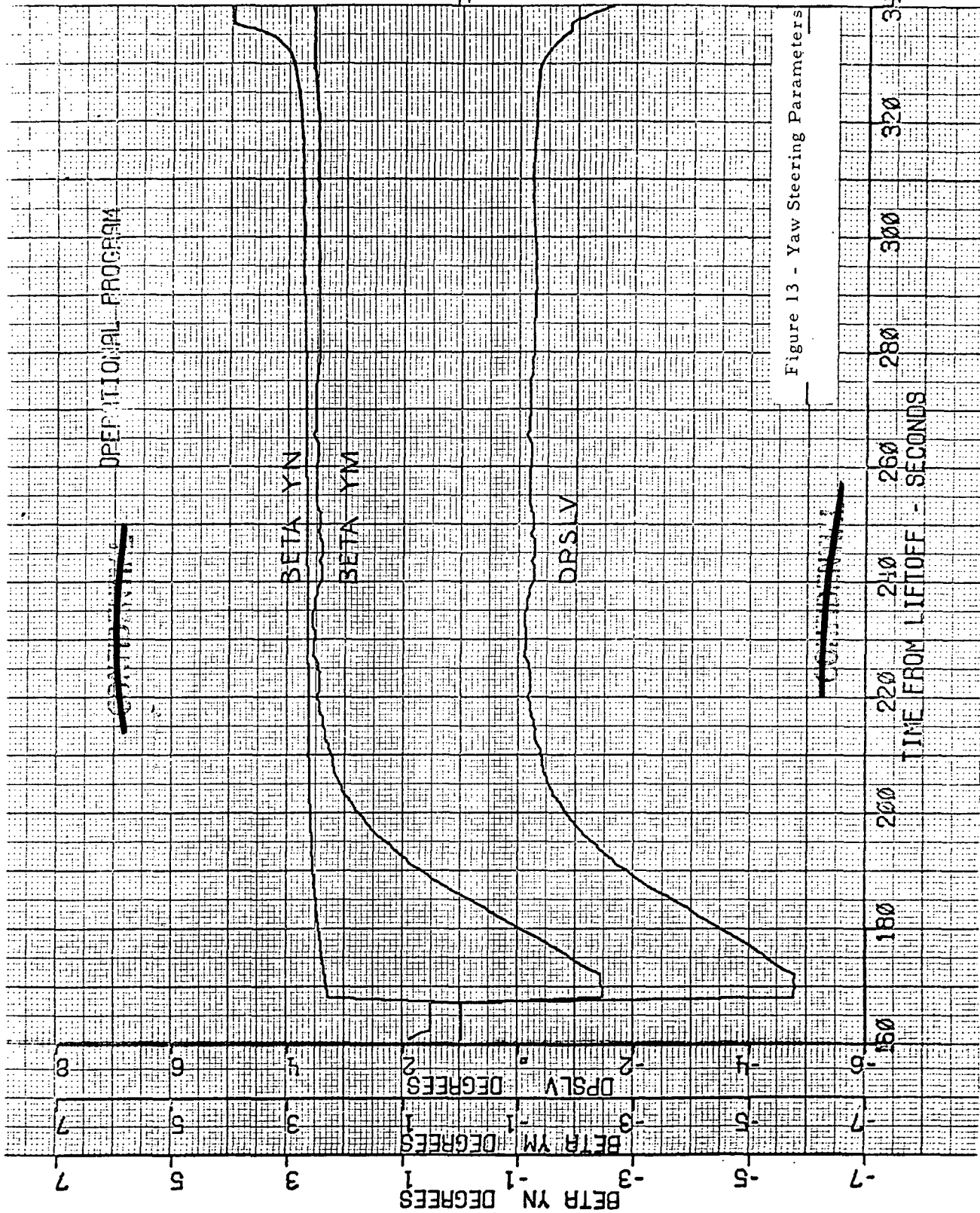


Figure 13 - Yaw Steering Parameters

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REFERENCES

1. Gemini GT-3 Ascent Post Flight Analysis Report, dated 9 April 1965, IBM CD No. 3-260-6096 (Confidential).
2. Gemini GT-4 Ascent Post Flight Analysis Report, dated 1 July 1965, IBM CD No. 3-260-6118 (Confidential).
3. Ascent Operational Program Math Flow 3 Mod II MVS Analysis, dated 25 May 1965, IBM No. 65-554-0042.

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952-8497-2

GEMINI GT-6
RENDEZVOUS
AND CATCH-UP
POST FLIGHT REPORT

IBM NO 66-554-0042

ORIGINATING GROUP Gemini Systems Engineering

CONTENT APPROVED BY

A. J. Spinning

CONTRACT NO NASA 9-4792

DATE 23 March 1966

Prepared by: L. M. Masiowski
E. H. Mertz

IBM FEDERAL SYSTEMS DIVISION
ELECTRONICS SYSTEMS CENTER
OWEGO NEW YORK

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INTRODUCTION

For the purpose of the final report on the operation of the IBM Gemini Computer #16 aboard the Gemini 6 spacecraft during the Catch-Up and Rendezvous phases, emphasis will be placed upon:

- 1) The Rendezvous mode test between 12,235 and 13,274 seconds elapsed time.
- 2) The Catch-Up phase between 13,600 and 13,769 seconds.
- 3) The use of the Rendezvous mode prior to the closed loop transfer maneuver.
- 4) The closed loop Rendezvous phase between 17,702 and 20,641 seconds TPI at 19,139 seconds elapsed time.
- 5) The TPF phase between 20,900 and 21,250 seconds.

Interest in Phases I and III developed because of the concern about an apparent incorrect value of transfer angle to Rendezvous, W_T , in the computer during and following the mode test, the reason for it and its effect upon the results from the computer in determining the TPI maneuver. Analysis of these phases was performed using selected DAS data input to a static simulator program and a telephone conversation with the Gemini 6 pilot.

Phases II, IV and V were analyzed using the post flight program which utilizes all the pertinent data from the DAS tapes. Briefly, the technique employed is to pass the flight DAS values of the three platform gimbal angles, the radar data (range, sine azimuth angle, sine elevation angle), the platform velocity sums and time associated with each parameter to the Math Flow 6 Operational Program by means of the normal ADCR \longleftrightarrow Control Program \longleftrightarrow Operational Program communication link. In addition, the data decks are prepared such that the actual flight MDIU/DCS inserts are used. The generated IVI readings, based on these flight inputs, are then compared to the flight IVI values. For Rendezvous, the post flight reconstruction uses flight DAS data from and elapsed time of 17,701.97 seconds (time in mode of 3,803.46) to an elapsed time of 20,641.62 seconds (time in mode of 6,743.57). This is sufficient time to exercise the taking of radar points and the display and decrementing of the IVI readings prior to the primary burn, and to follow the IVI displays through that burn and through the first and second vernier burns. The Catch-Up reconstruction uses the data from an elapsed time of 13,600.9 seconds (time in mode of 1.903 seconds) to 13,768.8 seconds (time in mode of 169.83 seconds).

PHASES I AND III

The DAS data of the periods indicated was converted to the format required by an IBM Rendezvous mode test program used for static simulation in floating point arithmetic to establish what the onboard computer should have been displaying to the pilot. A gap in the DAS data on hand at the present time exists between 15,482 and 17,279 seconds elapsed time and no displays occurring in this interval can be checked against the flight log. Inputs to the static simulator were data points consisting of radar range (R_R), sine of radar elevation angle ($\sin a'$), sine of radar azimuth angle ($\sin r'$), platform pitch gimbal angle (θ_b), platform yaw gimbal angle (Ψ_b), platform roll gimbal angle (ϕ_b), and time of each data point.

Since a questionable value of W_T was in the computer during the mode test prior to the coelliptic maneuver, three static simulation runs were made; the first used $W_T = 180^\circ$, the second used $W_T = 270^\circ$ and the third used $W_T = 130^\circ$. The results of the IVI readings from the simulation runs and the DAS data are tabulated in Table I.

TABLE I

COMPARISON OF IVI READINGS FROM MODE TEST PERIOD

<u>Time* (sec)</u> <u>in Mode</u>	<u>ΔV_T (fps)</u> <u>$W_T = 180^\circ$</u>	<u>ΔV_T (fps)</u> <u>$W_T = 270^\circ$</u>	<u>ΔV_T (fps)</u> <u>$W_T = 130^\circ$</u>	<u>ΔV_T (fps)</u> <u>DAS</u>
720	999	274	995	272
820	999	248	944	253
920	999	303	999	308
1020	999	301	966	308

*NOTE: Time in mode re-initialized to zero at 12,235 seconds.

It is concluded that the value of W_T in the computer during the interval of 12,235 to 13,274 seconds elapsed time was 270° . This agrees with the pilot's comment that W_T was not entered during the mode test. The initial value table for the Rendezvous mode sets the value of W_T to 270° . No inflight values of ΔV_T could be recalled by the pilot for this mode test interval.

PHASES I AND III (continued)

An insert of $W_T = 130^\circ$ was then made in accordance with the flight plan before proceeding with the mission. Three points recalled by the pilot from inflight MDIU readouts were:

<u>Radar Range (n. m.)</u>	<u>ΔV_T (fps)</u>	<u>ΔV_i (fps)</u>
117.89	544	--
61.	181	74.8
46.	96	34.

One static simulation run using $W_T = 130^\circ$ was made for the interval from 13,900 to 19,139 seconds elapsed time. Time in mode is again re-initialized to zero at 13,900 seconds. The time history of radar range, IVI readings and ΔV_i are tabulated in Table II.

TABLE II

<u>Time (sec) in Mode</u>	<u>Radar Range (n. m.)</u>	<u>ΔV_T (fps) Simulated</u>	<u>ΔV_i (fps) Simulated</u>	<u>ΔV_T (fps) DAS</u>
720	146.76	711	342.1	712
820	144.17	709	344.6	701
920	141.59	675	322.7	672
1020	139.01	657	313.3	652
1120	136.39	642	305.6	644
1220	133.82	621	294.0	622
1320	131.23	628	303.1	614
1420	128.59	593	280.4	591
1520	126.02	582	276.7	581

1620 to 3720 = No DAS data available

3820	66.33	213	90.6	214
3920	63.75	200	84.7	199
4020	61.19	181	73.3	181
4120	58.63	166	67.5	169
4220	56.09	151	59.6	151
4320	53.55	139	54.8	136
4420	51.01	115	41.3	124
4520	48.58	112	42.3	109
4620	46.00	96	34.3	96
4720	43.52	87	31.5	85
4820	41.06	78	29.1	77
4920	38.62	72	27.9	72
5020	36.20	70	32.4	69

PHASES I AND III (continued)

The only other source of a value of 180° for W_T at 13,900 seconds elapsed time would be a memory modification or program problem. A dump of the computer memory gave no clue to the source of $W_T = 180^\circ$. However, a review of the program listing revealed that W_T is synonymous with an Ascent quantity N24 and a Re-entry quantity CKN5. Although this can cause no operational problem, it is possible that readouts of MDIU Address 83 in the Prelaunch or Re-entry modes could display an erroneous value of W_T . It is unlikely that the readout would be exactly 180°.00. The DAS data indicates that the computer mode switch was turned from the Catch-Up mode directly to the Rendezvous mode. Both modes initialize W_T to 270°.

PHASE II

Catch-Up - During this reconstruction, post flight IVI readings of 41., -1., 1. were obtained and compared with the flight DAS values of 42., -1., 1. The post flight IVI's counted down to zero as the DAS velocity sums were recognized and used by the Operational Program logic. For this simulation START COMP was depressed at a mode time of 22 seconds which corresponds to an elapsed time of 13,621 seconds.

PHASE IV

Rendezvous - The following table presents the comparison between the reconstruction and the flight DAS IVI readings. Some overlap exists with Table II.

TABLE III

Nominal Time in Mode (seconds)	Post Flight IVI (fps)			Flight DAS IVI (fps)			Note
	<u>X</u>	<u>Y</u>	<u>Z</u>	<u>X</u>	<u>Y</u>	<u>Z</u>	
4510	111.	-0.	0.	109.	0.	0.	
4610	97.	0.	0.	96.	0.	0.	
4710	84.	0.	0.	85.	0.	0.	
4810	76.	0.	0.	77.	0.	0.	
4910	73.	0.	0.	72.	0.	0.	
5010	68.	0.	0.	69.	0.	0.	
5022	30.	2.	-6.	31.	1.	-7.	i
5980	7.	-4.	-8.	7.	-5.	-7.	ii
6700	4.	5.	-2.	4.	6.	-2.	iii

NOTE: i - START COMP button was depressed at 18,921 seconds elapsed time.

SECRET

PHASE IV (continued)

- ii - For this first vernier display the data for the first two radar points were missing from the DAS flight record and were ignored in the reconstruction.
- iii - All the radar points were available for the second vernier IVI display.

It is also noted that the post flight IVI's did count down to within one foot per second of the flight values during the three burns.

PHASE V

The relative trajectory history of the closing moments of the Rendezvous maneuver, taken from flight DAS data, is presented in Figures 1, 2 and 3. The first figure indicates the radar range (GT-6 to GT-7) and GT-6 pitch angle variation with time as GT-6 closed on GT-7. At the termination of the data, GT-6 was directly below GT-7 at approximately 150 feet separation. Figure 2 indicates that the closure velocity was approximately 41 fps prior to the braking thrust and ended at 6 fps with 1000 feet separation, following 80 seconds of thrust management. Both Figures 2 and 3 show that 1500 feet of relative range was used in reducing the closure velocity by this 35 fps.

CONCLUSIONS

There is no evidence in the DAS data that $W_T = 180^\circ$ was in the computer at any time. If it had been there after 13,243 seconds (the time of the last ΔV_T display in the mode test) but corrected to 130° prior to 14,600 seconds (the time of the first ΔV_T display in the closed loop phase of the mission) it would not appear in the DAS data. The only evidence that it did exist was the inflight readout check of MDIU Address 83 just after 13,900 seconds.

Since there was a necessity to occasionally interpolate DAS gimbal angle data to determine the values used in the computation of the ΔV displays and also no lateness of radar data was considered, it is not unusual that the simulated reconstruction of the IVI and ΔV_i reading were not in exact agreement with the DAS data. The differences are considered negligible but could probably be reduced with considerable effort by performing an exercise in precisely defining the gimbal angle and lateness data inputs to the computer.

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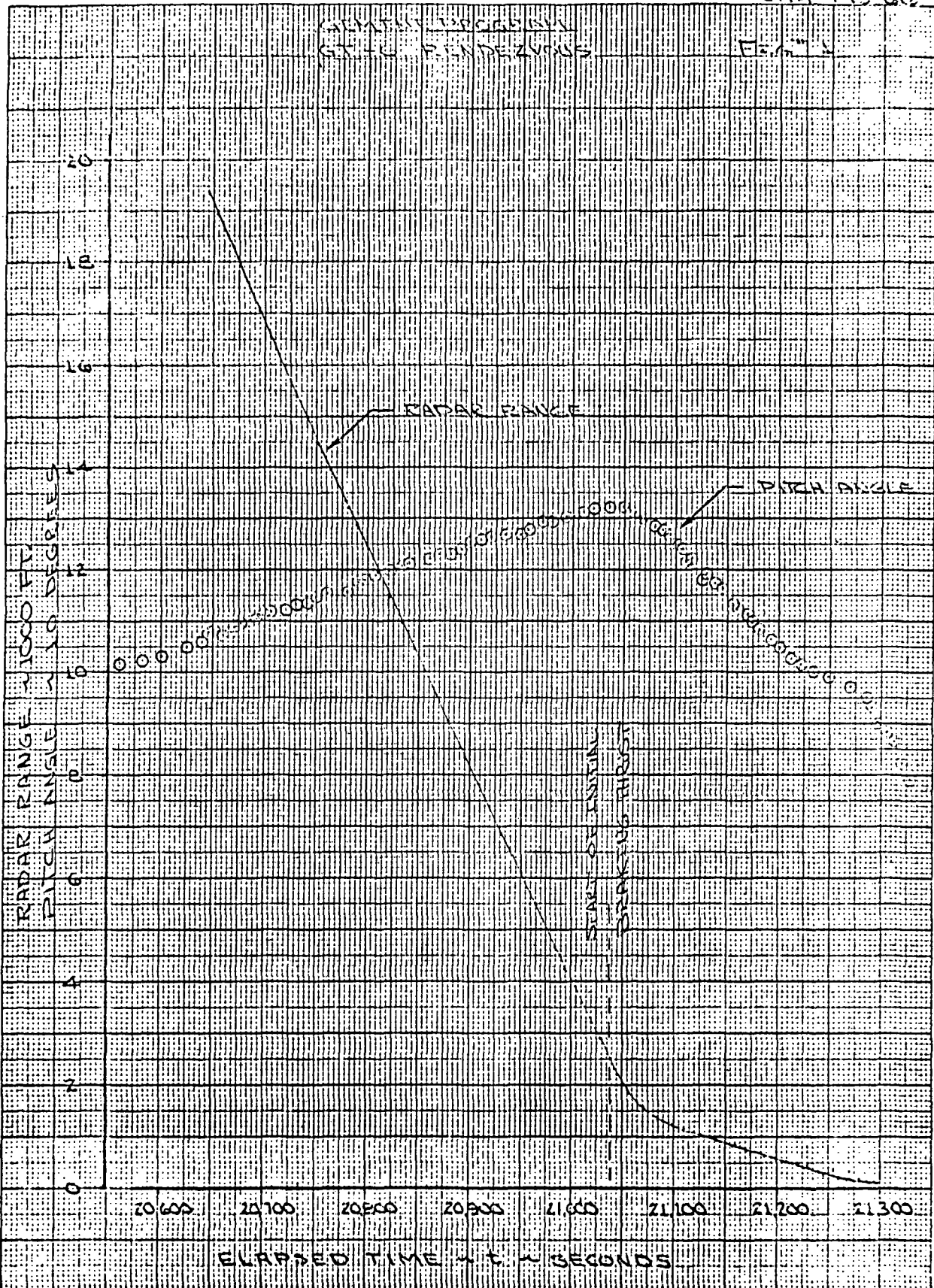
LMH 1-13-64

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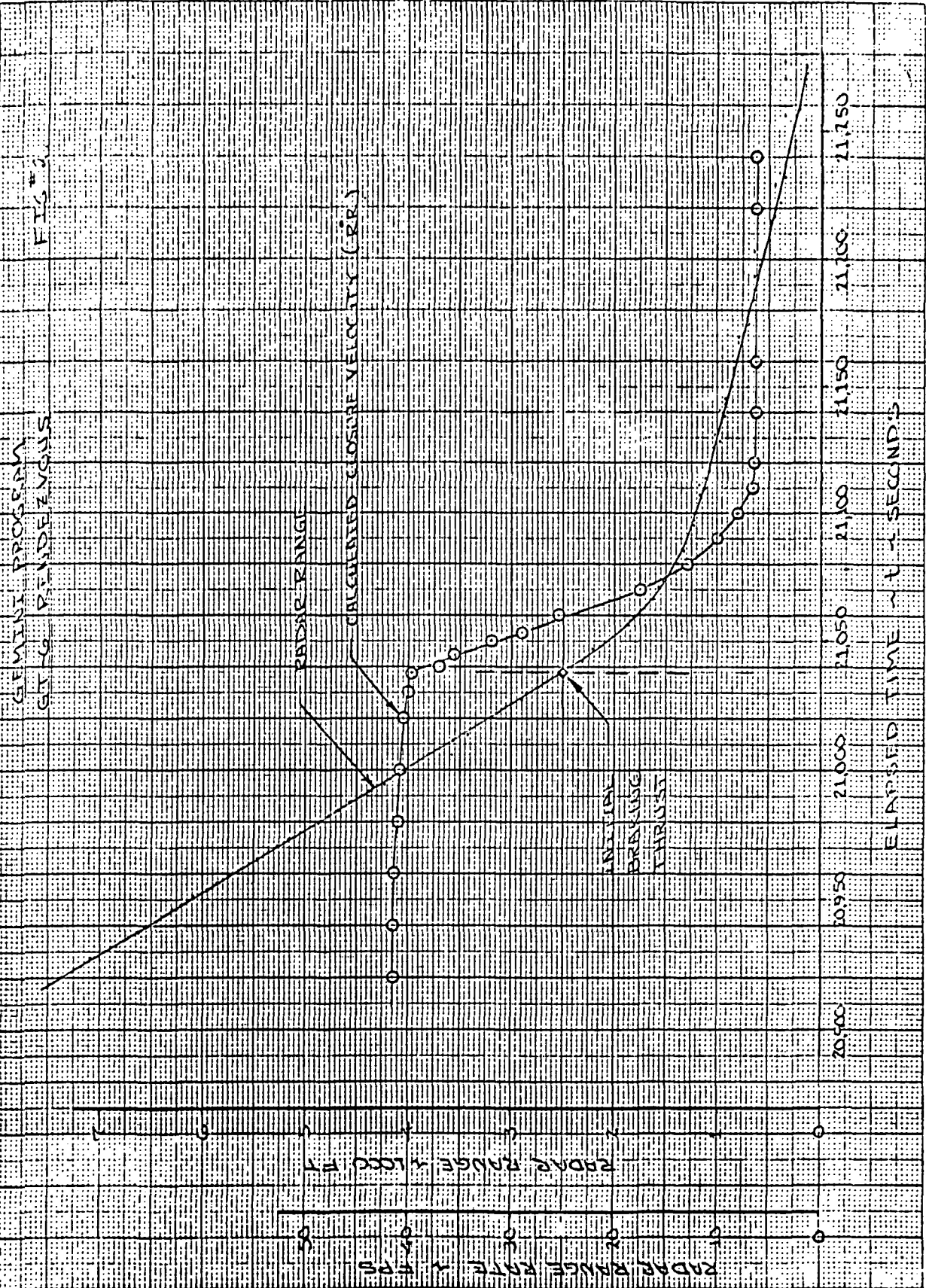


FIG. 2

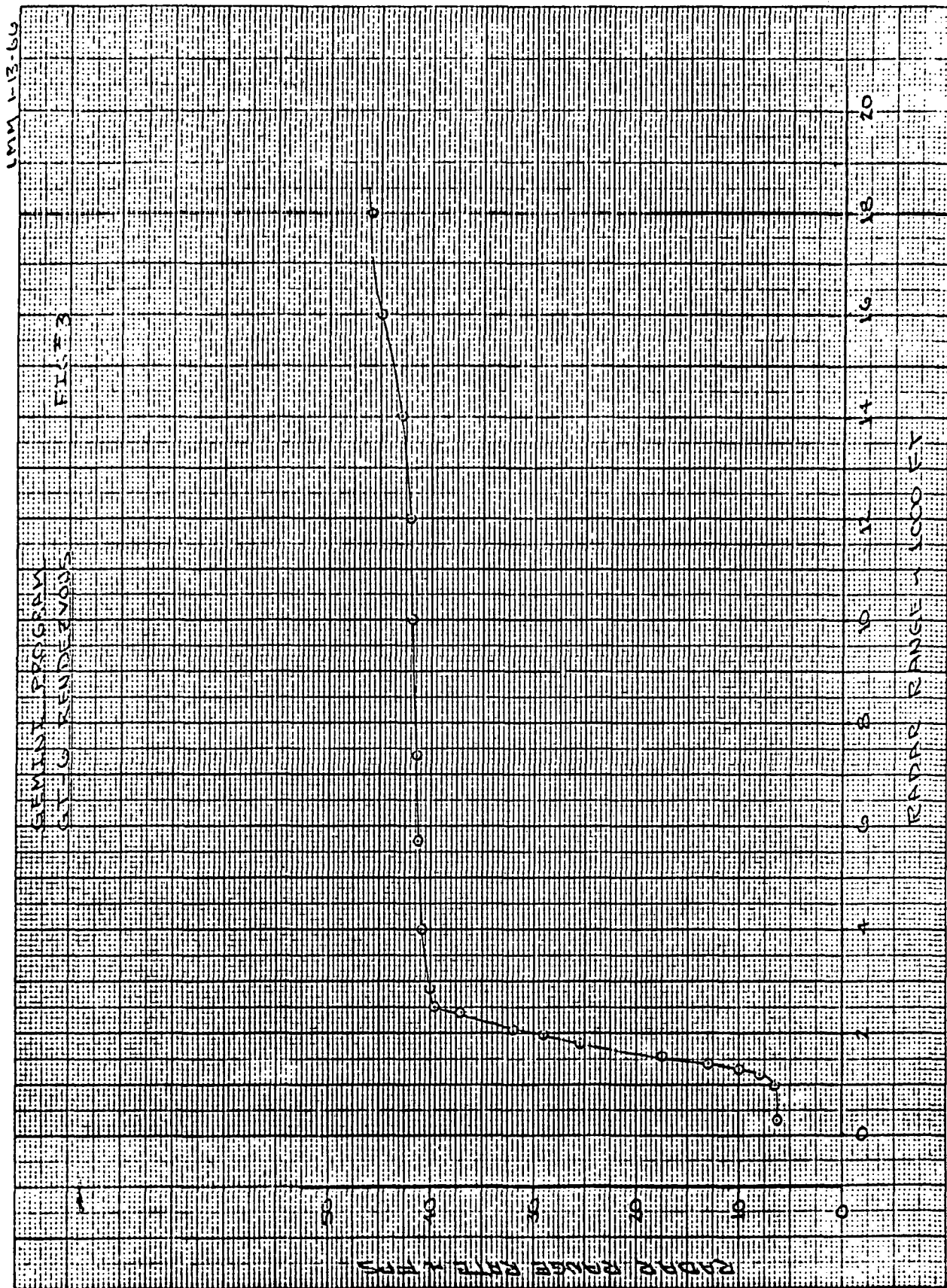
GEMINI PROGRAM
ST-6 READELENGUS

RADAR RANGE RATE (FPS)

RADAR RANGE (MILES)

ELAPSED TIME - SECONDS

CLASSIFIED



CONCLUSIONS (continued)

The nearly identical (Post Flight vs. Flight) IVI displays resulting when flight DAS parameters are used to drive a ground-based Operational Program indicates that the flight computer behaved in a normal fashion and exhibited no anomalies during the exercise of the Catch-Up and Rendezvous logic.

Extrapolation of the range vs. time curve of Figure 1 to the nominal time of intercept indicates that the point of closest approach without the TPF maneuver would probably have been within 300 feet. This is further indicated by the linearity of the same curve up to the time that the TPF maneuver was initiated.

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952-5497-2

GT-7/6
RE-ENTRY
MISSION
RECONSTRUCTION
REPORT

IBM NO 66-554-0040

ORIGINATING GROUP Gemini Systems Engineering

CONTENT APPROVED BY
A. J. Manning

CONTRACT NO NAS9-4792

DATE 15 March 1966

Prepared by: J. B. MacPherson

IBM FEDERAL SYSTEMS DIVISION
ELECTRONICS SYSTEMS CENTER
OWEGO NEW YORK

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INTRODUCTION

This report presents the results of a partial reconstruction of the Gemini 7/6 flights. The failure of the on-board recorders made it impossible to do a complete reconstruction, and for this reason the data reflects only those times that ground receiving stations obtained data; namely from just beyond the end of retro to just under 400,000 ft.

An attempt was also made to reconstruct the data for Spacecraft 7 from the end of blackout to the termination of closed loop guidance. The results did not agree with the telemetry data as well as they should, however, for two reasons: (1) apparent failure to initialize all the program variables necessary to allow starting the operational program off in the middle of the closed-loop guidance logic, and (2) difficulty in synchronizing the computer clock, the computer cycle time Δt , and the accelerometer pulse sums to avoid large velocity errors due to a small time bias encountered during the high acceleration phase of re-entry. These difficulties could have been overcome, but it was felt that the time and expense involved could not be justified.

SUMMARY OF RESULTS

Tables I and II show the comparison of reconstructed (R/C) and telemetry (T/M) data for Spacecrafts 6 and 7, respectively. It is believed that the differences can be explained by an uncertainty in the initial conditions used to start the reconstructions; see Section III for a discussion of the problem.

SECRET

TABLE I (S/C 6) ($T_E = 92170.375$ sec)

	<u>r_s</u>	<u>V_E</u>	<u>γ</u>	<u>θ</u>	<u>θ_E</u>	<u>ψ_E</u>
T/M	21307736 ft	24389.179 fps	-1.422°	28.822°	260.481°	92.242°
R/C	21307952 ft	24388.816 fps	-1.421°	28.822°	260.479°	92.241°

TABLE II (S/C 7) ($T_E = 1,188,595.2$ sec.)

	<u>r_s</u>	<u>V_E</u>	<u>γ</u>	<u>θ</u>	<u>θ_E</u>	<u>ψ_E</u>
T/M	21302140 ft	24407.125 fps	-1.392°	28.846°	256.804°	88.023°
R/C	21302096 ft	24407.162 fps	-1.392°	28.846°	256.805°	88.023°

Tables III and IV contain the tabulated results for each computer cycle for the entire reconstruction. In both cases the data begins just beyond the end of retro-fire and terminates below an altitude of 400,000 feet.

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DISCUSSION

The Gemini operational program simulation was initialized to begin integration during the vacuum phase as follows. The GT-5 reconstruction program was run in conjunction with Math Flow 6 Revision D to a point just beyond the end of retro-fire. This procedure assured proper setting of logical choices and initialization of variables to allow re-starting the simulation in the vacuum logic. The actual flight initial conditions were then loaded, and the required integration variables were initialized to a set of values calculated from the earliest available telemetry frame. The transformation is as follows:

$$X_E = r_s \cos \theta \cos \phi$$

$$Y_E = r_s \cos \theta \sin \phi$$

$$Z_E = r_s \sin \theta$$

$$\begin{aligned} \dot{X}_E = & -W_E Y_E + V_E (\sin \gamma \cos \theta \cos \phi - \cos \gamma \sin \psi_E \sin \theta \\ & - \cos \gamma \cos \psi_E \cos \theta \sin \phi) \end{aligned}$$

$$\begin{aligned} \dot{Y}_E = & W_E Y_E + V_E (\sin \gamma \sin \theta \cos \phi + \cos \gamma \sin \psi_E \cos \theta \\ & - \cos \gamma \cos \psi_E \sin \theta \sin \phi) \end{aligned}$$

$$\dot{Z}_E = V_E (\sin \gamma \sin \theta + \cos \gamma \cos \psi_E \cos \theta)$$

where:

$$\theta = \theta_E - \Delta \theta_R + W_E T_T$$

is the inertial longitude of the spacecraft at integration time T_T .

The only significant error source in the reconstruction is the uncertainty in the value of T_T associated with the telemetry frame used for program initialization. This error is in turn due to the uncertainty in T_T at the end of retro-fire. T_T can be anywhere from 60.0 sec to about 60.6 sec at this point. Thus throughout the vacuum phase, T_T will be some multiple of 16 seconds more than this uncertain value at the end of retro-fire. The exact number of 16 second steps can be found from the difference between the TRS time T_E which tags the first telemetry frame and the elapsed time from lift-off at which retro-fire occurred. Furthermore, good estimates of T_T at the end of retro-fire were obtained by trial and error to bring the errors at 400,000 ft to an acceptable level.

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For GT-6, the first available telemetry record was at time 91133.86 sec, which corresponds to an integration time from retro of $T_T = 172.25$ sec, approximately. The navigation parameters for that frame were:

$$\begin{aligned}r_s &= 21\,827\,787 \text{ ft} \\V_E &= 23\,756.097 \text{ fps} \\\gamma &= -0.643^\circ \\\theta &= 11.189^\circ \\\theta_E &= 191.531^\circ \\\psi_E &= 61.452^\circ\end{aligned}$$

For GT-7 the first available telemetry record was at time 1,187,541.9 sec which corresponds to an integration time from retro of $T_T = 236.25$ sec, approximately. The navigation parameters for that frame were:

$$\begin{aligned}r_s &= 21\,831\,592 \text{ ft} \\V_E &= 23\,763.843 \text{ fps} \\\gamma &= -.067^\circ \\\theta &= 7.331^\circ \\\theta_E &= 188.663^\circ \\\psi_E &= 60.138^\circ\end{aligned}$$

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CONCLUSIONS

The reconstructions show that no anomalies occurred in the GT-6 and GT-7 flight computers during the vacuum phase of the re-entry mission. Furthermore, although the results obtained for the attempted reconstruction following blackout were not of the degree of accuracy required to demonstrate proper performance, it is believed that the large errors encountered can be attributed to simulation difficulties.

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TDAS (SEC)	TT (SEC)	RS (K- FEET)	PHI (DEG)	THETA E (DEG)	VE (FPS)	GAMMA (DEG)	PSIE (DEG)
1688.101	188.250	21823.430	11.664	192.426	23761.180	-0.667	61.658
1704.101	204.250	21818.916	12.137	193.325	23766.461	-0.691	61.873
1720.101	220.250	21814.256	12.606	194.228	23771.934	-0.715	62.097
1736.101	236.250	21809.430	13.071	195.134	23777.586	-0.739	62.331
1752.101	252.250	21804.454	13.534	196.045	23783.437	-0.762	62.573
1768.101	268.250	21799.306	13.993	196.960	23789.471	-0.785	62.825
1784.101	284.250	21794.020	14.447	197.879	23795.684	-0.808	63.086
1800.101	300.250	21788.584	14.899	198.803	23802.082	-0.830	63.357
1816.101	316.250	21782.988	15.345	199.732	23808.664	-0.852	63.637
1832.101	332.250	21777.248	15.788	200.665	23815.424	-0.874	63.926
1848.101	348.250	21771.366	16.227	201.603	23822.359	-0.895	64.224
1864.101	364.250	21765.332	16.660	202.546	23829.469	-0.917	64.532
1880.101	380.250	21759.168	17.090	203.494	23836.754	-0.937	64.849
1896.101	396.250	21752.862	17.514	204.448	23844.211	-0.958	65.175
1912.101	412.250	21746.408	17.933	205.407	23851.842	-0.978	65.510
1928.101	428.250	21739.834	18.347	206.371	23859.643	-0.998	65.855
1944.101	444.250	21733.116	18.756	207.341	23867.598	-1.017	66.210
1960.101	460.250	21726.266	19.159	208.317	23875.717	-1.036	66.573
1976.101	476.250	21719.296	19.557	209.298	23883.998	-1.055	66.946
1992.101	492.250	21712.198	19.949	210.285	23892.441	-1.074	67.328
2008.101	508.250	21704.972	20.335	211.278	23901.049	-1.092	67.719
2024.101	524.250	21697.628	20.714	212.277	23909.799	-1.109	68.120
2040.101	540.250	21690.164	21.087	213.282	23918.711	-1.126	68.529
2056.101	556.250	21682.586	21.454	214.293	23927.771	-1.143	68.948
2072.101	572.250	21674.896	21.814	215.311	23936.969	-1.159	69.376
2088.101	588.250	21667.090	22.167	216.334	23946.316	-1.175	69.812
2104.101	604.250	21659.180	22.513	217.364	23955.803	-1.191	70.258
2120.101	620.250	21651.162	22.852	218.400	23965.428	-1.206	70.713
2136.101	636.250	21643.040	23.183	219.442	23975.193	-1.220	71.176
2152.101	652.250	21634.820	23.507	220.491	23985.090	-1.235	71.648
2168.101	668.250	21626.504	23.823	221.546	23995.125	-1.248	72.129
2184.101	684.250	21618.092	24.131	222.607	24005.275	-1.262	72.618
2200.101	700.250	21609.590	24.431	223.674	24015.561	-1.275	73.116
2216.101	716.250	21601.004	24.723	224.748	24025.961	-1.287	73.621
2232.101	732.250	21592.322	25.006	225.827	24036.473	-1.299	74.135
2248.101	748.250	21583.562	25.280	226.913	24047.100	-1.310	74.657
2264.101	764.250	21574.728	25.546	228.005	24057.848	-1.321	75.187
2280.101	780.250	21565.822	25.803	229.104	24068.705	-1.332	75.724
2296.101	796.250	21556.832	26.050	230.208	24079.656	-1.342	76.269
2312.101	812.250	21547.780	26.289	231.317	24090.715	-1.351	76.821
2328.101	828.250	21538.662	26.518	232.433	24101.867	-1.360	77.380
2344.101	844.250	21529.472	26.737	233.554	24113.125	-1.369	77.947
2360.101	860.250	21520.224	26.946	234.681	24124.473	-1.377	78.519
2376.101	876.250	21510.926	27.146	235.813	24135.896	-1.384	79.099
2392.101	892.250	21501.572	27.335	236.950	24147.400	-1.391	79.684
2408.101	908.250	21492.170	27.514	238.093	24159.002	-1.398	80.276

TABLE III GT-6 RECONSTRUCTED DATA

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TDAS (SEC)	TT (SEC)	RS (K- FEET)	PHI (DEG)	THETA E (DEG)	VE (FPS)	GAMMA (DEG)	PSIE (DEG)
2424.101	924.250	21482.714	27.683	239.240	24170.672	-1.404	80.873
2440.101	940.250	21473.224	27.841	240.392	24182.402	-1.409	81.475
2456.101	956.250	21463.688	27.989	241.549	24194.219	-1.414	82.083
2472.101	972.250	21454.120	28.126	242.709	24206.094	-1.418	82.696
2488.101	988.250	21444.522	28.252	243.874	24218.006	-1.422	83.313
2504.101	1004.250	21434.886	28.367	245.043	24230.002	-1.426	83.934
2520.101	1020.250	21425.230	28.471	246.216	24242.043	-1.428	84.559
2536.101	1036.250	21415.552	28.564	247.392	24254.133	-1.431	85.188
2552.101	1052.250	21405.850	28.645	248.571	24266.252	-1.433	85.820
2568.101	1068.250	21396.138	28.715	249.753	24278.426	-1.434	86.455
2584.101	1084.250	21386.410	28.773	250.938	24290.625	-1.435	87.093
2600.101	1100.250	21376.680	28.820	252.125	24302.861	-1.435	87.733
2616.101	1116.250	21366.940	28.856	253.314	24315.113	-1.434	88.374
2632.101	1132.250	21357.204	28.880	254.505	24327.385	-1.434	89.017
2648.101	1148.250	21347.466	28.892	255.698	24339.664	-1.432	89.661
2664.101	1164.250	21337.734	28.892	256.892	24351.957	-1.430	90.306
2680.101	1180.250	21328.010	28.881	258.087	24364.250	-1.428	90.951
2696.101	1196.250	21318.308	28.857	259.283	24376.535	-1.425	91.597
2712.101	1212.250	21308.622	28.822	260.479	24388.816	-1.421	92.241
1453.427	1213.250	21307.952	28.819	260.562	24389.660	-1.421	92.286
1454.422	1214.250	21307.344	28.817	260.637	24390.428	-1.421	92.326

TABLE III (CONT'D) GT-6 RECONSTRUCTED DATA

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TDAS (SEC)	TT (SEC)	RS (K- FEET)	PHI (DEG)	THETA E (DEG)	VE (FPS)	GAMMA (DEG)	PSIE (DEG)
1688.101	252.250	21827.052	7.827	189.537	23769.227	-0.694	60.273
1704.101	268.250	21822.370	8.321	190.413	23774.818	-0.717	60.416
1720.101	284.250	21817.540	8.813	191.292	23780.580	-0.740	60.569
1736.101	300.250	21812.540	9.303	192.174	23786.520	-0.763	60.731
1752.101	316.250	21807.400	9.791	193.059	23792.641	-0.785	60.902
1768.101	332.250	21802.104	10.276	193.948	23798.939	-0.808	61.082
1784.101	348.250	21796.668	10.758	194.840	23805.408	-0.830	61.271
1800.101	364.250	21791.072	11.238	195.735	23812.057	-0.851	61.470
1816.101	380.250	21785.348	11.715	196.634	23818.875	-0.873	61.678
1832.101	396.250	21779.474	12.189	197.537	23825.854	-0.894	61.895
1848.101	412.250	21773.454	12.660	198.444	23833.004	-0.914	62.121
1864.101	428.250	21767.290	13.127	199.355	23840.324	-0.935	62.357
1880.101	444.250	21761.006	13.591	200.270	23847.805	-0.955	62.602
1896.101	460.250	21754.584	14.052	201.190	23855.447	-0.975	62.856
1912.101	476.250	21748.026	14.508	202.114	23863.252	-0.994	63.120
1928.101	492.250	21741.334	14.961	203.043	23871.207	-1.013	63.393
1944.101	508.250	21734.522	15.410	203.977	23879.320	-1.032	63.675
1960.101	524.250	21727.578	15.854	204.916	23887.584	-1.050	63.967
1976.101	540.250	21720.506	16.294	205.860	23896.004	-1.068	64.268
1992.101	556.250	21713.328	16.730	206.809	23904.566	-1.085	64.579
2008.101	572.250	21706.022	17.161	207.763	23913.277	-1.103	64.899
2024.101	588.250	21698.596	17.586	208.723	23922.131	-1.119	65.229
2040.101	604.250	21691.070	18.007	209.688	23931.129	-1.136	65.568
2056.101	620.250	21683.420	18.423	210.659	23940.254	-1.152	65.916
2072.101	636.250	21675.668	18.833	211.636	23949.529	-1.167	66.274
2088.101	652.250	21667.812	19.238	212.618	23958.926	-1.182	66.641
2104.101	668.250	21659.852	19.637	213.607	23968.461	-1.197	67.018
2120.101	684.250	21651.796	20.030	214.601	23978.121	-1.211	67.404
2136.101	700.250	21643.634	20.417	215.601	23987.900	-1.225	67.800
2152.101	716.250	21635.384	20.797	216.608	23997.814	-1.238	68.204
2168.101	732.250	21627.038	21.171	217.621	24007.834	-1.251	68.619
2184.101	748.250	21618.608	21.539	218.640	24017.973	-1.264	69.042
2200.101	764.250	21610.090	21.900	219.665	24028.232	-1.276	69.474
2216.101	780.250	21601.492	22.254	220.697	24038.592	-1.287	69.916
2232.101	796.250	21592.816	22.600	221.735	24049.057	-1.298	70.367
2248.101	812.250	21584.062	22.939	222.780	24059.637	-1.309	70.825
2264.101	828.250	21575.226	23.271	223.831	24070.311	-1.319	71.295
2280.101	844.250	21566.332	23.595	224.888	24081.088	-1.329	71.772
2296.101	860.250	21557.364	23.911	225.952	24091.949	-1.338	72.258
2312.101	876.250	21548.332	24.219	227.023	24102.902	-1.346	72.753
2328.101	892.250	21539.236	24.519	228.099	24113.947	-1.355	73.256

TABLE IV GT-7 RECONSTRUCTED DATA

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TDAS (SEC)	TT (SEC)	RS (K- FEET)	PHI (DEG)	THETA E (DEG)	VE (FPS)	GAMMA (DEG)	PSI E (DEG)
2344.101	908.250	21530.090	24.811	229.182	24125.076	-1.362	73.767
2360.101	924.250	21520.880	25.093	230.272	24136.285	-1.369	74.287
2376.101	940.250	21511.628	25.367	231.367	24147.564	-1.376	74.815
2392.101	956.250	21502.332	25.632	232.469	24158.914	-1.382	75.350
2408.101	972.250	21492.986	25.888	233.577	24170.350	-1.388	75.894
2424.101	988.250	21483.602	26.134	234.691	24181.838	-1.393	76.445
2440.101	1004.250	21474.176	26.371	235.811	24193.393	-1.398	77.003
2456.101	1020.250	21464.716	26.599	236.937	24205.002	-1.402	77.568
2472.101	1036.250	21455.232	26.816	238.069	24216.670	-1.405	78.141
2488.101	1052.250	21445.710	27.024	239.206	24228.391	-1.408	78.720
2504.101	1068.250	21436.172	27.221	240.348	24240.143	-1.411	79.305
2520.101	1084.250	21426.610	27.409	241.496	24251.947	-1.413	79.897
2536.101	1100.250	21417.034	27.585	242.649	24263.785	-1.415	80.495
2552.101	1116.250	21407.440	27.751	243.807	24275.662	-1.416	81.098
2568.101	1132.250	21397.848	27.907	244.969	24287.568	-1.416	81.707
2584.101	1148.250	21388.240	28.051	246.136	24299.498	-1.416	82.321
2600.101	1164.250	21378.636	28.185	247.308	24311.445	-1.415	82.940
2616.101	1180.250	21369.022	28.308	248.483	24323.406	-1.414	83.563
2632.101	1196.250	21359.422	28.419	249.662	24335.387	-1.413	84.190
2648.101	1212.250	21349.830	28.519	250.845	24347.373	-1.411	84.821
2664.101	1228.250	21340.244	28.608	252.031	24359.365	-1.408	85.456
2680.101	1244.250	21330.676	28.685	253.221	24371.324	-1.405	86.094
2696.101	1260.250	21321.126	28.750	254.413	24383.293	-1.401	86.735
2712.101	1276.250	21311.602	28.804	255.608	24395.236	-1.397	87.378
2728.101	1292.250	21302.096	28.846	256.805	24407.162	-1.392	88.023
2606.659	1293.250	21301.444	28.849	256.888	24407.896	-1.392	88.067
2607.643	1294.250	21300.856	28.851	256.962	24408.557	-1.391	88.107
2608.643	1295.250	21300.264	28.853	257.037	24409.330	-1.391	88.147
2609.694	1296.375	21299.640	28.855	257.115	24410.029	-1.391	88.190

TABLE IV (CONT'D) GT-7 RECONSTRUCTED DATA

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