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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

GEMINI GT-4 ASCENT POSTFLIGHT ANALYSIS REPORT

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Federal Systems Division
Space Guidance Center
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July 1, 1965

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GEMINI GT-4

ASCENT

POST-FLIGHT

ANALYSIS REPORT

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CONTENT APPROVED BY

H F Branning

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H F Branning

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SPACE GUIDANCE CENTER
OWEGO NEW YORK

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ABSTRACT

This report presents an analysis of the Ascent portion of the GT-4 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 2° and 1.25°, respectively. No GDC operation anomalies were observed during the ascent phase of the flight.

I. Introduction

This report presents the results of the analysis of the performance of the on-board computer during the ascent phase of the GT-4 flight.

The purpose of this study was to verify that no anomalies occurred in the computer or its program during the pre-launch 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-4 flight are discussed in the sections to follow.

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II. Discussion of Ascent Flight Reconstruction

Appendix A contains a tabulation of the DAS data obtained from the GT-4 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-4 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:

A. Gimbal Angle and Attitude Error Behavior

B. Position and Velocity Comparisons

C. Platform Azimuth Alignment

D. IGS Injection Conditions

E. Navigation Accuracy

F. IVAR and IVI Operation

G. IGS Discretes and Lift-off Synchronization

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A. Gimbal Angle and Attitude Error Behavior

Figures 1 through 3 present a comparison of the primary and back-up system attitude errors. Inspection of the IGS attitude errors from lift-off through SECO revealed no unusual or unexpected behavior.

The differences noted in the Stage I pitch attitude error are belived due to pitch programmer error in the primary system and pitch program start time uncertainties in the back-up system. At Stage II guidance initiation the IGS pitch attitude error reached a maximum of $+14^{\circ}$. This was a considerable decrease compared to the GT-3 flight where this same signal reached a maximum of $+23^{\circ}$. Thus the changes to the pitch program made for the GT-4 mission resulted in a sizable improvement.

The +1.5 to $+2^{\circ}$ attitude error between 190 seconds and SECO reflects the sensitivity of the IGS equations to altitude and radial velocity errors. Both the IGS targeted radial velocity and altitude were biased to compensate for IGS guidance and navigation errors seen in the IGS Predicted Performance Report (Reference 2). These biased values tended to increase the IGS error seen on telemetry. The insertion conditions listed in Section D also indicate that the vehicle was considerably above targeted altitude and had a significant amount of radial velocity at injection. This would tend to indicate that the IGS attitude commands might have improved the injection conditions had a switchover been made.

The yaw attitude error signal seen in Figure 2 indicates good agreement between the IGS and RGS systems during Stage I operation. During Stage II the behavior of the yaw attitude error signals is very similar to that seen and reported in the GT-3 mission (see Reference 1). The difference between the primary and back-up system attitude error in general is less than 1°. As SECO is approached it is noted that the IGS error is changing rapidly, increasing to near -1° just prior to SECO. This is evidently due to the out-of-plane velocity measured by the IGS which requires a yaw right correction by the launch vehicle to null the component.

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A. (Continued)

The roll attitude error comparison provided in Figure 3 readily illustrates several perturbations which are affecting the roll orientation of the vehicle on the flight. The most obvious are the engine misalignments along the roll axis (note the change in roll error at staging) and the TARS roll gyro drift rates at high acceleration (note the change in IGS roll error between 100 and 150 seconds and 260 to 330 seconds). The effects are somewhat similar to or less than those seen on GT-3.

Inspection of the roll gimbal angle data indicate the vehicle rolled 12.78° during the roll program as compared to 12.9° which was desired.

Immediately following SECO, a significant change is noted in the pitch attitude of the vehicle. This is due to a pitch up rate on the vehicle which is first seen at SECO. Between 333.5 and 350 seconds the platform pitch gimbal angle increases from -12.5° to -.25° and a corresponding change is therefore noted in the IGS pitch attitude error.

At 354.2 the rendezvous equations are entered as evidenced by the sudden shifts in IGS attitude error. The roll error signal reaches +86° corresponding to the counter clockwise rotation required to put the astronauts in a heads up orientation. The pitch attitude error signal is +9° reflecting the pitch down maneuver required to put the spacecraft in a horizontal attitude. The yaw attitude error reaches -25° reflecting the yaw right rotation of the vehicle required to correct the IGS out-of-plane velocity when forward thrusting is applied.

B. 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.

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B. (Continued)

The largest position difference between the flight results and those obtained through reconstruction is seen in the X component of the FORTRAN Run (451 feet at 359 seconds). Inspection will show that the FORTRAN result is within 38 feet of the Operational Program result. The major contributors to the 451 foot difference are: (1) insufficient flight data in the area of SECO, and (2) a time error at 307 seconds which introduced a perturbation into the acceleration profile at that time. For this flight, a DAS frame containing data from the computation cycle immediately preceeding entry to the SECO countdown loop was not generated, thus making it impossible to accurately reconstruct the acceleration profile in that area. The approximation for the acceleration level near SECO used during post flight reconstruction resulted in the position error noted. DAS frame synchronization of flights GT-2 and GT-3 was such that data generated in the computation cycle prior to entry to the SECO countdown was transmitted, allowing more accurate reconstruction of the flight profile. It should be noted that time quantization is not a significant problem in the GT-4 data since the time transmitted has been rescaled and is accurate to 1 millisecond.

The reconstructed velocities, with the exception of the Z component following platform release and all components near SECO, are within .5 ft/sec of the flight values. The Z velocity difference after platform release is .7 ft/sec in the Operational Program run. This difference is attributed to an error of one quanta (.036 degrees) in reconstructing the roll gimbal angle at platform release. The velocity difference appears when the roll gimbal angle is used to obtain a measure of platform azimuth misalignment and to revise the velocity initial conditions based on the detected misalignment. Velocity differences at SECO are attributed to the acceleration profile reconstruction which was discussed in the previous paragraph. The effects of the azimuth updates on the position and velocity data is also seen in this table. The Operational Program Z velocity difference, which was .7 ft/sec at platform release, reduces to .35 ft/sec following both updates.

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B. (Continued)

The reasons why a bit-for-bit reconstruction of the flight data was not obtained are many. Several of the more significant factors will be discussed. The primary limitation is in the telemetry area, in that all the inputs to the IGS are not monitored. The data which was not available thus had to be reconstructed and supplied as an input to the Operational Program. This analysis used linear interpolation between data points, and as exhibited in the Stage II pitch attitude error, a more sophisticated fit should be used to remove the apparent noise induced by linear interpolation. A second limitation used in this analysis is the assumption that all telemetry data is valid at the telemetered "time from lift-off" in the ascent mode. This assumption is acceptable for the summed acceleration data, but the gimbal angles, velocities, positions, etc., all require "time tagging" in order to conform with the "time from lift-off" time base. A third limitation is the accuracy to which computation cycle times can be reconstructed. Failure to reconstruct the time of each computation cycle exactly will also frustrate attempts at bit-for-bit repeatability.

The manner in which the DCS constants are loaded into the simulation also contributed slightly to the differences. The DCS parameters were loaded in decimal and following conversion to octal, it was noted that they differed from the octal value loaded for flight in the least significant bit.

In summary, it is felt that bit-for-bit repeatability under the present circumstances would be rather difficult to achieve, and certainly would require a considerable amount of time and manpower to overcome some of the obstacles mentioned above. It is felt that both the FORTRAN and the Operational Program results produced acceptable reconstruction of the flight parameters and it is thought that a limited amount of effort in the area of filtering or smoothing the data and intermediate computation cycle reconstruction would result in a reduction in the differences noted.

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TABLE 1 - POSITION AND VELOCITY COMPARISON

		Position (Feet)			Velocity (Ft/Sec)		
		X	Y	Z	V_X	V_Y	V_Z
Prior to Platform Release	Flight	-17328	-20909920	-56184	1282.36	0	-395.46
	FORTRAN	-17325	-20909917	-56178	1282.36	0	-395.47
	Op. Prog.	-17326	-20909917	-56182	1282.36	0	-395.46
After Platform Release	Flight	-16084	-20909920	-56568	1282.56	.12	-395.35
	FORTRAN	-16081	-20909917	-56561	1282.63	.02	-394.70
	Op. Prog.	-16082	-20909917	-56565	1282.64	.03	-394.66
After Lift-off 2.226	Flight	-9636	-20909944	-58552	1282.09	-22.52	-395.17
	FORTRAN	-9633	-20909995	-58545	1282.15	-22.57	-394.63
	Op. Prog.	-9634	-20909997	-58549	1282.17	-22.56	-394.59
Before Update 100.667	Flight	171892	-20990452	-97804	3595.09	-1845.20	-361.74
	FORTRAN	171924	-20990496	-97743	3595.07	-1845.34	-361.28
	Op. Prog.	171926	-20990517	-97732	3595.17	-1845.26	-361.16
Between Updates 136.168	Flight	353216	-21070716	-109524	6952.66	-2695.72	-280.59
	FORTRAN	353225	-21070713	-109605	6952.24	-2695.90	-281.35
	Op. Prog.	353227	-21070746	-109585	6952.37	-2695.80	-281.20
Following Updates 148.263	Flight	447104	-21105508	-112720	8637.76	-3069.99	-247.25
	FORTRAN	447147	-21105512	-112765	8637.42	-3070.16	-247.73
	Op. Prog.	447146	-21105545	-112747	8637.54	-3070.04	-247.60

Flight - DAS Flight Data
FORTRAN - FORTRAN Flight Reconstruction Results
Op. Prog. - Operational Program Flight Reconstruction Results

TABLE 1 (Continued)

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		Position (Feet)			Velocity (Ft/Sec)		
		X	Y	Z	V_X	V_Y	V_Z
After	Flight	991260	-21251300	-124696	11633.30	-2059.94	-215.74
Lift-of	FORTRAN	991211	-21251262	-124771	11632.83	-2060.16	-216.25
201.166	Op. Prog.	991218	-21251293	-124746	11632.99	-2060.02	-216.08
Prior to	Flight	3165832	-21203612	-144692	24739.49	3625.54	-41.06
SECO	FORTRAN	3165474	-21203627	-144846	24738.95	3625.26	-41.62
330.849	Op. Prog.	3165507	-21203650	-144798	24739.19	3625.47	-41.39
After	Flight	3344556	-21176376	-144904	25417.49	3993.13	-26.67
SECO	FORTRAN	3344112	-21176411	-145072	25417.00	3991.96	-27.24
337.922	Op. Prog.	3344146	-21176435	-145022	25417.19	3992.18	-27.00
Near	Flight	3827212	-21094948	-145380	25330.05	4568.77	-23.37
SECO+20	FORTRAN	3826749	-21094986	-145557	25329.64	4568.47	-24.05
356.940	Op. Prog.	3826786	-21095011	-145505	25329.86	4568.70	-23.79
Near	Flight	3949776	-21072476	-145492	25303.31	4714.47	-22.52
SECO +25	FORTRAN	3949329	-21072512	-145672	25302.82	4714.20	-23.21
361.782	Op. Prog.	3949368	-21072536	-145619	25303.04	4714.43	-22.95

Flight - DAS Flight Data
FORTRAN - FORTRAN Flight Reconstruction Results
Op. Prog. - Operational Program Flight Reconstruction Results

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C. 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 one quanta ($.036^{\circ}$) of the value desired by the IGS. The value read by the GDC was 77.976 degrees (2166 quanta) and the commanded roll gimbal angle was 77.944 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 4 $\widehat{\text{sec}}$ and would contribute less than a .5 ft/sec out-of-plane velocity difference at SECO.

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TABLE 2 - PLATFORM AZIMUTH ALIGNMENT

Time	FORTRAN Results (degrees)	Operational Program Results (degrees)
Platform Release	+.03222	.03384
105 Seconds	-.14234	-.14020
145 Seconds	-.12827	-.12725

Values of V_{ZG} received by the IGS via DCS from the Burroughs system were -358.25 at 105 seconds and -254.5 at 145 seconds.

Differences between the final FORTRAN and Operational Program results above is approximately 4 sec or equivalently a .5 ft/sec out-of-plane velocity error at SECO.

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D. IGS Injection Conditions

Table 3 presents the IGS measured injection conditions obtained during the flight and those obtained via reconstruction. The table also lists the quoted insertion conditions obtained from the flight for comparison with the IGS results. Column 4 of the table lists the IGS navigation errors as measured by STL. These errors have been combined with the insertion conditions listed in Column 1 and the results are entered in Column 5 of the table. A comparison of this data with the quoted insertion conditions indicates that some inconsistencies may exist (See Section E).

Had a switchover to the IGS been accomplished early during flight, the following conditions would result at SECO + 20:

$$V = 25760.6 \pm 4.9 \text{ ft/sec}$$
$$R = 21438860 \text{ ft}$$
$$\Gamma = 0 \text{ deg}$$
$$V_R = 0 \text{ ft/sec}$$

All of the above numbers are based on the perturbations suggested by Table 3 and predicted navigation errors reported in Reference 2. The injection conditions would result in lowering perigee 1470 feet and raising apogee 49200 ± 16880 feet from the flight values. The IVAR corrections following SECO + 20 would permit the astronauts to: (1) add 10 ft/sec separation velocity, (2) correct for thrust tail-off deficiency, and (3) correct for IGS SECO delivery uncertainty (± .022 second). The orbit achieved using IGS guidance would therefore have had a perigee of 81 nm and an apogee of 163.6 nm which agrees quite closely with the desired 81 - 161 nm orbit.

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TABLE 3 - IGS INJECTION CONDITIONS
(At approximately SECO +20: 354.523 Sec.)

	IGS (1) Flight Values	FORTRAN (3) Reconstruction	Op. Program (3) Reconstruction	Navigation Error (4)	Corrected IGS (5) Flight Values	Quoted Insertion Condition
V_X ft/sec	25343.28	25342.38	25342.59	-4.2	25347.48	
V_Y ft/sec	4495.75	4495.47	4495.70	-5.6	4501.35	
V_Z ft/sec	-23.69	-24.37	-24.11	+11.0	-34.69	
X ft	3765960	3765516	3765553	+150	3765810	
Y ft	-21105904	-21105940	-21105964	-560	-21105344	
Z ft	-145324	-145499	-145447	+600	-145924	
V ft/sec	25738.96	25738.03	25738.26		25740.20	25745
R ft	21439747	21439705	21439724		21439174	21440331
V_R ft/sec	26.04	25.63	25.48		21.28	26.5
$V_\perp$ ft/sec	19.68 (2)	19.95	19.68		8.68	0
Γ deg	.05797	.05706	.05673		.04738	.059

(1) IGS parameters listed were obtained from in-flight DAS data.

(2) Out-of-plane velocity was obtained from Op. Prog. reconstruction.

(3) FORTRAN and Op. Program results were derived from reconstruction of the mission using DAS gimbal angle and accelerometer data.

(4) Navigation errors obtained from STL on 6-30-65.

(5) IGS flight values corrected for navigation errors.

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E. Navigation Accuracy

Table 3 quotes the IGS velocity and position errors at SECO + 20. As can be noted, the worst error is seen along the Z-axis (perpendicular to the orbit plane). From the platform performance standpoint, this flight far surpassed the accuracies obtained during Ascent on GT-2 and GT-3. The in-plane component platform errors (X and Y-axis) were on the order of 5 FPS at SECO whereas the out-of-plane error was approximately 11 FPS. Thus, platform performance was within 1 or 2 σ of nominal.

Note the differences between the corrected IGS flight values (Column 5) and the quoted insertion conditions. Ideally the IGS values after correction for the measured navigation errors should agree with the quoted injection conditions. Any differences which are noted must be attributed to either inaccuracies in the estimates of IGS navigation error or errors in quoted insertion conditions. It is suggested this particular area be further pursued by NASA in an attempt to resolve these differences.

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F. IVAR and IVI Operation

The attached table lists the IVI and FDI readings following SECO + 20. These readings were obtained from the post-flight reconstruction simulation. The roll attitude error is initially saturated (unlimited value is 86 degrees) and the flight data indicates that the astronaut did not begin rolling the spacecraft to the heads up orientation until 375 seconds (approximately 40 seconds after SECO). The roll maneuver was completed at 398 seconds with a resulting roll gimbal angle of six degrees. The pitch attitude error reads initially 9.3 degrees, indicating a desired pitch down to a local horizontal attitude. This maneuver is not made and the attitude error increases to 15.8 degrees as the spacecraft downrange angle increases. The yaw attitude error is seen to be at a saturated yaw right command (unlimited value is - 24.9 degrees, initially) following SECO + 20. This occurs since the required out-of-plane correction (- 19.8 ft/sec) is large with respect to the in-plane correction (26 ft/sec). Program limiting restricts the out-of-plane correction to one half of the in-plane correction which results in yaw attitude commands of approximately 25 degrees. The IVI readings indicate that the astronaut thrusted forward to gain 6 ft/sec during the separation maneuver.

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TABLE 4 - IVAR OPERATION

Time (Sec)	IVI-X (Ft/Sec)	IVI-Y Ft/Sec)	IVI-Z Ft/Sec)	$\Delta\theta$ (Deg)	$\Delta\psi$ (Deg)	$\Delta\phi$ (Deg)
353.8	26	0	0	9.3	-24.9	86.0
354.1	26	5	0	9.3	-24.8	86.1
354.5	26	5	-12	9.2	-24.7	86.3
358.6	26	5	-11	9.1	-23.9	88.2
360.2	26	4	-11	7.4	-23.7	88.8
362.7	26	3	-11	7.0	-23.7	89.5
366.6	23	3	-11	8.4	-24.9	88.7
367.5	23	4	-11	9.1	-25.1	88.5
368.3	23	4	-10	9.6	-25.2	88.3
369.0	21	4	-10	10.1	-25.3	88.2
375.0	21	5	-10	11.3	-26.2	87.8
380.4	21	7	-10	12.6	-26.9	76.0
381.1	21	7	-9	12.8	-27.0	71.6
382.8	21	9	-9	13.1	-27.3	62.0
383.5	21	9	-7	13.3	-27.5	57.5
384.4	20	9	-7	13.4	-27.7	52.3
385.2	20	11	-7	13.6	-27.8	47.8
386.0	20	11	-4	13.7	-28.0	43.3
387.6	20	12	-4	13.9	-28.2	36.0
388.4	20	12	-2	14.0	-28.4	32.5
390.0	20	13	-2	14.3	-28.7	23.5
390.8	20	13	+1	14.4	-28.9	19.4
393.2	20	13	3	14.8	-29.3	11.1
394.9	20	12	3	15.2	-29.5	7.8
395.6	20	12	4	15.3	-29.6	6.3
398.0	20	12	5	15.8	-29.9	6.0

Convention:

IVI-X	IVI-Y	IVI-Z
+ Forward	+ Right	+ Down
- AFT	- Left	- Up

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G. IGS Discretes and Lift-off Synchronization

Detailed analysis of IGS time since lift-off, "t", 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 20.5 $\pm$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. Thus the synchronization accuracy obtained from this flight appears reasonable.

Table 5 presents a lists of various discrete events issued or controlled by the IGS. In particular, note the SECO time. The number quoted was obtained from MAC and differs from a NASA quoted number of 333.704 $^{+0}_{-.1}$ seconds. The IGS data in the area near SECO was analyzed in detail in order to determine which of the two numbers appeared more reasonable. First, it was noted that a frame of data was available during the SECO countdown (333.499 seconds). Since the IGS updates elapsed time from lift-off, "t", every 43 milliseconds during this period an estimate of lift-off synchronization was obtained at this time. This was found to indicate the IGS lagged real time by 15 $\pm$22 milliseconds. This figure agreed fairly well with the time synchronization reported in the previous paragraph. IGS "time to go", T_G, in the immediate area prior to SECO was then used to estimate when the SECO discrete was issued. This indicated the discrete was issued at 333.726 $\pm$.022 seconds after lift-off.

Another time estimate of 333.750 $\pm$.022 seconds was obtained using the first IGS frame following SECO and reconstructing the IGS frames back to SECO. Therefore, the MAC quoted SECO time appears a bit more reasonable in light of the IGS data.

It is suggested that the procedure to be used in time alignment and correction of discretes be reviewed in order to improve the agreement between the MAC and NASA results.

In conclusion it is felt the MAC quoted SECO time better fits the facts presented by other IGS data and should be officially quoted. The IGS SECO time is thus compatible with the RGS quoted time of 333.744 seconds.

Analysis of the IGS velocity data in the area near SECO provided an estimate of 79 $\pm$ 25 FPS for the Stage II engine cutoff impulse. The uncertainty is rather large since a frame of IGS data was not available in the immediate SECO area due to a DAS frame sync during the SECO countdown.

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TABLE 5 - IGS DISCRETE EVENTS

Time (1) (sec)	Event	Comments
-3.77/-3.34	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 20.5 ±15 m seconds.
10.38	Roll Program Initiate	
20.33	Roll Program Termination	
22.87	Start Pitch Step 1	
88.59	Start Pitch Step 2	
105.25	Gain Change	
105.273	Receipt of First Update (Value - -358.25 FPS)	Time quoted is DAS time in mode when update is seen on telemetry.
119.23	Start Pitch Step 3	
146.068	Receipt of Second Update (Value - -254.5 FPS)	Time quoted is DAS time in mode when update is seen on telemetry.
168.049	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.
333.776	IGS SECO (uncertainty +.022, -.078 secs.)	Time quoted was obtained from MAC (see text).
354.848	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.

III. 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. No discrepancies can be found in the operation of the digital computer or its output during the Ascent portion of the mission.

2. IGS navigation errors at SECO + 20 were approximately - 4.2, - 5.6, and + 11 FPS on the X, Y, and Z-axes, respectively. This resulted in IGS errors of approximately 5 FPS in velocity magnitude and 9 FPS in the out-of-plane direction.

3. IMU performance was within 1 or 2 σ of nominal.

4. With the exception of the attitude errors seen at Stage II guidance initiation, the maximum IGS pitch and yaw attitude error seen during flight were less than 2° and 1.25°, respectively.

5. IGS was successful in accepting airborne azimuth updates and reducing what could have been a potential 50 FPS out-of-plane velocity error to one less than 10 FPS. The calculated platform misalignment on this flight was on the order of - .12°.

6. IGS lift-off synchronization was established late by 20 ± 15 milliseconds.

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IV. Recommendations

The analysis performed did not result in any recommendation in the GDC analytic equation area. However, the following recommendations are made:

A. GDC DAS Telemetry

In order to make the output more useful:

1) Add η_X to DAS telemetry. This quantity defines the GDC computed value of platform azimuth misalignment and should be telemetered after platform release and all azimuth updates.

2) Add t, SF_X, SF_Y, and SF_Z at SECO to DAS telemetry. These quantities would define the time at which the SECO discrete was issued by the IGS as well as the IGS measured values of summed acceleration. They would be particularly useful in the evaluation of the engine cut-off impulse as well as the time at which IGS SECO is issued.

The above quantities can be made available by multiplexing them with the V_{ZG} quantity which is currently available on telemetry. The software modifications required to the computer program are minimal.

B. Analog Telemetry Data

1) Add IGS computer-issued SECO discrete to Martin telemetry to be sampled at a 400 cps rate. This will allow accurate evaluation of the relative time displacement between the primary and backup SECO signals.

C. Start Computation Discrete

1) It is suggested the "Start Computation discrete be added to the Ascent mode which would require the astronaut to push the "Start Comp" button before the Ascent computations are initiated. This would eliminate an "apparent" problem which appeared much later during flight - a brief summary of which follows:

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C. Start Computation Discrete (cont'd)

At 76 hours and 50 minutes after liftoff of the GT-4 flight the DAS data indicated the computer time in mode, "t", started counting backwards. Analysis of the data indicated the astronaut had turned the mode switch from Catch-up to Ascent to Prelaunch at this time. Apparently the mode switch was left in the Ascent position for a sufficient length of time to allow initialization and liftoff determination by the Ascent mode. The Ascent mode determines liftoff using T_E, the elapsed time indicator. In the process of determining liftoff, computer time in mode, "t" is set equal to T_E. Thus, when this occurred, t in the computer as well as t obtained via telemetry overflowed, since the value obtained was much larger than any reasonable value expected in the Ascent mode. Although the overflow in no way affected the computer or its program, it did leave a "one" bit in the sign bit position of the telemetry word. A "one" bit in this position of course is used to interpret the quantity as a negative data word. Since time is not zeroed when the computer is turned to Prelaunch, this large "apparently negative" number began counting toward zero.

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APPENDIX A

GT-4 FLIGHT DATA

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GT-4 TELEMETRY DATA FROM NASA/MSC PROCESSED TAPE 6/ 3/65

TIME FROM LIFTOFF	THETA DEGREES	PSI DEGREES	PHI DEGREES	SFX QUANTA*.001	SFY QUANTA*.0 1
0.	89.85599995	-0.07200000	77.97599983	1.21999998	0.20299999
0.	89.85599995	-0.07200000	77.93999958	1.22199997	0.20599999
0.42578125	89.89199924	-0.07200000	77.93999958	1.22399998	0.20400000
0.	89.89199924	-0.07200000	77.93999958	1.22299998	0.20400000
0.	89.89199924	-0.10800000	77.93999958	1.22499998	0.20599999
0.42675781	89.89199924	-0.07200000	77.93999958	1.22699998	0.20499999
0.	89.89199924	-0.07200000	77.93999958	1.22699998	0.20699999
0.42480469	89.89199924	-0.07200000	77.93999958	1.22999997	0.20499999
0.42578125	89.89199924	-0.07200000	77.97599983	1.22999997	0.20499999
0.	89.89199924	-0.07200000	77.93999958	1.23199998	0.20599999
0.42578125	89.89199924	-0.07200000	77.97599983	1.23399998	0.20599999
0.42578125	89.89199924	-0.10800000	77.93999958	1.23299998	0.20599999
0.	89.89199924	-0.07200000	77.93999958	1.23699997	0.20599999
0.42675781	89.89199924	-0.07200000	77.93999958	1.23499998	0.20699999
0.	89.85599995	-0.07200000	77.93999958	1.23899998	0.20699999
0.	89.85599995	-0.07200000	77.97599983	1.23999998	0.20699999
0.42578125	89.89199924	-0.07200000	77.97599983	1.23999998	0.20699999
99999.00000000	99999.00000000	99999.00000000	99999.00000000	99.99899864	99.99899864
0.	89.89199924	-0.07200000	77.93999958	1.24399997	0.20800000
0.42578125	89.89199924	-0.07200000	77.93999958	1.24499997	0.20800000
0.	89.85599995	-0.07200000	77.93999958	1.24699998	0.20800000
0.	89.89199924	-0.10800000	77.93999958	1.24699998	0.20699999
0.42578125	89.85599995	-0.07200000	77.97599983	1.24799998	0.20899999
0.	89.89199924	-0.07200000	77.93999958	1.24999999	0.21100000
0.	89.85599995	-0.07200000	77.97599983	1.25199997	0.20899999
0.	89.89199924	-0.07200000	77.97599983	1.25299998	0.20899999
0.53320313	89.85599995	-0.07200000	78.01199913	1.25299998	0.20999999
2.22558594	90.10799980	0.07200000	78.19199944	1.25099997	0.20999999
4.48535156	90.07199955	0.03600000	78.29999924	1.24899998	0.21100000
7.17089844	90.07199955	0.07200000	78.29999924	1.24599998	0.21100000
9.42871094	90.03599930	0.10800000	78.29999924	1.24399997	0.21200000
11.69921875	90.07199955	0.07200000	80.38799953	1.23899998	0.21599999
99999.00000000	99999.00000000	99999.00000000	99999.00000000	99.99899864	99.99899864
16.67675781	90.07199955	0.07200000	86.29199982	1.23499998	0.21799999
18.95019531	90.07199955	0.10800000	89.24399948	1.23399998	0.22099999
21.22070313	90.07199955	0.14399999	91.04399967	1.23399998	0.22399999
23.74609375	89.96399975	0.21600000	91.07999992	1.23599999	0.23000000
26.10058594	88.05599976	0.32399999	91.07999992	1.25199997	0.23899999
28.45898438	86.65199947	0.39600000	91.15199947	1.29899998	0.25399999
30.81542969	84.92399979	0.39600000	91.15199947	1.37399998	0.27199999
33.17285156	83.23199940	0.39600000	91.18799973	1.48899998	0.28699999
35.52832031	81.25199986	0.07200000	91.15199947	1.64599997	0.30199999
37.91406250	79.45199966	-0.18000000	91.18799973	1.85099997	0.30399999
40.31347656	77.57999992	-0.43200000	91.22399998	2.10299996	0.29399999
42.71289063	75.70799923	-0.36000000	91.22399998	2.40899995	0.28299999
45.11328125	73.97999954	-0.39600000	91.18799973	2.76199996	0.27299999
47.51269531	72.39599991	-0.28800000	91.18799973	3.15599996	0.26600000
49.91210938	70.88399982	-0.10800000	91.07999992	3.58699995	0.26399999
52.31152344	69.04799938	-0.43200000	91.07999992	4.06699991	0.25900000
54.70605469	67.60799980	0.14399999	91.00799942	4.58699989	0.26699999

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GT-4 TELEMETRY DATA FROM NASA/MSC PROCESSED TAPE 6/ 3/65

TIME FROM LIFTOFF	THETA DEGREES	PSI DEGREES	PHI DEGREES	SFX QUANTA*.001	SFY QUANTA*.001
57.62304688	65.62799931	0.10800000	90.97199917	5.29099989	0.28800000
60.01757813	64.40399933	-0.21600000	91.04399967	5.91499990	0.29999999
62.38964844	62.53199959	0.50399999	90.97199917	6.56899989	0.33600000
64.74609375	60.47999954	0.25200000	90.97199917	7.28599989	0.37300000
67.09863281	59.25599957	0.	91.00799942	8.04499984	0.39599999
99999.00000000	99999.00000000	99999.00000000	99999.00000000	99.99899864	99.99899864
71.90136719	56.26799965	-0.03600000	90.97199917	9.71599984	0.40899999
74.25976563	54.17999983	0.68399999	90.93599987	10.62099981	0.45099999
76.62109375	52.48799992	-0.25200000	90.97199917	11.59599984	0.48199999
79.02246094	50.93999958	-0.21600000	91.04399967	12.65299976	0.49199999
81.42382813	50.00399971	-1.69199999	90.97199917	13.74299979	0.45299999
83.82714844	47.66399956	-1.25999999	90.97199917	14.91199982	0.38499999
86.23046875	46.11599970	-1.08000000	90.93599987	16.15999961	0.33399999
88.63476563	44.74799967	-1.51199999	90.82799911	17.47099972	0.28100000
91.04003906	43.37999964	-1.33199999	90.79199982	18.85399961	0.20899999
93.44433594	42.44399977	-1.47600000	90.75599957	20.29599977	0.14399999
95.84960938	40.96799994	-1.65599999	90.75599957	21.80299973	0.05999999
98.25390625	39.70799971	-1.33199999	90.75599957	23.39299965	-0.00900000
100.66699219	38.44799995	-1.25999999	90.71999931	25.06399965	-0.06999999
-6231.08593750	37.25999975	-1.25999999	90.68399906	99.99899864	26.80099964
0.82812500	100.79999924	0.05934375	0.05941406	0.10574999	0.10587499
107.81933594	35.71199989	-0.97200000	90.64799976	30.44799948	-0.23599999
110.22558594	34.37999964	-1.00799999	90.64799976	32.40299940	-0.28199999
112.63183594	32.75999975	-1.11600000	90.57599926	34.45299959	-0.33499999
115.03906250	31.17599988	-1.29599999	90.53999996	36.60199928	-0.39199999
117.44531250	29.73599982	-1.51199999	90.50399971	38.85499954	-0.45999999
119.85058594	28.51199985	-1.44000000	90.43199921	41.19899940	-0.53499999
122.26367188	28.22399998	-1.15200000	90.43199921	43.64199924	-0.59799999
124.67382813	27.97199988	-1.18799999	90.39599991	46.16299915	-0.65799999
127.08789063	27.43199992	-1.04400000	90.35999966	48.78199911	-0.71699999
129.50097656	27.00000000	-0.86399999	90.32399940	51.49499941	-0.76799999
131.91503906	26.56799984	-0.82799999	90.28799915	54.31499910	-0.81899999
134.32910156	25.99199986	-0.86399999	90.25199986	57.24799919	-0.86999999
136.16796875	25.37999988	-1.00799999	90.21599960	59.56099892	-0.91399999
138.58300781	24.83999991	-1.00799999	90.17999935	62.71699905	-0.97699998
141.00292969	24.26399994	-1.04400000	90.10799980	66.01599884	-1.04399998
143.41601563	23.68799996	-0.93600000	90.07199955	69.46099854	-1.11299998
145.84179688	23.14799976	-0.93600000	90.00000000	73.08199883	-1.18199998
148.26269531	22.57199979	-1.00799999	89.96399975	76.86999893	-1.25499998
153.08789063	99999.00000000	99999.00000000	87.83999920	83.99299908	-1.39499998
155.50000000	20.62799978	-0.18000000	88.59599972	84.97799873	-1.40499997
157.91113281	20.05199981	-0.28800000	88.59599972	85.99899864	-1.41199997
99999.00000000	99999.00000000	99999.00000000	99999.00000000	99.99899864	99.99899864
162.74121094	19.00799990	-0.25200000	88.63199997	88.10999870	-1.42399998
165.15234375	19.04399991	-0.21600000	88.63199997	89.19699860	-1.43099998
167.29882813	19.00799990	-0.21600000	88.59599972	90.17199898	-1.43999998
169.75878906	18.46799994	-0.18000000	88.55999947	91.31299877	-1.44599998
172.20898438	13.82399988	-0.10800000	88.55999947	92.47199821	-1.45199998
174.65917969	8.92799997	-0.03600000	88.55999947	93.67599869	-1.45599997
179.60937500	2.77199998	-0.10800000	88.59599972	96.20299816	-1.46299997

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GT-4 TELEMETRY DATA FROM NASA/MSC PROCESSED TAPE 6/ 3/65

TIME FROM LIFTOFF	THETA DEGREES	PSI DEGREES	PHI DEGREES	SFX QUANTA*.001	SFY QUANTA*.001
182.09472656	2.08800000	-0.10800000	88.59599972	97.50399876	-1.46999998
184.57226563	1.58399999	-0.14399999	88.55999947	98.81899834	-1.47499998
99999.00000000	99999.00000000	99999.00000000	99999.00000000	99.99899864	99.99899864
188.74218750	99999.00000000	-0.18000000	88.55999947	101.07399845	-1.48499997
191.22070313	0.57600000	-0.21600000	88.55999947	102.43499851	-1.49399997
193.69824219	0.39600000	-0.25200000	88.55999947	103.81899834	-1.50499998
196.17675781	0.18000000	-0.28800000	88.55999947	105.21999836	-1.51299998
198.65625000	-0.03600000	-0.32399999	88.55999947	106.64499855	-1.52399997
201.16601563	-0.28800000	-0.32399999	88.55999947	108.10799789	-1.53599998
203.66992188	-0.43200000	-0.32399999	88.55999947	109.58999825	-1.54699998
206.17382813	-0.61200000	-0.36000000	88.52399921	111.09099865	-1.56099997
208.67871094	-0.79200000	-0.39600000	88.52399921	112.62099838	-1.57399997
210.38769531	-0.93600000	-0.39600000	88.52399921	113.67499828	-1.58499998
212.89257813	-1.18799999	-0.46799999	88.52399921	115.24299812	-1.59999998
215.39746094	-1.29599999	-0.43200000	88.52399921	116.83199787	-1.61399998
217.90234375	-1.61999999	-0.54000000	88.52399921	118.44799805	-1.63299997
220.40722656	-1.69199999	-0.54000000	88.48799992	120.08699799	-1.65399997
222.91796875	-1.94399999	-0.50399999	88.52399921	121.76099777	-1.67399998
225.42089844	-1.94399999	-0.46799999	88.48799992	123.45399857	-1.69299997
227.12988281	-2.05199999	-0.43200000	88.48799992	124.62899780	-1.70399998
229.63476563	-2.16000000	-0.36000000	88.45199966	126.37199783	-1.72199997
232.13964844	-2.30399999	-0.32399999	88.48799992	128.14799690	-1.74099997
234.64453125	-2.51999998	-0.36000000	88.45199966	129.95499802	-1.75599997
237.14941406	-2.73599997	-0.32399999	88.41599941	131.79399681	-1.77399997
239.65332031	-2.95199999	-0.32399999	88.45199966	133.66199684	-1.78899997
242.16503906	-3.31199998	-0.28800000	88.41599941	135.57299805	-1.80499998
244.66992188	-3.63599998	-0.28800000	88.37999916	137.51099777	-1.81999998
246.37890625	-3.95999998	-0.25200000	88.41599941	138.85799789	-1.83299997
248.88281250	-4.28399998	-0.32399999	88.41599941	140.85899734	-1.85099997
251.38769531	-4.71599996	-0.28800000	88.37999916	142.89799690	-1.86799997
253.89257813	-4.93199998	-0.32399999	88.34399986	144.97999763	-1.88699998
256.39746094	-5.21999997	-0.36000000	88.34399986	147.10499763	-1.90699998
258.90234375	-5.50799996	-0.36000000	88.34399986	149.27099800	-1.92999998
261.41406250	-5.79599994	-0.39600000	88.30799961	151.48799706	-1.95399997
263.91699219	-6.04799998	-0.39600000	88.30799961	153.75199699	-1.97899997
265.62597656	-6.33599997	-0.39600000	88.30799961	155.31899643	-1.99599998
99999.00000000	99999.00000000	99999.00000000	99999.00000000	99.99899864	99.99899864
270.63378906	-6.62399995	-0.39600000	88.23599911	160.06099701	-2.04899997
273.13671875	-6.73199999	-0.43200000	88.19999981	162.51499748	-2.07799995
275.63964844	-6.94799995	-0.39600000	88.16399956	165.03199768	-2.10599998
278.14257813	-7.12799996	-0.39600000	88.16399956	167.60899734	-2.13499996
280.64550781	-7.45199996	-0.43200000	88.12799931	170.24699783	-2.16599995
282.35937500	-7.66799998	-0.39600000	88.12799931	172.09799767	-2.18699995
284.86523438	-7.88399994	-0.43200000	88.05599976	174.85699654	-2.22099996
99999.00000000	99999.00000000	99999.00000000	99999.00000000	99.99899864	99.99899864
289.87695313	-8.60399997	-0.43200000	88.01999950	180.61399651	-2.28999996
292.38281250	-8.85599995	-0.43200000	88.01999950	183.61399651	-2.32899997
294.88769531	-9.03599989	-0.43200000	87.98399925	186.70099640	-2.36899996
297.39257813	-9.25199997	-0.50399999	87.94799995	189.88399696	-2.41399994
299.89648438	-9.43199992	-0.46799999	87.87599945	193.17399788	-2.45899996

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GT-4 TELEMETRY DATA FROM NASA/MSC PROCESSED TAPE 6/ 3/65

TIME FROM LIFTOFF	THETA DEGREES	PSI DEGREES	PHI DEGREES	SFX QUANTA*.001	SFW QUANTA*.001
301.57031250	-9.79199994	-0.43200000	87.87599945	195.42399788	-2.49099997
304.69824219	-10.18799996	-0.43200000	87.80399990	199.77699661	-2.54999995
307.07226563	-10.54799998	-0.39600000	87.76799965	203.20099640	-2.59799996
309.44628906	-10.58399999	-0.43200000	87.73199940	206.74199677	-2.64599997
311.82910156	-10.61999989	-0.39600000	87.69599915	210.42799759	-2.69999996
314.20214844	-10.69199991	-0.36000000	87.62399960	214.24399757	-2.75099996
316.57812500	-10.76399994	-0.39600000	87.58799934	218.20999718	-2.80699995
318.95214844	-10.87199998	-0.39600000	87.51599979	222.33099747	-2.86699995
321.33593750	-11.01599991	-0.43200000	87.40799999	226.64699745	-2.93499994
99999.00000000	99999.00000000	99999.00000000	99999.00000000	99.99899864	99.99899864
326.08984375	-11.44799995	-0.46799999	87.33599949	235.83499718	-3.08199996
328.46484375	-11.59199989	-0.43200000	87.22799969	240.75899696	-3.16599995
330.84863281	-12.13199997	-0.50399999	87.15599918	245.94099617	-3.25799996
333.49902344	-12.49199998	-0.54000000	87.08399963	251.01399612	-3.35499996
335.78027344	-11.01599991	-1.61999999	87.83999920	253.14499664	-3.39699996
337.92187500	-8.20799994	-1.90799999	89.02799988	253.21599579	-3.39999995
340.44628906	-5.43599999	-1.11600000	89.27999973	253.26799583	-3.39999995
342.96289063	-3.23999998	-0.28800000	88.48799992	253.29999542	-3.40299994
345.46289063	-1.40400000	0.25200000	87.15599918	253.31299591	-3.40299994
347.54785156	-0.46799999	0.57600000	86.03999996	253.32099724	-3.40199995
350.02539063	-0.25200000	0.93600000	85.46399975	253.32699585	-3.40099996
352.50878906	-0.39600000	1.40400000	85.60799980	253.32999611	-3.39999995
354.52343750	359.06399918	1.90799999	86.25599957	253.33499718	-3.40099996
356.94042969	358.16399765	2.41199997	87.40799999	253.33599663	-3.39999995
359.35839844	357.19199753	2.80800000	88.55999947	253.34099579	-3.39899996
361.78222656	356.36399841	2.95199999	89.42399979	253.34199715	-3.39999995
99999.00000000	99999.00000000	99999.00000000	99999.00000000	99.99899864	99.99899864
366.61523438	357.47999954	1.61999999	88.70399952	253.36999702	-3.39799994
369.03222656	99999.00000000	99999.00000000	99999.00000000	253.38899612	-3.39699996
371.45703125	359.24399948	0.90000000	88.16399956	253.39399719	-3.39799994
373.87304688	359.56799698	0.57600000	88.12799931	253.39699554	-3.39699996
376.29003906	0.03600000	0.25200000	87.51599979	253.39799690	-3.39999995
378.70800781	0.50399999	359.96399689	85.46399975	253.39899635	-3.40099996
381.13183594	0.82799999	359.53199768	71.63999939	253.39999580	-3.39799994
383.54785156	1.18799999	359.06399918	57.45599985	253.40499687	-3.39699996
385.96582031	1.44000000	358.55999756	43.30799961	253.40599632	-3.39799994
388.38281250	1.58399999	358.19999695	32.54399967	253.40699577	-3.39599994
390.80859375	1.76400000	357.69599915	19.40399981	253.40799713	-3.39599994
393.22167969	2.05199999	357.29999924	11.08799994	253.40899658	-3.39399993
395.63574219	2.37599999	356.93999863	6.26400000	253.41199684	-3.39499995
398.04882813	2.69999999	356.65199661	6.04799998	253.41499710	-3.39599994
400.46289063	2.91599998	356.86799622	6.44399995	253.41499710	-3.39499995
99999.00000000	99999.00000000	99999.00000000	99999.00000000	99.99899864	99.99899864
405.30175781	3.27599999	357.15599823	7.34399998	253.41899681	-3.39499995
407.71777344	3.49199998	357.19199753	7.84799999	253.41999626	-3.39399993
410.13183594	3.77999997	357.15599823	8.31599998	253.42299652	-3.39499995
412.55273438	4.06799996	357.04799652	8.81999993	253.42399597	-3.39399993
414.96777344	4.31999999	356.90399933	9.32399988	253.42699623	-3.39499995
417.38574219	4.64399999	356.68799973	9.82799995	253.42999649	-3.39399993
419.80273438	5.00399995	356.36399841	10.11599994	253.43099594	-3.39399993

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GT-4 TELEMETRY DATA FROM NASA/MSC PROCESSED TAPE 6/ 3/65

TIME FROM LIFTOFF	SFZ QUANTA*.001	VX FT/SEC	VY FT/SEC	VZ FT/SEC	DTHLVO DEGREES
0.	-724.91598511	1282.35937500	0.	-395.46484375	-0.12583945
0.	-725.64199066	1282.35937500	0.	-395.46484375	-0.09059566
0.42578125	-726.50598907	1282.35937500	0.	-395.46484375	-0.11829892
0.	-727.23498535	1282.35937500	0.	-395.46484375	-0.12583945
0.	-727.96099091	1282.35937500	0.	-395.46484375	-0.09059566
0.42675781	-728.82698822	1282.35937500	0.	-395.46484375	-0.09065030
0.	-729.55298615	1282.35937500	0.	-395.46484375	-0.12583945
0.42480469	-730.41999054	1282.35937500	0.	-395.46484375	-0.09059566
0.42578125	-731.14598846	1282.35937500	0.	-395.46484375	-0.09059566
0.	-731.87198639	1282.35937500	0.	-395.46484375	-0.09065030
0.42578125	-732.73799133	1282.35937500	0.	-395.46484375	-0.09059566
0.42578125	-733.46498871	1282.35937500	0.	-395.46484375	-0.09065030
0.	-734.19298553	1282.35937500	0.	-395.46484375	-0.09059566
0.42675781	-735.05899048	1282.35937500	0.	-395.46484375	-0.09065030
0.	-735.78498840	1282.35937500	0.	-395.46484375	-0.09059566
0.	-736.51398468	1282.35937500	0.	-395.46484375	-0.12583945
0.42578125	-737.37799072	1282.35937500	0.	-395.46484375	-0.09059566
99999.00000000	99.99899864	99999.00000000	99999.00000000	99999.00000000	99999.00000000
0.	-738.83399200	1282.35937500	0.	-395.46484375	-0.09059566
0.42578125	-739.69898987	1282.35937500	0.	-395.46484375	-0.09059566
0.	-740.42698669	1282.35937500	0.	-395.46484375	-0.09065030
0.	-741.15298462	1282.35937500	0.	-395.46484375	-0.09059566
0.42578125	-742.01799011	1282.35937500	0.	-395.46484375	-0.12583945
0.	-742.74598694	1282.35937500	0.	-395.46484375	-0.09065030
0.	-743.47399139	1282.35937500	0.	-395.46484375	-0.09065030
0.	-744.23899078	1282.56250000	0.11718750	-395.35156250	-0.11840820
0.53320313	-745.16098785	1282.53125000	0.49218750	-395.23046875	-0.12583945
2.22558594	-746.09498596	1282.08593750	-22.51562500	-395.17187500	0.09108743
4.48535156	-747.05498505	1281.75390625	-45.19140625	-395.14453125	0.06316561
7.17089844	-748.20598602	1281.51171875	-68.61328125	-395.00781250	0.05584364
9.42871094	-749.18399048	1280.93750000	-97.66015625	-394.94140625	0.05584364
11.69921875	-750.17898560	1280.28515625	-123.47656250	-395.19921875	0.09338237
99999.00000000	99.99899864	99999.00000000	99999.00000000	99999.00000000	99999.00000000
16.67675781	-752.38498688	1279.49609375	-182.48437500	-395.07421875	0.03070854
18.95019531	-753.40998840	1279.20312500	-211.19921875	-395.21875000	0.06944939
21.22070313	-754.44599152	1279.00000000	-241.09765625	-395.35937500	0.03857692
23.74609375	-755.61598969	1278.95312500	-276.12500000	-395.78125000	0.62859619
26.10058594	-756.72399139	1280.28515625	-310.45312500	-396.50781250	0.42642252
28.45898438	-757.84698486	1284.64062500	-346.21093750	-397.82812500	0.73050265
30.81542969	-758.98598480	1291.72265625	-383.58203125	-399.44531250	0.68372950
33.17285156	-760.13498688	1302.70703125	-421.95703125	-400.76953125	0.66159967
35.52832031	-761.30198669	1317.78906250	-462.16406250	-402.09375000	0.34582626
37.91406250	-762.49498749	1337.55078125	-504.02734375	-402.12890625	0.26118653
40.31347656	-763.70498657	1361.89843750	-547.12500000	-400.97656250	0.08551399
42.71289063	-764.92298889	1391.51953125	-591.02343750	-399.73046875	-0.08267263
45.11328125	-766.15599060	1425.72265625	-636.41406250	-398.58203125	-0.07300109
47.51269531	-767.39798737	1463.92187500	-682.72265625	-397.73437500	0.04622673
49.91210938	-768.65298462	1505.73046875	-730.33984375	-397.38671875	0.20315722
52.31152344	-769.91899109	1552.32031250	-779.06640625	-396.73828125	0.09911974
54.70605469	-771.18898773	1602.81250000	-828.38671875	-397.38281250	0.33544437

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GT-4 TELEMETRY DATA FROM NASA/MSC PROCESSED TAPE 6/ 3/65

TIME FROM LIFTOFF	SFZ QUANTA*.001	VX FT/SEC	VY FT/SEC	VZ FT/SEC	DTHLVO DEGREES
57.62304688	-772.74698639	1657.39843750	-877.91015625	-399.12109375	0.06169029
60.01757813	-774.03298950	1717.05468750	-928.19531250	-400.16406250	0.58816145
62.38964844	-775.30298615	1779.82812500	-978.91796875	-402.79296875	0.35227396
64.74609375	-776.55598450	1848.16406250	-1027.77343750	-406.12500000	0.07759097
67.09863281	-777.81298828	1938.87500000	-1088.87109375	-409.42578125	0.51772852
99999.00000000	99.99899864	99999.00000000	99999.00000000	-409.78515625	0.57499285
71.90136719	-780.40198517	2101.35937500	-1192.16406250	-410.44531250	0.91606530
74.25976563	-781.67498779	2189.38281250	-1243.06250000	-414.47656250	0.56455632
76.62109375	-782.94998932	2284.23437500	-1294.09765625	-417.42578125	0.59876192
79.02246094	-784.24898529	2387.07812500	-1346.26171875	-418.29296875	0.70678823
81.42382813	-785.57299042	2493.12890625	-1400.94140625	-414.30859375	1.41166399
83.82714844	-786.89598846	2606.89062500	-1455.49218750	-407.46093750	0.85497606
86.23046875	-788.20999146	2728.35156250	-1509.15625000	-402.30468750	1.01452933
88.63476563	-789.53498840	2855.95312500	-1563.91015625	-396.94921875	1.22369713
91.04003906	-790.85998535	2990.57031250	-1618.68750000	-389.72265625	1.10889526
93.44433594	-792.20198822	3130.93359375	-1675.18750000	-383.18750000	1.41275683
95.84960938	-793.54698944	3277.63281250	-1732.00000000	-374.77734375	1.13933060
98.25390625	-794.88898468	3432.41796875	-1788.56640625	-367.85937500	1.12474130
100.66699219	-796.23398590	3595.08984375	-1845.19531250	-361.74218750	1.14359264
-6231.08593750	-0.12800000	152.30078125	3764.19140625	-1902.06640625	-4.97877252
0.82812500	0.10587499	3.32031250	3.32421875	3.32421875	0.04655458
107.81933594	-800.23999023	4118.40625000	-2015.17187500	-347.81250000	2.07353687
110.22558594	-801.60298920	4308.73046875	-2073.94921875	-343.20312500	1.99064568
112.63183594	-802.94898987	4460.01953125	-2117.69140625	-339.30078125	1.58580656
115.03906250	-804.26998901	4667.09765625	-2173.15625000	-333.71875000	1.20588398
117.44531250	-805.57098389	4883.82031250	-2226.37500000	-327.05468750	1.00627846
119.85058594	-806.85498810	5109.78906250	-2277.54296875	-319.70312500	0.81678163
122.26367188	-808.14998627	5345.68750000	-2328.99609375	-313.25390625	1.09813088
124.67382813	-809.48098755	5589.07812500	-2383.82421875	-307.20703125	1.41204649
127.08789063	-810.83798981	5841.70703125	-2441.25781250	-301.37109375	1.40390490
129.50097656	-812.21498871	6103.67968750	-2501.10937500	-295.93750000	1.57679071
131.91503906	-813.61898804	6375.57421875	-2563.41015625	-291.00781250	1.71191922
134.32910156	-815.04998779	6658.17968750	-2628.54687500	-286.19140625	1.66738637
136.16796875	-816.15098572	6952.66406250	-2695.72265625	-280.58984375	1.63465609
138.58300781	-817.61499023	7259.89843750	-2764.82421875	-274.41015625	1.62618665
141.00292969	-819.10998535	7581.05468750	-2836.86328125	-267.85156250	1.64186877
143.41601563	-820.62899017	7916.43750000	-2911.56250000	-261.10546875	1.63503858
145.84179688	-822.18299103	8268.96875000	-2989.42578125	-254.35156250	1.65077534
148.26269531	-823.76198578	8637.75781250	-3069.98828125	-247.25000000	1.64651330
153.08789063	-826.62498474	9330.80078125	-3202.42187500	-233.58593750	1.52548231
155.50000000	-826.99798584	9425.12890625	-3163.46875000	-232.38671875	1.37696663
157.91113281	-827.37298584	9522.90234375	-3124.76562500	-231.48437500	1.36942609
99999.00000000	99.99899864	99999.00000000	-3086.03515625	-230.58593750	1.39559938
162.74121094	-828.11798859	9724.94531250	-3046.86328125	-229.88671875	1.45379262
165.15234375	-828.48698425	9828.92968750	-3007.76171875	-228.99218750	2.05583301
167.29882813	-828.82199097	9922.14453125	-2973.63281250	-227.91796875	2.52394703
169.75878906	-829.20898438	10031.20703125	-2934.91796875	-227.11718750	13.90402973
172.20898438	-829.55998993	10141.95312500	-2892.98046875	-226.32031250	10.35773969
174.65917969	-829.81798553	10257.00390625	-2841.84375000	-225.72656250	6.03406447
179.60937500	-830.05698395	10498.40625000	-2710.64843750	-224.64062500	0.52018739

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GT-4 TELEMETRY DATA FROM NASA/MSC PROCESSED TAPE 6/ 3/65

TIME FROM LIFTOFF	SFZ QUANTA*.001	VX FT/SEC	VY FT/SEC	VZ FT/SEC	DTHLVO DEGREES
182.09472656	-830.11598969	10622.62109375	-2638.83203125	-223.75000000	0.14676715
184.57226563	-830.16298676	10748.12109375	-2566.08593750	-223.06250000	-0.16780414
99999.00000000	99.99899864	99999.00000000	99999.00000000	99999.00000000	-0.45041015
188.74218750	-830.21598816	10963.21875000	-2441.23046875	-221.74609375	-0.52308339
191.22070313	-830.23698425	11092.96093750	-2366.03515625	-220.66015625	-0.51259222
193.69824219	-830.25498962	11224.85546875	-2290.61718750	-219.37890625	-0.49663689
196.17675781	-830.26398468	11358.31640625	-2214.35546875	-218.39843750	-0.56073140
198.65625000	-830.27098846	11494.02343750	-2137.88281250	-217.11718750	-0.55346408
201.16601563	-830.27198792	11633.30078125	-2059.94140625	-215.73828125	-0.59122138
203.66992188	-830.26598358	11774.33984375	-1981.54296875	-214.45703125	-0.50658165
206.17382813	-830.25698853	11917.13281250	-1902.90625000	-212.88281250	-0.48390541
208.67871094	-830.24298859	12016.15234375	-1848.98828125	-211.76171875	-0.45439898
210.38769531	-830.23098755	12162.87109375	-1769.58984375	-210.18750000	-0.36418581
212.89257813	-830.20698547	12311.92968750	-1689.55859375	-208.51562500	-0.41063111
215.39746094	-830.17798615	12462.93359375	-1609.08203125	-206.94531250	-0.30309658
217.90234375	-830.14398956	12616.46875000	-1528.15625000	-204.88281250	-0.37850189
220.40722656	-830.10099030	12772.14453125	-1446.38281250	-202.62109375	-0.20479646
222.91796875	-830.05298615	12931.11328125	-1363.98046875	-200.45703125	-0.25615950
225.42089844	-830.00198364	13040.48828125	-1307.84765625	-199.25000000	-0.03988831
227.12988281	-829.96298981	13203.38671875	-1224.90625000	-197.19140625	0.08704396
229.63476563	-829.90599060	13368.80859375	-1141.89453125	-195.23046875	0.17299509
232.13964844	-829.84198761	13537.33593750	-1058.24609375	-193.17968750	0.29692209
234.64453125	-829.77298737	13708.78125000	-974.14062500	-191.52343750	0.50221033
237.14941406	-829.69598389	13883.23046875	-889.28515625	-189.57421875	0.45729499
239.65332031	-829.60998535	14060.39843750	-803.62890625	-187.92187500	0.53226317
242.16503906	-829.51298523	14241.62890625	-716.64453125	-186.17578125	0.43259701
244.66992188	-829.40298462	14366.69921875	-656.81250000	-184.97656250	0.47707522
246.37890625	-829.31998444	14553.11328125	-567.83203125	-183.13671875	0.41975625
248.88281250	-829.18498993	14742.82031250	-477.43359375	-181.19921875	0.36036091
251.38769531	-829.03498840	14936.11328125	-385.54687500	-179.36718750	0.27014773
253.89257813	-828.86798859	15133.48046875	-292.01171875	-177.33984375	0.21026061
256.39746094	-828.69098663	15334.91406250	-197.52343750	-175.21484375	0.28610306
258.90234375	-828.49898529	15540.22656250	-101.57812500	-172.79687500	0.32948844
261.41406250	-828.28998566	15750.37109375	-3.75781250	-170.28515625	0.24[illegible]00146
263.91699219	-828.06598663	15896.06640625	63.79296875	-168.51562500	0.18[illegible]73774
265.62597656	-827.90098572	16113.52343750	164.01562500	-165.91015625	0.31[illegible]78987
99999.00000000	99.99899864	99999.00000000	99999.00000000	99999.00000000	99999.00[illegible]00000
270.63378906	-827.38698578	16563.07812500	368.44531250	-160.42578125	0.38647956
273.13671875	-827.11499023	16795.75390625	472.08984375	-157.44140625	0.59542878
275.63964844	-826.82798767	17034.44140625	577.19140625	-154.56640625	0.68870188
278.14257813	-826.52098846	17278.84765625	684.24609375	-151.59765625	0.73219654
280.64550781	-826.19699097	17448.91796875	758.18750000	-149.45312500	0.89737789
282.35937500	-825.95998383	17704.68359375	868.87109375	-146.29687500	0.99731725
284.86523438	-825.60099030	17966.46484375	981.07421875	-142.85156250	1.09780303
99999.00000000	99.99899864	99999.00000000	99999.00000000	99999.00000000	99999.00000000
289.87695313	-824.80198669	18512.92578125	1213.45312500	-135.88671875	1.14255445
292.38281250	-824.35998535	18797.78515625	1333.84765625	-131.97265625	1.22544566
294.88769531	-823.88898468	19090.99609375	1457.03906250	-127.96484375	1.44352001
297.39257813	-823.39798737	19393.42578125	1582.18750000	-123.47656250	1.64536583
299.89648438	-822.87598419	19605.46875000	1669.33203125	-120.58984375	2.05151632

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GT-4 TELEMETRY DATA FROM NASA/MSC PROCESSED TAPE 6/ 3/65

TIME FROM LIFTOFF	SFZ QUANTA*.001	VX FT/SEC	VY FT/SEC	VZ FT/SEC	DTHLVO DEGREES
301.57031250	-822.51198578	19920.06250000	1797.49218750	-115.82812500	1.81043790
304.69824219	-821.77298737	20232.48046875	1925.00390625	-111.46875000	1.45914748
307.07226563	-821.16298676	20555.21093750	2056.48828125	-106.82812500	1.17222480
309.44628906	-820.52198792	20888.73046875	2191.52734375	-101.90234375	1.16441105
311.82910156	-819.85398865	21235.73828125	2329.57421875	-96.79296875	1.19380820
314.20214844	-819.15998840	21711.68750000	2514.96093750	-90.23828125	1.28576991
316.57812500	-818.43198395	22089.81640625	2659.49609375	-84.77343750	1.31669702
318.95214844	-817.66698456	22482.92968750	2807.64453125	-78.92968750	1.34177747
321.33593750	-816.85898590	22894.89453125	2960.32812500	-72.31640625	1.33177808
99999.00000000	99.99899864	99999.00000000	99999.00000000	99999.00000000	99999.00000000
326.08984375	-815.09098816	23772.69921875	3280.27734375	-58.07031250	1.42669041
328.46484375	-814.12098694	24243.59765625	3448.71875000	-49.94921875	1.72995092
330.84863281	-813.06898499	24739.48828125	3625.53906250	-41.06250000	2.08479303
333.49902344	-811.99198914	25079.59375000	3747.76171875	-34.59375000	2.20030522
335.78027344	-811.53498840	25420.89062500	3927.39843750	-27.33593750	3.72862890
337.92187500	-811.52598572	25417.48828125	3993.12890625	-26.67187500	6.58337575
340.44628906	-811.51799011	25410.16406250	4070.31250000	-26.23828125	9.31015217
342.96289063	-811.51799011	25400.69140625	4146.45312500	-25.50390625	11.46166253
345.46289063	-811.51699066	25390.94921875	4210.31640625	-25.23828125	13.19625795
347.54785156	-811.51699066	25379.19531250	4285.14062500	-24.80859375	14.11472750
350.02539063	-811.51699066	25366.73828125	4359.98046875	-24.47265625	14.31416905
352.50878906	-811.51799011	25353.73437500	4434.85937500	-24.13671875	14.11090255
354.52343750	-811.51699066	25343.27734375	4495.74609375	-23.68750000	9.17939496
356.94042969	-811.51599121	25330.04687500	4568.76562500	-23.36718750	8.44386530
359.35839844	-811.51699066	25316.99609375	4641.54296875	-23.04687500	7.63899553
361.78222656	-811.51799011	25303.30859375	4714.47265625	-22.52343750	6.97805154
99999.00000000	99.99899864	99999.00000000	4787.33203125	-22.00390625	7.00039995
366.61523438	-811.51599121	25277.91796875	4860.19140625	-21.88281250	8.42577899
369.03222656	-811.51699066	25265.39453125	4932.79687500	-21.55859375	10.14130449
371.45703125	-811.51599121	25251.24609375	5005.77343750	-21.03515625	10.52395916
373.87304688	-811.51699066	25236.74218750	5078.27343750	-20.71484375	11.01305556
376.29003906	-811.51599121	25221.82421875	5150.94921875	-19.99218750	11.64574981
378.70800781	-811.51498413	25206.69531250	5223.59375000	-19.46875000	12.28199589
381.13183594	-811.51599121	25191.31250000	5296.19921875	-19.33984375	12.77305937
383.54785156	-811.51498413	25176.16406250	5368.70703125	-19.01562500	13.29909337
385.96582031	-811.51599121	25160.40625000	5441.01562500	-18.49218750	13.71742892
388.38281250	-811.51498413	25144.43359375	5513.48046875	-18.26953125	13.98610139
390.80859375	-811.51599121	25128.19921875	5585.93359375	-17.84375000	14.33203685
393.22167969	-811.51699066	25111.83984375	5657.97265625	-17.61718750	14.78758335
395.63574219	-811.51599121	25095.45703125	5730.19531250	-17.09375000	15.27881074
398.04882813	-811.51898956	25078.87500000	5801.95312500	-16.57031250	15.76878130
400.46289063	-811.51898956	25061.78125000	5873.98046875	-16.24609375	16.15269279
99999.00000000	99.99899864	99999.00000000	99999.00000000	99999.00000000	99999.00000000
405.30175781	-811.51898956	25027.29296875	6018.17968750	-15.39453125	16.84292459
407.71777344	-811.51998901	25009.66015625	6090.00390625	-15.07031250	17.22765565
410.13183594	-811.51898956	24992.02734375	6161.92578125	-14.54687500	17.68107104
412.55273438	-811.51998901	24973.94140625	6233.79296875	-14.21875000	18.13361216
414.96777344	-811.51898956	24955.87890625	6305.66015625	-13.69531250	18.55233026
417.38574219	-811.51998901	24937.59765625	6377.32421875	-13.37109375	19.04049778
419.80273438	-811.52098846	24918.91796875	6448.91796875	-12.94531250	19.56729674

GT-4 TELEMETRY DATA FROM NASA/MSC PROCESSED TAPE 6/ 3/65

TIME FROM LIFTOFF	DPSLVO DEGREES	DPHLVO DEGREES	FLOW TAG DECIMAL	VZG FT/SEC	PDOT DEGREES/SEC
0.	-0.10054041	-0.00557343	22537.00000000	0.	-0.51600731
0.	-0.09305453	0.03048997	47.00000000	0.	-0.51600731
0.42578125	-0.13578421	-0.00562807	38573.00000000	0.	-0.51600731
0.	-0.10054041	-0.00557343	22537.00000000	0.	-0.51600731
0.	-0.09305453	-0.00557343	47.00000000	0.	-0.51600731
0.42675781	-0.09299988	-0.00557343	38573.00000000	0.	-0.51600731
0.	-0.10054041	0.03043533	22548.00000000	0.	-0.51600731
0.42480469	-0.09305453	-0.00557343	38525.00000000	0.	-0.51600731
0.42578125	-0.09305453	-0.00557343	38580.00000000	0.	-0.51600731
0.	-0.09299988	-0.00557343	22548.00000000	0.	-0.51600731
0.42578125	-0.09305453	-0.00546415	38525.00000000	0.	-0.51600731
0.42578125	-0.09299988	-0.00551879	38580.00000000	0.	-0.51600731
0.	-0.09305453	0.03048997	22559.00000000	0.	-0.51600731
0.42675781	-0.09299988	-0.00551879	38525.00000000	0.	-0.51600731
0.	-0.09305453	-0.00562807	22530.00000000	0.	-0.51600731
0.	-0.10054041	-0.00551879	22559.00000000	0.	-0.51600731
0.42578125	-0.09305453	-0.00557343	38525.00000000	0.	-0.51600731
99999.00000000	99999.00000000	99999.00000000	99999.00000000	0.	-0.51600731
0.	-0.09305453	-0.00551879	22559.00000000	0.	-0.51600731
0.42578125	-0.09305453	-0.00557343	38525.00000000	0.	-0.51600731
0.	-0.09299988	-0.00551879	22537.00000000	0.	-0.51600731
0.	-0.09305453	-0.00557343	47.00000000	0.	-0.51600731
0.42578125	-0.10054041	-0.00557343	38573.00000000	0.	-0.51600731
0.	-0.09299988	-0.00551879	22537.00000000	0.	-0.51600731
0.	-0.09299988	0.03054462	47.00000000	0.	-0.51600731
0.	-0.13572957	0.03611805	22559.00000000	0.	-0.51600731
0.53320313	-0.10054041	0.03617269	38525.00000000	0.	-0.51600731
2.22558594	0.09234419	0.21610726	39160.00000000	0.	-0.51600731
4.48535156	0.04977843	0.35997842	22559.00000000	0.	-0.51600731
7.17089844	0.08502222	0.39609647	38525.00000000	0.	-0.51600731
9.42871094	0.08502222	0.36008770	39160.00000000	0.	-0.51600731
11.69921875	0.09004924	0.17638286	22559.00000000	0.	-0.51600731
99999.00000000	99999.00000000	99999.00000000	99999.00000000	99999.00000000	99999.00000000
16.67675781	0.07431248	0.10452925	38989.00000000	0.	-0.51600731
18.95019531	0.10955627	0.12627658	22537.00000000	0.	-0.51600731
21.22070313	0.14327010	0.22545096	47.00000000	0.	-0.51600731
23.74609375	0.21419480	0.22780055	22548.00000000	0.	-0.70900121
26.10058594	0.35183682	0.22796447	22559.00000000	0.	-0.70900121
28.45898438	0.44210464	0.30446262	22559.00000000	0.	-0.70900121
30.81542969	0.46800473	0.34172814	22686.00000000	0.	-0.70900121
33.17285156	0.45734963	0.34446022	6144.00000000	0.	-0.70900121
35.52832031	0.16534527	0.30861537	6151.00000000	0.	-0.70900121
37.91406250	-0.02437012	0.34746551	6151.00000000	0.	-0.70900121
40.31347656	-0.24796327	0.38877450	6151.00000000	0.	-0.70900121
42.71289063	-0.14764142	0.39576862	6151.00000000	0.	-0.70900121
45.11328125	-0.12327129	0.33052663	6151.00000000	0.	-0.70900121
47.51269531	-0.02928786	0.33691969	6151.00000000	0.	-0.70900121
49.91210938	0.17206618	0.27277053	6151.00000000	0.	-0.70900121
52.31152344	-0.12633122	0.28145853	6151.00000000	0.	-0.70900121
54.70605469	0.50570738	0.25648735	47.00000000	0.	-0.70900121

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GT-4 TELEMETRY DATA FROM NASA/MSC PROCESSED TAPE 6/ 3/65

TIME FROM LIFTOFF	DPSLVO DEGREES	DPHLVO DEGREES	FLOW TAG DECIMAL	VZG FT/SEC	PDOT DEGREES/SEC
57.62304688	0.42669573	0.23009549	38525.00000000	0.	-0.70900121
60.01757813	0.18769366	0.23840100	38525.00000000	0.	-0.70900121
62.38964844	0.89939963	0.29052903	38525.00000000	0.	-0.70900121
64.74609375	0.70962958	0.22834696	38525.00000000	0.	-0.70900121
67.09863281	0.43603943	0.27779755	38937.00000000	0.	-0.70900121
99999.00000000	0.06026961	0.25080463	99999.00000000	0.	-0.70900121
71.90136719	0.47264925	0.26626819	38937.00000000	0.	-0.70900121
74.25976563	1.18326239	0.28965476	38989.00000000	0.	-0.70900121
76.62109375	0.26610426	0.29856133	39160.00000000	0.	-0.70900121
79.02246094	0.28391740	0.38500424	39160.00000000	0.	-0.70900121
81.42382813	-1.18397273	0.29451786	39160.00000000	0.	-0.70900121
83.82714844	-0.72416423	0.36473223	39160.00000000	0.	-0.70900121
86.23046875	-0.49128202	0.27244268	39160.00000000	0.	-0.70900121
88.63476563	-0.94497067	0.24763542	38989.00000000	0.	-0.51600731
91.04003906	-0.71329056	0.22463134	38989.00000000	0.	-0.51600731
93.44433594	-0.84759945	0.16086467	38989.00000000	0.	-0.51600731
95.84960938	-0.97589777	0.13829771	38989.00000000	0.	-0.51600731
98.25390625	-0.67531470	0.16179357	38989.00000000	0.	-0.51600731
100.66699219	-0.59198637	0.17616430	38989.00000000	0.	-0.51600731
-6231.08593750	1.20091160	-0.58160447	105547.00000000	11.14843750	0.
0.82812500	0.04660922	0.04666387	849.00000000	3.33984375	0.00018249
107.81933594	-0.28249672	0.13813379	38937.00000000	-358.25000000	-0.51600731
110.22558594	-0.30593794	0.12048458	38937.00000000	-358.25000000	-0.51600731
112.63183594	-0.39882854	0.10261679	38525.00000000	-358.25000000	-0.51600731
115.03906250	-0.56368205	0.12327129	38525.00000000	-358.25000000	-0.51600731
117.44531250	-0.76809602	0.03114567	38525.00000000	-358.25000000	-0.51600731
119.85058594	-0.65078066	0.05032485	38525.00000000	-358.25000000	-0.23499957
122.26367188	-0.35981449	0.02005344	38525.00000000	-358.25000000	-0.23499957
124.67382813	-0.39407473	-0.01464393	38525.00000000	-358.25000000	-0.23499957
127.08789063	-0.31735802	-0.04016152	38525.00000000	-358.25000000	-0.23499957
129.50097656	-0.06179957	-0.06660803	38525.00000000	-358.25000000	-0.23499957
131.91503906	-0.09381951	-0.09534947	38525.00000000	-358.25000000	-0.23499957
134.32910156	-0.08901105	-0.12452805	38525.00000000	-358.25000000	-0.23499957
136.16796875	-0.22851089	-0.15605622	47.00000000	-358.25000000	-0.23499957
138.58300781	-0.18802151	-0.18370483	47.00000000	-358.25000000	-0.23499957
141.00292969	-0.21878470	-0.24872825	6151.00000000	-358.25000000	-0.23499957
143.41601563	-0.17851388	-0.27522939	6151.00000000	-358.25000000	-0.23499957
145.84179688	-0.17332294	-0.34019818	6144.00000000	-254.50000000	-0.23499957
148.26269531	-0.20523360	-0.36806536	6144.00000000	-254.50000000	-0.23499957
153.08789063	-0.11163265	-2.43985370	6144.00000000	-254.50000000	-0.23499957
155.50000000	0.62837762	-1.65388991	22686.00000000	-254.50000000	-0.23499957
157.91113281	0.55903752	-1.64678651	22686.00000000	-254.50000000	-0.23499957
99999.00000000	0.59745052	-1.63973776	99999.00000000	-254.50000000	-0.23499957
162.74121094	0.60236826	-1.66694924	22559.00000000	-254.50000000	-0.23499957
165.15234375	0.65438700	-1.66126652	22559.00000000	-254.50000000	-0.23499957
167.29882813	0.66963198	-1.69011724	22548.00000000	-254.50000000	-0.09793320
169.75878906	0.33096376	-1.64591224	22537.00000000	-254.50000000	-0.09963435
172.20898438	0.35921343	-1.64383587	22530.00000000	-254.50000000	-0.09268869
174.65917969	0.44713166	-1.64580296	40053.00000000	-254.50000000	-0.09383210
179.60937500	0.49559870	-1.64569367	39634.00000000	-254.50000000	-0.09132222

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GT-4 TELEMETRY DATA FROM NASA/MSC PROCESSED TAPE 6/ 3/65

TIME FROM LIFTOFF	DPSLVO DEGREES	DPHLVO DEGREES	FLOW TAG DECIMAL	VZG FT/SEC	PDOT DEGREES/SEC
182.09472656	0.46691190	-1.64552976	39160.00000000	-254.50000000	-0.08999396
184.57226563	0.43587551	-1.64514726	38989.00000000	-254.50000000	-0.09138049
99999.00000000	0.44068396	-1.68066426	99999.00000000	-254.50000000	-0.09269573
188.74218750	0.37380272	-1.64405443	47.00000000	-254.50000000	-0.09394352
191.22070313	0.30173054	-1.67907965	23622.00000000	-254.50000000	-0.09269487
193.69824219	0.34140030	-1.67793219	22548.00000000	-254.50000000	-0.09411171
196.17675781	0.27260660	-1.67711256	22537.00000000	-254.50000000	-0.09277961
198.65625000	0.27610366	-1.67596509	40053.00000000	-254.50000000	-0.09327266
201.16601563	0.27719649	-1.67470834	6704.00000000	-254.50000000	-0.09450957
203.66992188	0.20900386	-1.67328766	39599.00000000	-254.50000000	-0.09459580
206.17382813	0.21064311	-1.70771182	38937.00000000	-254.50000000	-0.09525833
208.67871094	0.17824068	-1.67061022	38525.00000000	-254.50000000	-0.09691380
210.38769531	0.17791282	-1.70492510	23622.00000000	-254.50000000	-0.09784975
212.89257813	0.14381651	-1.70284872	22548.00000000	-254.50000000	-0.09772318
215.39746094	0.18490694	-1.70191982	22530.00000000	-254.50000000	-0.09680153
217.90234375	0.10857272	-1.69858669	6842.00000000	-254.50000000	-0.09884461
220.40722656	0.07748169	-1.73290157	39634.00000000	-254.50000000	-0.09674539
222.91796875	0.11217906	-1.73126233	38989.00000000	-254.50000000	-0.09880597
225.42089844	0.14796927	-1.72825703	38525.00000000	-254.50000000	-0.09868900
227.12988281	0.18660083	-1.72705492	47.00000000	-254.50000000	-0.09911504
229.63476563	0.22047858	-1.76120588	22559.00000000	-254.50000000	-0.09694944
232.13964844	0.26020297	-1.75983985	22537.00000000	-254.50000000	-0.09812488
234.64453125	0.26167830	-1.72170006	40053.00000000	-254.50000000	-0.09818357
237.14941406	0.26124117	-1.79202370	6704.00000000	-254.50000000	-0.09788262
239.65332031	0.30342443	-1.75524995	39599.00000000	-254.50000000	-0.09852359
242.16503906	0.34063531	-1.75371999	38989.00000000	-254.50000000	-0.09661113
244.66992188	0.38347428	-1.78863592	38525.00000000	-254.50000000	-0.09569845
246.37890625	0.31069175	-1.82311474	23622.00000000	-254.50000000	-0.09486388
248.88281250	0.35139970	-1.78617705	22548.00000000	-254.50000000	-0.09592940
251.38769531	0.35571638	-1.82098372	22530.00000000	-254.50000000	-0.09266179
253.89257813	0.28582986	-1.81928983	6842.00000000	-254.50000000	-0.09258111
256.39746094	0.29271469	-1.85464290	39634.00000000	-254.50000000	-0.09348248
258.90234375	0.29533748	-1.88868457	39160.00000000	-254.50000000	-0.09054700
261.41406250	0.26096795	-1.88720925	38937.00000000	-254.50000000	-0.08924542
263.91699219	0.22741806	-1.92157878	38525.00000000	-254.50000000	-0.08975853
265.62597656	0.22840160	-1.88464111	22559.00000000	-254.50000000	-0.08865503
99999.00000000	99999.00000000	99999.00000000	99999.00000000	99999.00000000	99999.00000000
270.63378906	0.23184402	-1.95348944	40053.00000000	99999.00000000	-0.08750927
273.13671875	0.26845384	-1.95168626	6704.00000000	-254.50000000	-0.08459000
275.63964844	0.23463074	-2.02222848	39599.00000000	-254.50000000	-0.08043554
278.14257813	0.27260660	-2.02102637	38989.00000000	-254.50000000	-0.07968187
280.64550781	0.24129701	-2.05594230	38525.00000000	-254.50000000	-0.07211999
282.35937500	0.24211663	-2.09063968	47.00000000	-254.50000000	-0.06994714
284.86523438	0.23911134	-2.08900043	22559.00000000	-254.50000000	-0.06102968
99999.00000000	99999.00000000	99999.00000000	99999.00000000	99999.00000000	99999.00000000
289.87695313	0.28238744	-2.15937874	6842.00000000	-254.50000000	-0.04712896
292.38281250	0.24687044	-2.15877765	39634.00000000	-254.50000000	-0.04169298
294.88769531	0.21004205	-2.19413075	39160.00000000	-254.50000000	-0.02837262
297.39257813	0.20632643	-2.26565650	38937.00000000	-254.50000000	-0.01234450
299.89648438	0.24222592	-2.26549259	38525.00000000	-254.50000000	0.00868139

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GT-4 TELEMETRY DATA FROM NASA/MSC PROCESSED TAPE 6/ 3/65

TIME FROM LIFTOFF	DPSLVO DEGREES	DPHLVO DEGREES	FLOW TAG DECIMAL	VZG FT/SEC	PDOT DEGREES/SEC
301.57031250	0.20053443	-2.30199313	47.00000000	-254.50000000	0.01050141
304.69824219	0.27014773	-2.33816582	38525.00000000	-254.50000000	0.01138955
307.07226563	0.22801911	-2.41012871	38525.00000000	-254.50000000	0.01236328
309.44628906	0.18550800	-2.44624677	38525.00000000	-254.50000000	0.01343007
311.82910156	0.28380812	-2.48274732	38525.00000000	-254.50000000	0.01460508
314.20214844	0.24129701	-2.55498341	38937.00000000	-254.50000000	0.01589087
316.57812500	0.26298969	-2.62716490	38937.00000000	-254.50000000	0.01730386
318.95214844	0.24331874	-2.66339222	38989.00000000	-254.50000000	0.01885581
321.33593750	0.14015553	-2.73540977	38989.00000000	-254.50000000	0.02056314
99999.00000000	99999.00000000	99999.00000000	99999.00000000	99999.00000000	0.02245063
326.08984375	0.00644770	-2.84441963	39160.00000000	-254.50000000	0.02452999
328.46484375	-0.15578301	-2.95260987	39160.00000000	-254.50000000	0.02682450
330.84863281	-0.59531949	-3.02440882	39599.00000000	-254.50000000	0.02936790
333.49902344	-0.83617938	-3.09538817	32924.00000000	-254.50000000	0.03212730
335.78027344	-1.84065467	-2.28166649	38937.00000000	-254.50000000	0.03212730
337.92187500	-1.98545474	-1.12080711	47.00000000	-254.50000000	0.03212730
340.44628906	-1.01917386	-1.00256284	39599.00000000	-254.50000000	0.03212730
342.96289063	-0.08190765	-1.85130976	38937.00000000	-254.50000000	0.03212730
345.46289063	0.54608747	-3.16423652	38525.00000000	-254.50000000	0.03212730
347.54785156	0.91666635	-4.28837675	47.00000000	-254.50000000	0.03212730
350.02539063	1.25112717	-4.83080328	39599.00000000	-254.50000000	0.03212730
352.50878906	1.70951499	-4.68474644	39160.00000000	-254.50000000	0.03212730
354.52343750	-24.65660906	86.25597572	47.00000000	-254.50000000	0.03212730
356.94042969	-24.15265036	87.40798378	47.00000000	-254.50000000	0.03212730
359.35839844	-23.75666308	88.55999088	34872.00000000	-254.50000000	0.03212730
361.78222656	-23.61262798	89.42398262	34872.00000000	-254.50000000	0.03212730
99999.00000000	-23.75666308	89.63998032	99999.00000000	-254.50000000	0.03212730
366.61523438	-24.94462466	88.70402622	1612.00000000	-254.50000000	0.03212730
369.03222656	-25.30465770	88.20001221	33433.00000000	-254.50000000	0.03212730
371.45703125	-25.66463614	88.16400337	33433.00000000	-254.50000000	0.03212730
373.87304688	-25.98866034	88.12799454	33419.00000000	-254.50000000	0.03212730
376.29003906	-26.31262994	87.51600933	33419.00000000	-254.50000000	0.03212730
378.70800781	-26.60064554	85.46400166	33405.00000000	-254.50000000	0.03212730
381.13183594	-27.03264141	71.64002132	35043.00000000	-254.50000000	0.03212730
383.54785156	-27.50064635	57.45600891	35043.00000000	-254.50000000	0.03212730
385.96582031	-28.00465965	43.30800438	35043.00000000	-254.50000000	0.03212730
388.38281250	-28.36463809	32.54400492	34983.00000000	-254.50000000	0.03212730
390.80859375	-28.86865163	19.40397310	34983.00000000	-254.50000000	0.03212730
393.22167969	-29.26463890	11.08796906	34983.00000000	-254.50000000	0.03212730
395.63574219	-29.62467194	6.26399601	39634.00000000	-254.50000000	0.03212730
398.04882813	-29.91263270	6.04799801	39634.00000000	-254.50000000	0.03212730
400.46289063	-29.69663477	6.44398522	39599.00000000	-254.50000000	0.03212730
99999.00000000	99999.00000000	99999.00000000	99999.00000000	99999.00000000	99999.00000000
405.30175781	-29.40867400	7.34398592	39160.00000000	-254.50000000	0.03212730
407.71777344	-29.37266517	7.84799939	39160.00000000	-254.50000000	0.03212730
410.13183594	-29.40867400	8.31594944	39043.00000000	-254.50000000	0.03212730
412.55273438	-29.51664567	8.81996298	38989.00000000	-254.50000000	0.03212730
414.96777344	-29.66062593	9.32397652	38989.00000000	-254.50000000	0.03212730
417.38574219	-29.87667871	9.82798994	38937.00000000	-254.50000000	0.03212730
419.80273438	-30.20064831	10.11595082	38937.00000000	-254.50000000	0.03212730

GT-4 TELEMETRY DATA FROM NASA/MSC PROCESSED TAPE 6/ 3/65

TIME FROM LIFTOFF	OMYY DEGREES/SEC	X FEET*.001	Y FEET*.001	Z FEET*.001	TG SECONDS
0.	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.42578125	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.42675781	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.42480469	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.42578125	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.42578125	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.42578125	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.42675781	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.42578125	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
99999.00000000	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.42578125	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.42578125	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.	-0.00000021	-17.32799983	-20909.91992188	-56.18399954	175.00000000
0.	-0.00000021	-16.08399987	-20909.91992188	-56.56799984	175.00000000
0.53320313	-0.00000021	-13.19199991	-20909.91992188	-57.45999956	175.00000000
2.22558594	-0.00000021	-9.63599992	-20909.94384766	-58.55199957	175.00000000
4.48535156	-0.00000021	-6.73999995	-20910.02392578	-59.44399977	175.00000000
7.17089844	-0.00000021	-3.84799999	-20910.15185547	-60.33599997	175.00000000
9.42871094	-0.00000021	-0.40400000	-20910.37597656	-61.39599991	175.00000000
11.69921875	-0.00000021	2.50399998	-20910.62377930	-62.29199982	175.00000000
99999.00000000	99999.00000000	5.41599995	-20910.93579102	-63.19199991	175.00000000
16.67675781	-0.00000021	8.87599993	-20911.38378906	-64.25999928	175.00000000
18.95019531	-0.00000021	11.78399992	-20911.83178711	-65.15999985	175.00000000
21.22070313	-0.00000021	14.68799996	-20912.34399414	-66.05599976	175.00000000
23.74609375	-0.00000021	17.91599989	-20912.99584961	-67.05599976	175.00000000
26.10058594	-0.00000021	20.92799997	-20913.68798828	-67.98799992	175.00000000
28.45898438	-0.00000021	23.95199990	-20914.45996094	-68.92399979	175.00000000
30.81542969	-0.00000021	26.98799992	-20915.31982422	-69.86399937	175.00000000
33.17285156	-0.00000021	30.04799986	-20916.26782227	-70.80799961	175.00000000
35.52832031	-0.00000021	33.13199997	-20917.31176758	-71.75199986	175.00000000
37.91406250	-0.00000021	36.29599953	-20918.46386719	-72.71199989	175.00000000
40.31347656	-0.00000021	39.53599977	-20919.72387695	-73.67599964	175.00000000
42.71289063	-0.00000021	42.83599997	-20921.08789063	-74.63599968	175.00000000
45.11328125	-0.00000021	46.21599960	-20922.55981445	-75.59599972	175.00000000
47.51269531	-0.00000021	49.68399954	-20924.14379883	-76.54799938	175.00000000
49.91210938	-0.00000021	53.24399996	-20925.83984375	-77.50399971	175.00000000
52.31152344	-0.00000021	56.91199970	-20927.64794922	-78.45599937	175.00000000
54.70605469	-0.00000021	60.68799973	-20929.57177734	-79.40399933	175.00000000

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GT-4 TELEMETRY DATA FROM NASA/MSC PROCESSED TAPE 6/ 3/65

TIME FROM LIFTOFF	OMWY DEGREES/SEC	X FEET*.001	Y FEET*.001	Z FEET*.001	TG SECONDS
57.62304688	-0.00000021	64.53199959	-20931.57983398	-80.33999920	175.00000000
60.01757813	-0.00000021	68.55199909	-20933.73583984	-81.29599953	175.00000000
62.38964844	-0.00000021	72.71599960	-20936.00781250	-82.25199986	175.00000000
64.74609375	-0.00000021	76.99199963	-20938.37182617	-83.20399952	175.00000000
67.09863281	-0.00000021	81.42799950	-20940.84790039	-84.16399956	175.00000000
99999.00000000	-0.00000021	86.10399914	-20943.47998047	-85.14399910	175.00000000
71.90136719	-0.00000021	91.00000000	-20946.25195313	-86.12799931	175.00000000
74.25976563	-0.00000021	97.25599957	-20949.79980469	-87.33599949	175.00000000
76.62109375	-0.00000021	102.53599930	-20952.79589844	-88.31599998	175.00000000
79.02246094	-0.00000021	108.14399910	-20955.96386719	-89.32399940	175.00000000
81.42382813	-0.00000021	114.00399971	-20959.26391602	-90.32399940	175.00000000
83.82714844	-0.00000021	120.13199997	-20962.69580078	-91.31199932	175.00000000
86.23046875	-0.00000021	126.53999996	-20966.25976563	-92.28399944	175.00000000
88.63476563	-0.00000021	133.25199890	-20969.95190430	-93.24399948	175.00000000
91.04003906	-0.00000021	140.27999878	-20973.77978516	-94.19199944	175.00000000
93.44433594	-0.00000021	147.63999939	-20977.73999023	-95.11999989	175.00000000
95.84960938	-0.00000021	155.34799957	-20981.83593750	-96.03199959	175.00000000
98.25390625	-0.00000021	163.41199875	-20986.06787109	-96.92399979	175.00000000
100.66699219	-0.00000021	171.89199829	-20990.45190430	-97.80399990	175.00000000
-6231.08593750	-0.51600731	-0.00399999	180.74399948	-20994.95996094	-3.01110840
0.82812500	0.00018270	3.42799997	3.43199998	3.43599999	0.10485840
107.81933594	-0.00000021	196.97599983	-21003.09179688	-100.42399979	175.00000000
110.22558594	-0.00000021	207.03199959	-21007.98779297	-101.25999928	175.00000000
112.63183594	-0.00000021	217.52799988	-21013.01586914	-102.08399963	175.00000000
115.03906250	-0.00000021	228.50799942	-21018.17993164	-102.89199924	175.00000000
117.44531250	-0.00000021	239.99599838	-21023.47583008	-103.68799973	175.00000000
119.85058594	-0.00000021	252.01599884	-21028.89184570	-104.46799946	175.00000000
122.26367188	-0.00000021	264.61999893	-21034.44799805	-105.23199940	175.00000000
124.67382813	-0.00000021	277.79599762	-21040.12377930	-105.97999954	175.00000000
127.08789063	-0.00000021	291.58799744	-21045.94799805	-106.71599960	175.00000000
129.50097656	-0.00000021	306.00399780	-21051.91186523	-107.43599987	175.00000000
131.91503906	-0.00000021	321.06399918	-21058.02392578	-108.14399910	175.00000000
134.32910156	-0.00000021	336.79199982	-21064.28784180	-108.83999920	175.00000000
136.16796875	-0.00000021	353.21599960	-21070.71582031	-109.52399921	175.00000000
138.58300781	-0.00000021	370.36799622	-21077.30395508	-110.19599915	175.00000000
141.00292969	-0.00000021	388.32399750	-21084.08398438	-110.84799957	175.00000000
143.41601563	-0.00000021	407.02399826	-21091.01977539	-111.48799992	175.00000000
145.84179688	-0.00000021	426.64799881	-21098.17578125	-112.11199951	175.00000000
148.26269531	-0.00000021	447.10399628	-21105.50781250	-112.71999931	175.00000000
153.08789063	-0.00000021	490.62799835	-21120.71582031	-113.87599945	175.00000000
155.50000000	-0.00000021	513.23999786	-21128.39184570	-114.43599987	175.00000000
157.91113281	-0.00000021	536.09199524	-21135.97583008	-114.99599934	175.00000000
99999.00000000	-0.00000021	559.17199707	-21143.46386719	-115.55599976	175.00000000
162.74121094	-0.00000021	582.56399536	-21150.87988281	-116.11199951	175.00000000
165.15234375	-0.00000021	606.13999939	-21158.17993164	-116.66399956	175.00000000
167.29882813	-0.00000021	627.34399414	-21164.59985352	-117.15599918	173.42333984
169.75878906	-0.00000021	651.87999725	-21171.86791992	-117.71599960	166.87145996
172.20898438	-0.00000021	676.59199524	-21179.00781250	-118.27199936	166.11010742
174.65917969	-0.00000021	701.58399963	-21186.03588867	-118.82399940	163.15405273
179.60937500	-0.00000021	752.95599365	-21199.79199219	-119.93999958	157.31042480

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GT-4 TELEMETRY DATA FROM NASA/MSC PROCESSED TAPE 6/ 3/65

TIME FROM LIFTOFF	OMYY DEGREES/SEC	X FEET*.001	Y FEET*.001	Z FEET*.001	TG SECONDS
182.09472656	-0.00000021	779.19599915	-21206.43994141	-120.49599934	155.52587891
184.57226563	-0.00000021	805.67599487	-21212.88793945	-121.05199909	152.32690430
99999.00000000	-0.00000021	823.92399597	-21217.18383789	-121.42799950	149.22473145
188.74218750	-0.00000021	850.93199921	-21223.32788086	-121.97999954	146.25598145
191.22070313	-0.00000021	878.26399994	-21229.28393555	-122.52799988	144.58947754
193.69824219	-0.00000021	905.91599274	-21235.05175781	-123.07199955	141.55151367
196.17675781	-0.00000021	933.89599609	-21240.63598633	-123.61199951	139.90612793
198.65625000	-0.00000021	962.23599243	-21246.03198242	-124.15199947	136.66650391
201.16601563	-0.00000021	991.25999451	-21251.29980469	-124.69599915	135.20141602
203.66992188	-0.00000021	1020.56399536	-21256.35986328	-125.23599911	132.79589844
206.17382813	-0.00000021	1040.74798584	-21259.69995117	-125.59999943	130.11633301
208.67871094	-0.00000021	1070.66398621	-21264.42797852	-126.13199997	127.08105469
210.38769531	-0.00000021	1100.95199585	-21268.95996094	-126.65999985	124.31848145
212.89257813	-0.00000021	1131.60798645	-21273.29199219	-127.18399906	121.97802734
215.39746094	-0.00000021	1162.63598633	-21277.42382813	-127.70399952	119.92358398
217.90234375	-0.00000021	1194.04399109	-21281.35595703	-128.21999931	116.85607910
220.40722656	-0.00000021	1225.84399414	-21285.07983398	-128.73199844	115.85021973
222.91796875	-0.00000021	1258.10798645	-21288.60791016	-129.23599815	112.69128418
225.42089844	-0.00000021	1280.27198792	-21290.88793945	-129.57999992	110.23999023
227.12988281	-0.00000021	1313.14399719	-21294.05981445	-130.07199860	107.60485840
229.63476563	-0.00000021	1346.42799377	-21297.02392578	-130.56399918	105.66784668
232.13964844	-0.00000021	1380.12799072	-21299.77978516	-131.05199814	102.71472168
234.64453125	-0.00000021	1414.25199890	-21302.32788086	-131.53199959	99.75708008
237.14941406	-0.00000021	1448.80799866	-21304.65991211	-132.00799942	98.29382324
239.65332031	-0.00000021	1483.78399658	-21306.77978516	-132.47999954	95.38928223
242.16503906	-0.00000021	1519.33198547	-21308.69189453	-132.95199966	93.15673828
244.66992188	-0.00000021	1543.77198792	-21309.86376953	-133.26799965	90.63891602
246.37890625	-0.00000021	1579.99198914	-21311.39599609	-133.72799873	88.09887695
248.88281250	-0.00000021	1616.66799927	-21312.70776367	-134.18399811	85.22766113
251.38769531	-0.00000021	1653.83599854	-21313.78784180	-134.63599968	83.18029785
253.89257813	-0.00000021	1691.49598694	-21314.63598633	-135.08399963	80.48242188
256.39746094	-0.00000021	1729.65599060	-21315.25195313	-135.52399826	78.57739258
258.90234375	-0.00000021	1768.32398987	-21315.62377930	-135.95999908	76.41967773
261.41406250	-0.00000021	1795.00799561	-21315.73999023	-136.25599861	73.93334961
263.91699219	-0.00000021	1834.64399719	-21315.70776367	-136.67999840	71.21008301
265.62597656	-0.00000021	1874.73199463	-21315.41992188	-137.09999847	68.67395020
99999.00000000	99999.00000000	99999.00000000	99999.00000000	99999.00000000	99999.00000000
270.63378906	-0.00000021	1956.53199768	-21314.08789063	-137.91599846	63.78088379
273.13671875	-0.00000021	1998.28399658	-21313.03588867	-138.31599998	61.87231445
275.63964844	-0.00000021	2040.62399292	-21311.72387695	-138.70399857	59.50378418
278.14257813	-0.00000021	2083.57199097	-21310.14794922	-139.08799934	56.71984863
280.64550781	-0.00000021	2113.20797729	-21308.91577148	-139.34399986	54.52478027
282.35937500	-0.00000021	2157.32397461	-21306.87182617	-139.71599960	51.74609375
284.86523438	-0.00000021	2202.00799561	-21304.55590820	-140.07599831	49.45971680
99999.00000000	99999.00000000	2247.34799194	-21301.95581055	-140.42799950	46.73010254
289.87695313	-0.00000021	2293.40399170	-21299.05981445	-140.77599907	44.29113770
292.38281250	-0.00000021	2340.16397095	-21295.86791992	-141.11199951	42.50842285
294.88769531	-0.00000021	2387.61599731	-21292.37597656	-141.43599892	40.05834961
297.39257813	-0.00000021	2420.40798950	-21289.81176758	-141.65199852	37.66149902
299.89648438	-0.00000021	2469.12799072	-21285.79199219	-141.95999908	35.14624023

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GT-4 TELEMETRY DATA FROM NASA/MSC PROCESSED TAPE 6/ 3/65

TIME FROM LIFTOFF	OMYY DEGREES/SEC	X FEET*.001	Y FEET*.001	Z FEET*.001	TG SECONDS
301.57031250	-0.00000021	2517.91198730	-21281.51196289	-142.25199890	32.66088867
304.69824219	-0.00000021	2565.61599731	-21277.08789063	-142.52399826	30.20458984
307.07226563	-0.00000021	2614.02398682	-21272.36376953	-142.78399849	27.81274414
309.44628906	-0.00000021	2663.21197510	-21267.32397461	-143.03199959	25.40917969
311.82910156	-0.00000021	2713.38796997	-21261.93994141	-143.26799965	23.14721680
314.20214844	-0.00000021	2764.23199463	-21256.23999023	-143.49199867	20.70007324
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318.95214844	-0.00000021	2885.45599365	-21241.73193359	-143.95999908	15.91418457
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326.08984375	-0.00000021	3050.41998291	-21220.03198242	-144.45199966	8.77258301
328.46484375	-0.00000021	3107.44799805	-21212.04394531	-144.58399963	6.39221191
330.84863281	-0.00000021	3165.83197021	-21203.61181641	-144.69199944	4.01184082
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417.38574219	-0.00000021	5332.68798828	-20767.68383789	-146.48799896	1.70007324
419.80273438	-0.00000021	5392.93597412	-20752.22778320	-146.51999855	1.70007324

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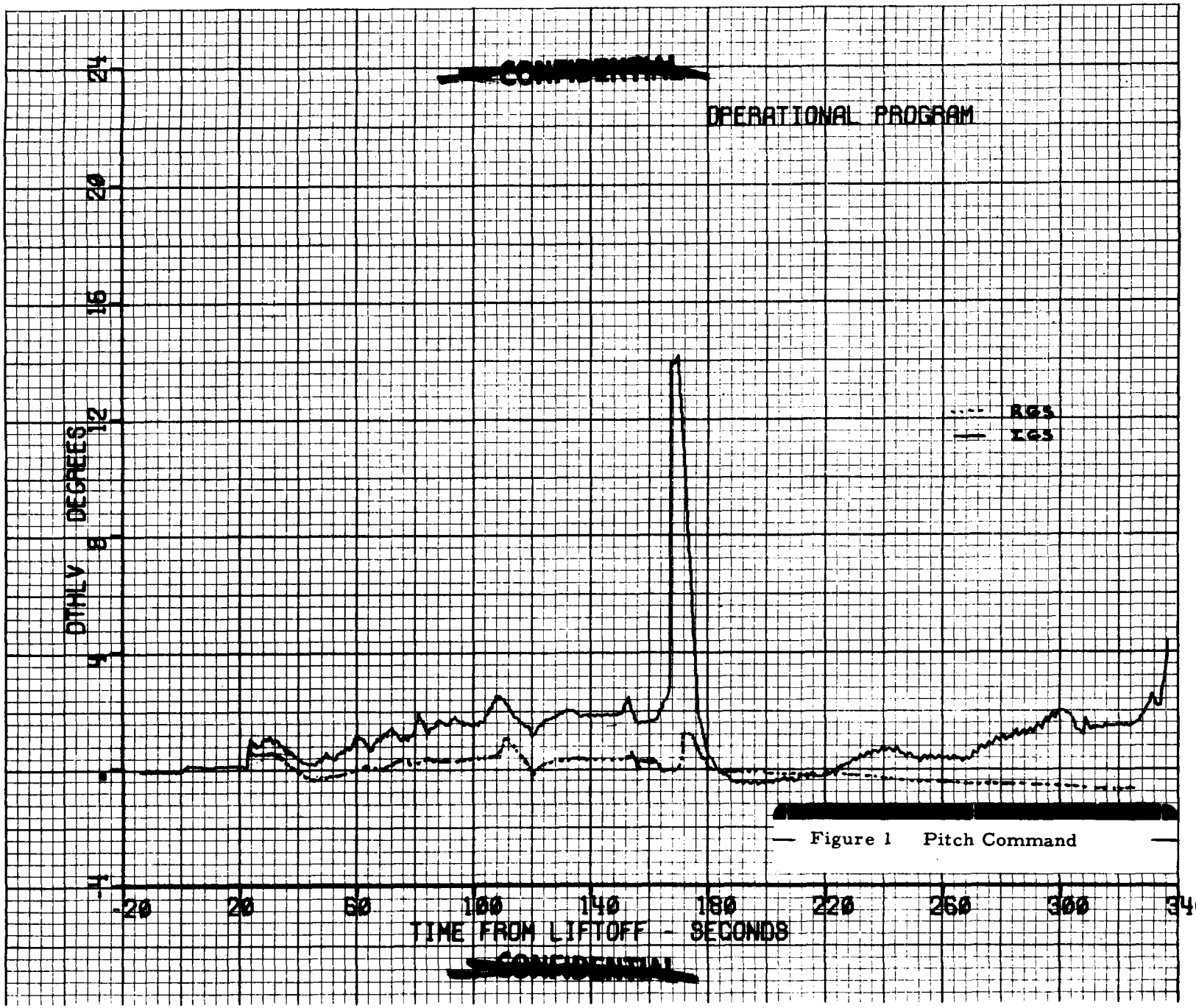
UNCLASSIFIED

APPENDIX B

FLIGHT RECONSTRUCTION GRAPHS

UNCLASSIFIED



— Figure 1 Pitch Command —

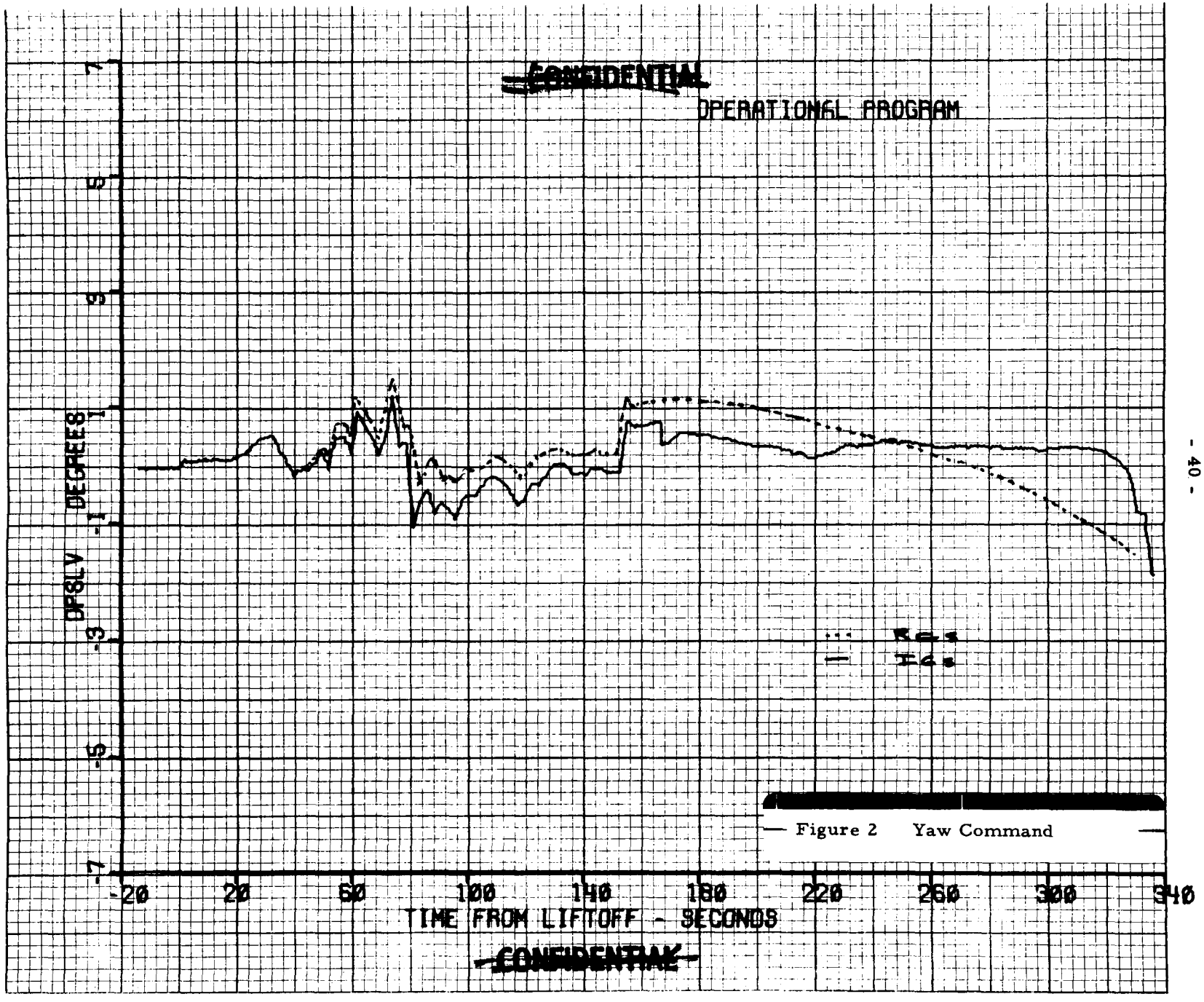


Figure 2 Yaw Command

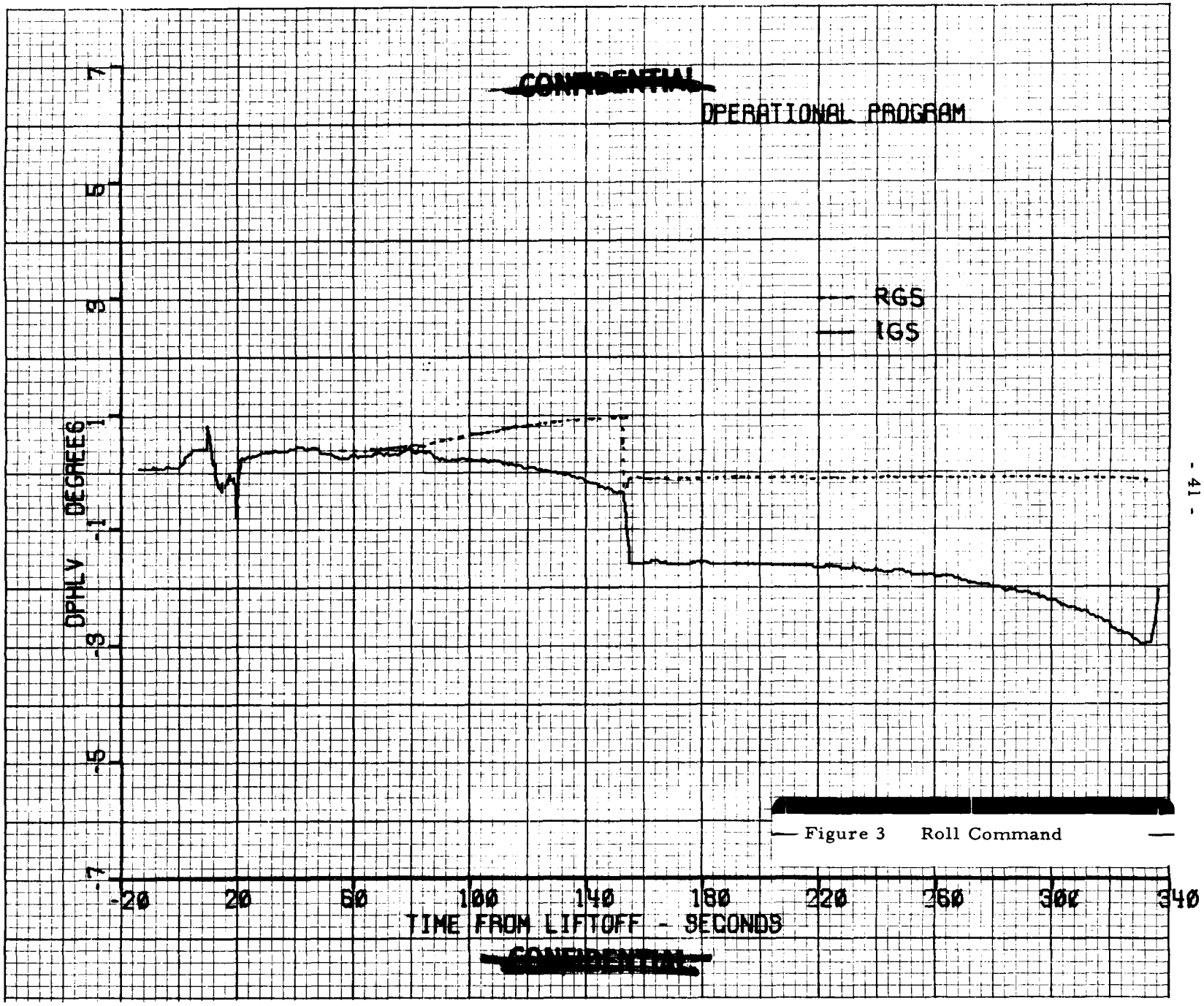


Figure 3 Roll Command

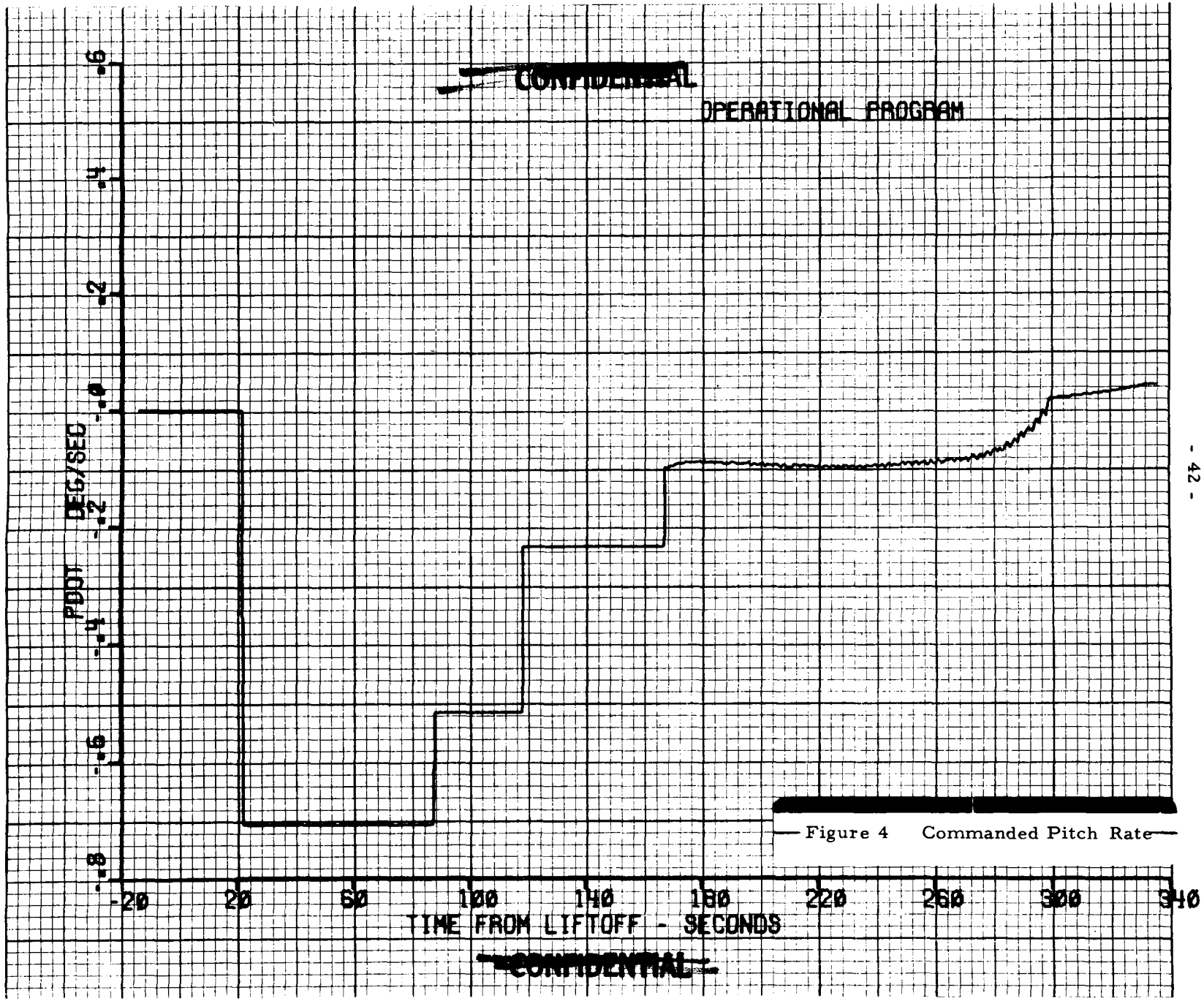


Figure 4 Commanded Pitch Rate

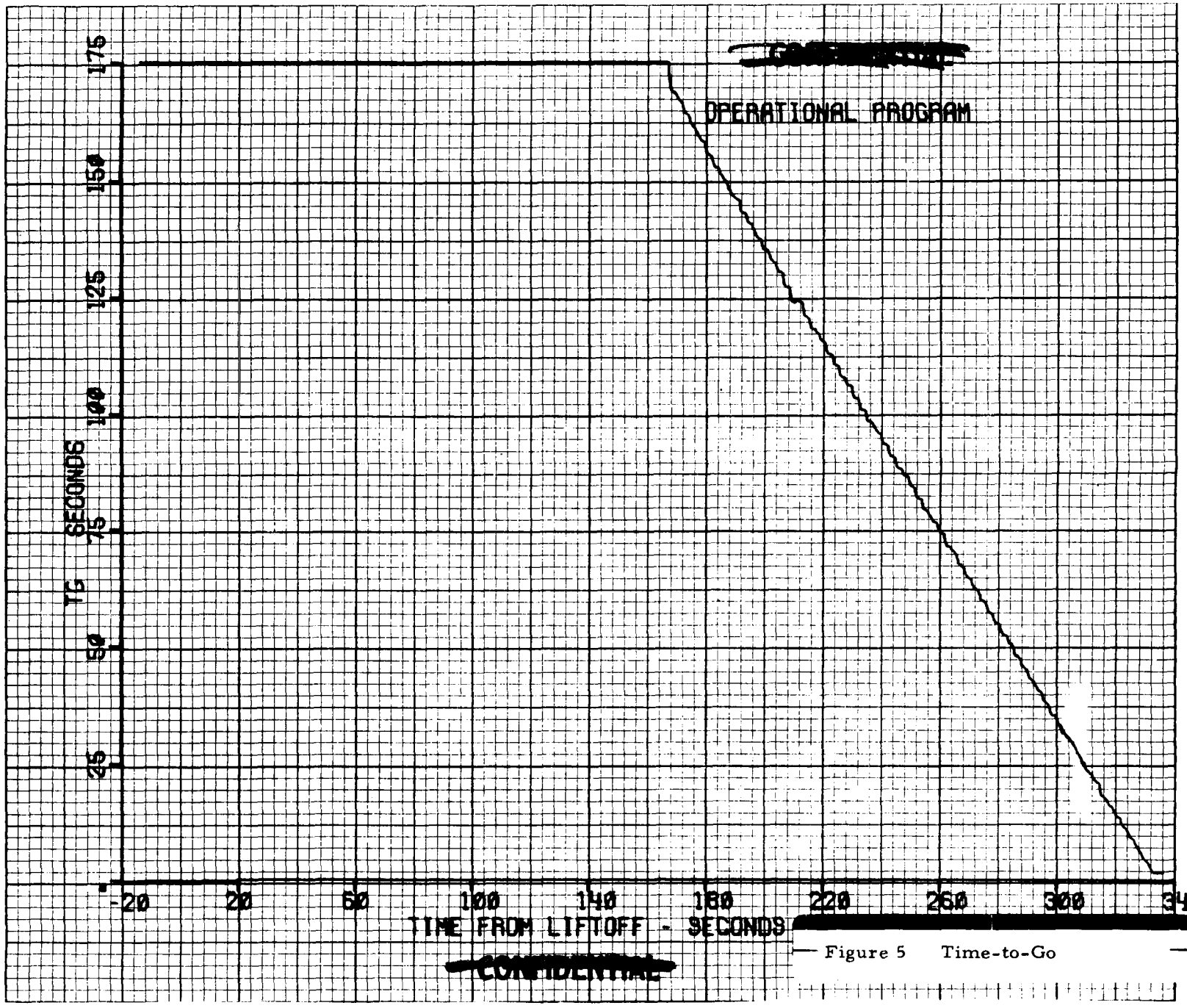


Figure 5 Time-to-Go

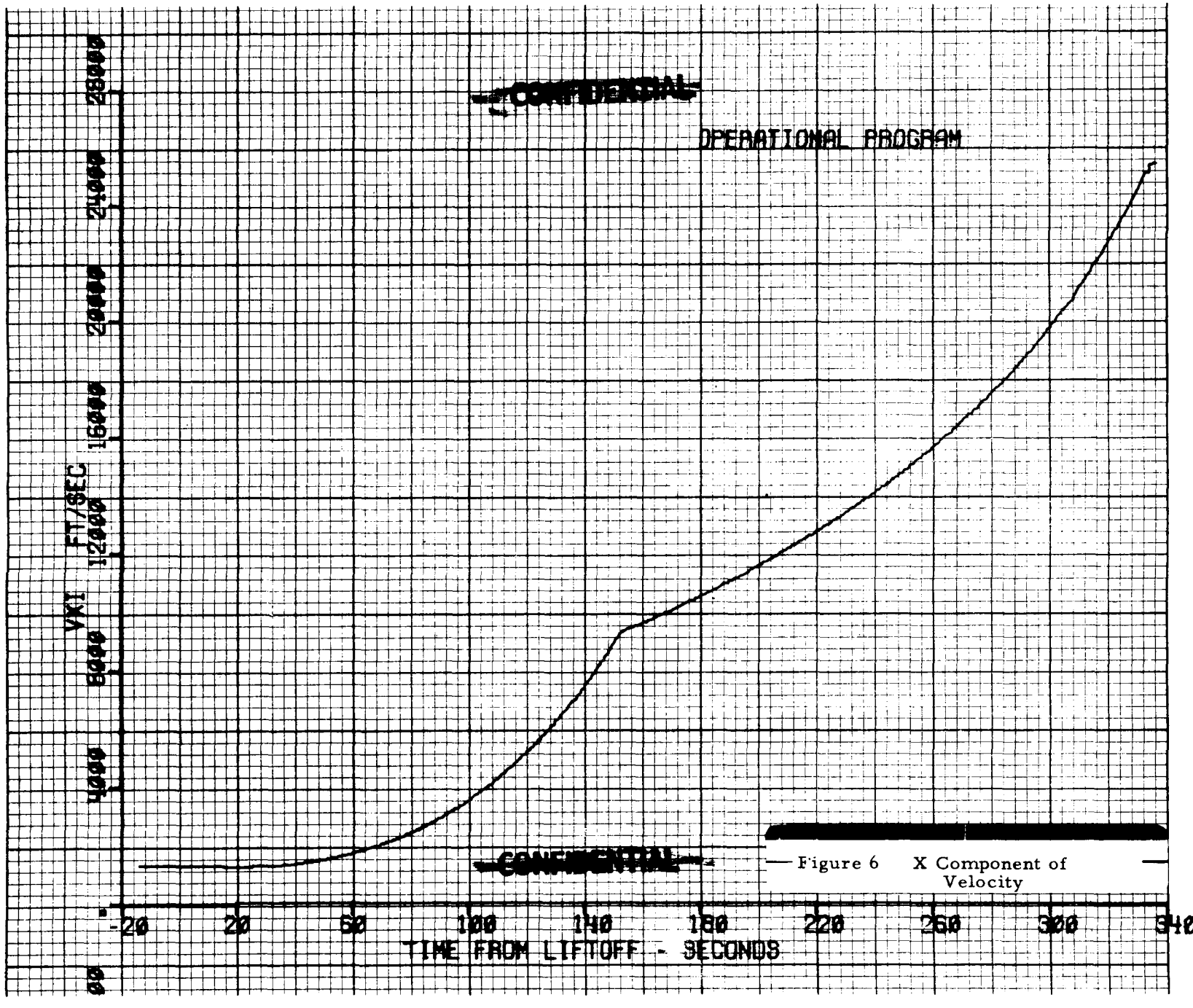


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Figure 6 X Component of Velocity

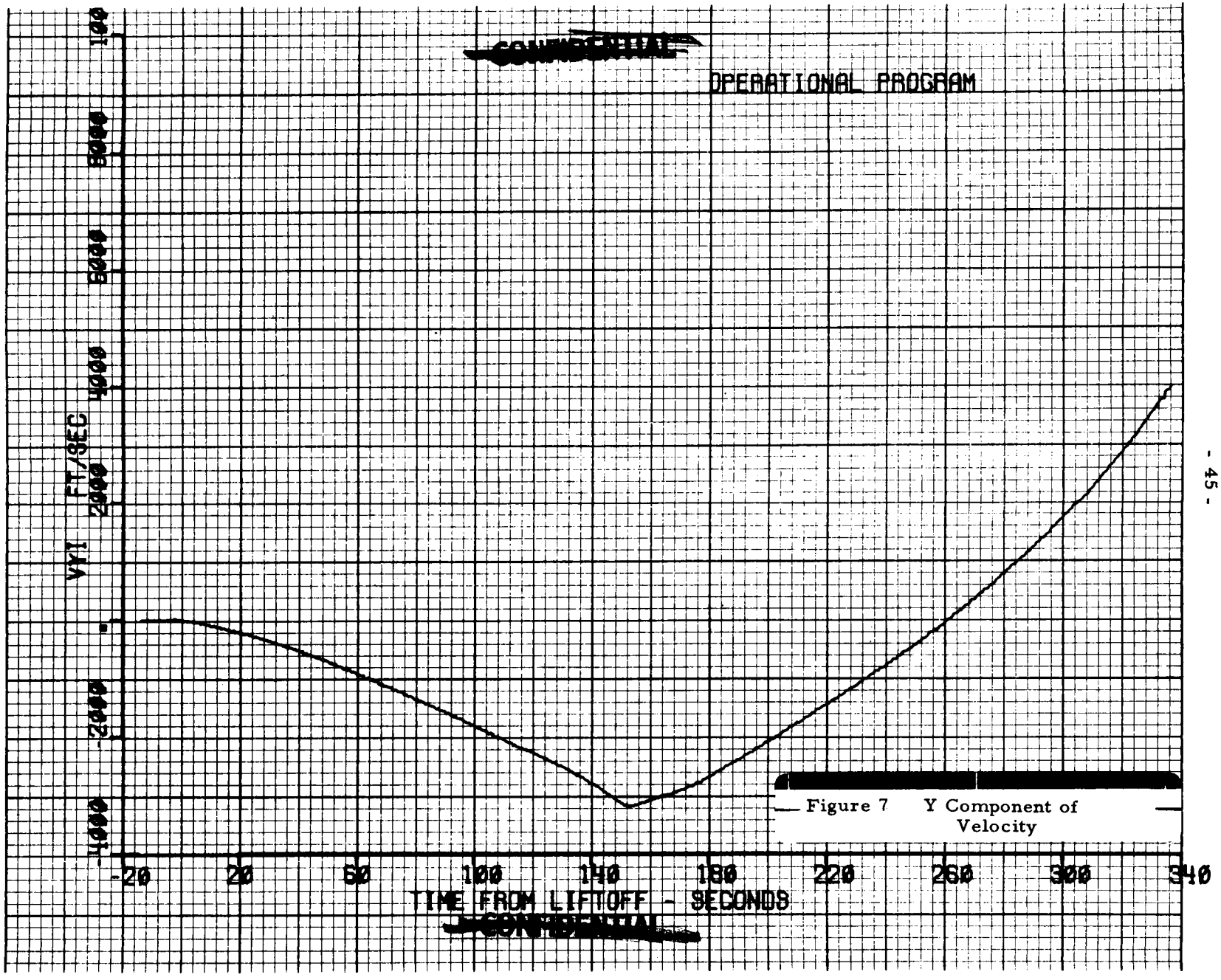

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Figure 7 Y Component of Velocity

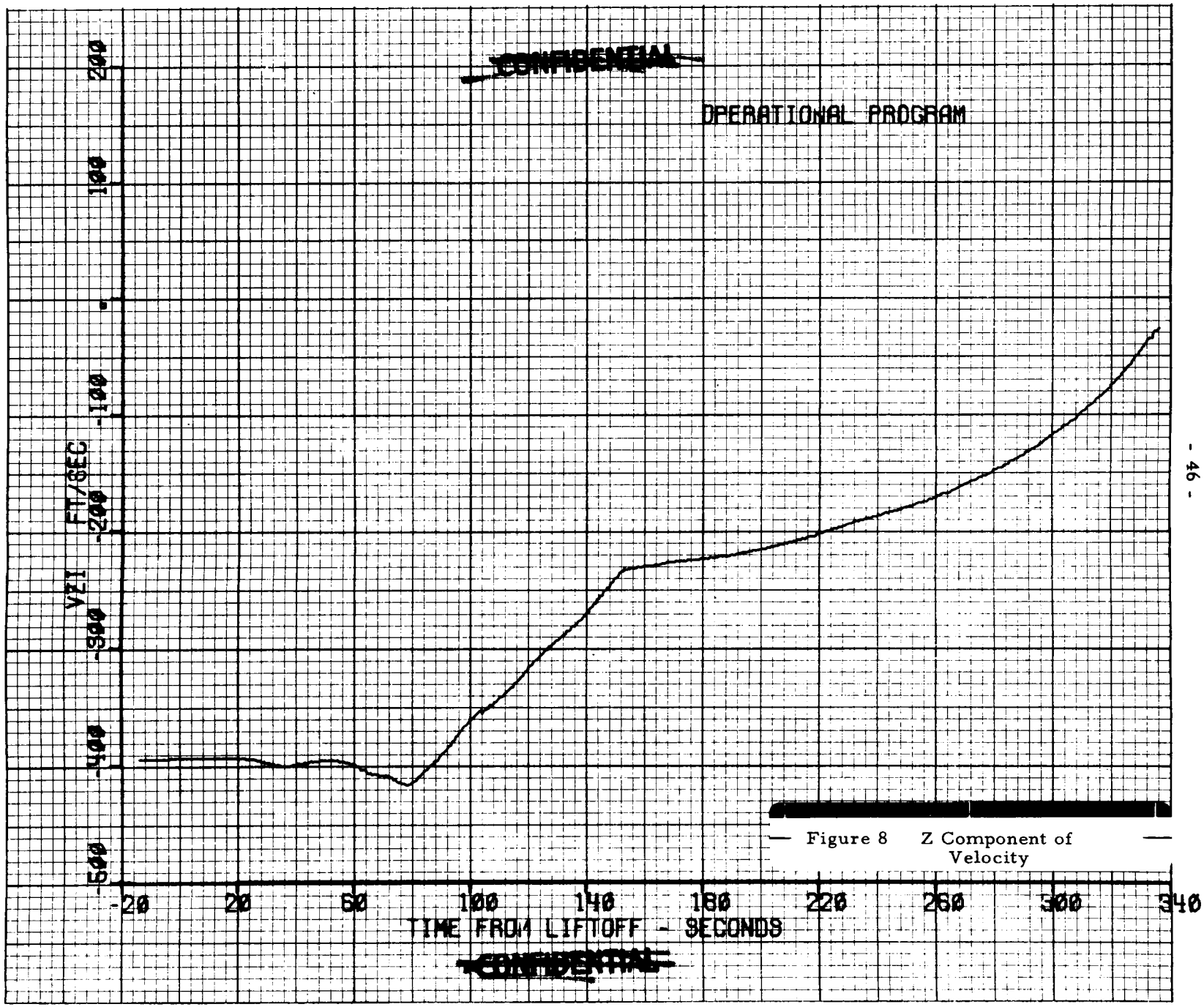

Figure 8 Z Component of Velocity

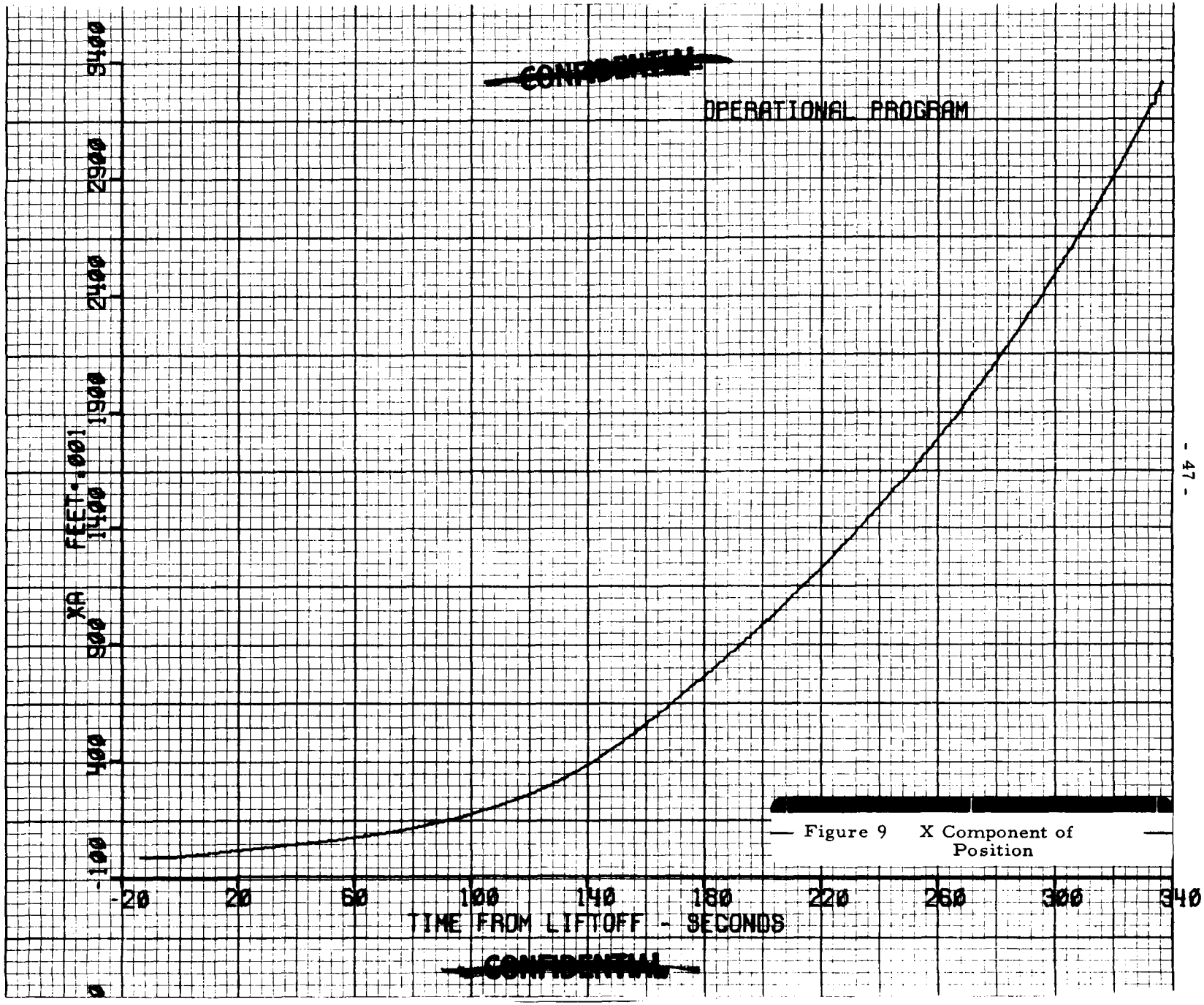

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Figure 9 X Component of Position

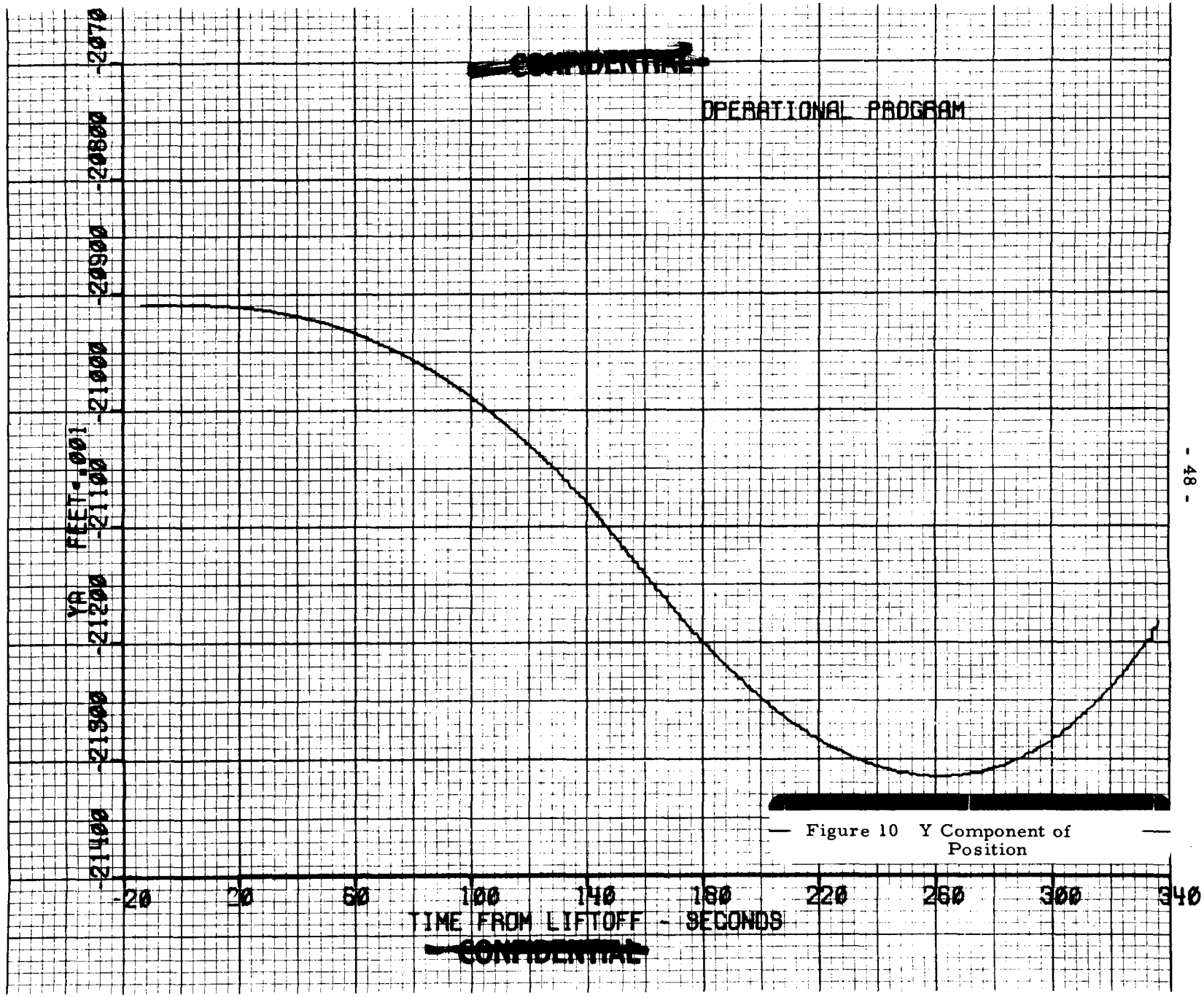

Figure 10 Y Component of Position

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OPERATIONAL PROGRAM

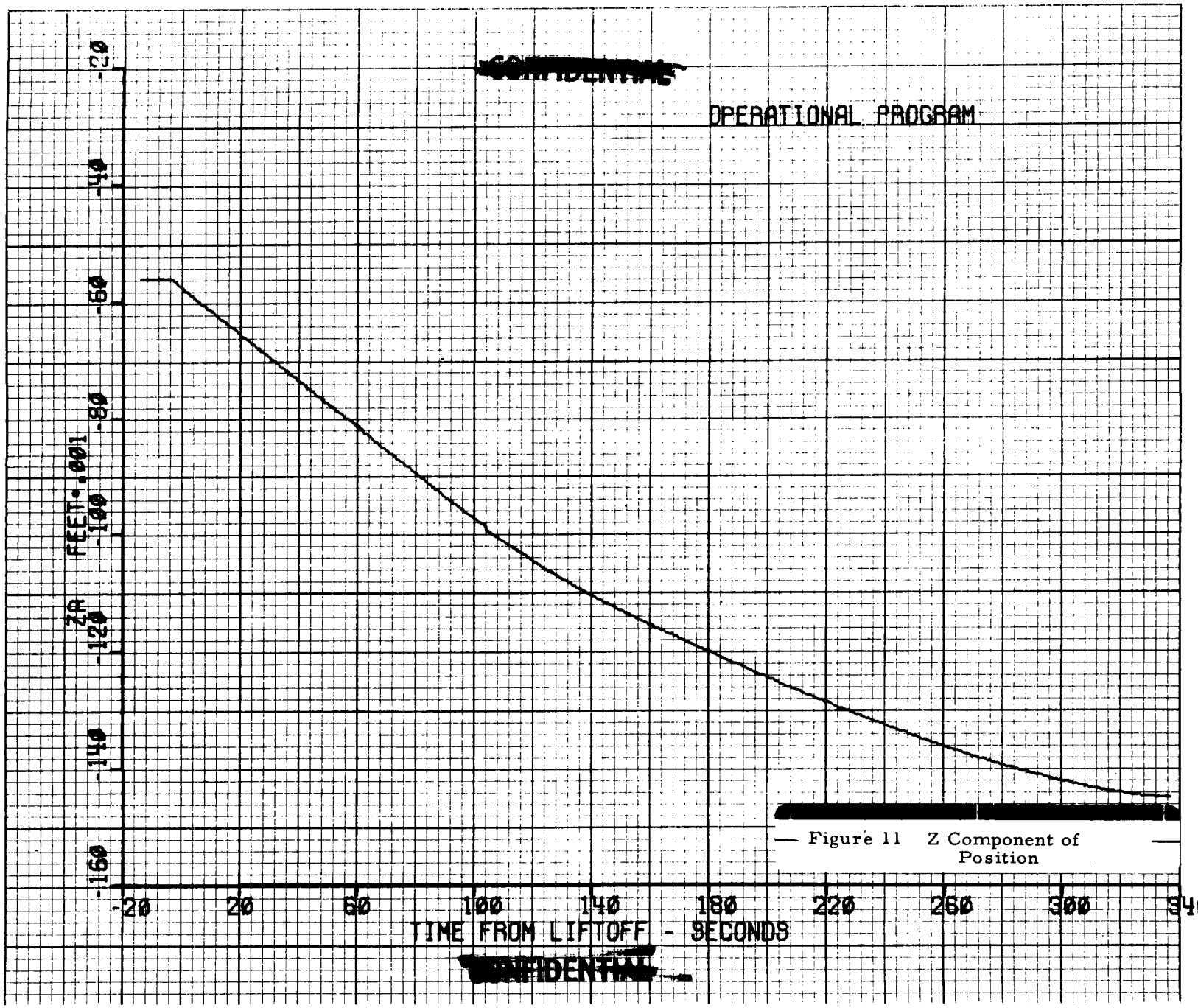

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Figure 11 Z Component of Position

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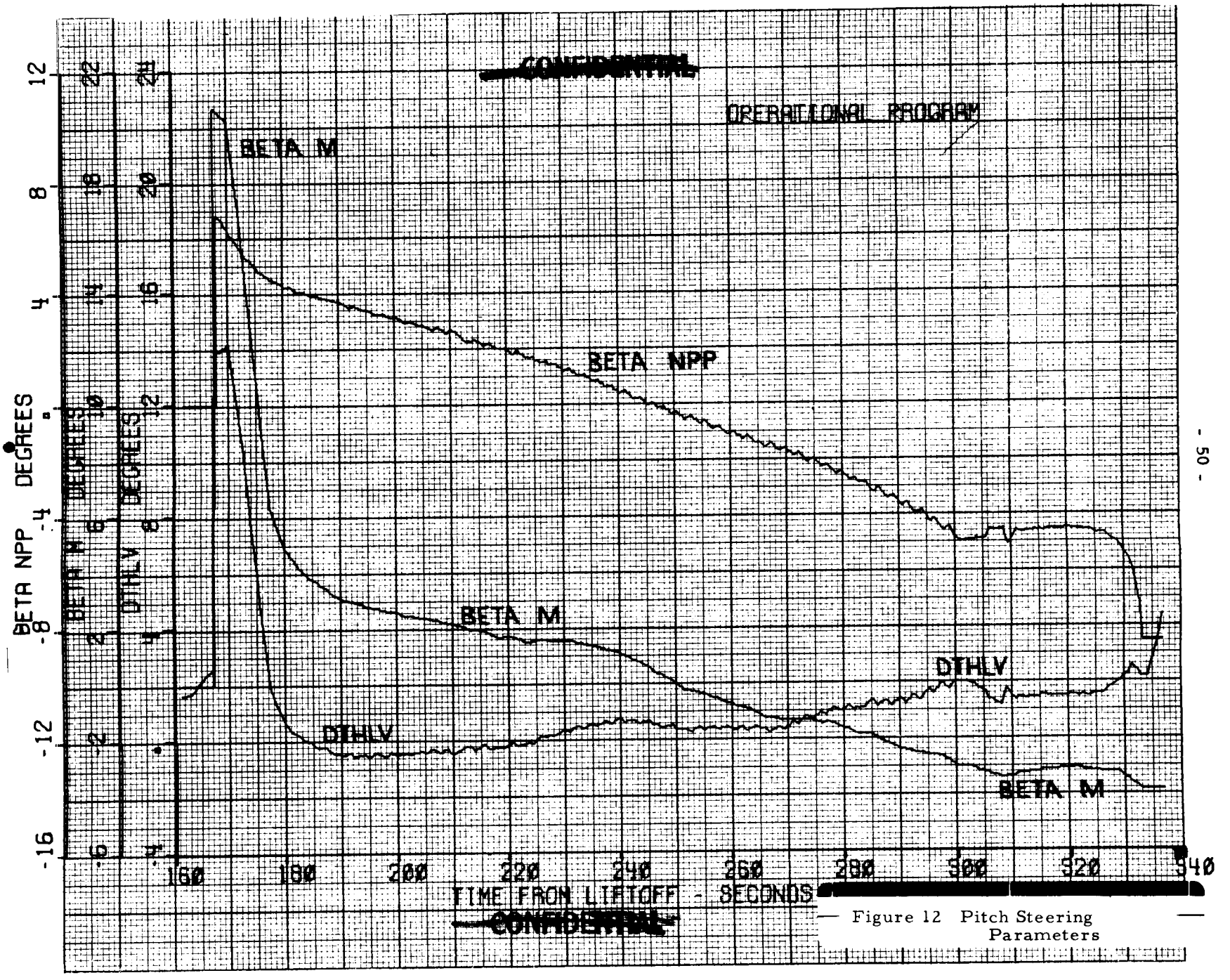

Figure 12 Pitch Steering Parameters

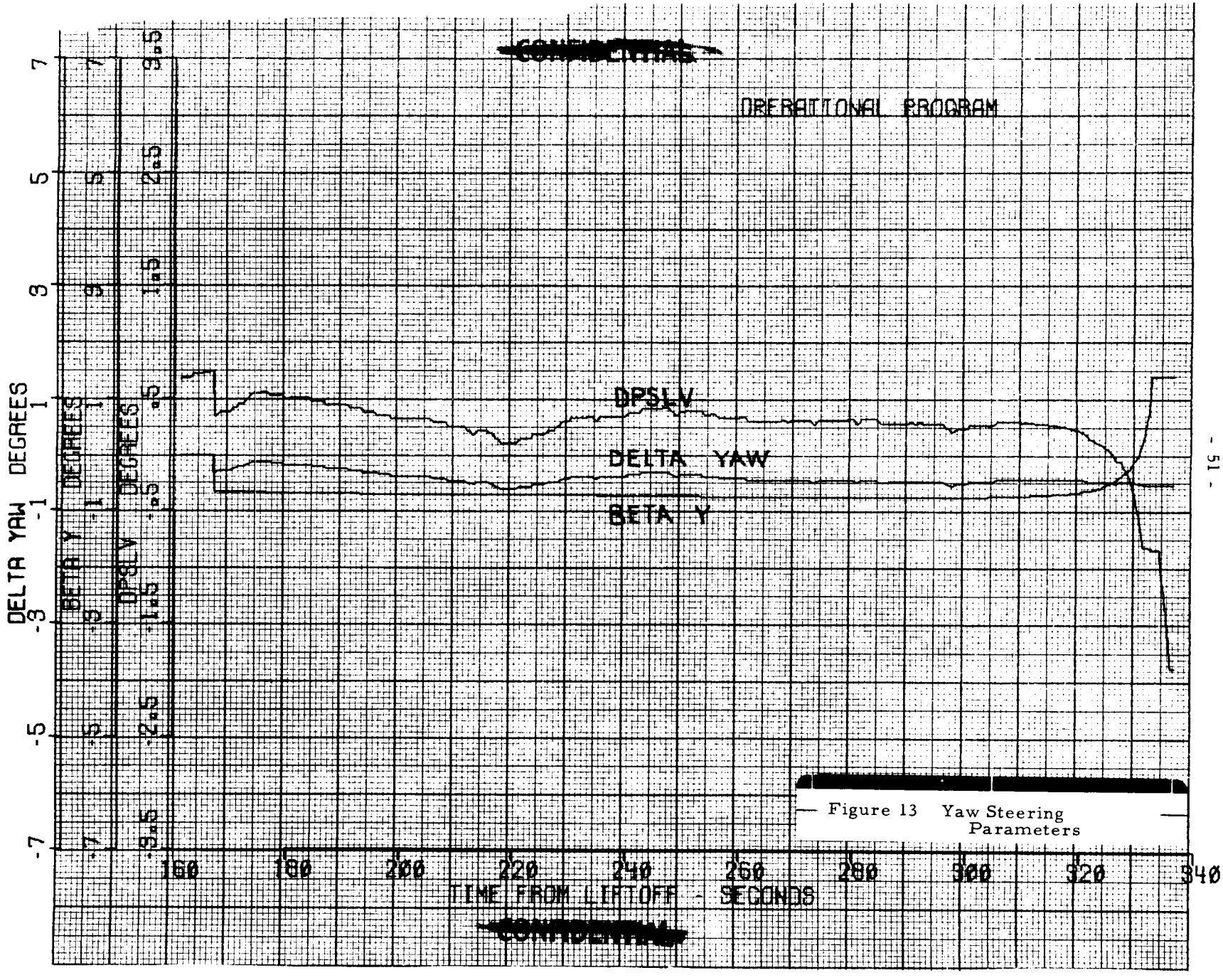

Figure 13 Yaw Steering Parameters

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1. Gemini GT-3 Ascent Post-Flight Analysis Report, dated 9 April 1965, IBM CD # 3-260-6096 ([redacted]).

2. Gemini GT-4 Ascent Predicted Performance, dated 10 May 1965, IBM CD # 3-260-6100 ([redacted]).

3. Ascent Operational Program Math Flow 3 MOD II MVS Analysis, dated 25 May 1965, IBM #65-554-0042.

[redacted]