

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

APOLLO



GUIDANCE, NAVIGATION AND CONTROL

E-2587

MISSION J1 (AS510/ CM112/ LM10)
G&N ERROR ANALYSIS
(APOLLO 15)
by
F. D. Grant
S. B. Helfant
B. A. Kriegsman

R. Jones

JUNE 1971



CHARLES STARK DRAPER
LABORATORY

CAMBRIDGE MASSACHUSETTS 02139

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GUIDANCE, NAVIGATION AND CONTROL

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ABSTRACT

This document has three principal sections. The first is concerned with the effects of measured CM and LM IMU test data uncertainties on navigational and orbital uncertainties and compares them with Block II uncertainty effects. The second section covers effects of radar and IMU uncertainties on the powered lunar landing. The third section gives data on G&N system performance and operation for both CM and LM. The electrical power requirements for the CM and LM are presented in the Appendix.

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June 1971

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CM AND LM G&N ERROR STUDY

1. INTRODUCTION

The results of a G&N IMU Error Study for the important CM and LM burns for the Apollo 15 mission are presented here. The detailed effects of IMU test data computed uncertainties, but not of Block II IMU uncertainties, are given here.

For a more complete error analysis, including effects of Block II uncertainties, the reader should refer to MIT/IL Report, E-2427, "Mission G G&N Error Analysis," July 1969. This includes data on mission profile, on burns, on MSFN update uncertainties, and on initial conditions for burns and reentry. Since the profiles for the Apollo 15 and Apollo 11 missions are quite similar, it was decided that only data on the effects of measured IMU test data uncertainties should be presented here. Data on the IMU uncertainties themselves are given in the next section. In Sections 3 and 4 the effects of these IMU uncertainties on CM and LM burn guidance are presented and compared with the effects of Block II IMU uncertainties. Computer-printed error tables in Section 6 give detailed uncertainty data for the various burns and for reentry.

2. IMU UNCERTAINTIES

Only measured test data uncertainties for the CM and LM IMUs are considered here. These were for IMU No. 48 in CM 112 and IMU No. 12 in LM 10. These uncertainties were computed by taking the rms of performance data deviations from the computed average. These uncertainties were received from S. Helfant on June 2, 1971, and are given in Table 1. Those IMU uncertainties, for which test data was not available, were assumed to be the same as Block II uncertainties. These included initial Stable Member misalignments, and acceleration squared sensitive gyro drift and accelerometer indication errors. All these uncertainties are given in the error tables for the different CM and LM burns.

3. RESULTS OF ERROR STUDIES FOR CM

Table 2 summarizes one sigma state vector uncertainties due to measured IMU test data and to Block II uncertainties as well as to MSFN tracking uncertainties. Three-sigma perigee uncertainties are given for the free-fall coasts following EOI, LOI, DOI and the lunar ascent burn. Because the measured rms uncertainty for the CM IMU Y gyro bias drift (NBDY) is 2.4 meru as compared to the Block II figure of 2 meru, the rss altitude and altitude rate uncertainties are about the same or slightly greater than the same uncertainties due to Block II uncertainties for all CM burns.

The IMU Stable Member alignment times prior to some of the burns were changed for the error simulations in accordance with the mission plan. (See "Apollo 15 Preliminary Flight Plan," MSC, April 20, 1971.) For example, the CM IMU is now realigned 225 min before reentry interface instead of 90 min, the figure used for the Apollo 11 mission.

a. Earth Orbit Insertion Indication Uncertainties (Tables 3-8)

Error data is given for EOI, which occurs by definition 10 sec after SIVB cutoff. Cutoff and perigee altitudes are 93.7 and 93.6 nmi, respectively. These are slightly lower than for previous missions, where these altitudes have been about 103 nmi. Table 2 shows that the rss state vector altitude and track uncertainties of 2,596 and 17,900 ft due to IMU test data uncertainties are about 0.8 and 0.7 of the corresponding uncertainties due to Block II uncertainties.

The 3-sigma indicated perigee error due to test data uncertainties is -3.6 nmi, while that due to Block II uncertainties is -6.4 nmi. (By the term "3-sigma perigee error" is meant that there is 99.86% confidence that the actual indicated perigee error will not be less than the given figure.) The largest contributors to perigee uncertainty were X accelerometer bias and the effective Z accelerometer input axis misalignment about YSM, as Table 8 shows. This table also shows the marked non-linearity of perigee error with IMU error. Here perigee error is defined as the scalar difference between the indicated and the nominal perigee altitudes, where the indicated orbit differs from the nominal because of the effect of the particular IMU error on cutoff position and velocity. Figures 1-3 show indicated perigee error and altitude vs various IMU errors. These show the marked change in slope occurring at the origin, and that perigee error sensitivity depends on IMU error polarity. Data for 3-sigma perigee uncertainties was obtained using a Monte Carlo randomization technique. Attention was restricted of course to the negative side of the perigee error distribution.

Average-g computation in the CMC computer is continued for about 2 min after earth parking orbit insertion time. Orbit computations will continue to be

affected by IMU accelerometer bias during this period. With measured test data IMU uncertainties indicated 3-sigma perigee uncertainties increase from -3.6 to -3.9 nmi. This is not a serious decrease.

In the computations for the error tables the assumption is implicitly made that the IMU uncertainty prior to launch (or burn ignition) is directly correlated with the uncertainty effective during the burn itself. Under this assumption the position and velocity errors due to the initial misalignment effect are summed directly with errors due to the burn phase to yield the combined errors. If, however, the IMU uncertainty prior to launch is assumed uncorrelated with the uncertainty effective during the burn, the resulting rss position and velocity uncertainties will be quite different. Comparative data (in ft and ft/sec) are given for earth orbit insertion time for IMU test data uncertainties.

IMU Error <u>Assumption</u>	Position Uncertainty			Velocity Uncertainty		
	<u>Alt</u>	<u>Tk</u>	<u>Rge</u>	<u>Alt</u>	<u>Tk</u>	<u>Rge</u>
Correl.	2,596	17,898	1,297	8.1	44.2	3.1
Not-Correl.	2,482	17,934	1,798	7.7	44.1	4.2

Note that the most marked difference is in range.

b. TLI Burn Uncertainties (Tables 9-11)

Translunar injection burn duration was 354 sec for this mission, whereas for Apollo 11 it had been 310 sec. The rss state vector uncertainties due to IMU test data uncertainties range from 1.2 to 0.7 of the corresponding uncertainties due to Block II uncertainties. The rss indicated velocity correction at 10 hours out due to test data uncertainties is 12.0 ft/sec, while that due to Block II uncertainties is 16.4 ft/sec, and that due to MSFN tracking uncertainties is 5.3 ft/sec. Largest contributors to velocity correction uncertainty were the Y gyro bias drift and X PIPA bias uncertainties.

c. LOI Burn Uncertainties (Tables 12-14)

This burn inserts the CSM into a 170 by 58 nmi orbit around the moon with cutoff altitude at 74 nmi and cutoff flight path angle of 2.1 deg. The rss altitude uncertainty of 1,080 ft due to test data uncertainties is about the same for Block II uncertainties. By comparison the uncertainty due to MSFN tracking uncertainty was about three times greater. The 3-sigma perilune error of -10,280 ft due to test data is about the same as that due to Block II uncertainties and is 75% of the error due to tracking uncertainties. Y gyro bias drift (NBDY) was by far the largest contributor to perigee uncertainty as Table 14 shows.

d. DOI Burn Uncertainties (Tables 15-17)

The descent orbit injection burn of 23 sec and delta-V of 208 ft/sec changes the CSM orbit from 170 by 58 nmi to a 58 by 9.6 nmi orbit at a cutoff altitude of 58 nmi. State vector uncertainties at DOI cutoff are predominantly due to accelerometer bias uncertainties. The 3-sigma perilune uncertainty of -1800 ft due to IMU test data uncertainties is greatly less than the uncertainty of -4,480 ft due to Block II uncertainties or the error of -13,150 ft due to MSFN tracking uncertainty.

e. TEI Burn Uncertainties (Tables 22-24)

The transearth injection burn duration for this mission is 139 sec. For Apollo 11 it was 160 sec. The rss altitude and altitude state vector uncertainties due to IMU test data uncertainties are about the same as those due to Block II uncertainties and are much less than those due to tracking uncertainties. The rss required velocity correction at 20 hours out due to test data uncertainties is 6.3 ft/sec, while that due to Block II uncertainties is 8.3 ft/sec, and that due to MSFN uncertainties is 11.4 ft/sec. Major IMU error sources were the Y and Z gyro bias drift uncertainties and the X accelerometer bias, as Table 24 shows.

f. Reentry Uncertainties (Tables 25-28)

The CEP at drogue parachute deploy (at 23,000 ft altitude) due to IMU test data uncertainties was 1.37 nmi. With Block II uncertainties it was 1.50 nmi. The effect of MSFN update uncertainties was relatively insignificant. Largest IMU error source contributors were Z and X gyro bias drift in track and X accelerometer bias in range. Uncertainties were larger because alignment time of IMU Stable Member was 225 min before reaching 400,000 ft altitude interface. In previous missions this had been 90 min.

4. RESULTS OF ERROR STUDIES FOR LM

a. Lunar Ascent Burn Uncertainties (Tables 18-21)

The ascent burn injects the LM into a 9 by 46 nmi orbit with cutoff altitude of about 9.9 nmi and a resulting 162 deg nominal coast to apogee. These altitudes are relative to the landing side radius. This in turn is about 1.9 nmi less than the mean moon radius. The rss altitude uncertainty at cutoff due to IMU test data uncertainties is 524 ft, while with Block II uncertainties it is 902 ft. With test data uncertainties the 3-sigma perilune error is -1,600 ft while with Block II uncertainties this error is -2,475 ft. Table 21 shows the three major contributors to perilune error are Y gyro bias drift, Y Stable Member misalignment and X accelerometer bias. This table shows that perilune error is approximately linear with IMU error out to 3-sigma levels. MIT/IL Report E-2427 (for Apollo 11) gives curves (Fig. 3.4) for perilune error and altitude vs IMU error up to 40 times the 1σ Block II uncertainty levels for the significant IMU errors.

TABLE 1

Test Data RMS Uncertainties for CM and LM IMUs

Error	Error Units	CM IMU (No. 48)	LM IMU (No. 12)
ACBX	cm/sec ²	0.11	0.06
ACBY	cm/sec ²	0.06	0.04
ACBZ	cm/sec ²	0.08	0.05
SFEX	PPM	14	34
SFEY	PPM	25	19
SFEZ	PPM	64	25
NBDX	meru	1.5	1.1
NBDY	meru	2.4	1.3
NBDZ	meru	1.1	1.2
ADIAZ	meru/g	2.2	2.8
ADIAZ	meru/g	4.1	1.7
ADIAZ	meru/g	2.4	2.0
ADSRAZ	meru/g	1.8	1.3
ADSRAZ	meru/g	3.7	1.0
ADSRAZ	meru/g	1.3	2.0
ADOAX	meru/g	0.5	0.3
ADOAY	meru/g	0.4	0.2
ADOAZ	meru/g	0.5	0.2
Measured Accelerometer Input Axis Misalignments			
XIA abt. YSM	arc secs	+ 45	+ 38
XIA abt. ZSM	arc secs	+ 10	- 11
YIA abt. XSM	arc secs	- 4	+ 18
YIA abt. ZSM	arc secs	- 26	- 22
ZIA abt. XSM	arc secs	+ 8	- 99
ZIA abt. YSM	arc secs	0	0

NOTE: Test data covers period, Aug. 11, 1970 - May 19, 1971 for CM and period, Sept. 8, 1970 - May 19, 1971 for LM IMU.
(Accelerometer IA misalignments are not compensated for.)

TABLE 2
 Position and Velocity Uncertainties at Burn Cutoff Due to
 CM/LM IMU and MSFN Tracking Uncertainties

Burn	Burn Time secs	Uncert. Source	RSS Position Uncert. (feet)			RSS Velocity Uncert. (ft/sec)			3σ Perigee Error (n mi)
			Alt.	Track	Range	Alt.	Track	Range	
EOI	714	Test Data	2,596	17,898	1,297	8.08	44.18	3.14	-3.60
		Block II	3,221	25,283	1,656	10.29	62.56	3.87	-6.37
TLI	354	Test Data	2,021	1,072	600	13.90	7.03	3.42	
		Block II	1,758	1,746	664	11.93	11.43	3.65	
		Tkg.	828	378	6,857	7.89	0.19	0.88	
LOI	392	Test Data	1,081	573	356	5.85	3.02	1.72	-1.70
		Block II	1,087	1,018	650	5.76	5.25	3.14	-1.73
		Tkg.	3,214	6,950	3,891	1.54	11.79	1.68	-2.25
DOI	23	Test Data	5	3	4	0.24	0.14	0.14	-0.30
		Block II	9	9	9	0.37	0.37	0.35	-0.74
		Tkg.	3,040	7,900	5,150	3.30	7.45	1.10	-2.20
Lunar Ascent (LM)	433	Test Data	524	768	373	2.94	3.97	1.36	-0.26
		Block II	902	1,100	797	4.51	5.39	3.27	-0.41
TEI	139	Test Data	261	127	59	3.94	1.90	0.77	
		Block II	236	232	107	3.48	3.40	1.36	
		Tkg.	1,023	707	1,000	3.91	3.22	1.94	
Reentry (Drogue Deploy)	524	Test Data	25,863	11,680	2,182	97.89	41.45	12.44	
		Block II	22,143	19,875	4,016	82.55	66.95	11.80	
		Tkg.	283	1,165	614	0.68	1.99	0.39	

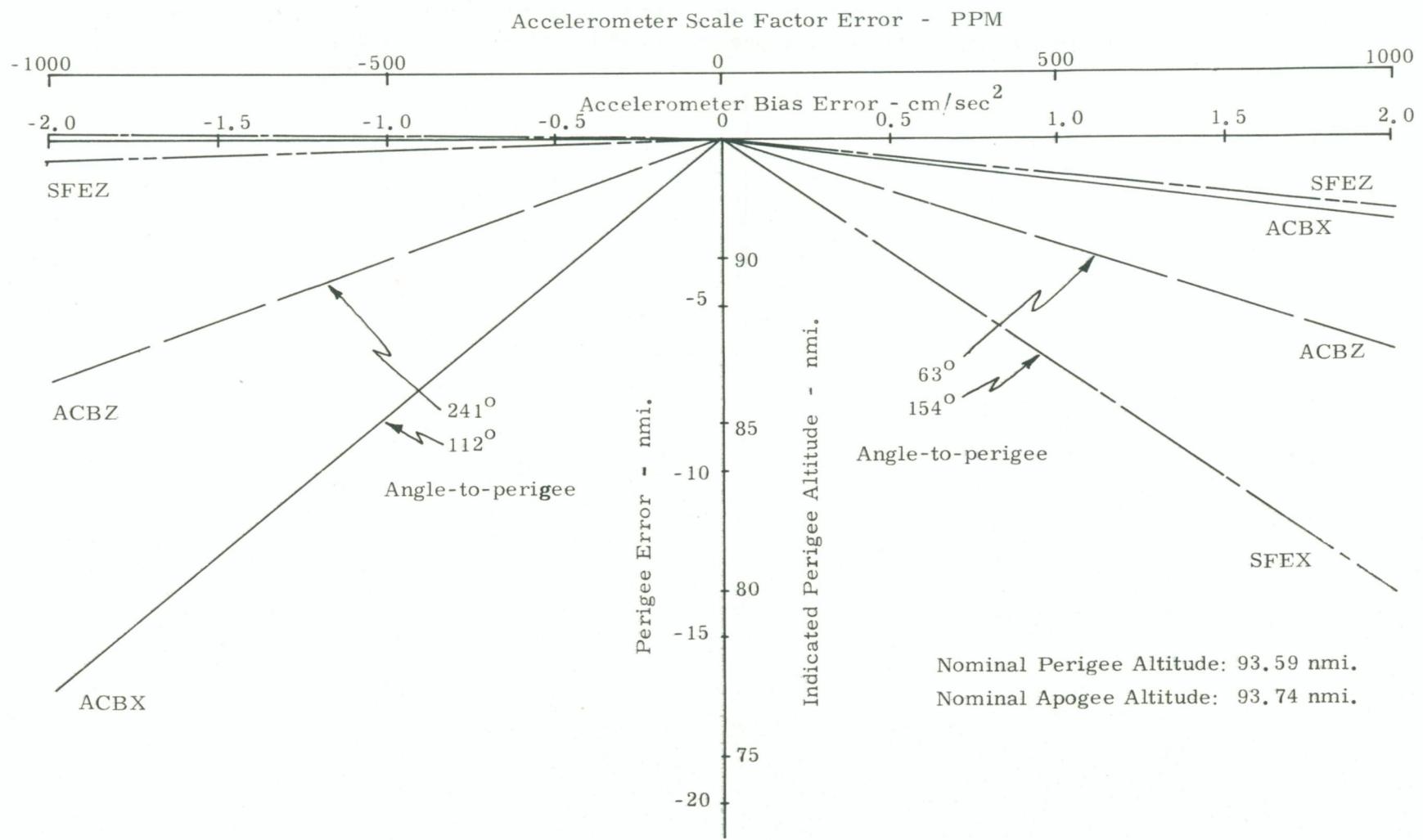


Figure 1 Indicated Perigee Error and Altitude vs. Accelerometer Bias and Scale Factor Errors for Coast Following Earth Orbit Insertion

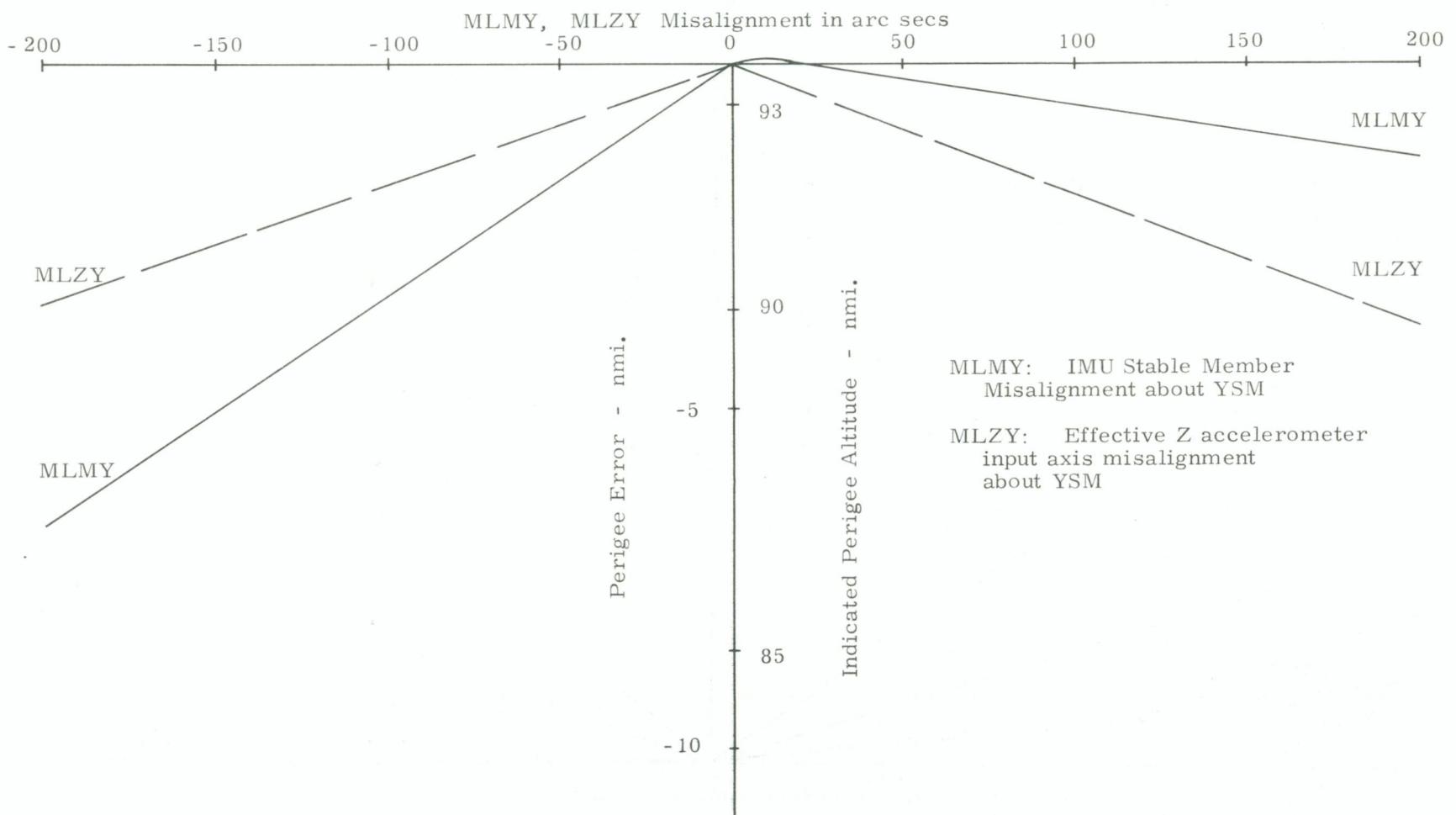


Figure 2 Indicated Perigee Error and Altitude vs. MLMY and MLZY Misalignments for Coast Following Earth Orbit Insertion

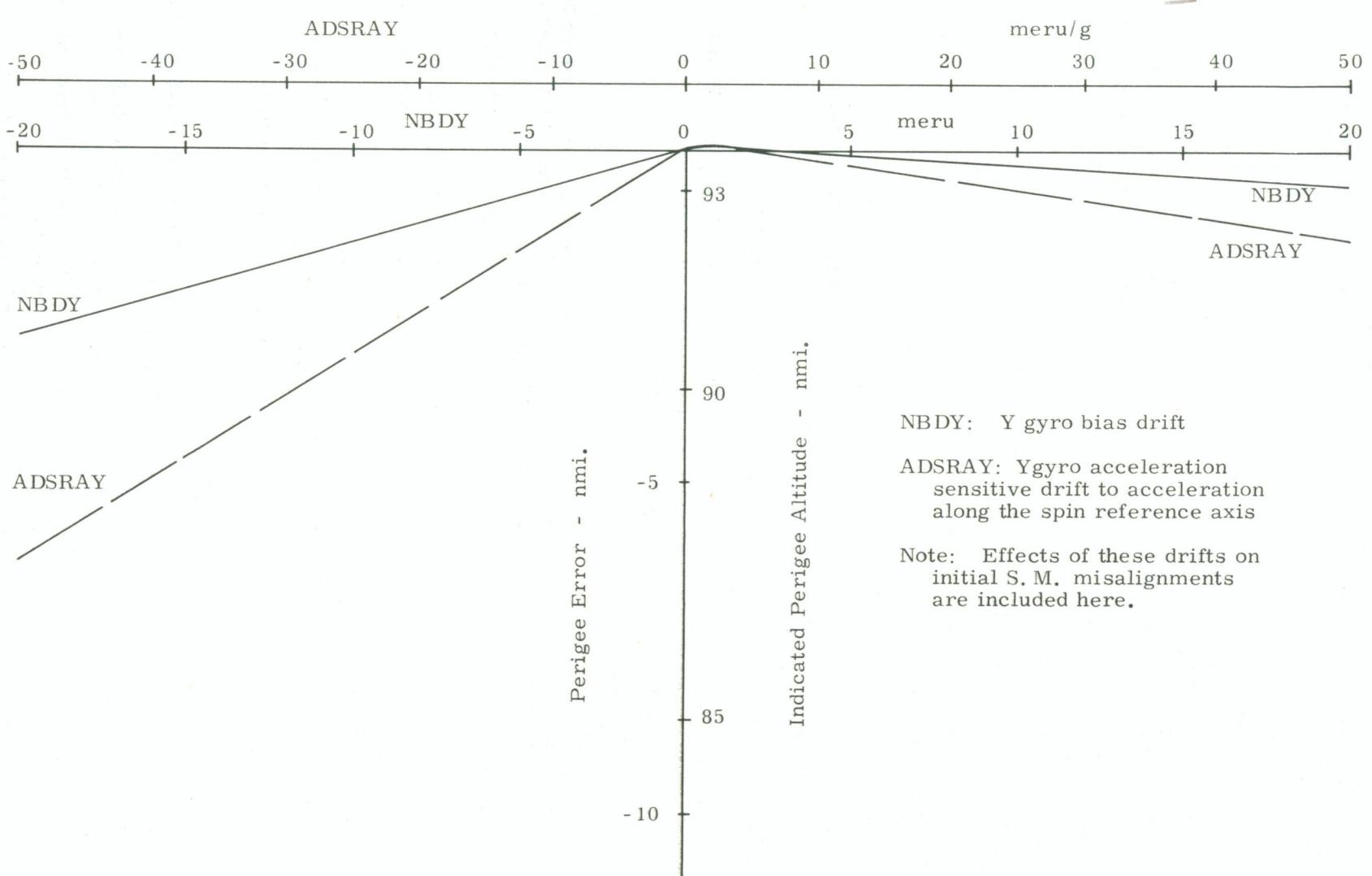


Figure 3 Indicated Perigee Error and Altitude vs. NBDY and ADSRAY
 for Coast Following Earth Orbit Insertion

5. ERROR TABLE DEFINITIONS

Definition of Local Vertical Axes - Many error tables give uncertainty data relative to local vertical coordinates axes (indicated or actual) at nominal event time. These axes (positive direction) are defined as follows:

$$\begin{aligned}\underline{\text{Altitude}} &= \text{unit } (\underline{R}) \\ \underline{\text{Track}} &= \text{unit } (\underline{V} \times \underline{R}) \\ \underline{\text{Range}} &= \text{unit } (\underline{\text{Altitude}} \times \underline{\text{Track}})\end{aligned}$$

The one exception to the above definitions is at reentry end. Here, range is defined as parallel to the ground track of the descending spacecraft and track as normal to the altitude-range plane.

Symbols for IMU Uncertainties

Accelerometer Bias Uncertainty

ACBX	X accelerometer bias, etc.
CM/S. SQ.	centimeters/sec ²

Accelerometer Scale Factor Uncertainty

SFUX	X accelerometer scale factor uncertainty, etc.
PPM	parts per million

Accelerometer Acceleration Squared Indication Uncertainty

NCXX	X accelerometer acceleration squared indication uncertainty, etc.
MG/GSQ	micro-gs/g-squared

Gyro Bias Drift

NBDXINIT	Effect on initial SM misalignment due to X-gyro bias drift before burn ignition (for reentry tables before reaching 400,000 ft altitude)
NBDXBURN	Effect of gyro drift during burn (for reentry tables, after reaching 400,000 ft altitude)
NBDXCOMB	Total of combined effect of X gyro bias drift
MERU	Milli-earth rate unit = 0.015 deg/hour = 0.90 sec/min.

Gyro Acceleration Sensitive Drift

ADX-Terms	rss of uncertainties due to X gyro's ADIAX, ADSRAX, and ADOAX drift uncertainties
MERU/G	Milli-earth rate unit/g = 0.015 deg/hour/g

Gyro Acceleration Squared Sensitive Drift

ADIXX	X gyro acceleration squared sensitive drift due to acceleration along its input axis
ADSYY	Y gyro acceleration squared sensitive drift due to acceleration along its spin reference axis
ADIZZ	Z gyro acceleration squared sensitive drift due to acceleration along its input axis
MERU/GSQ	Milli-earth rate unit/g ² = 0.015 deg/hour/g ²

6. ERROR TABLES WITH CM AND LM IMU TEST DATA
COMPUTED UNCERTAINTIES

Earth Orbit Insertion

3. State Vector Uncertainties at EOI
4. State Vector Uncertainties at EOI (AD Terms)
5. State Vecotr Uncertainties at EOI Rel. to S. M. Axes
6. State Vector Uncertainties at EOI (AD Terms) Rel. to S. M. Axes
7. S. M. Misalignments and Drifts at EOI
8. Indicated Perigee Deviations for Coast Following EOI

Translunar Injection

9. State Vector Uncertainties at TLI Cutoff
10. S. M. Misalignments and Drifts at TLI Cutoff
11. Velocity Correction and Other Uncertainties at TLI Cutoff

Lunar Orbit Insertion

12. State Vector Uncertainties at LOI Cutoff
13. S. M. Misalignments and Drifts at LOI Cutoff
14. Perilune Deviations for Coast Following LOI

Descent Orbit Injection

15. State Vector Uncertainties at DOI Cutoff
16. S. M. Misalignments and Drifts at DOI Cutoff
17. Perilune Deviations for Coast Following DOI

LM Lunar Ascent Burn

18. State Vector Uncertainties at Ascent Burn Cutoff
19. State Vector Uncertainties at Ascent Burn Cutoff (AD Terms)
20. S. M. Misalignments and Drifts at Ascent Burn Cutoff
21. Perilune Deviations for Coast Following Ascent Burn Cutoff

Transearch Injection

22. State Vector Uncertainties at TEI Cutoff
23. S. M. Misalignments and Drifts at TEI Cutoff
24. Velocity Correction and Other Uncertainties at TEI Cutoff

Earth Reentry

- 25. Position Uncertainties at Drogue Parachute Deploy
- 26. Indicated State Vector Uncertainties at Drogue Deploy
- 27. Indicated State Vector Uncertainties at Drogue Deploy (AD Terms)
- 28. S. M. Misalignments and Drifts at Drogue Deploy

INDICATION UNCERTAINTIES		(INDIC.- TRUE) AT TIME FROM LAUNCH = 0 HR, 11 MIN, 54.500 SEC (714.500 SECS)					
UNCERT.	ONE SIGMA SOURCE	POSITION UNCERTAINTIES IN FEET (REL. TO NOM. AXES)			VELOCITY UNCERTAINTIES IN FT/SEC (REL. TO NOM. AXES)		
		ALT.	TRACK	RANGE	ALT.	TRACK	RANGE
INITIAL STARBOARD MEMBER MISALIGNMENTS (UNCORRELATED WITH EFFECTS OF IMU UNCERTAINTIES LISTED BELOW)							
ABOUT XI	50.0 SECs	16.1	2,173.0	12.2	0.047	5.348	0.028
ABOUT YI	5.0 SECs	-	162.1	0.3	229.5	0.563	0.000
ABOUT ZI	5.0 SECs	-	1.0	-	0.7	0.001	0.000
ACCELEROMETER INPUT AXIS MISALIGNMENTS							
X ABOUT Y	0.0 SECs	0.0	0.0	0.0	0.000	0.000	0.000
X ABOUT Z	10.0 SECs	0.0	0.0	0.0	0.000	0.000	0.000
Y ABOUT X	0.0 SECs	0.0	0.0	0.0	0.000	0.000	0.000
Y ABOUT Z	- 26.0 SECs	8.3	1,129.9	6.3	0.024	2.780	0.014
Z ABOUT X	12.0 SECs	0.0	0.0	0.0	0.000	0.000	0.000
Z ABOUT Y	- 45.0 SECs	2,078.1	-	975.5	6.251	-	0.015
ACCEL.BIAS (INIT.EARTH LAUNCH S.M. MLMS)	-	DUE TO ACBX	-	23 SECs.ABOUT YSM, DUE TO ACBY	13 SECs.ABOUT XSM	-	-
ACBXINIT	754.5	527.6	-	1,059.3	2.622	1.292	2.003
ACBXBURN	0.110 CM/S.SQ	422.6	-	7.0	766.1	1.285	0.018
ACBXCOMB	1,177.2	520.4	-	293.1	3.909	1.273	0.004
ACBYINIT	-	2.0	-	262.2	1.3	-	0.248
ACBYBURN	0.060 CM/S.SQ	3.4	472.6	2.6	0.010	1.242	0.006
ACBYCOMB	-	1.4	210.2	1.1	0.006	0.993	0.005
ACBZINIT	-	0.0	0.0	0.0	0.000	0.000	0.000
ACBZBURN	0.080 CM/S.SQ	-	678.8	2.1	318.0	2.133	0.005
ACBZCOMB	-	678.3	2.1	318.0	-	2.133	0.005
ACCELEROMETER SCALE FACTOR UNCERTAINTIES							
SFXU	14 PPM	-	61.0	0.9	110.9	0.175	0.002
SFYU	25 PPM	-	0.0	0.0	0.000	0.000	0.000
SFUZ	64 PPM	-	424.3	3.2	194.5	0.922	0.001
GYRO BIAS DRIFT (INIT.EARTH LCH.S.M.MLMS.APT.XI)	-	DUE TO BDX	347 SECs, DUE TO BDY	97 SECs, DUE TO BDZ	15 SECs)	-	-
NBDXINIT	1.50 MERU	112.2	15,065.9	85.0	0.320	37.081	0.203
NBDXBURN	(16 ARCSecs.DRIFT -	0.5	72.1	0.3	0.000	0.073	0.000
NBDXCOMB	SINCE LAUNCH)	111.6	14,983.7	94.6	0.329	37.006	0.203
NBDYINIT	2.40 MERU	31.3	4,207.0	23.7	0.091	10.354	0.056
NBDYBURN	(26 ARCSecs.DRIFT -	347.1	0.3	295.2	1.440	0.002	0.767
NBDYCOMB	SINCE LAUNCH)	315.8	4,207.4	318.0	1.348	10.357	0.824
NBDZINIT	1.10 MERU	5.1	700.9	3.9	0.014	1.724	0.009
NBDZBURN	(12 ARCSecs.DRIFT	1.2	184.2	1.0	0.004	0.626	0.003
NBDZCOMB	SINCE LAUNCH)	6.5	885.2	4.9	0.019	2.351	0.012
GYRO ACCELERATION SENSITIVE DRIFT (RSS OF UNCERTAINTIES DUE TO ADIA, ADSRA, AND ADDA DRIFT UNCERTAINTIES FOR EACH GYRO)							
ADX-TERMS	2.2, 1.8, 0.5 M/G	37.1	4,991.1	28.1	0.109	12.316	0.067
ADY-TERMS	4.1, 3.7, 0.4 M/G	472.1	6,486.0	544.8	1.721	15.966	1.235
ADZ-TERMS	2.4, 1.3, 0.5 M/G	14.2	1,927.9	10.8	0.042	4.879	0.026
GYRO ACCELERATION SQUARED SENSITIVE DRIFT							
ADTXZ	0.60 MERU/GSQ	-	0.3	47.5	0.2	0.052	0.000
ADSYY	0.60 MERU/GSQ	-	114.4	0.0	115.6	0.396	0.000
ADIZZ	0.60 MERU/GSQ	-	0.9	136.0	0.7	0.062	0.001
RSS UNCERT. (FT AND FT/SEC)	2,595.9	17,898.3	1,296.6	8.078	44.180	3.140	
RSS UNCERT. (NM/MI AND FT/SEC)	0.427	2.945	0.213	8.078	44.180	3.140	

TABLE 3 STATE VECTOR UNCERTAINTIES AT EOI

INDICATION UNCERTAINTIES (INDICATED = TRUE) (FEET AND FT/SEC) AT TIME = 714,500 SECs.
(REFL. TO NOM. AXES)

	ALT.	TRACK	RANGE	ALT.	TRACK	RANGE
UNCERTAINTIES DUE TO GYRO ACCELERATION SENSITIVE DRIFT TERMS						
ADIAXINIT		0.0	0.0	0.000	0.000	0.000
ADIAXBURN	2.20 MERU/G	-0.7	-0.5	0.001	0.093	0.000
ADIAXCOMB	-	0.7	-0.5	0.001	0.093	0.000
ADSAXINIT		0.0	0.0	0.000	0.000	0.000
ADSAXBURN	1.80 MERU/G	0.0	0.0	0.000	0.000	0.000
ADSAXCOMB	-	0.0	0.0	0.000	0.000	0.000
ADDAINIT		37.4	-5,022.0	-28.4	-0.110	0.068
ADDAXBURN	0.50 MERU/G	-0.2	31.7	0.2	0.044	0.000
ADDAZCOMB	-	37.2	-4,990.3	28.2	0.110	0.068
RSS FOR X GYRO		37.1	4,991.1	28.1	0.109	0.067
ADIAYINIT		0.0	0.0	0.000	0.000	0.000
ADIAYBURN	4.10 MERU/G	0.0	0.0	0.000	0.000	0.000
ADIAYCOMB	-	0.0	0.0	0.000	0.000	0.000
ADSAYINIT		48.3	6,486.0	36.6	0.142	0.088
ADSAYBURN	3.70 MERU/G	-515.3	0.1	505.8	1.842	1.140
ADSAYCOMB	-	467.5	6,486.1	542.5	1.699	1.228
ADDAINIT		0.0	0.0	0.000	0.000	0.000
ADDAZBURN	0.40 MERU/G	-67.0	0.1	51.6	0.280	0.143
ADDAZCOMB	-	67.0	0.1	51.6	0.280	0.143
RSS FOR Y GYRO		472.1	6,486.0	544.8	1.721	1.235
ADIAZINIT		11.4	1,529.4	8.6	0.034	0.021
ADIAZBURN	2.40 MERU/G	-2.9	395.3	2.3	0.009	0.006
ADIAZCOMB	-	14.3	1,925.7	10.9	0.043	0.027
ADSAZINIT		0.0	0.0	0.000	0.000	0.000
ADSAZBURN	1.30 MERU/G	0.0	0.0	0.000	0.000	0.000
ADSAZCOMB	-	0.0	0.0	0.000	0.000	0.000
ADDAZINIT		0.0	0.0	0.000	0.000	0.000
ADDAZBURN	0.50 MERU/G	-0.7	94.8	0.5	0.003	0.002
ADDAZCOMB	-	0.7	94.8	0.5	0.003	0.002
RSS FOR Z GYRO		14.2	1,927.9	10.8	0.042	0.026
RSS FOR ALL GYROS		474.0	8,408.3	545.8	1.726	1.238

TABLE 4 STATE VECTOR UNCERTAINTIES AT EOI (AD TERMS)

INDICATION UNCERTAINTIES (INDIC.- TRUE) AT TIME FROM LAUNCH = 0 HR, 11 MIN, 54.500 SEC (714.500 SECs)			POSITION UNCERTAINTIES IN FEET			VELOCITY UNCERTAINTIES IN FT/SEC						
UNCERT.	ONE SIGMA		(REL. TO NOM. AXES)	XSM	YSM	ZSM	XSM	YSM	ZSM			
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH EFFECTS OF IMU UNCERTAINTIES LISTED BELOW)												
ABOUT XI	50.0	SECS		0.3	2,173.1	-	1.6	0.003	5.348	-	0.010	
ABOUT YI	5.0	SECS		131.3	-	0.0	248.4	0.131	-	0.000	0.699	
ABOUT ZI	5.0	SECS		0.0	-	137.5	0.1	0.000	-	0.180	0.000	
ACCELEROMETER INPUT AXIS MISALIGNMENTS												
X ABOUT Y	0.0	SECS		0.0	0.0	0.0	0.000	0.000	0.000	0.000		
X ABOUT Z	10.0	SECS		0.0	0.0	0.0	0.000	0.000	0.000	0.000		
Y ABOUT X	0.0	SECS		0.0	0.0	0.0	0.000	0.000	0.000	0.000		
Y ABOUT Z	- 26.0	SECS		0.1	1,130.0	-	0.8	0.001	2.780	-	0.005	
Z ABOUT X	12.0	SECS		0.0	0.0	0.0	0.000	0.000	0.000	0.000		
Z ABOUT Y	- 45.0	SECS		69.9	1.5	-	2,294.7	0.581	0.010	-	6.715	
ACCEL.BIAS (INIT.EARTH LAUNCH S.M. MLMS. - DUE TO ACBX - 23 SECS.ABOUT YSM, DUE TO ACBY 13 SECS.ABOUT XSM)												
ACBXINIT	-			607.7	526.4	-	1,150.3	-	0.611	1.298	-	3.241
ACBXBURN	0.110	CM/S.SQ		874.5	0.1	-	30.3	2.364	0.000	-	0.242	
ACBXCOMB				266.6	526.6	-	1,180.7	1.752	1.299	-	3.484	
ACBYINIT	-			0.0	-	262.3	0.2	-	0.000	-	0.248	0.001
ACBYBURN	0.060	CM/S.SQ		0.0	472.6	-	0.3	0.000	1.242	-	0.002	
ACBYCOMB				0.0	210.2	-	0.0	0.000	0.993	-	0.000	
ACBZINIT				0.0	0.0	0.0	0.000	0.000	0.000	0.000	0.000	
ACBZBURN	0.080	CM/S.SQ	-	23.3	0.4	749.2	-	0.190	0.003	2.294		
ACBZCOMB	-			23.3	0.4	749.2	-	0.190	0.003	2.294		
ACCELEROMETER SCALE FACTOR UNCERTAINTIES												
SFXU	14	PPM	-	126.5	0.0	4.2	-	0.320	0.000	0.034		
SFYU	25	PPM		0.0	0.0	0.0	-	0.000	0.000	0.000		
SFUZ	64	PPM	-	18.3	0.3	466.4	-	0.135	0.002	0.965		
GYRO BIAS DRIFT (INIT.EARTH LCH.S.M.MLMS.ABT.XI - DUE TO BDY 347 SECS, DUE TO BDY 97 SECS, DUE TO BDY 16 SECS)												
NBDXINIT	1.50	MERU		2.6	15,066.6	-	11.5	0.025	37.082	-	0.078	
NBDXBURN	(16	ARCSECS.DRIFT		0.0	72.2	0.0	0.000	-	0.073	0.000		
NBDXCOMB	SINCE LAUNCH)			2.6	14,994.3	-	11.4	0.025	37.008	-	0.078	
NBDYINIT	2.40	MERU		0.7	4,207.2	-	3.1	0.006	10.354	-	0.021	
NBDYBURN	(26	ARCSECS.DRIFT		106.1	0.1	443.1	0.032	-	0.001	1.632		
NBDYCOMB	SINCE LAUNCH)			106.9	4,207.0	439.9	0.039	10.353	1.609			
NBDZINIT	1.10	MERU		0.0	700.9	-	0.4	0.000	1.724	-	0.003	
NBDZBURN	(12	ARCSECS.DRIFT		0.0	184.2	-	0.0	0.000	0.526	-	0.000	
NBDZCOMB	SINCE LAUNCH)			0.1	885.2	-	0.5	0.001	2.351	-	0.003	
GYRO ACCELERATION SENSITIVE DRIFT (RSS OF UNCERTAINTIES DUE TO ADIA, ADSRA, AND ADDA DRIFT UNCERTAINTIES FOR EACH GYRO)												
ADX-TERMS	2.2,	1.8,	0.5 M/G	0.8	4,991.4	3.7	0.008	12.316	0.025			
ADY-TERMS	4.1,	3.7,	0.4 M/G	219.4	6,485.8	688.8	0.194	15.961	2.146			
ADZ-TERMS	2.4,	1.3,	0.5 M/G	0.2	1,928.0	1.3	0.002	4.879	0.009			
GYRO ACCELERATION SQUARED SENSITIVE DRIFT												
ADIXX	0.60	MERU/GSQ		0.0	-	47.5	0.0	0.000	0.052	0.000		
ADSYY	0.60	MERU/GSQ		51.3	0.0	154.4	0.044	0.000	0.467			
ADIZZ	0.60	MERU/GSQ		0.0	136.0	-	0.0	0.000	0.362	-	0.000	
RSS UNCERT.(FT AND FT/SEC)				441.9	17,899.0	2,863.9	1.935	44.179	8.449			
RSS UNCERT.(N.MI.AND FT/SEC)				0.072	2.945	0.471	1.935	44.179	8.449			

TABLE 5 STATE VECTOR UNCERTAINTIES AT EOI REL. TO S. M. AXIS

INDICATION UNCERTAINTIES (INDICATED - TRUE) (FEET AND FT/SEC) AT TIME =							714.500 SECs.
		(REL. TO NOM. AXES)			(REL. TO NOM. AXES)		
		XSM	YSM	ZSM	XSM	YSM	ZSM
UNCERTAINTIES DUE TO GYRO ACCELERATION SENSITIVE DRIFT TERMS							
ADIAAXINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADIAAXBURN	2.20 MERU/G	0.0	-	96.0	0.000	-	0.093
ADIAAXCOMB		0.0	-	96.0	0.000	-	0.093
ADSAXINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADSAXBURN	1.80 MERU/G	0.0	0.0	0.0	0.000	0.000	0.000
ADSAXCOMB		0.0	0.0	0.0	0.000	0.000	0.000
ADOAXINIT		-	0.9	5,022.2	3.9	-	12.361
ADOAXBURN	0.50 MERU/G	-	0.0	31.7	0.0	0.000	0.044
ADOAXCOMB		-	0.9	4,990.5	3.8	-	12.317
RSS FOR X GYRO		0.8	4,991.4	3.7	0.008	12.316	0.025
ADIAYINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADIAYBURN	4.10 MERU/G	0.0	0.0	0.0	0.000	0.000	0.000
ADIAYCOMB		0.0	0.0	0.0	0.000	0.000	0.000
ADSAYINIT		1.2	6,486.2	-	5.0	0.011	15.965
ADSAYBURN	3.70 MERU/G	217.8	-	0.4	688.8	0.184	-
ADSAYCOMB		219.0	6,485.9		683.8	0.195	15.962
ADOAYINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADOAYBURN	0.40 MERU/G	15.7	0.0	83.1	0.001	0.000	0.315
ADOAYCOMB		15.7	0.0	83.1	0.001	0.000	0.315
RSS FOR Y GYRO		219.4	6,485.8	688.8	0.194	15.961	2.146
ADIAZINIT		0.3	1,529.4	-	1.2	0.003	3.764
ADIAZBURN	2.40 MERU/G	0.1	396.3	-	0.3	0.001	1.105
ADIAZCOMB		0.3	1,925.8	-	1.4	0.003	4.869
ADSAZINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADSAZBURN	1.30 MERU/G	0.0	0.0	0.0	0.000	0.000	0.000
ADSAZCOMB		0.0	0.0	0.0	0.000	0.000	0.000
ADAOAZINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADAOAZBURN	0.50 MERU/G	0.0	94.8	0.0	0.000	0.332	0.000
ADAOAZCOMB		0.0	94.8	0.0	0.000	0.332	0.000
RSS FOR Z GYRO		0.2	1,928.0	1.3	0.002	4.879	0.009
RSS FOR ALL GYROS		219.6	8,408.3	688.8	0.195	20.744	2.147

TABLE 6 STATE VECTOR UNCERTAINTIES AT EOI (AD TERMS) REL. TO S.M. AXIS

INITIAL STABLE MEMBER MISALIGNMENTS AND DRIFT ANGLES SUMMARY (AT TIME = 714.500 SECS.)	UNCERT. ONE SIGMA SOURCE	MLM. ANGLE ABOUT STABLE MEMBER AXES	MLM. ANGLE ABOUT LOCAL VERTICAL AXES			
			ARC-SECS.	ARC-SECS.		
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH ALIGNMENT UNCERT. DUE TO LISTED GYPC AND PIPA UNCERT.)						
ABOUT XI	50	SECS	0.00	0.00	- 50.00	44.59 - 0.15 - 22.61
ABOUT YI	5	SECS	0.00	5.00	0.00	0.03 4.99 0.02
ABOUT ZI	5	SECS	5.00	0.00	0.00	2.26 - 0.04 4.45
INITIAL S.M. MLM'S. DUE TO TMU ERROR EFFECTS ON EARTH LAUNCH ERECTION AND ALIGNMENT (LAUNCH FLIGHT AZIMUTH = 80.100 DEG)						
ACBX	0.110	CM/S.SQ	0.00	- 23.13	- 12.09	10.63 - 23.17 - 5.60
ACBY	0.060	CM/S.SQ	12.61	0.00	- 1.95	7.44 - 0.11 10.37
ACRZ	0.080	CM/S.SQ	0.00	- 0.00	- 0.00	0.00 - 0.00 0.00
NBDX	1.50	MERJ	0.00	0.00	- 346.64	309.14 - 1.15 - 156.80
NBDY	2.40	MERU	0.00	0.00	- 96.79	86.32 - 0.32 43.78
NBDZ	1.10	MERU	0.00	0.00	- 16.12	14.38 - 0.05 7.29
ADTAX	2.20	MERU/G	0.00	0.00	- 0.00	0.00 - 0.00 0.00
ADSRAX	1.80	MERU/G	0.00	0.00	0.00	0.00 0.00 0.00
ADDOAX	0.50	MERU/G	-	0.00	115.54	- 103.04 0.38 52.26
ADIAY	4.10	MERU/G	0.00	0.00	0.00	0.00 - 0.00 0.00
ADSRAY	3.70	MERU/G	0.00	0.00	- 149.23	133.08 - 0.49 67.50
ADDOAY	0.40	MERU/G	0.00	0.00	- 0.00	0.00 - 0.00 0.00
ADIAZ	2.40	MERU/G	0.00	0.00	- 25.18	31.39 - 0.11 15.91
ADSRAZ	1.30	MERU/G	0.00	0.00	0.00	0.00 - 0.00 0.00
ADDOAZ	0.50	MERU/G	0.00	0.00	- 0.00	0.00 - 0.00 0.00
RSS INITIAL S.M. MLM'S.			13.57	23.67	411.46	367.02 23.74 186.47
DRIFT ANGLES DUE TO GYRO DRIFT SINCE EARTH LAUNCH START						
NBDX	1.50	MERU	16.12	- 0.00	0.00	7.29 - 0.13 14.37
NBDY	2.40	MERU	0.00	25.79	0.00	0.17 25.79 0.15
NBDZ	1.10	MERJ	0.00	0.00	- 11.82	10.54 - 0.03 5.34
ADIAZ	2.20	MERU/G	25.78	- 0.00	0.00	11.66 - 0.21 22.99
ADSRAX	1.80	MERU/G	-	0.00	- 2.00	- 0.00 0.00 - 0.00
ADDOAX	0.50	MERU/G	-	2.34	- 0.00	- 1.05 0.01 - 2.08
ADIAY	4.10	MERU/G	0.00	0.00	0.00	0.00 - 0.00 0.00
ADSRAY	3.70	MERU/G	0.00	27.32	0.00	0.11 27.32 0.10
ADDOAY	0.40	MERU/G	0.00	4.68	0.00	0.03 4.68 0.02
ADIAZ	2.40	MERU/G	0.00	0.00	- 11.23	10.02 - 0.03 5.08
ADSRAZ	1.30	MERU/G	0.00	0.00	0.00	0.00 - 0.00 0.00
ADDOAZ	0.50	MERU/G	-	0.00	- 5.86	5.22 - 0.01 - 2.65
RSS DRIFT ANGLE (ARCSecs.)			32.30	31.64	17.73	21.53 31.64 29.91
OVERALL RSS MLM. (ARCSecs.)			35.04	39.52	411.84	367.65 39.56 188.85
OVERALL RSS MLM. (MF.)			0.1698	0.1914	1.2966	1.7824 0.1913 0.9155

TABLE 7 S.M. MISALIGNMENTS AND DRIFTS AT EOI

NOMINAL ALTITUDES		***** INDICATED DEVIATIONS IN (AT TIME = 0 HR, 11 MIN, 54.500 SEC (714.500 SECS)) *****							
PERIGEE= 93.59 N.MI. APOGEE = 93.73 N.MI. ORB.ANGLE TO PERIGEE = 179.9 DEG.		PERIGEE ALTITUDE DUE TO ONE AND THREE SIGMA POS.+ NEG. IMU ERRS. (IN NAUTICAL MILES)							
UNCERT. SOURCE	ONE SIGMA UNCERTAINTY	ONE SIGMA PRESENT ALT. UNCERT.	DEVIATIONS IN PERIGEE DUE TO 1 SIG. IMU ERRS. NEG.	DEVIATIONS IN PERIGEE DUE TO 3 SIG. IMU ERRS. POS.	ANGLE TO PERIGEE(DEG) FOR 3 SIG. IMU ERRS. NEG.	ANGLE TO PERIGEE(DEG) POS.			
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH EFFECTS OF IMU UNCERTAINTIES LISTED BELOW)									
ABOUT XI	50.0 SECS	0.0027	- 0.0243	0.0240 - 0.0726	0.0674	156.047°	216.0057		
ABOUT YI	5.0 SECS	- 0.0267	- 0.1647	0.0907 - 0.4997	0.0285	198.9606	29.8670		
ABOUT ZI	5.0 SECS	- 0.0002	0.0010	- 0.0010	0.0031 - 0.0031	181.0450	178.9736		
ACCELEROMETER INPUT AXIS MISALIGNMENTS									
X ABOUT Y	0.0 SECS	0.0000	0.0000	0.0000	0.0000	179.9893	179.9893		
X ABOUT Z	10.0 SECS	0.0000	0.0000	0.0000	0.0000	179.9880	179.9907		
Y ABOUT X	0.0 SECS	0.0000	0.0000	0.0000	0.0000	179.9893	179.9893		
Y ABOUT Z - 26.0 SECS	0.0014	- 0.0127	0.0126	- 0.0380	0.0370	171.3181	194.3590		
Z ABOUT X	12.0 SECS	0.0000	0.0000	0.0000	0.0000	179.9877	179.9909		
Z ABOUT Y - 45.0 SECS	0.3420	- 0.6754	- 0.7611	- 2.2219	- 2.3532	64.8284	241.7972		
ACCELEROMETER BIAS									
ACBXINIT		0.1242	- 0.0296	- 0.7680	- 0.3556	2.3127	24.8166	202.5356	
ACBXBURN	0.11 CM/S.SQ	0.0696	- 1.3758	0.1322	- 4.1379	0.1314	154.7920	333.0727	
ACBXCOMB		0.1938	- 0.8726	- 0.0498	- 2.6957	- 0.3300	113.7041	288.9698	
ACBYINIT		- 0.0003	0.0016	- 0.0016	0.0049 -	0.0050	181.8364	178.2480	
ACBYBURN	0.06 CM/S.SQ	0.0006	- 0.0055	0.0055	- 0.0166	0.0165	175.7092	185.3377	
ACBYCOMB		0.0002	- 0.0039	0.0039	- 0.0117	0.0117	177.2429	183.2201	
ACBZINIT		0.0000	0.0000	0.0000	0.0000	0.0000	179.9893	179.9893	
ACBZBURN	0.08 CM/S.SQ	- 0.1117	- 0.2585	- 0.1625	- 0.8340	- 0.6723	238.0176	66.6895	
ACBZCOMB		- 0.1117	- 0.2585	- 0.1625	- 0.8340	- 0.6723	238.0176	66.6895	
ACCELEROMETER SCALE FACTOR UNCERTAINTIES									
SFXU	14.0 PPM	- 0.0101	0.1202 -	0.1854	0.1308 -	0.5632	325.2203	158.5116	
SFYU	25.0 PPM	0.0000	0.0000	0.0000	0.0000	0.0000	179.9893	179.9893	
SFUZ	64.0 PPM	- 0.0698	- 0.0066	- 0.0914	- 0.0832	- 0.3741	246.8826	93.6957	
GYRO BIAS DRIFT									
NBDXINIT	1.5 MERU	0.0194	- 0.1618	- 0.1084	- 0.3919	0.1214	146.3748	317.2865	
NBDXBURN	(16 ARCSEC.DRIFT-	0.0001	0.0005	- 0.0005	- 0.0014	- 0.0014	180.4807	179.5064	
NBDXCOMB	SINCE S.M.ALIGN)	0.0193	- 0.1613	- 0.1083	- 0.3911	- 0.1214	146.4155	317.2829	
NBDYINIT	2.4 MERU	0.0052	- 0.0471	- 0.0455	- 0.1372	0.1025	159.5538	267.9998	
NBDYBURN	(26 ARCSEC.DRIFT-	0.0571	- 0.2979	- 0.0044	- 0.9216	- 0.2355	220.1498	48.8607	
NBDYCOMB	SINCE S.M.ALIGN) -	0.0519	- 0.3321	- 0.0244	- 1.0100	- 0.1626	214.3034	40.7500	
NBDZINIT	1.1 MERU	0.0009	- 0.0078	- 0.0078	- 0.0236	0.0232	174.1479	187.9836	
NBDZBURN	(12 ARCSEC.DRIFT	0.0002	- 0.0026	- 0.0026	- 0.0079	0.0078	177.9808	182.2258	
NBDZCOMB	SINCE S.M.ALIGN)	0.0011	- 0.0105	- 0.0104	- 0.0314	- 0.0309	172.6727	191.1402	
GYRO ACCELERATION SENSITIVE DRIFT (RSS OF UNCERTAINTIES DUE TO ADIA, ADSRA AND ADOA UNCERTAINTIES FOR EACH GYRO)									
ADX-TERMS 2.2, 1.8, 0.5 M/G	0.0060	0.0534	0.0559	0.1083	0.1611	0.0000	0.0000	0.0000	
ADY-TERMS 4.1, 3.7, 0.4 M/G	0.0775	0.4773	0.0393	1.4299	0.2080	0.0000	0.0000	0.0000	
ADZ-TERMS 2.4, 1.3, 0.5 M/G	0.0024	0.0220	0.0217	0.0657	0.0620	0.0000	0.0000	0.0000	
3 - SIGMA PERIGEE ERROR (IMU ONLY)					-	3.6003	(99.86 % CONFID. THAT PERIGEE ERROR WILL BE MORE POS.THAN THIS FIGURE)		

TABLE 8 INDICATED PERIGEE DEVIATIONS FOR COAST FOLLOWING EOI

INDICATION UNCERTAINTIES (INDICATED = TRUE) AT TIME = 0 HR, 5 MIN, 54.000 SECS (354.000 SECS)

UNCERT.	ONE SIGMA SOURCE UNCERTAINTY	POSITION UNCERTAINTIES IN FEET (REL. TO NOM. AXES)			VELOCITY UNCERTAINTIES IN FT/SEC (REL. TO NOM. AXES)			FT/SEC RANGE
		ALT.	TRACK	RANGE	ALT.	TRACK		
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH GYRO DRIFT RATE TERMS)								
ABOUT XSM	0.20 MR.	4.6	-	159.3	-	1.2	0.031	-
ABOUT YSM	0.20 MR.	-	309.2	-	2.3	79.3	-	2.113
ABOUT ZSM	0.20 MR.	-	0.2	262.7	-	0.0	0.001	0.014
ACCELEROMETER INPUT AXIS MISALIGNMENTS								
X ABOUT Y	45.0 SECS	-	53.3	-	2.6	167.1	-	0.016
X ABOUT Z	10.0 SECS	-	0.3	-	0.0	0.9	-	0.002
Y ABOUT X	- 4.0 SECS	-	0.1	-	15.4	0.2	-	0.000
Y ABOUT Z	- 26.0 SECS	-	0.7	-	165.5	2.4	-	0.096
Z ABOUT X	8.0 SECS	-	0.8	-	0.0	0.2	-	0.005
Z ABOUT Y	0.0 SECS	-	0.0	-	0.0	0.0	-	0.000
ACCELEROMETER BIAS (AVERAGE G COMPUTATION STARTED 30 SECS. BEFORE BURN IGNITION)								
ACBX	C.110 CM/S.SQ	-	81.8	-	4.0	252.0	-	0.020
ACBY	C.060 CM/S.SQ	-	0.5	-	142.6	2.1	-	0.730
ACBZ	C.080 CM/S.SQ	-	190.7	-	0.1	52.9	-	0.001
ACCELEROMETER SCALE FACTOR UNCERTAINTIES								
SFXU	14.0 PPM	-	5.6	-	0.3	17.7	-	0.039
SFYU	25.0 PPM	-	0.2	-	0.5	0.0	-	0.003
SFUZ	64.0 PPM	-	50.6	-	0.0	14.3	-	0.325
GYRO BIAS DRIFT (S.M. ALIGNED 120 MINS. BEFORE BURN IGNITION)								
NBDXINIT	1.5 MERU	-	18.3	-	627.3	-	4.8	0.123
NBDXBURN	(170 ARCSecs.DRIFT	-	0.3	-	11.4	-	0.1	0.003
NBDXCOMB	SINCE S.M.ALIGN)	-	18.5	-	638.7	-	4.9	0.126
NBDYINIT	2.4 MERU	-	1,947.8	-	14.2	499.9	-	13.313
NBDYBURN	(272 ARCSecs.DRIFT	-	36.8	-	0.3	8.4	-	0.370
NBDYCOMB	SINCE S.M.ALIGN)-	-	1,984.6	-	14.5	508.2	-	13.683
NBDZINIT	1.1 MERU	-	0.4	-	758.6	-	0.0	0.003
NBDZBURN	(125 ARCSecs.DRIFT	-	0.2	-	14.7	-	0.0	0.000
NBDZCOMB	SINCE S.M.ALIGN)	-	0.5	-	773.3	-	0.0	0.003
GYRO ACCELERATION SENSITIVE DRIFT (RSS OF UNCERTAINTIES DUE TO ADIA, ADSRA, AND ADDA DRIFT UNCERTAINTIES FOR EACH GYRO)								
ADX-TERMS	2.2, 1.8, 0.5 M/G	-	0.3	-	10.3	0.3	-	0.003
ADY-TERMS	4.1, 3.7, 0.4 M/G	-	22.2	-	0.2	5.0	-	0.106
ADZ-TERMS	2.4, 1.3, 0.5 M/G	-	0.0	-	13.1	0.0	-	0.235
GYRO ACCELERATION SQUARED SENSITIVE DRIFT								
ADIXX	0.6 MERJ/GSQ	-	0.1	-	1.8	0.0	-	0.021
ADSYY	0.6 MERU/GSQ	-	1.4	-	0.0	0.3	-	0.016
ADIZZ	0.6 MERU/GSQ	-	0.0	-	1.2	0.0	-	0.000
RSS IMU UNCERT.		-	2,020.8	-	1,071.8	599.6	-	13.601
RSS TKG-UPDATE UNCERT.		-	328.4	-	377.7	6,857.0	-	7.027
RSS UNCERT.(FT AND FT/SEC)		-	2,184.0	-	1,126.4	6,883.2	-	7.030
RSS UNCERT.(N.MI AND FT/SEC)		-	0.359	-	0.187	1.132	-	15.982
								3.529
								3.529

TABLE 9 STATE VECTOR UNCERTAINTIES AT TLI CUTOFF

INITIAL STABLE MEMBER MISALIGNMENTS AND DRIFT ANGLES SUMMARY (AT TIME = 354.000 SECS.)

UNCERT. SOURCE	ONE SIGMA UNCERT. VALUE	MLM. ANGLE ABOUT STABLE MEMBER AXES ARC-SECS.			MLM. ANGLE ABOUT LOCAL VERTICAL AXES ARC-SECS.		
		XSM	YSM	ZSM	ALT.	TRACK	RANGE
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH GYRO DRIFT RATE TERMS)							
ABOUT XSM	0.20 MR.	41.25	0.00	0.00	-	11.86	-
ABOUT YSM	0.20 MR.	0.00	41.25	0.00	-	0.15	41.24
ABOUT ZSM	0.20 MR.	0.00	0.00	41.25	-	39.50	0.02
RSS INITIAL S.M. MLMs.		41.25	41.25	41.25	41.25	41.25	41.25
DRIFT ANGLES SINCE IMU STABLE MEMBER REALIGNMENT (ALIGNED 120 MINS. BEFORE BURN IGNITION)							
NBDX	1.50 MERU	170.43	-	0.00	-	49.02	-
NBDY	2.40 MERU	0.00	272.68	-	-	1.04	272.65
NBDZ	1.10 MERJ	0.00	0.00	-	119.69	-	0.07
ADIAZ	2.20 MERU/G	9.27	-	0.00	-	2.66	-
ADSRAZ	1.80 MERU/G	-	0.11	-	0.00	0.03	-
ADOAZ	0.50 MERU/G	-	1.18	0.00	-	0.34	0.01
ADTAY	4.10 MERU/G	0.00	0.25	-	0.00	0.25	0.00
ADSRAY	3.70 MERU/G	0.00	8.76	-	0.00	0.03	8.75
ADDAY	0.40 MERU/G	0.00	1.68	-	0.00	1.68	0.02
ADIAZ	2.40 MERU/G	0.00	0.00	-	5.68	5.44	-
ADSRAZ	1.30 MERU/G	0.00	-	0.00	-	0.07	0.00
ADOAZ	0.50 MERU/G	0.00	0.00	-	2.10	2.01	-
ADIXX	0.6 MERU/GSQ	2.17	0.00	-	0.00	-	0.03
ADSYY	0.6 MERU/GSQ	0.00	0.65	-	0.00	0.00	0.65
ADIZZ	0.6 MERU/GSQ	0.00	0.00	-	0.65	-	0.00
ADIZZ	0.6 MERU/GSQ	0.00	0.00	-	0.62	-	0.18
RSS DRIFT ANGLE (ARCSECS.)		170.70	272.83	125.13	129.51	272.81	167.43
OVERALL RSS MLM. (ARCSECS.)		175.61	275.93	131.75	135.92	275.91	172.43
OVERALL RSS MLM. (MR.)		0.8514	1.3377	0.6397	0.6589	1.3376	0.8360

TABLE 10 S.M. MISALIGNMENTS AND DRIFTS AT TLI CUTOFF

INDICATION UNCERTAINTIES IN (AT TIME = 0 HR, 5 MIN, 54.000 SEC (354.000 SECS))								
UNCERT. SOURCE	ONE SIGMA UNCERTAINTY	INERTIAL FLIGHT PATH ANGLE (DEG)	INERTIAL VELOCITY (FT/SEC)	INERTIAL AZIMUTH (DEG)	LATITUDE (ARC-MINS)	LONGITUDE (ARC-MINS)	REQD. VELOC. CORRECT. AT INJECT. + 8 HR. (FPS) POS.	REQD. VELOC. CORRECT. NEG.
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH GYRO DRIFT RATE TERMS)								
ABOUT XSM	0.20 MR.	- 0.0000	- 0.0033	- 0.0016	0.0239	- 0.0083	0.0418	0.0418
ABOUT YSM	0.20 MR.	-	0.0033	0.1941	0.0000	0.0040	1.2831	1.2831
ABOUT ZSM	0.20 MR.	0.0000	0.0007	0.0029	- 0.0394	0.0134	0.0749	0.0749
ACCELEROMETER INPUT AXIS MISALIGNMENTS								
X ABOUT Y	45.0 SECS	-	0.0003	0.9872	0.0000	0.0082	0.0275	4.9682
X ABOUT Z	10.0 SECS	-	0.0000	0.0059	0.0000	0.0000	0.0002	0.0296
Y ABOUT X	- 4.0 SECS	-	0.0000	0.0014	0.0002	- 0.0023	0.0008	0.0078
Y ABOUT Z	- 26.0 SECS	-	0.0000	0.0157	0.0018	- 0.0247	0.0089	0.0929
Z ABOUT X	8.0 SECS	-	0.0000	0.0021	0.0000	0.0000	0.0000	0.0162
Z ABOUT Y	0.0 SECS	-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ACCELEROMETER BIAS (AVERAGE G COMPUTATION STARTED 30 SECS. BEFORE BURN IGNITION)								
ACBX	0.110 CM/S.SQ	-	0.0003	1.2276	0.0000	0.0123	0.0414	6.1156
ACBY	0.060 CM/S.SQ	-	0.0000	0.0103	0.0012	- 0.0213	0.0076	0.0557
ACBZ	0.080 CM/S.SQ	-	0.0017	- 0.3911	0.0000	- 0.0025	- 0.0087	3.2730
ACCELEROMETER SCALE FACTOR UNCERTAINTIES								
SFXU	14.0 PPM	-	0.0000	0.1131	0.0000	- 0.0009	0.0029	0.5712
SFYU	25.0 PPM	-	0.0000	0.0000	0.0000	0.0001	0.0000	0.0003
SFUZ	64.0 PPM	-	0.0005	- 0.1273	0.0000	- 0.0007	- 0.0024	1.0130
GYRO BIAS DRIFT (S.M. ALIGNED 120 MINS. BEFORE BURN IGNITION)								
NBDXINIT	1.5 MERU	-	0.0002	- 0.0128	- 0.0063	0.0939	- 0.0329	0.1645
NBDXBURN (170 ARCSEC.DRIFT)	-	-	0.0000	- 0.0003	- 0.0062	0.0017	- 0.0006	0.0062
NBDXCOMB SINCE S.M.ALIGN)	-	-	0.0002	- 0.0131	- 0.0055	0.0956	- 0.0335	0.1706
NBDYINIT	2.4 MERU	-	0.0205	1.2251	- 0.0001	0.0254	0.0818	8.0837
NBDYBURN (272 ARCSEC.DRIFT)	-	-	0.0005	0.0259	0.0000	0.0004	0.0014	0.2042
NBDYCOMB SINCE S.M.ALIGN)	-	-	0.0211	1.2511	- 0.0001	0.0258	0.0832	8.2870
NBDZINIT	1.1 MERU	-	0.0000	0.0024	0.0083	- 0.1139	0.0388	0.2163
NBDZBURN (125 ARCSEC.DRIFT)	-	-	0.0000	0.0001	0.0002	- 0.0022	0.0008	0.0086
NBDZCOMB SINCE S.M.ALIGN)	-	-	0.0000	0.0025	0.0085	- 0.1161	0.0395	0.2249
GYRO ACCELERATION SENSITIVE DRIFT (RSS OF UNCERTAINTIES DUE TO ADIA, ADSRA AND ADDA) UNCERTAINTIES FOR EACH GYRO)								
ADX-TERMS 2.2, 1.8, 0.5 M/G	0.0000	-	0.0003	0.0002	0.0015	0.0005	0.0064	0.0064
ADY-TERMS 4.1, 3.7, 0.4 M/G	0.0004	-	0.0158	0.0000	0.0003	0.0008	0.1285	0.1285
ADZ-TERMS 2.4, 1.3, 0.5 M/G	0.0000	-	0.0001	0.0002	0.0019	0.0006	0.0083	0.0083
RSS IMU UNCERT.	-	0.0214	2.0669	0.0114	0.1635	0.1128	12.0298	12.0298
RSS TKG.UPDATE UNCERT.	-	0.0052	0.1381	0.0003	0.3357	1.1269	5.3370	5.3370
RSS UNCERTAINTIES	-	0.0220	2.0715	0.0114	0.3733	1.1325	13.1605	13.1605

TABLE 11 VELOCITY CORRECTION AND OTHER UNCERTAINTIES AT TLI CUTOFF

TRUE UNCERTAINTIES (TRUE - INDICATED) AT TIME = 0 HR, 6 MIN, 32.040 SECs (392.040 SECs)

UNCERT. SOURCE	ONE SIGMA UNCERTAINTY	POSITION UNCERTAINTIES IN FEET (REL. TO TRUE AXES AT NORM. TIME)			VELOCITY UNCERTAINTIES IN FT/SEC (REL. TO TRUE AXES AT NORM. TIME)		
		ALT.	TRACK	RANGE	ALT.	TRACK	RANGE
INITIAL STABLF MEMBER MISALIGNMENTS (UNCORRELATED WITH GYRO DRIFT RATE TERMS)							
ABOUT XSM	0.20 MR.	-	0.2	1.2	-	0.4	-
ABOUT YSM	0.20 MR.	-	108.7	30.0	9.2	-	0.162
ABOUT ZSM	0.20 MR.	-	31.0	99.7	-	35.1	-
ACCELEROMETER INPUT AXIS MISALIGNMENTS							
X ABOUT Y	45.0 SECS	0.0	-	0.5	-	1.3	-
X ABOUT Z	10.0 SECS	0.0	-	0.0	-	0.0	-
Y ABOUT X	- 4.0 SECS	0.0	-	0.1	-	0.0	-
Y ABOUT Z	- 26.0 SECS	-	19.5	62.8	-	22.1	-
Z ABOUT X	8.0 SECS	0.0	-	0.0	-	0.0	-
Z ABOUT Y	0.0 SECS	0.0	-	0.0	-	0.0	-
ACCELEROMETER BIAS (AVERAGE G COMPUTATION STARTED 30 SECs. BEFORE BURN IGNITION)							
ACBX	0.110 CM/S.SQ	1.3	-	105.1	-	300.1	-
ACBY	0.060 CM/S.SQ	48.8	-	157.0	-	55.1	-
ACBZ	0.080 CM/S.SQ	229.5	-	62.2	-	22.2	-
ACCELEROMETER SCALE FACTOR UNCERTAINTIES							
SFUX	14.0 PPM	0.0	-	2.5	-	7.3	-
SFUY	25.0 PPM	0.0	-	0.0	-	0.0	-
SFUZ	64.0 PPM	0.4	-	0.1	-	0.0	-
GYRO BIAS DRIFT (S.M. ALIGNED 180 MINS. BEFORE BURN IGNITION)							
NBDXINIT	1.5 MERU	-	1.4	7.1	-	2.5	-
NBDXBURN (252 ARCSecs.DRIFT	0.0	-	0.0	0.1	-	0.0	-
NBDXCOMB SINCE S.M.ALIGN)-	1.5	-	7.3	-	2.6	-	0.014
NBDYINIT	2.4 MERU	-	1,027.4	-	283.3	87.0	-
NBDYBURN (403 ARCSecs.DRIFT-	12.9	-	12.9	-	3.6	1.0	-
NBDYCOMB SINCE S.M.ALIGN)-	1,040.3	-	-	287.0	-	88.0	-
NBDZINIT	1.1 MERU	-	134.2	-	431.7	152.2	-
NBDZBURN (184 ARCSecs.DRIFT-	1.7	-	1.7	-	5.5	1.0	-
NBDZCOMB SINCE S.M.ALIGN)-	135.9	-	-	437.2	-	154.1	-
GYRO ACCELERATION SENSITIVE DRIFT (RSS OF UNCERTAINTIES DUE TO ADIA, ADSRA, AND ADDA DRIFT UNCERTAINTIES FOR EACH GYRO)							
ADX-TERMS	2.2, 1.3, 0.5 M/G	0.0	-	0.0	-	0.0	-
ADY-TERMS	4.1, 3.7, 0.4 M/G	0.5	-	0.1	-	0.0	-
ADZ-TERMS	2.4, 1.3, 0.5 M/G	0.2	-	0.5	-	0.2	-
GYRO ACCELERATION SQUARED SENSITIVE DRIFT							
ADIXX	0.6 MERU/GSQ	0.0	-	0.0	-	0.0	-
ADSYY	0.6 MERJ/GSQ	0.0	-	0.0	-	0.0	-
ADIZZ	0.6 MERU/GSQ	0.0	-	0.0	-	0.0	-
RSS IMU UNCERT.		1,081.2	-	572.6	-	356.3	-
RSS TKG.UPDATE UNCERT.		3,213.5	-	6,949.7	-	3,890.9	-
RSS UNCERT.(FT AND FT/SEC)		3,390.5	-	6,973.2	-	3,907.2	-
RSS UNCERT.(N.MI.AND FT/SEC)		0.558	-	1.147	-	0.643	-

TABLE 12 STATE VECTOR UNCERTAINTIES AT LOI CUTOFF

INITIAL STABLE MEMBER MISALIGNMENTS AND DRIFT ANGLES SUMMARY (AT TIME = 392.040 SECS.)

UNCERT. SOURCE	ONE SIGMA UNCERT. VALUE	MLM. ANGLE ABOUT STABLE MEMBER AXES ARC-SECS.			MLM. ANGLE ABOUT LOCAL VERTICAL AXES ARC-SECS.		
		XSM	YSM	ZSM	ALT.	TRACK	RANGE
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH GYRO DRIFT RATE TERMS)							
ABOUT XSM	0.20 MR.	41.25	-	0.00	-	0.05	13.65
ABOUT YSM	0.20 MR.	-	0.00	41.25	0.00	11.51	37.37
ABOUT ZSM	0.20 MR.	-	0.00	0.00	41.25	39.61	10.88
RSS INITIAL S.M. MLMs.		41.25		41.25		41.25	41.25
DRIFT ANGLES SINCE IMU STABLE MEMBER REALIGNMENT (ALIGNED 180 MINS. BEFORE BURN IGNITION)							
NBDX	1.50 MERU	252.51	-	0.00	-	0.34	83.60
NBDY	2.40 MERU	-	0.00	404.01	0.00	112.77	366.02
NBDZ	1.10 MFRU	0.00	-	0.00	-	177.81	48.85
ADIAx	2.20 MERU/G	-	3.06	0.00	-	0.00	1.01
ADSRAX	1.80 MERU/G	-	0.00	0.00	-	0.00	0.00
ADDAx	0.50 MERU/G	-	0.01	0.00	-	0.00	0.01
ADIAY	4.10 MERU/G	0.00	-	0.00	-	0.00	0.00
ADSRAY	3.70 MERU/G	0.00	-	0.00	-	0.02	0.08
ADDAy	0.40 MERU/G	0.00	-	0.55	0.00	0.15	0.50
ADIAz	2.40 MERU/G	0.00	-	0.00	-	0.05	0.01
ADSRaz	1.30 MERU/G	0.00	-	0.00	-	0.00	0.00
ADDAz	0.50 MERU/G	-	0.00	0.00	-	0.66	0.18
ADTxz	0.6 MERU/GSQ	0.19	-	0.00	-	0.00	0.06
ADSYy	0.6 MERU/GSQ	0.00	-	0.00	-	0.00	0.00
ADIZz	0.6 MERU/GSQ	0.00	-	0.00	-	0.00	0.00
RSS DRIFT ANGLE (ARCSECS.)		252.52		404.01	185.17	210.56	378.61
OVERALL RSS MLM. (ARCSECS.)		255.87		406.11	189.71	214.56	380.86
OVERALL RSS MLM. (MR.)		1.2405		1.9689	0.9197	1.0402	1.8464
							1.3303

TABLE 13 S.M. MISALIGNMENTS AND DRIFTS AT LOI CUTOFF

NOMINAL ALTITUDES

PERIGEE = 58.280 N.MT.

APOGEE = 169.999 N.MI.

ORB. ANGLE TO PERIGEE = 313.9 DEG.

***** DEVIATIONS IN PERIGEE ALTITUDE DUE TO ONE AND THREE SIGMA POS.+ NEG. IMU ERRS. (IN FEET) *****
 (AT TIME = 0 HR, 6 MIN, 32.040 SEC (392.040 SECS))

UNCERT. SOURCE	ONE SIGMA UNCERTAINTY	ONE SIGMA PRESENT ALT.	DEVIATIONS IN PERIGEE DUE TO 1 SIG. IMU ERRS.	DEVIATIONS IN PERIGEE DUE TO 3 SIG. IMU ERRS.	ANGLE TO PERIGEE(DEG) FOR 3 SIG. IMU ERRS.	
		UNCERT.	NEG.	POS.	NEG.	POS.
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH GYRO DRIFT RATE TERMS)						
ABOUT XSM	0.20 MR.	- 0.2437	0.7621	- 0.7691	2.3070	- 2.3074
ABOUT YSM	0.20 MR.	- 128.7109	- 356.7947	- 356.1955	- 1072.1689	1066.7760
ABOUT ZSM	0.20 MR.	- 30.9810	8.9639	- 6.0298	26.6946	- 27.2885
ACCELEROMETER INPUT AXIS MISALIGNMENTS						
X ABOUT Y	45.0 SECS	0.0029	6.3210	- 6.3218	18.9604	- 18.9680
X ABOUT Z	10.0 SECS	- 0.0001	0.1350	- 0.1350	0.4049	- 0.4049
Y ABOUT X	- 4.0 SECS	0.0353	- 0.0084	0.0084	- 0.0252	0.0252
Y ABOUT Z	- 26.0 SECS	- 19.5264	5.3066	- 5.3322	15.8432	- 16.0735
Z ABOUT X	8.0 SECS	0.0234	0.1323	- 0.1323	0.3969	- 0.3969
Z ABOUT Y	0.0 SECS	0.0000	0.0000	0.0000	0.0000	- 0.0000
ACCELEROMETER BIAS (AVERAGE G COMPUTATION STARTED 30 SECS. BEFORE BURN IGNITION)						
ACBX	0.110 CM/S.SQ	- 1.3201	733.1541	- 746.4347	2160.8039	- 2280.3736
ACBY	0.060 CM/S.SQ	48.8436	- 13.6771	13.5526	- 41.4082	40.2870
ACBZ	0.080 CM/S.SQ	229.5177	643.7140	- 645.8787	1924.5617	- 1944.0454
ACCELEROMETER SCALE FACTOR UNCERTAINTIES						
SFUX	14.0 PPM	0.0253	21.0423	- 21.0526	63.0961	- 63.1887
SFYU	25.0 PPM	- 0.0043	0.0010	- 0.0010	0.0031	- 0.0031
SFUZ	64.0 PPM	0.4058	2.2718	- 2.2718	6.8153	- 6.8155
GYRO BIAS DRIFT (S.M. ALIGNED 180 MINS. BEFORE BURN IGNITION)						
NBDXINIT	1.5 MERU	- 1.4392	4.5419	- 4.5433	13.6219	- 13.6337
NBDXBURN (125 ARCSFC.DRIFT-	0.0269	0.1134	- 0.1134	0.3401	- 0.3401	313.9605
NBDXCOMB SINCE S.M.ALIGN)	- 1.4661	4.6553	- 4.6556	13.9617	- 13.9741	313.9477
NBDYINIT	2.4 MERU	- 1027.3746	- 3395.3988	3341.8722	- 10336.1948	9853.7242
NBDYBURN (403 ARCSFC.DRIFT-	12.9378	- 71.0389	71.0185	- 213.1779	212.9941	313.9138
NBDYCOMB SINCE S.M.ALIGN)	- 1040.3122	- 3467.4566	3411.8184	- 10558.0901	10056.5589	311.6497
NBDZINIT	1.1 MERU	- 134.1816	38.3545	- 39.5925	111.4426	- 122.5882
NBDZBURN (184 ARCSFC.DRIFT-	1.7043	0.4680	- 0.4684	1.4026	- 1.4067	313.9678
NBDZCOMB SINCE S.M.ALIGN)	- 135.8855	38.7990	- 40.0849	112.6380	- 124.2145	314.3497
GYRO ACCELERATION SENSITIVE DRIFT (RSS OF UNCERTAINTIES DUE TO ADIA, ADSRA AND ADOA UNCERTAINTIES FOR EACH GYRO)						
ADX-TERMS 2.2, 1.8, 0.5 M/G	0.0038	0.0379	0.0379	0.1137	0.1137	0.0000
ADY-TERMS 4.1, 3.7, 0.4 M/G	0.4753	2.6981	2.6981	8.0942	8.0945	0.0000
ADZ-TERMS 2.4, 1.3, 0.5 M/G	0.1703	0.0465	0.0465	0.1396	0.1396	0.0000

3 - SIGMA PERIGEE ERROR (IMU ONLY)

-10,300.0000 (99.96 % CONFID. THAT PERIGEE ERROR WILL BE MORE POS.THAN THIS FIGURE)

3 - SIGMA PERIGEE ERROR (IMU + TKG.UPDATE)

-17,700.0000

TABLE 14 PERILUNE DEVIATIONS FOR COAST FOLLOWING LOI

TRUE UNCERTAINTIES (TRUE - INDICATED) AT TIME = 0 HR, 0 MIN, 22.850 SECs (22.850 SECs)

UNCERT.	ONE SIGMA SOURCE	POSITION UNCERTAINTIES IN FEET (REL TO TRUE AXES AT NOM.TIME)				VELOCITY UNCERTAINTIES IN FT/SEC (REL TO TRUE AXES AT NOM.TIME)			
		ALT.	TRACK	RANGE	ALT.	TRACK	RANGE		
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH GYRO DRIFT RATE TERMS)									
ABOUT XSM	0.20 MR.	0.0	-	0.5	0.0	0.000	-	0.040	0.000
ABOUT YSM	0.20 MR.	-	0.5	0.0	0.0	-	0.042	0.000	0.000
ABOUT ZSM	0.20 MR.	0.0	-	0.1	0.0	0.000	-	0.011	0.000
ACCELEROMETER INPUT AXIS MISALIGNMENTS									
X ABOUT Y	45.0 SECS	-	0.5	0.0	-	0.1	-	0.042	0.000
X ABOUT Z	10.0 SECS	0.0	-	0.0	0.0	0.000	-	0.000	0.000
Y ABOUT X	- 4.0 SECS	0.0	-	0.0	0.0	0.000	-	0.004	0.000
Y ABOUT Z	- 26.0 SECS	0.0	-	0.1	0.0	0.000	-	0.007	0.000
Z ABOUT X	8.0 SECS	0.0	-	0.0	0.0	0.000	-	0.000	0.000
Z ABOUT Y	0.0 SECS	0.0	-	0.0	0.0	0.000	-	0.000	0.000
ACCELEROMETER BIAS (AVERAGE G COMPUTATION STARTED 30 SECs. BEFORE BURN IGNITION)									
ACBX	0.110 CM/S.SQ	4.9	-	0.0	1.3	0.186	-	0.000	0.048
ACBY	0.060 CM/S.SQ	0.0	-	2.7	0.0	0.000	-	0.104	- 0.001
ACBZ	0.080 CM/S.SQ	-	0.9	0.0	3.5	-	0.032	-	0.134
ACCELEROMETER SCALE FACTOR UNCERTAINTIES									
SFXU	14.0 PPM	0.0	-	0.0	0.0	-	0.001	0.000	0.000
SFYU	25.0 PPM	0.0	-	0.0	0.0	0.000	-	0.000	0.000
SFUZ	64.0 PPM	0.0	-	0.0	-	0.1	0.003	0.000	- 0.012
GYRO BIAS DRIFT (S.M. ALIGNED 60 MINS. BEFORE BURN IGNITION)									
NBDXINIT	1.5 MERU	0.0	-	0.9	0.0	0.000	-	0.079	- 0.001
NBDXBURN	(82 ARCSECS.DRIFT	0.0	-	0.0	0.0	0.000	-	0.000	0.000
NBDXCOMB	SINCE S.M.ALIGN)	0.0	-	0.9	0.0	0.000	-	0.079	- 0.001
NBDYINIT	2.4 MERU	-	1.5	0.0	0.0	-	0.131	- 0.001	0.001
NBDYBURN	(130 ARCSECS.DRIFT	0.0	-	0.0	0.0	0.000	-	0.000	0.000
NBDYCOMB	SINCE S.M.ALIGN)-	1.5	-	1.0	0.0	-	0.131	- 0.001	0.001
NBDZINIT	1.1 MERU	0.0	-	0.2	0.0	0.000	-	0.016	0.000
NBDZBURN	(59 ARCSECS.DRIFT	0.0	-	0.0	0.0	0.000	-	0.000	0.000
NBDZCOMB	SINCE S.M.ALIGN)	0.0	-	0.2	0.0	0.000	-	0.016	0.000
GYRO ACCELERATION SENSITIVE DRIFT (RSS OF UNCERTAINTIES DUE TO ADIA, ADSRA, AND ADDA DRIFT UNCERTAINTIES FOR EACH GYRO)									
ADX-TERMS	2.2, 1.8, 0.5 M/G	0.0	-	0.0	0.0	0.000	-	0.000	0.000
ADY-TERMS	4.1, 3.7, 0.4 M/G	0.0	-	0.0	0.0	0.000	-	0.000	0.000
ADZ-TERMS	2.4, 1.3, 0.5 M/G	0.0	-	0.0	0.0	0.000	-	0.000	0.000
GYRO ACCELERATION SQUARED SENSITIVE DRIFT									
ADIXX	0.6 MERJ/GSQ	0.0	-	0.0	0.0	0.000	-	0.000	0.000
ADSYY	0.6 MERU/GSQ	0.0	-	0.0	0.0	0.000	-	0.000	0.000
ADIZZ	0.6 MERU/GSQ	0.0	-	0.0	0.0	0.000	-	0.000	0.000
RSS IMU UNCERT.		5.2	-	2.9	3.8	0.237	-	0.138	0.143
RSS TKG.UPDATE UNCERT.		3,044.2	-	7,903.7	5,154.6	3.297	-	7.459	1.129
RSS UNCERT.(FT AND FT/SEC)		3,044.2	-	7,903.7	5,154.6	3.306	-	7.460	1.138
RSS UNCERT.(N.MI.AND FT/SEC)		0.501	-	1.300	0.848	3.306	-	7.460	1.138

TABLE 15 STATE VECTOR UNCERTAINTIES AT DOI CUTOFF

INITIAL STABLE MEMBER MISALIGNMENTS AND DRIFT ANGLES SUMMARY (AT TIME = 22.850 SECS.)

UNCERT. SOURCE	ONE SIGMA UNCERT. VALUE	MLM. ANGLE ABOUT STABLE MEMBER AXES ARC-SECS.			MLM. ANGLE ABOUT LOCAL VERTICAL AXES ARC-SECS.		
		XSM	YSM	ZSM	ALT.	TRACK	RANGE
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH GYRC DRIFT RATE TERMS)							
ABOUT XSM	0.20 MR.	41.25	0.00	0.00	-	39.92	-
ABOUT YSM	0.20 MR.	0.00	41.25	0.00	-	0.20	41.25
ABOUT ZSM	0.20 MR.	0.00	0.00	41.25	10.37	0.46	-
RSS INITIAL S.M. MLM.		41.25	41.25	41.25	41.25	41.25	41.25
DRIFT ANGLES SINCE IMU STABLE MEMBER REALIGNMENT (ALIGNED 50 MINS. BEFORE BURN IGNITION)							
NBDX	1.50 MERU	81.73	-	0.00	0.00	79.10	-
NBDY	2.40 MERU	-	0.00	130.77	-	0.64	130.77
NBDZ	1.10 MERU	0.00	-	0.00	-	15.07	0.67
ADIAZ	2.20 MERU/G	0.05	-	0.00	0.00	0.05	-
ADSRAX	1.80 MERU/G	0.00	-	0.00	0.00	0.00	-
ADDAZ	0.50 MERU/G	0.04	-	0.00	0.00	0.04	-
ADIAY	4.10 MERU/G	0.00	-	0.00	0.00	0.00	-
ADSRAY	3.70 MERU/G	0.00	-	0.34	0.00	0.00	-
ADDAY	0.40 MERU/G	-	0.00	0.01	-	0.00	0.01
ADIAZ	2.40 MERU/G	0.00	-	0.00	0.22	0.05	-
ADSRAY	1.30 MERU/G	-	0.00	0.00	-	0.00	0.00
ADDAZ	0.50 MERU/G	-	0.00	0.00	-	0.00	0.01
ADIXX	0.6 MERU/GSQ	0.00	-	0.00	0.00	0.00	-
ADSYY	0.6 MERU/GSQ	-	0.00	0.01	-	0.00	0.01
ADIZZ	0.6 MERU/GSQ	-	0.00	0.00	-	0.00	0.01
RSS DRIFT ANGLE (ARCSECS.)		81.73	130.78	59.94	80.53	130.77	61.56
OVERALL RSS MLM. (ARCSECS.)		91.55	137.13	72.76	90.48	137.12	74.10
OVERALL RSS MLM. (MR.)		0.4438	0.6648	0.3527	0.4386	0.6548	0.3592

TABLE 16 S. M. MISALIGNMENTS AND DRIFTS AT DOI CUTOFF

NOMINAL ALTITUDES		DEVIATIONS IN PERIGEE ALTITUDE DUE TO ONE AND THREE SIGMA POS. + NEG. IMU ERRS. (IN FEET)									
PERIGEE = 9.625 N.MI.		(AT TIME = 0 HR, 0 MIN, 22.850 SEC (22.850 SEC'S))									
APOGEE = 58.439 N.MI.		*****									
ORB. ANGLE TO PERIGEE = 180.4 DEG.		PERIGEE ALTITUDE DUE TO ONE AND THREE SIGMA POS. + NEG. IMU ERRS.									
UNCERT.	ONE SIGMA SOURCE	ONE SIGMA UNCERTAINTY	ONE SIGMA PRESENT ALT.	DEVIATIONS IN PERIGEE DUE TO 1 SIG. IMU ERRS.	DEVIATIONS IN PERIGEE DUE TO 3 SIG. IMU ERRS.	ANGLE TO PERIGEE(DEC) FOR 3 SIG. IMU ERRS.					
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH GYRO DRIFT RATE TERMS)											
ABOUT XSM	0.20 MR.	-	0.0022	1.7461 -	1.7449 -	5.2423 -	5.2307	180.4283	180.4288		
ABOUT YSM	0.20 MR.	-	0.4727	0.5434 -	0.5303 -	1.6694 -	1.5516	180.4809	180.3762		
ABOUT ZSM	0.20 MR.	-	0.0005	0.4702 -	0.4701 -	1.4108 -	1.4099	180.4285	180.4286		
ACCELEROMETER INPUT AXIS MISALIGNMENTS											
X ABOUT Y	45.0 SECS	-	0.4819	47.7260 -	47.7393 -	143.1381 -	143.2573	180.4823	180.3748		
X ABOUT Z	10.0 SECS	-	0.0000	0.0000 -	0.0000 -	0.0000 -	0.0000	180.4285	180.4285		
Y ABOUT X	- 4.0 SECS	-	0.0002	0.1692 -	0.1693 -	0.5077 -	0.5078	180.4286	180.4285		
Y ABOUT Z	- 26.0 SECS	-	0.0004	0.2963 -	0.2963 -	0.8891 -	0.8887	180.4285	180.4286		
Z ABOUT X	8.0 SECS	-	0.0000	0.0000 -	0.0000 -	0.0000 -	0.0000	180.4285	180.4285		
Z ABOUT Y	0.0 SECS	-	0.0000	0.0000 -	0.0000 -	0.0000 -	0.0000	180.4285	180.4285		
ACCELEROMETER BIAS (AVERAGE G COMPUTATION STARTED 30 SECS. BEFORE BURN IGNITION)											
ACBX	0.110 CM/S.SQ	-	4.8797	216.0287 -	215.7741 -	648.8476	646.5558	180.1937	180.6644		
ACBY	0.060 CM/S.SQ	-	0.0135	4.5109 -	4.5022 -	13.5589 -	13.4805	180.4279	180.4291		
ACBZ	0.080 CM/S.SQ	-	0.9224	567.3635 -	567.4259 -	1701.9034	1702.4646	180.4659	180.3907		
ACCELEROMETER SCALE FACTOR UNCERTAINTIES											
SFX	14.0 PPM	-	0.0083	0.8250 -	0.8250 -	2.4749 -	2.4749	180.4295	180.4276		
SFY	25.0 PPM	-	0.0000	0.0000 -	0.0000 -	0.0000 -	0.0000	180.4285	180.4285		
SFUZ	64.0 PPM	-	0.0367	52.6284 -	52.6279 -	157.8869 -	157.8822	180.4249	180.4322		
GYRO BIAS DRIFT (S.M. ALIGNED 60 MINS. BEFORE BURN IGNITION)											
NBDXINIT	1.5 MERU	-	0.0044	3.4392 -	3.4342 -	10.3325 -	10.2875	180.4281	180.4290		
NBDXBURN (82 ARCSEC.DRIFT	-	0.0000	0.0110 -	0.0110 -	0.0329 -	0.0329 -	0.0329	180.4285	180.4285		
NBDXCMB SINCE S.M.ALIGN)	-	0.0044	3.4501 -	3.4451 -	10.3656 -	10.3202	180.4281	180.4290			
NBDYINIT	2.4 MERU	-	1.4892	1.7561 -	1.6262 -	5.6577	4.4891	180.5935	180.2636		
NBDYBURN (130 ARCSEC.DRIFT-	-	0.0032	0.0098 -	0.0098 -	0.0295 -	0.0295	180.4291	180.4280			
NBDYCOMB SINCE S.M.ALIGN) -	-	1.4924	1.7663 -	1.6356 -	5.6909	4.5149	180.5940	180.2631			
NBDZINIT	1.1 MERU	-	0.0009	0.6789 -	0.6787 -	2.0372 -	2.0354	180.4284	180.4286		
NBDZBURN (59 ARCSEC.DRIFT	-	0.0000	0.0022 -	0.0022 -	0.0065 -	0.0065	180.4285	180.4285			
NBDZCOMB SINCE S.M.ALIGN)	-	0.0009	0.6810 -	0.6808 -	2.0437 -	2.0419	180.4284	180.4286			
GYRO ACCELERATION SENSITIVE DRIFT (RSS OF UNCERTAINTIES DUE TO ADIA, ADSRA AND ADDA UNCERTAINTIES FOR EACH GYRO)											
ADX-TERMS	2.2, 1.8, 0.5 M/G	-	0.0000	0.0015 -	0.0015 -	0.0046 -	0.0046	0.0000	0.0000		
ADY-TERMS	4.1, 3.7, 0.4 M/G	-	0.0013	0.0041 -	0.0041 -	0.0124 -	0.0124	0.0000	0.0000		
ADZ-TERMS	2.4, 1.3, 0.5 M/G	-	0.0000	0.0013 -	0.0013 -	0.0038 -	0.0038	0.0000	0.0000		
3 - SIGMA PERIGEE ERROR (IMU ONLY)						- 1,800.0000	(99.86 % CONFID. THAT PERIGEE ERROR WILL BE MORE POS. THAN THIS FIGURE)				
3 - SIGMA PERIGEE ERROR (IMU + TKG.UPDATE)						-13,250.0000					

TABLE 17 PERILUNE DEVIATIONS FOR COAST FOLLOWING DOI

INDICATION UNCERTAINTIES (INDICATED = TRUE) AT TIME = 0 HR, 7 MIN, 13.000 SECs (433.000 SECs)

UNCFPT. SOURCE	ONE SIGMA UNCERTAINTY	POSITION UNCERTAINTIES IN FEET (REL. TO NOM. AXES)			VELOCITY UNCERTAINTIES IN FT/SEC (REL. TO NOM. AXES)			FT/SEC RANGE
		ALT.	TRACK	RANGE	ALT.	TRACK		
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH GYRO DRIFT RATE TERMS)								
ABOUT XSM	0.56 MR.	0.2	671.0	0.3	0.001	3.623		0.002
ABOUT YSM	0.40 MR.	-	373.3	0.1	2.176	0.000		0.961
ABOUT ZSM	0.40 MR.	0.0	212.9	0.1	0.000	0.580		0.000
ACCELEROMETER INPUT AXIS MISALIGNMENTS								
X ABOUT Y	38.0 SECs	-	189.4	0.0	1.053	0.000		0.180
X ABOUT Z	- 11.0 SECs		0.0	0.0	0.000	0.000		0.000
Y ABOUT X	18.0 SECs		0.0	87.8	0.000	0.474		0.000
Y ABOUT Z	- 22.0 SECs		0.0	56.9	0.000	0.155		0.000
Z ABOUT X	- 99.0 SECs		0.0	0.0	0.000	0.000		0.000
Z ABOUT Y	0.0 SECs		0.0	0.0	0.000	0.000		0.000
ACCELEROMETER BIAS (AVERAGE G COMPUTATION STARTED 30 SECs. BEFORE BURN IGNITION)								
ACBX	0.060 CM/S.SQ	214.7	0.0	37.5	0.958	0.000	-	0.161
ACBY	0.040 CM/S.SQ	0.0	138.4	0.1	0.000	0.588		0.000
ACBZ	0.050 CM/S.SQ	30.7	-	0.1	0.135	0.000		0.723
ACCELEROMETER SCALE FACTOR UNCERTAINTIES								
SFUX	34.0 PPM	-	18.9	0.0	0.057	0.000		0.009
SFYU	19.0 PPM		0.0	0.0	0.000	0.000		0.000
SFUZ	25.0 PPM	-	4.5	0.0	0.025	0.000	-	0.134
ACCELERATION SQUARED INDICATION UNCERT.								
NCXX	10 MG/GSQ	1.0	0.0	-	0.003	0.000	-	0.001
NCYY	10 MG/GSQ	0.0	0.0	0.0	0.000	0.000		0.000
NCZZ	10 MG/GSQ	0.7	0.0	3.6	0.004	0.000		0.023
GYRO BIAS DRIFT (S.M. ALIGNED 40 MINS. BEFORE BURN IGNITION)								
NRDXINIT	1.1 MERU	0.0	193.8	0.1	0.000	1.046		0.001
NBDXBURN (	46 ARCSecs.DRIFT	0.0	13.9	0.0	0.000	0.110		0.000
NBDXCOMB	SINCE S.M.ALIGN)	0.0	207.7	0.1	0.000	1.156		0.001
NBDYINIT	1.3 MERU -	212.3	0.0	160.1	-	1.238	0.000	0.546
NBDYBURN (	54 ARCSecs.DRIFT-	15.8	0.0	7.4	-	0.130	0.000	0.034
NBDYCOMB	SINCE S.M.ALIGN)-	228.1	0.0	167.5	-	1.368	0.000	0.581
NBDZINIT	1.2 MERU	0.0	111.8	0.1	0.000	0.304		0.000
NBDZBURN (	51 ARCSecs.DRIFT	0.0	4.2	0.0	0.000	0.011		0.000
NBDZCOMB	SINCE S.M.ALIGN)	0.0	116.0	0.1	0.000	0.315		0.000
GYRO ACCELERATION SENSITIVE DRIFT (RSS OF UNCERTAINTIES DUE TO ACIA, ADSRA, AND ADDA DRIFT UNCERTAINTIES FOR EACH GYRO)								
ADX-TERMS	2.8, 1.3, 0.3 MG	0.0	87.8	0.0	0.000	0.483		0.000
ADY-TERMS	1.7, 1.0, 0.2 MG	3.9	5.8	1.7	0.035	0.031		0.008
ADZ-TERMS	2.0, 2.0, 0.2 MG	0.0	6.3	0.0	0.000	0.032		0.000
GYRC ACCELERATION SQUARED SENSITIVE DRIFT								
ADI _{XX}	0.6 MERU/GSQ	0.0	0.3	0.0	0.000	0.002		0.000
ADS _{YY}	0.6 MERU/GSQ -	0.8	0.0	0.3	-	0.008	0.000	0.002
ADI _{ZZ}	0.6 MERJ/GSQ	0.0	0.2	0.0	0.000	0.000		0.000
RSS UNCERT.(FT AND FT/SEC)		524.1	768.1	373.4	2.942	3.966		1.364
RSS UNCERT.(N.MI.AND FT/SEC)		0.086	0.126	0.061	2.942	3.966		1.364

TABLE 18 STATE VECTOR UNCERTAINTIES AT ASCENT BURN CUTOFF

INDICATION UNCERTAINTIES (INDICATED - TRUE) (FEET AND FT/SEC) AT TIME = 433.000 SECs.
 (REL. TO NOM. AXES) (PFL. TO NOM. AXES)

ALT. TRACK RANGE ALT. TRACK RANGE

UNCERTAINTIES DUE TO GYRO ACCELERATION SENSITIVE DRIFT TERMS

ADIAXINIT		0.0	81.6	0.0	0.000	0.441	0.000
ADIAXBURN	2.80 MERU/G	0.0	6.2	0.0	0.000	0.042	0.000
ADIAXCOMB		0.0	87.8	0.0	0.000	0.483	0.000
ADSAXINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADSAXBURN	1.30 MERU/G	0.0	0.0	0.0	0.000	0.000	0.000
ADSAXCOMB		0.0	0.0	0.0	0.000	0.000	0.000
ADOAXINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADOAXBURN	0.30 MERU/G	0.0	1.2	0.0	0.000	0.010	0.000
ADOAXCOMB		0.0	1.2	0.0	0.000	0.010	0.000
RSS FOR X GYRO		0.0	87.8	0.0	0.000	0.483	0.000
ADIAYINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADIAYBURN	1.70 MERU/G	0.0	0.0	0.0	0.000	0.000	0.000
ADIAYCOMB		0.0	0.0	0.0	0.000	0.000	0.000
ADSAYINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADSAYBURN	1.00 MERU/G	3.8	0.0	1.6	0.035	0.000	- 0.008
ADSAYCOMB		3.8	0.0	1.6	0.035	0.000	- 0.008
ADOAYINIT		0.0	5.8	0.0	0.000	0.031	0.000
ADOAYBURN	0.20 MERU/G	0.4	0.0	0.2	- 0.003	0.000	0.001
ADOAYCOMB		0.4	5.8	0.2	- 0.003	0.031	0.001
RSS FOR Y GYRO		3.9	5.8	1.7	0.035	0.031	0.008
ADIAZINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADIAZBURN	2.00 MERU/G	0.0	- 1.9	0.0	0.000	- 0.004	0.000
ADIAZCOMB		0.0	- 1.9	0.0	0.000	- 0.004	0.000
ADSAZINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADSAZBURN	2.00 MERU/G	0.0	0.0	0.0	0.000	0.000	0.000
ADSAZCOMB		0.0	0.0	0.0	0.000	0.000	0.000
ADAOAZINIT		0.0	5.8	0.0	0.000	0.031	0.000
ADAOAZBURN	0.20 MERU/G	0.0	0.1	0.0	0.000	0.000	0.000
ADAOAZCOMB		0.0	6.0	0.0	0.000	0.032	0.000
RSS FOR Z GYRO		0.0	6.3	0.0	0.000	0.032	0.000
RSS FOR ALL GYROS		3.8	88.2	1.6	0.035	0.485	0.008

TABLE 19 STATE VECTOR UNCERTAINTIES AT ASCENT BURN CUTOFF (AD TERMS)

INITIAL STABLE MEMBER MISALIGNMENTS AND DRIFT ANGLES SUMMARY (AT TIME = 433.000 SECS.)

UNCERT. SOURCE	ONE SIGMA UNCERT. VALUE	MLM. ANGLE ABOUT STABLE MEMBER AXES ARC-SECS.			MLM. ANGLE ABOUT LOCAL VERTICAL AXES ARC-SECS.		
		XSM	YSM	ZSM	ALT.	TRACK	RANGE
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH GYRO DRIFT RATE TERMS)							
ABOUT XSM	0.66 MR.	137.50	0.00	0.00	135.39	- 0.01	- 24.01
ABOUT YSM	0.40 MR.	0.00	82.50	0.00	0.01	82.50	0.04
ABOUT ZSM	0.40 MR.	0.00	0.00	82.50	14.41	- 0.04	81.23
RSS INITIAL S.M. MLMs.		137.50	82.50	82.50	136.16	82.50	84.71
DRIFT ANGLES SINCE IMU STABLE MEMBER REALIGNMENT (ALIGNED 40 MINS. BEFORE BURN IGNITION)							
NBDX	1.10 MERJ	46.87	0.00	- 0.00	46.15	- 0.00	- 8.18
NBDY	1.30 MERJ	- 0.00	55.39	0.00	0.01	55.39	0.02
NBDZ	1.20 MERJ	- 0.00	- 0.00	- 51.13	- 8.93	0.02	- 50.34
ADIAx	2.80 MERU/G	18.52	0.00	0.00	18.24	- 0.00	- 3.23
ADSRAX	1.30 MERU/G	0.00	0.00	0.00	0.00	0.00	0.00
ADOAx	0.30 MERU/G	0.77	0.00	- 0.00	0.76	- 0.00	- 0.13
ADIAy	1.70 MERU/G	0.00	0.00	0.00	0.00	0.00	0.00
ADSRAY	1.00 MERU/G	- 0.00	- 2.59	- 0.00	- 0.00	- 2.59	- 0.00
ADOAy	0.20 MERU/G	- 0.00	1.32	0.00	0.00	1.32	0.00
ADIAz	2.00 MERU/G	0.00	0.00	5.19	0.90	- 0.00	5.11
ADSRaz	2.00 MERU/G	0.00	0.00	0.00	0.00	0.00	0.00
ADOAz	0.20 MERU/G	0.00	- 0.00	1.06	0.18	- 0.00	1.04
ADIXx	0.6 MERU/GSQ	0.08	0.00	0.00	0.07	- 0.00	- 0.01
ADSYY	0.6 MERU/GSQ	- 0.00	0.66	0.00	0.00	0.66	0.00
ADIZZ	0.6 MERU/GSQ	- 0.00	0.00	- 0.66	- 0.11	0.00	- 0.65
RSS DRIFT ANGLE (ARCSECS.)		50.40	55.47	51.41	50.43	55.47	51.38
OVERALL RSS MLM. (ARCSECS.)		146.45	99.42	97.21	145.20	99.42	99.07
OVERALL RSS MLM. (MR.)		0.7100	0.4820	0.4713	0.7039	0.4820	0.4803

TABLE 20 S.M. MISALIGNMENTS AND DRIFTS AT ASCENT BURN CUTOFF

NOMINAL ALTITUDES		DEVIATIONS IN PERIGEE ALTITUDE DUE TO ONE AND THREE SIGMA POS.+ NEG. IMU ERRS. (IN FEET)							
PERIGEE = 9.026 N.MI. APOGEE = 45.598 N.MI. ORB. ANGLE TO PERIGEE = 342.2 DEG.		(AT TIME = 0 HR, 7 MIN, 13.000 SEC (433.000 SECS))							
UNCERT. SOURCE	ONE SIGMA UNCERTAINTY	ONE SIGMA PRESENT ALT.	DEViations IN PERIGEE DUE TO 1 SIG. IMU ERRS. UNCERT. NEG.	DEViations IN PERIGEE DUE TO 3 SIG. IMU ERRS. POS. NEG.	ANGLE TO PERIGEE (DEG) FOR 3 SIG. IMU ERRS. NFG. POS.				
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH GYRO DRIFT RATE TERMS)									
ABOUT XSM	0.56 MR.	- 0.1132	- 0.0069	0.0552 0.1241	0.3102	342.2665	342.2665		
ABOUT YSM	0.40 MR.	373.3147	279.6891	- 332.3799 686.5610	- 1160.5778	345.9714	338.3607		
ABOUT ZSM	0.40 MR.	- 0.0447	0.0015	- 0.0008 0.0065	- 0.0006	342.2648	342.2650		
ACCELEROMETER INPUT AXIS MISALIGNMENTS									
X ABOUT Y	38.0 SECS	189.3818	136.8955	- 147.4914 378.7264	- 474.0709	343.9818	340.5622		
X ABOUT Z	- 11.0 SECS	0.0000	0.0000	0.0000 0.0000	0.0000	342.2649	342.2649		
Y ABOUT X	18.0 SECS	- 0.0193	- 0.0036	0.0045 0.0003	- 0.0085 0.0012	342.2649	342.2649		
Y ABOUT Z	- 22.0 SECS	- 0.0128	0.0004	- 0.0003 0.0000	- 0.0008 0.0000	342.2649	342.2649		
Z ABOUT X	- 99.0 SECS	0.0000	0.0000	0.0000 0.0000	0.0000	342.2649	342.2649		
Z ABOUT Y	0.0 SECS	0.0000	0.0000	0.0000 0.0000	0.0000	342.2649	342.2649		
ACCELEROMETER BIAS (AVERAGE G COMPUTATION STARTED 30 SECS. BEFORE BURN IGNITION)									
ACBX	0.050 CM/S.SQ	- 214.7420	- 86.6512	78.2580 284.9582	209.4304	340.7510	343.7938		
ACBY	0.040 CM/S.SQ	- 0.0299	- 0.0030	0.0037 0.0069	- 0.0131	342.2649	342.2649		
ACBZ	0.050 CM/S.SQ	- 30.7029	8.6640	- 8.9339 25.2272	- 27.6603	342.5201	341.9862		
ACCELEROMETER SCALE FACTOR UNCERTAINTIES									
SFX	34.0 PPM	18.9334	- 1.7516	1.7245 5.3363	5.0922	342.3514	342.1785		
SFY	19.0 PPM	0.0000	0.0000	0.0000 0.0000	0.0000	342.2649	342.2649		
SFUZ	25.0 PPM	4.4557	- 2.5173	2.5040 7.5924	7.4723	342.2048	342.3240		
GYRO BIAS DRIFT (S.M. ALIGNED 40 MINS. BEFORE BURN IGNITION)									
NBDXINIT	1.1 MERU	- 0.0407	- 0.0069	0.0110 0.0088	0.0450	342.2650	342.2650		
NBDXBURN (46 ARCSEC.DRIFT-	0.0031	- 0.0013	0.0014	- 0.0036	0.0043	342.2649	342.2649		
NBDXCOMB SINCE S.M.ALIGN)	- 0.0434	- 0.0077	0.0129	- 0.0073	0.0544	342.2651	342.2650		
NBDYINIT	1.3 MERU	212.3341	165.4565	- 182.5034 446.2469	599.6485	344.3984	340.0672		
NBDYBURN (54 ARCSEC.DRIFT-	15.7537	25.7009	- 25.8799 76.5662	- 78.1769	342.4870	342.0426			
NBDYCOMB SINCE S.M.ALIGN)	228.0880	189.4211	- 210.1401 507.3791	- 693.8128	344.6162	339.8411			
NBDZINIT	1.2 MERU	- 0.0244	0.0007	- 0.0005 0.0027	0.0010	342.2648	342.2649		
NBDZBURN (51 ARCSEC.DRIFT-	0.0010	0.0000	0.0000 0.0001	- 0.0001	0.0001	342.2649	342.2649		
NBDZCOMB SINCE S.M.ALIGN)	- 0.0253	0.0008	- 0.0006 0.0029	- 0.0011	0.0011	342.2648	342.2649		
GYRO ACCELERATION SENSITIVE DRIFT (RSS OF UNCERTAINTIES DUE TO ADIA, ADSRA AND ADDA UNCERTAINTIES FOR EACH GYRO)									
ADX-TERMS	2.8, 1.3, 0.3 M/G	0.0193	0.0038	0.0047 0.0087	0.0167	0.0000	0.0000		
ADY-TERMS	1.7, 1.0, 0.2 M/G	3.8570	7.2828	7.2702 21.8859	21.7733	0.0000	0.0000		
ADZ-TERMS	2.0, 2.0, 0.2 M/G	0.0014	0.0003	0.0003 0.0008	0.0008	0.0000	0.0000		
3 - SIGMA PERIGEE ERROR (IMU ONLY)					- 1,600.0000	(99.86 % CONFID. THAT PERIGEE ERROR WILL BE MORE POS.THAN THIS FIGURE)			

TABLE 21 PERILUNE DEVIATIONS FOR COAST FOLLOWING ASCENT BURN CUTOFF

TRUE UNCERTAINTIES (TRUE - INDICATED) AT TIME = 0 HR, 2 MIN, 18.970 SECs (138.970 SECs)

UNCERT.	ONE SIGMA SOURCE	POSITION UNCERTAINTIES IN FEET (REL. TO TRUE AXES AT NOM. TIME)				VELOCITY UNCERTAINTIES IN FT/SEC (REL. TO TRUE AXES AT NOM. TIME)			
		ALT.	TRACK	RANGE		ALT.	TRACK	RANGE	
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH GYRO DRIFT RATE TERMS)									
ABOUT XSM	0.20 MR.	0.0	-	1.2	-	0.2	-	0.001	-
ABOUT YSM	0.20 MR.	-	40.2	2.3	-	2.3	-	0.606	0.033
ABOUT ZSM	0.20 MR.	-	2.8	39.2	-	8.4	-	0.053	0.589
ACCELEROMETER INPUT AXIS MISALIGNMENTS									
X ABOUT Y	45.0 SECS	0.0	-	0.3	1.3	-	0.002	-	0.006
X ABOUT Z	10.0 SECS	0.0	-	0.0	0.0	-	0.000	-	0.044
Y ABOUT X	- 4.0 SECS	0.0	-	0.1	0.0	-	0.000	-	0.001
Y ABOUT Z	- 26.0 SECS	-	1.7	24.7	-	5.3	-	0.034	0.371
Z ABOUT X	8.0 SECS	0.0	-	0.0	0.0	-	0.000	-	0.000
Z ABOUT Y	0.0 SECS	0.0	-	0.0	0.0	-	0.000	-	0.000
ACCELEROMETER BIAS (AVERAGE G COMPUTATION STARTED 30 SECs. BEFORE BURN IGNITION)									
ACBX	0.110 CM/S.SQ	0.8	-	10.8	50.3	-	0.078	-	0.127
ACBY	0.060 CM/S.SQ	1.9	-	27.4	5.9	-	0.031	-	0.321
ACBZ	0.080 CM/S.SQ	37.5	-	2.4	-	1.1	0.444	-	0.028
ACCELEROMETER SCALE FACTOR UNCERTAINTIES									
SFXU	14.0 PPM	0.0	-	0.6	2.7	-	0.004	-	0.009
SFYU	25.0 PPM	0.0	-	0.0	0.0	-	0.000	-	0.000
SFUZ	64.0 PPM	0.4	-	0.0	0.0	-	0.009	-	0.001
GYRO BIAS DRIFT (S.M. ALIGNED 120 MINS. BEFORE BURN IGNITION)									
NBDXINIT	1.5 MERU	-	0.2	4.6	-	1.0	-	0.006	0.103
NBDXBURN (165 ARCSECS.DRIFT	-	0.0	-	0.0	-	0.0	-	0.000	0.001
NBDXCOMB SINCE S.M.ALIGN)-	-	0.2	-	4.6	-	1.0	-	0.006	0.105
NBDYINIT	2.4 MERU	-	253.1	14.7	14.8	-	3.820	0.209	0.278
NBDYBURN (264 ARCSECS.DRIFT-	-	1.7	-	0.1	0.1	-	0.039	0.002	0.003
NBDYCOMB SINCE S.M.ALIGN)-	-	254.8	-	14.8	14.9	-	3.858	0.211	0.282
NBDZINIT	1.1 MERU	-	8.0	113.1	24.2	-	0.154	-	1.701
NBDZBURN (121 ARCSECS.DRIFT-	-	0.1	-	0.8	0.2	-	0.001	-	0.017
NBDZCOMB SINCE S.M.ALIGN)-	-	8.0	-	113.9	24.3	-	0.156	-	1.719
GYRO ACCELERATION SENSITIVE DRIFT (RSS OF UNCERTAINTIES DUE TO ADIA, ADSRA, AND ADDA DRIFT UNCERTAINTIES FOR EACH GYRO)									
ADX-TERMS	2.2, 1.3, 0.5 M/G	0.0	-	0.0	0.0	-	0.000	0.001	0.000
ADY-TERMS	4.1, 3.7, 0.4 M/G	0.2	-	0.0	0.0	-	0.004	0.000	0.000
ADZ-TERMS	2.4, 1.3, 0.5 M/G	0.0	-	0.2	0.0	-	0.000	0.005	0.001
GYRO ACCELERATION SQUARED SENSITIVE DRIFT									
ADIXX	0.6 MERU/GSQ	0.0	-	0.0	0.0	-	0.000	0.000	0.000
ADSYY	0.6 MERJ/GSQ	0.0	-	0.0	0.0	-	0.000	0.000	0.000
ADIZZ	0.6 MERJ/GSQ	0.0	-	0.0	0.0	-	0.000	0.000	0.000
RSS IMU UNCERT.		260.8	-	127.4	59.1	-	3.935	1.902	0.771
RSS TKG.UPDATE UNCERT.		1,023.0	-	706.8	1,001.3	-	3.913	3.224	1.940
RSS UNCERT.(FT AND FT/SEC)		1,055.7	-	718.2	1,003.0	-	5.549	3.743	2.088
RSS UNCERT.(N.MI.AND FT/SEC)		0.173	-	0.118	0.165	-	5.549	3.743	2.088

TABLE 22 STATE VECTOR UNCERTAINTIES AT TEI CUTOFF

INITIAL STABLE MEMBER MISALIGNMENTS AND DRIFT ANGLES SUMMARY (AT TIME = 138.970 SEC S.)

UNCERT. SOURCE	ONE SIGMA UNCERT. VALUE	MLM. ANGLE ABOUT STABLE MEMBER AXES ARC-SECS.			MLM. ANGLE ABOUT LOCAL VERTICAL AXES ARC-SECS.		
		XSM	YSM	ZSM	ALT.	TPACK	RANGE
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH GYRO DRIFT RATE TERMS)							
ABOUT XSM	0.20 MR.	41.25	0.00	0.00	-	0.62	8.69
ABOUT YSM	0.20 MR.	0.00	41.25	0.00	-	2.84	40.23
ABOUT ZSM	0.20 MR.	0.00	-	0.00	-	41.15	2.64
RSS INITIAL S.M. MLMs.		41.25	41.25	41.25		41.25	41.25
DRIFT ANGLES SINCE IMU STABLE MEMBER REALIGNMENT (ALIGNED 120 MINS. BEFORE BURN IGNITION)							
NBDX	1.50 MERJ	165.57	0.00	0.00	-	2.52	34.89
NBDY	2.40 MERU	0.00	264.92	0.00	-	18.24	258.41
NBDZ	1.10 MERJ	-	0.00	-	121.42	121.12	7.78
ADIAZ	2.20 MERU/G	-	3.12	-	0.00	0.04	0.65
ADSRAX	1.80 MERU/G	-	0.00	-	0.00	0.00	0.00
ADOAZ	0.50 MERU/G	-	0.03	-	0.00	0.00	0.00
ADIAY	4.10 MERU/G	-	0.00	-	0.00	0.00	0.00
ADSRAY	3.70 MERU/G	-	0.00	-	0.23	0.01	0.22
ADDAZ	0.40 MERU/G	-	0.00	-	0.56	0.03	0.55
ADIAZ	2.40 MERU/G	-	0.00	-	0.00	0.15	0.00
ADSRAY	1.30 MERU/G	-	0.00	-	0.00	0.00	0.00
ADDAZ	0.50 MERU/G	-	0.00	-	0.00	0.70	0.04
ADIXX	0.6 MERU/GSQ	-	0.58	-	0.00	0.00	0.12
ADSYY	0.6 MERU/GSQ	-	0.00	-	0.00	0.00	0.00
ADIZZ	0.6 MERU/GSQ	-	0.00	-	0.00	0.00	0.00
RSS DRIFT ANGLE (ARCSECS.)		165.60	264.92	121.42		122.51	260.88
OVERALL RSS MLM. (ARCSECS.)		170.67	268.11	128.24		129.27	264.12
OVERALL RSS MLM. (MR.)		0.8274	1.2998	0.6217		0.6267	1.2805
							0.8534

TABLE 23 S.M. MISALIGNMENTS AND DRIFTS AT TEI CUTOFF

***** UNCERTAINTIES IN (AT TIME = 0 HR, 2 MIN, 18.970 SEC (138.970 SECs)) *****													
***** UNCERTAINTIES IN (AT TIME = 0 HR, 2 MIN, 18.970 SEC (138.970 SECs)) *****													
UNCERT. SOURCE	CNE SIGMA UNCERTAINTY	INERTIAL FLIGHT PATH ANGLE (DEG)	INERTIAL VELOCITY (FT/SEC)	INERTIAL AZIMUTH (DEG)	FUEL CONS. (LBS.)	CUTOFF TIME (SECS.)	REQD. VELOC. CORRECT. AT INJECT. +20 HR. (FPS)	POS.	REQD. VELOC. CORRECT. NEG.				
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH GYRO DRIFT RATE TERMS)													
ABOUT XSM	0.20 MR.	0.0000	-	0.0057	-	0.0002	-	0.0152	-	0.0002	0.0293	0.0293	
ABOUT YSM	0.20 MR.	-	0.0042	-	0.0082	-	0.0002	-	0.0217	-	0.0003	0.8744	0.8744
ABOUT ZSM	0.20 MR.	-	0.0003	-	0.1286	-	0.0041	-	0.3415	-	0.0050	0.6612	0.6612
ACCELEROMETER INPUT AXIS MISALIGNMENTS													
X ABOUT Y	45.0 SECS	0.0000	-	0.0287	-	0.0000	-	0.0762	-	0.0011	0.0806	0.0806	
X ABOUT Z	10.0 SECS	0.0000	-	0.0002	-	0.0000	-	0.0004	-	0.0000	0.0005	0.0005	
Y ABOUT X	- 4.0 SECS	0.0000	-	0.0006	-	0.0000	-	0.0015	-	0.0000	0.0029	0.0029	
Y ABOUT Z	- 26.0 SECS	-	0.0002	-	0.0815	-	0.0026	-	0.2164	-	0.0032	0.4174	0.4174
Z ABOUT X	8.0 SECS	0.0000	-	0.0000	-	0.0000	-	0.0000	-	0.0000	0.0002	0.0002	
Z ABOUT Y	0.0 SECS	0.0000	-	0.0000	-	0.0000	-	0.0000	-	0.0000	0.0000	0.0000	
ACCELEROMETER BIAS (AVERAGE G COMPUTATION STARTED 30 SECS. BEFORE BURN IGNITION)													
ACBX	0.110 CM/S.SQ	0.0003	-	0.5933	-	0.0009	-	1.5758	-	0.0232	1.6756	1.6756	
ACBY	0.060 CM/S.SQ	0.0002	-	0.0706	-	0.0022	-	0.1874	-	0.0028	0.3577	0.3577	
ACBZ	0.080 CM/S.SQ	0.0031	-	0.0132	-	0.0002	-	0.0352	-	0.0005	0.6842	0.6842	
ACCELEROMETER SCALE FACTOR UNCERTAINTIES													
SFX	14.0 PPM	0.0000	-	0.0415	-	0.0001	-	0.1102	-	0.0016	0.1169	0.1169	
SFY	25.0 PPM	0.0000	-	0.0000	-	0.0000	-	0.0001	-	0.0000	0.0001	0.0001	
SFUZ	64.0 PPM	0.0001	-	0.0003	-	0.0000	-	0.0007	-	0.0000	0.0128	0.0128	
GYRO BIAS DRIFT (S.M. ALIGNED 120 MINS. BEFORE BURN IGNITION)													
NBDXINIT	1.5 MERU	0.0000	-	0.0225	-	0.0007	-	0.0598	-	0.0009	0.1155	0.1155	
NBDXBURN (165 ARCSEC.DRIFT	-	0.0000	-	0.0003	-	0.0000	-	0.0008	-	0.0000	0.0015	0.0015	
NBDXCOMB SINCE S.M.ALIGN)	-	0.0000	-	0.0228	-	0.0007	-	0.0606	-	0.0009	0.1171	0.1171	
NBDYINIT	2.4 MERU	-	0.0254	-	0.0522	-	0.0015	-	0.1386	-	0.0020	5.5090	5.5090
NBDYBURN (264 ARCSEC.DRIFT-	-	0.0003	-	0.0010	-	0.0000	-	0.0027	-	0.0000	0.0539	0.0539	
NBDYCOMB SINCE S.M.ALIGN) -	-	0.0266	-	0.0532	-	0.0015	-	0.1413	-	0.0021	5.5628	5.5628	
NBDZINIT	1.1 MERU	-	0.0009	-	0.3712	-	0.0118	-	0.9858	-	0.0145	1.9092	1.9092
NBDZBURN (121 ARCSEC.DRIFT	-	0.0000	-	0.0038	-	0.0001	-	0.0100	-	0.0001	0.0196	0.0196	
NBDZCOMB SINCE S.M.ALIGN) -	-	0.0009	-	0.3749	-	0.0119	-	0.9958	-	0.0147	1.9288	1.9288	
GYRO ACCELERATION SENSITIVE DRIFT (RSS OF UNCERTAINTIES DUE TO ADIA, ADSRA AND ADDA UNCERTAINTIES FOR EACH GYRO)													
ADX-TERMS	2.2, 1.8, 0.5 M/G	0.0000	-	0.0003	-	0.0000	-	0.0008	-	0.0000	0.0015	0.0015	
ADY-TERMS	4.1, 3.7, 0.4 M/G	0.0000	-	0.0001	-	0.0000	-	0.0003	-	0.0000	0.0060	0.0060	
ADZ-TERMS	2.4, 1.3, 0.5 M/G	0.0000	-	0.0011	-	0.0000	-	0.0029	-	0.0000	0.0058	0.0058	
RSS IMU UNCERT.	-	0.0272	-	0.7262	-	0.0132	-	1.9287	-	0.0284	6.2836	6.2836	
RSS TKG.UPDATE UNCERT.	-	0.0297	-	2.0933	-	0.0222	-	5.5600	-	0.0820	11.4000	11.4000	
RSS UNCERTAINTIES	-	0.0402	-	2.2156	-	0.0258	-	5.8850	-	0.0867	13.0170	13.0170	

TABLE 24 VELOCITY CORRECTION AND OTHER UNCERTAINTIES AT TEI CUTOFF

TRUE UNCERTAINTIES (TRUE - INDICATED) AT TIME = 0 HR, 8 MIN, 44.000 SECs (524.000 SECs)

UNCERT.	ONE SIGMA SOURCE UNCERTAINTY	POSITION UNCERTAINTIES IN FEET (REL TO TRUE AXES AT NOM.TIME)				POSITION UNCERTAINTIES IN ARC-MINS. (REL TO TRUE AXES AT NOM.TIME)			
		ALT.	TRACK	RANGE		ALT.	LATITUDE	LONGITUDE	
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH GYRO DRIFT RATE TERMS)									
ABOUT XSM	0.20 MR.	0.0	-	793.5	-	19.1	0.130	-	0.003
ABOUT YSM	0.20 MR.	0.0	-	3.0	-	29.2	0.001	-	0.005
ABOUT ZSM	0.20 MR.	0.0	-	1,779.5	-	41.0	0.292	-	0.006
ACCELEROMETER INPUT AXIS MISALIGNMENTS									
X ABOUT Y	45.0 SECS	0.0	-	15.1	-	786.5	0.002	-	0.138
X ABOUT Z	10.0 SECS	0.0	-	0.0	-	2.0	0.000	-	0.000
Y ABOUT X	- 4.0 SECS	0.0	-	77.0	-	1.4	0.013	-	0.000
Y ABOUT Z	- 26.0 SECS	0.0	-	1,121.6	-	20.7	0.184	-	0.003
Z ABOUT X	8.0 SECS	0.0	-	0.0	-	0.9	0.000	-	0.000
Z ABOUT Y	0.0 SECS	0.0	-	0.0	-	0.0	0.000	-	0.000
ACCELEROMETER BIAS (AVERAGE G COMPUTATION STARTED 600 SECs. BEFORE REACHING 400,000 FEET)									
ACBX	0.110 CM/S.SQ	0.0	-	34.8	1,818.8	0.000	0.005	-	0.318
ACBY	0.060 CM/S.SQ	0.0	-	1,069.6	-	19.6	0.176	-	0.003
ACBZ	0.080 CM/S.SQ	0.0	-	12.3	-	798.6	0.002	-	0.140
ACCELEROMETER SCALE FACTOR UNCERTAINTIES									
SFX	14.0 PPM	0.0	-	2.2	-	113.1	0.000	-	0.020
SFY	25.0 PPM	0.0	-	1.1	-	0.0	0.000	-	0.000
SFUZ	64.0 PPM	0.0	-	1.5	-	106.6	0.000	-	0.019
GYRO BIAS DRIFT (S.M. ALIGNED 225 MINS. BEFORE REACHING 400,000 FEET)									
NBDXINIT	1.5 MERU	0.0	-	5,842.7	-	140.4	0.95	-	0.021
NBDXBURN (	316 ARCSECS.DRIFT	0.0	-	96.8	-	0.0	0.016	-	0.000
NBDXCOMB	SINCE S.M.ALIGN)	0.0	-	5,939.4	-	140.4	0.975	-	0.021
NBDYINIT	2.4 MERU	0.0	-	35.1	-	343.8	0.006	-	0.060
NBDYBURN (	505 ARCSECS.DRIFT	0.0	-	5.9	-	28.8	0.001	-	0.005
NBDYCOMB	SINCE S.M.ALIGN)	0.0	-	41.0	-	315.0	0.007	-	0.055
NBDZINIT	1.1 MERU	0.0	-	9,608.4	-	221.1	1.577	-	0.033
NBDZBURN (	231 ARCSECS.DRIFT	0.0	-	122.6	-	0.5	0.020	-	0.000
NBDZCOMB	SINCE S.M.ALIGN)	0.0	-	9,731.0	-	220.6	1.598	-	0.033
GYRO ACCELERATION SENSITIVE DRIFT (RSS OF UNCERTAINTIES DUE TO ADIA, ADSRA, AND ADOA DRIFT UNCERTAINTIES FOR EACH GYRO)									
ADX-TERMS	2.2, 1.8, 0.5 M/G	0.0	-	301.7	-	0.4	0.050	-	0.000
ADY-TERMS	4.1, 3.7, 0.4 M/G	0.0	-	1.7	-	51.0	0.000	-	0.009
ADZ-TERMS	2.4, 1.3, 0.5 M/G	0.0	-	243.0	-	1.2	0.040	-	0.000
GYRO ACCELERATION SQUARED SENSITIVE DRIFT									
ADIXX	0.6 MERU/GSQ	0.0	-	285.4	-	1.1	0.047	-	0.000
ADSYY	0.6 MFRJ/GSQ	0.0	-	0.5	-	15.0	0.000	-	0.003
ADIZZ	0.6 MERU/GSQ	0.0	-	100.9	-	2.2	0.017	-	0.000
RSS IMU UNCERT.		0.0	-	11,841.2	-	2,183.1	1.944	-	0.381
RSS TKG.UPDATE JNCERT.		0.0	-	1,164.5	-	613.7	0.000	-	0.000
RSS UNCERT.(FT AND MINUTES)		0.0	-	11,898.2	-	2,267.7	1.944	-	0.381
RSS UNCERT.(N.MI.AND MINS.)		0.000	-	1.958	-	0.373	0.300	-	0.381

39 CEP (N.MI.)

1.375

TABLE 25 POSITION UNCERTAINTIES AT DROGUE PARACHUTE DEPLOY

INDICATION UNCERTAINTIES (INDICATED = TRUE) AT TIME = 0 HR, 3 MIN, 44.000 SECs (524.000 SECs)

UNCERT.	ONE SIGMA SOURCE	POSITION UNCERTAINTIES IN FEET (REL. TO NOM. AXES)			VELOCITY UNCERTAINTIES IN FT/SEC (REL. TO NOM. AXES)		
		ALT.	TRACK	RANGE	ALT.	TRACK	RANGE
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH GYRO DRIFT RATE TERMS)							
ABOUT XSM	0.20 MER	-	12.7	793.5	19.1	-	0.032
ABOUT YSM	0.20 MER	-	2,151.3	3.0	29.2	-	0.129
ABOUT ZSM	0.20 MER	-	10.2	1,779.5	41.0	-	0.032
ACCELEROMETER INPUT AXIS MISALIGNMENTS							
X ABOUT Y	45.0 SECS	384.9	-	15.1	786.5	1.357	0.068
X ABOUT Z	10.0 SECS	-	1.4	0.0	2.0	-	0.004
Y ABOUT X	- 4.0 SECS	-	0.2	77.0	1.4	-	0.001
Y ABOUT Z	- 26.0 SECS	-	2.7	1,121.6	20.7	-	0.010
Z ABOUT X	8.0 SECS	-	2.8	0.0	0.9	-	0.008
Z ABOUT Y	0.0 SECS	-	0.0	0.0	0.0	-	0.000
ACCELEROMETER BIAS (AVERAGE G COMPUTATION STARTED 600 SECs. BEFORE REACHING 400,000 FEET)							
ACBX	0.110 CM/S.SQ	-	908.9	24.8	1,818.8	-	2.077
ACBY	0.060 CM/S.SQ	-	3.1	1,069.6	19.6	-	0.008
ACBZ	0.080 CM/S.SQ	-	1,978.0	12.3	798.6	-	4.626
ACCELEROMETER SCALE FACTOR UNCERTAINTIES							
SFX	14.0 PPM	-	56.3	2.2	113.1	-	0.200
SFY	25.0 PPM	-	0.0	1.1	0.0	-	0.000
SFUZ	64.0 PPM	-	251.3	1.5	106.6	-	1.216
GYRO BIAS DRIFT (S.M. ALIGNED 225 MINS. BEFORE REACHING 400,000 FEET)							
NBDXINIT	1.5 MERU	-	93.4	5,842.7	140.4	-	0.236
NBDXBURN (316 ARCSECS.DRIFT	-	-	3.8	96.8	0.0	-	0.004
NBDXCOMB SINCE S.M.ALIGN)-	-	-	89.6	5,939.4	140.4	-	0.232
NBDYINIT	2.4 MERU	-	25,343.7	35.1	343.8	95.766	0.339
NBDYBURN (505 ARCSECS.DRIFT	-	-	329.0	5.9	28.8	1.597	0.059
NBDYCOMB SINCE S.M.ALIGN)	-	-	25,672.7	41.0	315.0	97.363	0.398
NBDZINIT	1.1 MERU	-	55.1	9,608.4	221.1	0.173	29.799
NBDZBURN (231 ARCSECS.DRIFT-	-	-	0.9	122.6	0.5	0.002	0.497
NBDZCOMB SINCE S.M.ALIGN)	-	-	54.2	9,731.0	220.6	0.175	30.296
GYRO ACCELERATION SENSITIVE DRIFT (RSS OF UNCERTAINTIES DUE TO ADIA, ADSRA, AND ADOA DRIFT UNCERTAINTIES FOR EACH GYRO)							
ADX-TERMS	2.2, 1.8, 0.5 M/G	-	12.6	301.7	0.4	0.005	1.911
ADY-TERMS	4.1, 3.7, 0.4 M/G	-	422.9	1.7	51.0	2.196	0.017
ADZ-TERMS	2.4, 1.3, 0.5 M/G	-	1.4	243.0	1.2	0.012	1.034
GYRO ACCELERATION SQUARED SENSITIVE DRIFT							
ADIXX	0.6 MERU/GSQ	-	9.9	285.4	1.1	-	0.002
ADSYY	0.6 MERU/GSQ	-	125.4	0.5	15.0	0.662	-
ADIZZ	0.6 MERJ/GSQ	-	0.4	100.9	2.2	0.010	0.438
RSS IMU UNCERT.	-	-	25,862.7	11,679.8	2,182.4	97.886	41.453
RSS TKG.UPDATE UNCERT.	-	-	283.0	1,164.5	613.7	0.681	1.991
RSS UNCERT.(FT AND FT/SEC)	-	-	25,864.2	11,737.7	2,267.1	97.888	41.501
RSS UNCERT.(N.MI.AND FT/SEC)	-	-	4.256	1.931	0.373	97.888	41.501

CEP (N.MI.)

1.359

TABLE 26 INDICATED STATE VECTOR UNCERTAINTIES AT DROGUE DEPLOY

INDICATION UNCERTAINTIES (INDICATED = TRUE) (FEET AND FT/SEC) AT TIME = 524.000 SECs.
(REL. TO NOM. AXES) (REL. TO NOM. AXES)

ALT. TRACK RANGE ALT. TRACK RANGE

UNCERTAINTIES DUE TO GYRO ACCELERATION SENSITIVE DRIFT TERMS

ADIAXINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADIAXBURN	2.20 MERU/G	12.6	300.4	0.3	0.002	1.901	0.039
ADIAXCOMB		12.6	300.4	0.3	0.002	1.901	0.039
ADSAXINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADSAXBURN	1.80 MERU/G	0.3	-	1.4	-	0.011	0.000
ADSAXCOMB		0.3	-	1.4	-	0.011	0.000
ADOAXINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADOAXBURN	0.50 MERU/G	0.7	27.6	0.3	-	0.198	0.006
ADOAXCOMB		0.7	27.6	0.3	-	0.198	0.006
RSS FOR X GYRO		12.6	301.7	0.4	0.005	1.911	0.040
ADIAYINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADIAYBURN	4.10 MERU/G	25.9	0.1	-	0.027	0.001	-
ADIAYCOMB		25.9	0.1	-	0.027	0.001	-
ADSAYINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADSAYBURN	3.70 MERU/G	-	405.7	1.6	-	2.122	0.017
ADSAYCOMB		-	405.7	1.6	-	2.122	0.017
ADOAYINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADOAYBURN	0.40 MERU/G	116.8	-	0.4	0.557	-	0.152
ADOAYCOMB		116.8	-	0.4	0.557	-	0.152
RSS FOR Y GYRO		422.9	1.7	51.0	2.196	0.017	0.761
ADIAZINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADIAZBURN	2.40 MERU/G	0.9	-	211.7	-	0.913	-
ADIAZCOMB		0.9	-	211.7	-	0.913	-
ADSAZINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADSAZBURN	1.30 MERU/G	-	0.1	-	0.000	-	0.000
ADSAZCOMB		-	0.1	-	0.000	-	0.000
ADCAZINIT		0.0	0.0	0.0	0.000	0.000	0.000
ADCAZBURN	0.50 MERU/G	-	1.0	119.0	-	0.484	0.011
ADCAZCOMB		-	1.0	119.0	-	0.484	0.011
RSS FOR Z GYRO		1.4	243.0	1.2	0.012	1.034	0.041
RSS FOR ALL GYROS		423.2	387.3	51.0	2.197	2.173	0.763

TABLE 27 INDICATED STATE VECTOR UNCERTAINTIES AT DROGUE DEPLOY (AD TERMS)

INITIAL STABLE MEMBER MISALIGNMENTS AND DRIFT ANGLES SUMMARY (AT TIME = 524.000 SECs.)

UNCERT. SOURCE	ONE SIGMA UNCERT. VALUE	MLM. ANGLE ABOUT STABLE MEMBER AXES ARC-SECS.			ALT.	MLM. ANGLE ABOUT LOCAL VERTICAL AXES ARC-SECS.		
		XSM	YSM	ZSM		TRACK	RANGE	
INITIAL STABLE MEMBER MISALIGNMENTS (UNCORRELATED WITH GYRO DRIFT RATE TERMS)								
ABOUT XSM	0.20 MR.	41.25	0.00	- 0.00	-	17.10	0.72	
ABOUT YSM	0.20 MR.	0.00	41.25	0.00	-	0.08	41.24	
ABOUT ZSM	0.20 MR.	0.00	0.00	41.25	-	37.53	0.24	
RSS INITIAL S.M. MLMs.		41.25	41.25	41.25	-	41.25	41.25	
DRIFT ANGLES SINCE IMU STABLE MEMBER REALIGNMENT 225 MINS. BEFORE REACHING 400,000 FEET								
NBDX	1.50 MERU	315.53	- 0.01	- 0.00	-	130.83	5.53	
NBDY	2.40 MERJ	0.01	504.86	- 0.00	-	0.99	504.77	
NBDZ	1.10 MERJ	0.00	0.00	- 231.40	-	210.57	1.34	
ADIAZ	2.20 MERU/G	30.87	- 0.00	0.00	-	12.80	0.54	
ADSRAZ	1.80 MERU/G	- 0.09	0.00	0.00	-	0.03	0.00	
ADOAZ	0.50 MERU/G	4.41	- 0.00	0.00	-	1.83	0.07	
ADIAY	4.10 MERU/G	0.00	0.21	0.00	-	0.00	0.21	
ADSRAY	3.70 MERU/G	- 0.00	32.69	0.00	-	0.05	32.69	
ADOAY	0.40 MERU/G	0.00	5.61	- 0.00	-	0.00	5.61	
ADIAZ	2.40 MERU/G	- 0.00	- 0.00	21.21	-	19.30	0.12	
ADSRAZ	1.30 MERU/G	0.00	- 0.00	0.06	-	0.06	0.00	
ADOAZ	0.50 MERU/G	0.00	0.00	- 7.01	-	6.38	0.04	
ADIXX	0.6 MERU/GSQ	27.38	- 0.00	0.00	-	11.35	0.48	
ADSYY	0.6 MERU/GSQ	0.00	10.10	0.00	-	0.02	10.10	
ADIZZ	0.6 MERU/GSQ	0.00	0.00	- 10.09	-	9.19	0.05	
RSS DRIFT ANGLE (ARCSECS.)		318.25	506.05	232.69	-	249.51	506.00	
OVERALL RSS MLM. (ARCSECS.)		320.91	507.73	236.32	-	252.89	507.67	
OVERALL RSS MLM. (MR.)		1.5558	2.4615	1.1457	-	1.2260	2.4613	
							308.11 1.4937	

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TABLE 28 S. M. MISALIGNMENTS AND DRIFTS AT DROGUE DEPLOY

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SECTION B

POWERED LANDING PGNCS
ERROR STUDY

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IMU ERROR SENSITIVITIES FOR APOLLO 15^{*}
POWERED LANDING MANEUVER

1. SUMMARY

Data are presented on the sensitivity of the position and velocity estimation errors during the powered landing maneuver to various IMU measurement errors. The most important point to be seen from these results is that the sensitivities of the down-range and cross-track position errors to accelerometer-bias errors are significantly lower than in the preceding flights, where DOI was performed by the LM about one-half orbit period prior to PDI.

2. GENERAL INFORMATION

Error-sensitivity data have been presented for the Apollo 12 powered-landing maneuver in Refs. (1) and (2). The particular error sources considered here were IMU alignment, gyro drift-rate bias, accelerometer bias, and accelerometer scale-factor.

In the preceding landing missions the DOI maneuver was performed by the LM approximately one-half orbit period prior to PDI. Under these conditions it was not reasonable to assume that LM state-estimation errors introduced during the DOI maneuver would be corrected by subsequent MSFN and landmark-tracking data. A N69 update was used in Apollo 12 to correct down-range position errors.

In Apollo 15 on the other hand, the DOI maneuver will be performed by the CM prior to separation at about 20 hours prior to touchdown. MSFN and landmark-tracking data taken during the orbits subsequent to DOI will be used to update the LM state-vector estimates. Under these conditions, only the powered-landing thrusting maneuver affects the landing-maneuver sensitivity to LM IMU errors (the DOI thrusting maneuver need not be considered here).

3. SIMULATION RESULTS

The basic error-sensitivity data are summarized in Tables 1-11 for the different IMU errors. In interpreting these results, the following points should be noted:

- 1.) Zero time is taken as the time that the throttle-up command is normally issued during the braking phase (i.e., TIG + 33.5 seconds).

*Except for several minor additions to the text, this section is identical to the information presented in MIT/CSD lab report E-2491 issued for Apollo 13.

- 2.) The last alignment of the IMU prior to PDI occurs about 1800 seconds before the start of the DOI maneuver.
- 3.) The state-vector estimation-error components referred to in the various tables are all expressed in stable-member coordinates.
- 4.) Landing-radar dropout-boundary models developed by D. Dyer of MSC (Ref. 3) were used in the simulation results. The effect here is to cause the altitude updating to start at about 300 seconds after TFTP (TIG + 33.5 seconds), and the velocity updatings at about 400 seconds. The corresponding acquisition altitudes are about 30,000 and 15,000 feet. Since Apollo 12 flight data have indicated acquisitions at altitudes greater than 35,000 feet, the results of this memo will tend to be high.
- 5.) Since LR altitude-data updatings start at about 300 seconds, the sensitivities of RXP to IMU errors are not shown after these times. Likewise, data for VXP, VYP and VZP error sensitivities are not given for times greater than 400 seconds, which was the typical time that LR velocity updating was started in the study.
- 6.) In cases where the error sensitivities were significantly different from the Apollo 12 results, the Apollo 12 sensitivity (Refs. 1 and 2) is shown in parentheses for comparison.

The important results are shown in Tables 4 and 6. It can be seen from Table 4 that the sensitivity of down-range position to X-accelerometer bias has been reduced from about 6.2×10^5 ft/fps² to about 3×10^3 ft/fps². Likewise, from Table 6 it can be seen that the sensitivity of down-range position to Z-accelerometer bias has been reduced from about 1.1×10^6 ft/fps² to about 1.2×10^5 ft/fps².

A list of appropriate conversion factors are shown below:

10^{+3} ft/fps ²	=	33.3 ft/cm/sec ²
10^{+3} fps/fps ²	=	33.3 fps/cm/sec ²
10^{+2} ft/(deg/hr)	=	1.5 ft/meru
10^{+2} fps/(deg/hr)	=	1.5 fps/meru
10^{+2} ft/(percent)	=	10^{-2} ft/ppm
10^{+2} fps/(percent)	=	10^{-2} fps/ppm

TABLE 1
SM X-AXIS ALIGNMENT

Time	ft/mr			fps/mr		
	RXP	RYP	RZP	VXP	VYP	VZP
-33.5 S	≈ 0					
0		≈ 0			≈ 0	
100		-62			-1.2	
200		-237			-2.3	
300		-528			-3.5	
400		-950			-4.7	
640		-1100				

TABLE 2
SM Y-AXIS ALIGNMENT

Apollo 12 values in parentheses

Time	ft / mr			fps / mr		
	RXP	RYP	RZP	VXP	VYP	VZP
-33.5 S	0 (-86)	≈ 0	0 (-300)	0 (0.21)	≈ 0	0 (-0.06)
0	0 (-80)		0 (-300)	0.03 (0.30)		-0.01 (-0.06)
100	51		-11 (-315)	1.01 (1.3)		-0.17 (-0.18)
200	209 (173)		-27 (-330)	2.14 (2.4)		-0.09 (-0.10)
300	488 (460)		-25 (-327)	3.45 (3.6)		0.17 (0.19)
400			29 (-260)	4.78 (5.0)		0.60 (0.65)
640			98 (-185)			

LANDING MANEUVER ERROR SENSITIVITIES

TABLE 3
SM Z-AXIS ALIGNMENT

Time	ft/mr			fps/mr		
	RXP	RYP	RZP	VXP	VYP	VZP
-33.5 S	≈ 0					
0		≈ 0			≈ 0	
100		13			0.19	
200		30			0.10	
300		30			-0.16	
400		-10			-0.58	
640		-80				

TABLE 4
X-AXIS ACCELEROMETER BIAS
Apollo 12 values in parentheses

Time	10^{+3} ft/fps ²			10^{+3} fps/fps ²		
	RXP	RYP	RZP	VXP	VYP	VZP
-33.5	0 (75)	0	0 (593)	0 (-0.44)	0	0 (0.19)
0	0 (61)		0 (600)	0.03 (-0.42)		0 (0.18)
100	9 (23)		0 (615)	0.13 (-0.34)		0 (0.13)
200	28 (-5)		0 (625)	0.23 (-0.27)		0 (0.07)
300	57 (-21)		0 (630)	0.34 (-0.17)		0 (0.01)
400			1 (627)	0.44 (-0.06)		0 (-0.05)
640			3 (620)			

LANDING MANEUVER ERROR SENSITIVITIES

TABLE 5
Y-AXIS ACCELEROMETER BIAS

Time	10^{-3} ft/fps ²			10^{-3} fps/fps ²		
	RXP	RYP	RZP	VXP	VYP	VZP
-33.5 S	0	0	0	0	0 (-0.10)	0
0		0			0.02 (-0.06)	
100		8 (1)			0.12 (0.03)	
200		26 (8)			0.22 (0.12)	
300		53 (26)			0.32 (0.22)	
400		91 (55)			0.41 (0.32)	
640		122 (84)				

TABLE 6
Z-AXIS ACCELEROMETER BIAS
Apollo 12 values in parentheses

Time	10^{-3} ft/fps ²			10^{-3} fps/fps ²		
	RXP	RYP	RZP	VXP	VYP	VZP
-33.5 S	0 (-139)	0	0 (836)	0 (-0.64)	0	0 (0.45)
0	0 (-160)		0 (850)	0 (-0.67)		0 (0.46)
100	1 (-232)		8 (902)	0 (-0.75)		0.12 (0.51)
200	1 (-310)		26 (950)	0 (-0.83)		0.22 (0.53)
300	2 (-398)		53 (1008)	0 (-0.91)		0.32 (0.55)
400			90 (1050)	0 (-0.93)		0.41 (0.56)
640			121 (1084)			

LANDING MANEUVER ERROR SENSITIVITIES

TABLE 7
X-AXIS DRIFT RATE

Time	10^{+2} ft/(deg/hr)			10^{+2} fps/(deg/hr)		
	RXP	RYP	RZP	VXP	VYP	VZP
-33.5	0	0	0	0	0	0
0		0			-0.01	
100		-13			-0.26	
200		-54			-0.48	
300		-125			-0.87	
400		-232			-1.18	
640		-309				

TABLE 8
Y-AXIS DRIFT RATE

Time	10^{+2} ft/(deg/hr)			10^{+2} fps/(deg/hr)		
	RXP	RYP	RZP	VXP	VYP	VZP
-33.5	0 (-7)	0	-26	0 (0.01)	0	0
0	0 (-6)		-26	0 (0.02)		0
100	8 (14)		-29	0.27		-0.04
200	52		-34	0.57		-0.02
300	125		-32	0.91		0.04
400			-15	1.24		0.16
640						

LANDING MANEUVER ERROR SENSITIVITIES

TABLE 9
Z-AXIS DRIFT RATE

Time	10^{+2} ft/(deg/hr)			10^{+2} fps/(deg/hr)		
	RXP	RYP	RZP	VXP	VYP	VZP
-33.5	0	0	0	0	0	0
0	0	0			0	
100	1	3			0.04	
200	1	7			0.03	
300	2	6			-0.04	
400		-4	↓	↓	-0.16	↓
640		-23				

TABLE 10
X-ACCELEROMETER SCALE FACTOR
Apollo 12 values in parentheses

Time	10^{+2} ft/(percent)			10^{+2} fps / (percent)		
	RXP	RYP	RZP	VXP	VYP	VZP
-33.5	0 (1.4)	0	0 (11)	0 (-0.001)	0	0
0	0 (1.2)		0 (12)	0 (-0.001)		
100	0 (-0.7)		0 (12)	-0.01 (-0.02)		
200	0 (-3)		0 (12)	0 (-0.02)		
300	0 (-4)		0 (12)	0.01 (0.007)		
400			0 (12)	0.05		
640			0 (12)			

LANDING MANEUVER ERROR SENSITIVITIES

TABLE 11
Z-ACCELEROMETER SCALE FACTOR
Apollo 12 values in parentheses

Time	10^2 ft/(percent)			10^2 fps/(percent)		
	RXP	RYP	RZP	VXP	VYP	VZP
-33.5 S	0 (-11)	0	0 (65)	0 (-0.05)	0	0 (0.04)
0	0 (-12)		0 (65)	0 (-0.05)		0 (0.03)
100	1 (-18)		-4 (65)	0 (-0.05)		-0.10 (-0.06)
200	1 (-24)		-20 (54)	0 (-0.06)		-0.21 (-0.16)
300	2 (-30)		-47 (27)	0 (-0.07)		-0.33 (-0.30)
400			-87 (-13)	0 (-0.07)		-0.45 (-0.43)
640			-115 (-44)			

LANDING MANEUVER ERROR SENSITIVITIES

REFERENCES

1. Kriegsman, B., and D. Gustafson, "Error Analysis for LM Navigation System During Powered-Landing Maneuver - Apollo 12 Trajectory", MIT Charles Stark Draper Laboratory, Mission Simulation Memo #31-69, October 20, 1969.
2. Grant, F., S. Helfant, and B. Kriegsman, "Mission H1 G&N Error Analysis", MIT Charles Stark Draper Laboratory, Report E-2454, October 1969.
3. Cox, K., "Preliminary Update of the Simplified LR Operating Boundary Model", MSC Memo #EG23-68-279.

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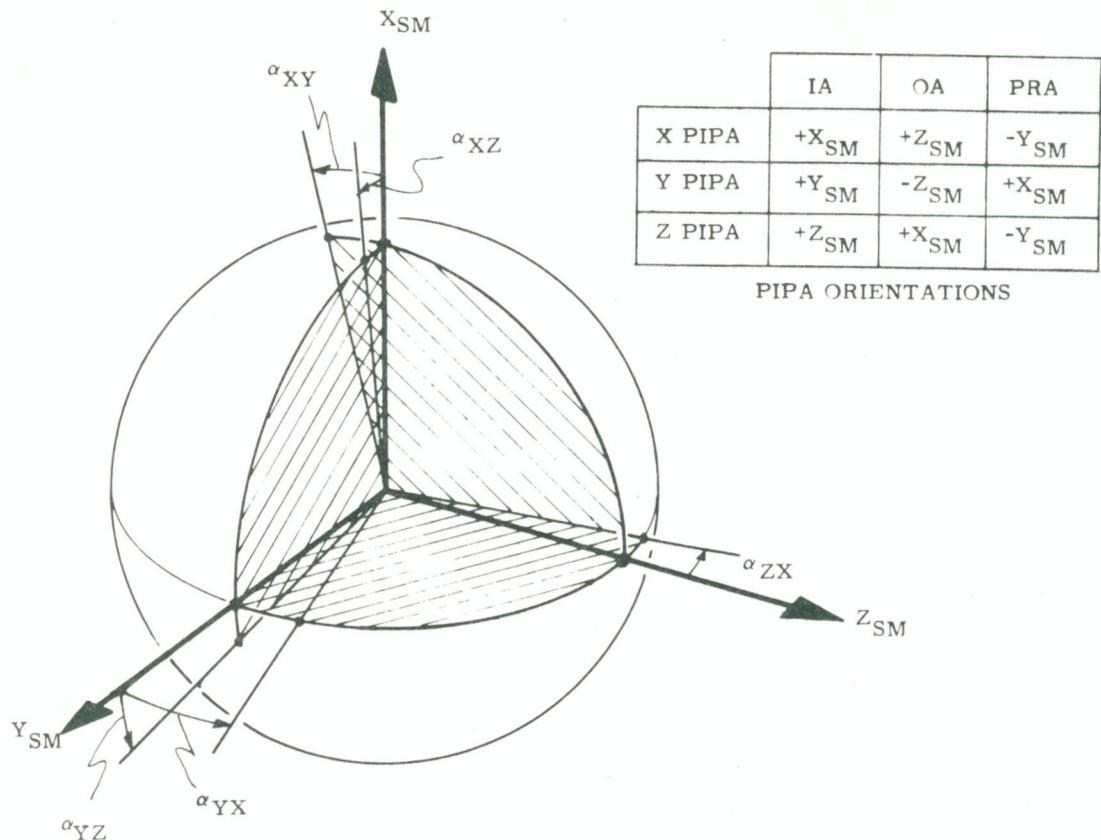
GYRO DRIFT TEST POSITIONS
FOR
SUNDANCE, LUMINARY, COLOSSUS, AND ON

STABLE MEMBER POSITION	STABLE MEMBER ORIENTATION	HORIZONTAL DRIFT	VERTICAL DRIFT
1	X DOWN Y SOUTH Z WEST	NBDY-ADOAY	
2	X DOWN Y WEST Z NORTH	+ NBDZ - ADOAZ	-NBDZ + ADIAZ
3	X SOUTH Y WEST Z NORTH	NBDX - ADOAX	
4	X EAST Y SOUTH Z DOWN	+ NBDY + ADSRAY	+ NBDZ + ADIAZ
5*	X WEST Y UP Z NORTH	+ NBDZ - ADSRAZ	
6*	X SOUTH Y DOWN Z EAST	+ NBDX+ADSRAZ	- NBDY+ADIAZ
7	X NORTH Y UP-WEST Z UP-EAST	- NBDX + (ADSRAZ/ $\sqrt{2}$)	
8	X EAST Y UP-NORTH Z UP-SOUTH	(-NBDZ - NBDY)/ $\sqrt{2}$ +(ADIAZ - ADIAZ)/2 +(ADSRAY+ADSRAZ)/2	
9	X UP-EAST Y UP-WEST Z SOUTH	- NBDZ + (ADSRAZ/ $\sqrt{2}$)	
10	X UP-NORTH Y UP-SOUTH Z EAST	(NBDY - NBDX)/ $\sqrt{2}$ +(ADIAZ - ADIAZ)/2 +ADSRAZ/2	
11	X NORTH Y WEST Z UP	- NBDX - ADOAX	
12	X UP Y SOUTH Z EAST	+ NBDY+ADOAY	
13	X UP Y EAST Z NORTH	+ NBDZ + ADOAZ	

* Positions 5 and 6 are lab test only

G & N MISSION RELIABILITY ANALYSIS
FAILURE RATES EXPRESSED IN "FAILURES PER 10^6 HOURS"

		IMU Assembly		IMU Electronics (PSA)		Optics Assembly		Optics Electronics (PSA)		IMU CDU		Optics CDU		AGC		DSKY		D&C		Mission Reliability
Mission		ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	
Mission J1 AS 510/CM 112	OPER HRS	295	-	295	-	42	-	42	-	295	-	295	-	295	-	295	-	295	-	0.8018
	MANNED	λ	129	10.2	110	6.3	94	-	77	-	155	-	91	-	235	60.3	2.3	-	2.3	-
Mission J1 AS 510/LM 10	OPER HRS	12.5	161.0	12.5	-	12.5	-	12.5	-	12.5	-	12.5	-	12.5	-	12.5	-	12.5	-	0.9887
	MANNED	λ	129	1.6	110	-	38	-	1.33	-	155	-	112	-	235	-	110	-	1.2	-
CM DES REF	OPER HRS	13.8	55.6	13.8	55.6	9.1	60.3	9.1	60.3	13.8	55.6	13.8	55.6	13.8	55.6	13.8	55.6	13.8	55.6	0.9840
	λ	129	10.2	110	6.3	94	-	77	-	155	-	91	-	235	60.5	2.3	-	2.3	-	
LM DES REF	OPER HRS	3.25	66.3	3.25	66.3	3.25	-	3.25	-	3.25	-	3.25	-	3.25	-	3.25	-	3.25	-	0.9969
	λ	129	1.6	110	-	38	-	1.33	-	155	-	112	-	235	-	110	-	1.2	-	



PIPA Misalignments from Ideal Stable Member Axes

(Angle in Sec)

Term	LM-IMU 12	CM-IMU 48
α_{XY}	+38	+45
α_{XZ}	-11	+10
α_{YZ}	-22	-26
α_{YX}	+18	-4
α_{ZX}	-99*	+8

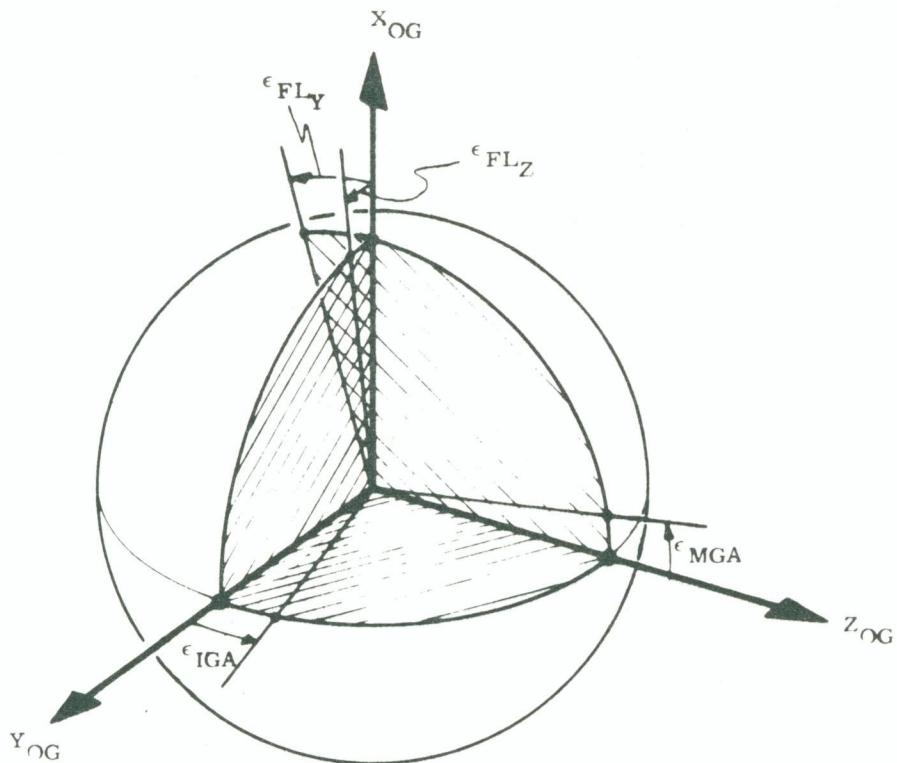
DEFINITION OF POSITIVE SENSE

PIPA INPUT-AXIS MISALIGNMENTS

with respect to

IDEAL STABLE MEMBER AXES

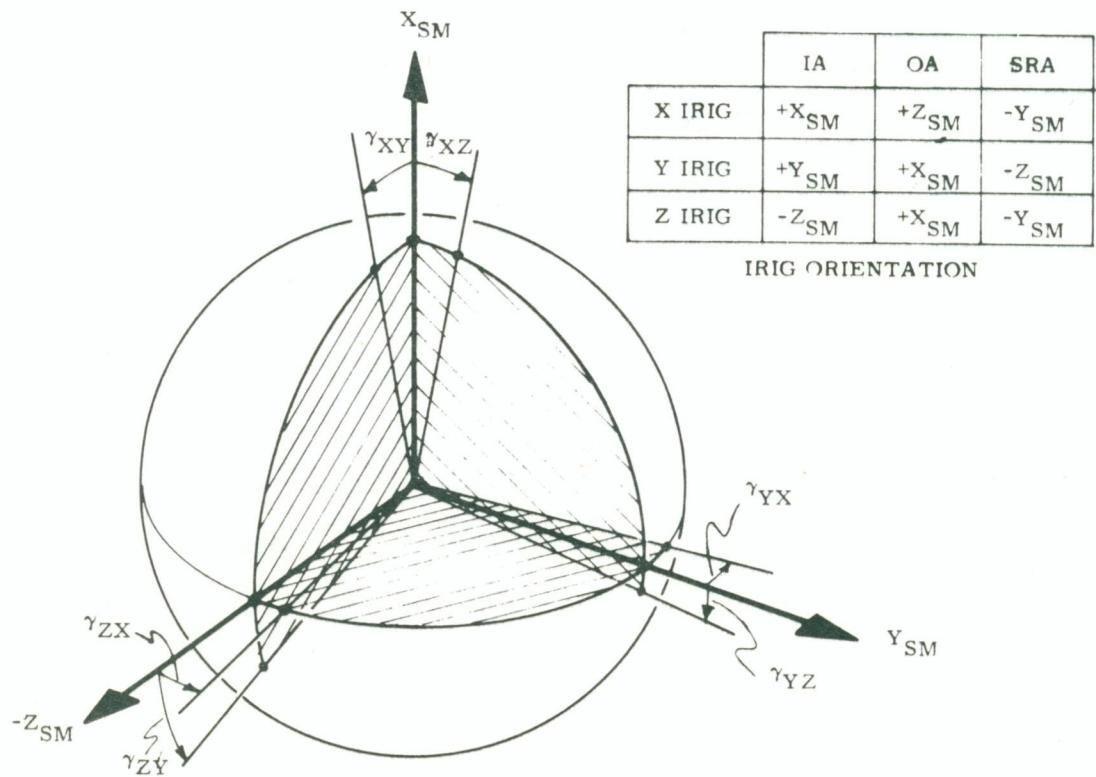
* Waivered: ACSK-C1248



Gimbal Axis Orthogonality Errors and Outer Gimbal Misalignment from Casemounting Axes

Term	LM-IMU 12	CM-IMU 48
ϵ_{IGA}	+30	-10
ϵ_{MGA}	-8	+6
ϵ_{FLY}	+13	+8
ϵ_{FLZ}	-8	-15

DEFINITION OF POSITIVE SENSE
 GIMBAL AXIS ORTHOGONALITY
 and
 OUTER GIMBAL ALIGNMENT
 with respect to
 CASE MOUNTING ALIGNMENT



IRIG Misalignments from Ideal Stable Member Axes

Term	(Angle in Sec)	
	LM-IMU 12	CM-IMU 48
γ_{XY}	-31	-13
γ_{XZ}	+19	-69
γ_{YZ}	-31	+43
γ_{YX}	-19	+1
γ_{ZX}	-27	-97
γ_{ZY}	-11	+37

Block II G & N
 DEFINITION OF POSITIVE SENSE
 IRIG INPUT-AXIS MISALIGNMENTS
 with respect to
 IDEAL STABLE MEMBER AXES

MISSION J1

AS-510/CM 112

G&N 217

IMU S/N 48

IRIGS

X = 8A119

Y = 8A117

Z = 8A125

PIPAS

X = 2AP232

Y = 2AP265R

Z = 2AP179

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NASA	TEMP	MAX	THERM	SUS	SUS	XFR	Avg	SD	WH	THERM	PAD	XFR	BIAS	TRQE	RES
ACC	SENS	SD	R	CAP	SG	CAP	TG	FUNC	RDT	RDT	HRS	SG	TG	RES	R

25JE69 0.4 691.9 .0505 167 4.5 471

TST	IMU	G&N														
DATE	LJC	TYP	ASSN	SYS	NBD	ADSRA	ADIA	DELSF+	DELSF-	RDT	HOURS	I+	I-	ID	ADOA	
28MY69	A45	CSS														
29MY69	A41	CSS	{- 9.2}	{- 1.9}	{- 3.1}							C121				
29MY69	SG	84.3, 68.7,	58.2,	TG 53.8,	68.3,	79.3						C116			- 3.9	
4JE69	A44	CSS	{- 12.9}	{- 1.9}	{- 0.6}							REF H5229			- 3.8	
9JE69	A44	CSS	{- 11.1}	{ 0.3}	{- 0.2}							167			- 1.9	
10JE69	A44	CSS										169				
12JE69	COMP	SELECT										168				
12JE69	A45	CSS										- 28 - 123	168	85.001	85.000	
16JE69	COMP	VERIF										72	75	167	85.001	85.000
16JE69	A45	CSS										62 - 38	167	85.001	85.000	
17JE69	DEMO	T/F = 1191.2														
17JE69	A45	CSS														
17JE69	VIB	IA ALIGN = -0.9														
18JE69	A45	CA1	0.1	- 3.4	- 2.8											
18JE69	A45	CA2	- 0.3	- 3.1	- 5.7							307	109	85.000	84.999 - 2.8	
18JE69	A45	CA3	0.2	- 2.9	- 2.4							174				
20JE69	A45	CB1	- 0.1	- 3.4	- 8.0											
20JE69	A45	CB2	- 0.1	- 3.5	- 8.1							383	112	85.000	84.999 - 4.7	
20JE69	A45	CB3	0.0	- 3.8	- 6.5							169				
22JE69	A45	CC1	2.0	- 3.5	- 5.0											
22JE69	A45	CC2	1.5	- 3.0	- 9.0							220	17	85.000	85.000 - 1.4	
22JE69	A45	CC3	1.6	- 3.2	- 8.5							157	471			
25JE69	NO	WAIVERS REQD	M/O TO 0814													
			UNIT INSTALLED IN IMU S/N 48X, REPLACING 7C-153													
7AU69	A03	SPO X 48	1.9	- 2.7								184	374	85.009		3.2
7AU69	A03	SPO X 48	2.2		- 4.9											
8AU69	A03	SPO X 48										C122				
8AU69	A03	SPO X 48										C125				
8AU69	A03	SPO X 48										C123	530			
3SE69	A03	SPO X 48	0.9	- 1.2								240	294	85.002		3.5
3SE69	AC3	SPO X 48	0.4		- 10.2							618				
16OC69	IMU	S/N 48 SHIPPED TO KSC														
18NG69	IMU	S/N 48 RETURNED TO AC/MKE.														
20NU69	A01	SPO X 48	3.7		- 4.9											
20NU69	A01	SPO X 48	3.7	- 7.9								451	594	C121	85.011	3.6
20NU69	A01	SPO X 48										C122	695			
20NU69																
5FE70	A03	SPO X 48	- 0.2		- 14.8											
5FE70	A03	SPO X 48	- 0.1	- 5.8												3.6
6FE70	A03	SPO X 48										394	541	85.015		
12FE70																
16FE70																
16FE70																
17FE70																
17FE70																
18FE70																
18FE70																
18FE70	A03	SCK X 48	4.5		- 8.1											

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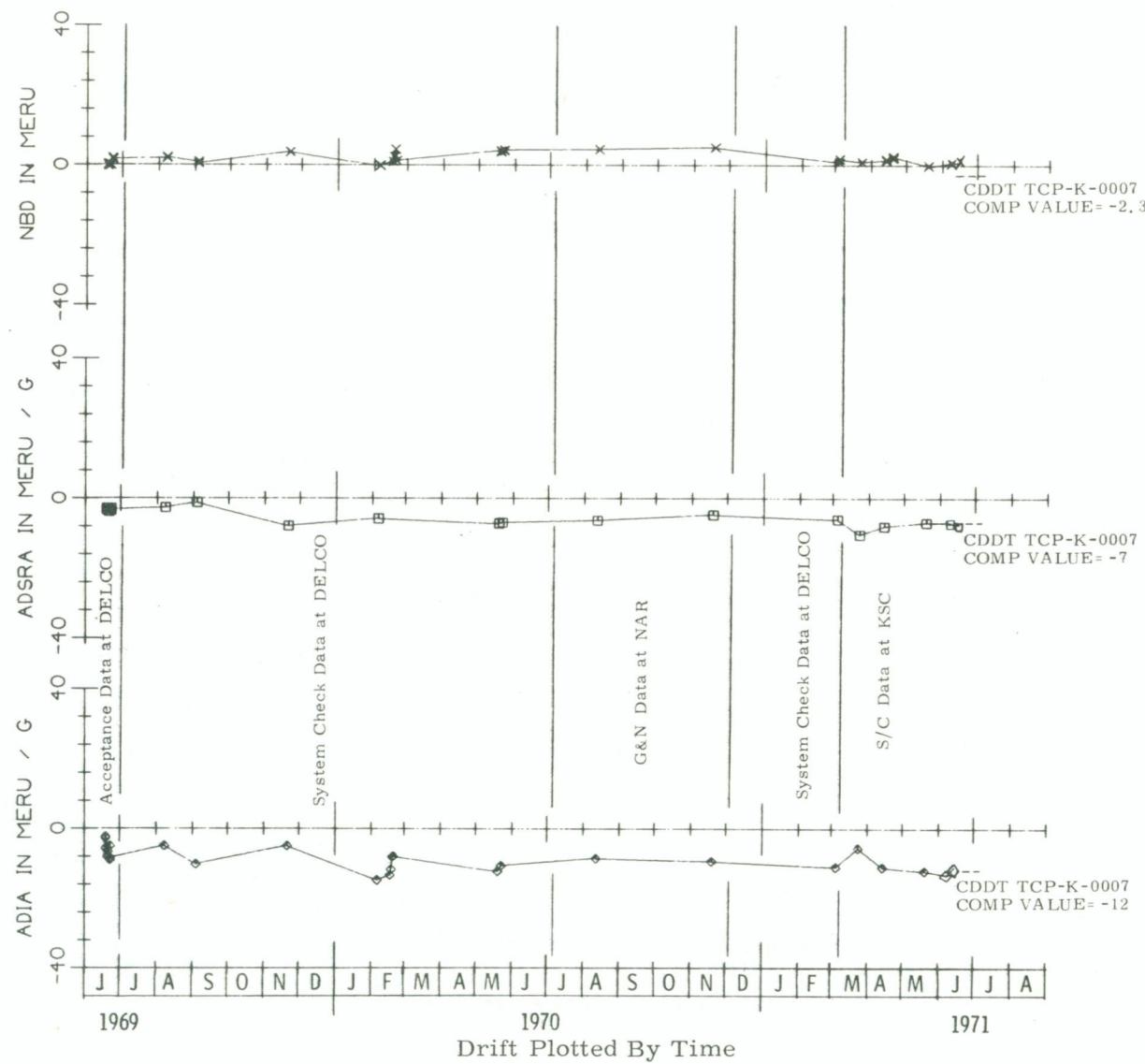
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DATE	LOC	TYP	ASSN	SYS	NBD	ADSRA	ADIA	DELSF+	DELSF-	RDT	HOURS	I+	I-	ID	ADDA	
19FE70																
19FE70 DATA AFTER OVERNIGHT STORAGE WITH X SRA UP FOLLOWS.																
19FE70	A03	SCK	X	48	1.2	-	7.9					823				
16MR70	IMU	S/N	48			SHIPPED FROM AC/MKE TO KSC.										
12MY70	IMU	S/N	48			SHIPPED FROM KSC TO AC/MKE.										
19MY70	A03	SPO	X	48	4.1	-	12.2									
19MY70	A03	SPO	X	48	3.8	-	7.2					C121				3.5
22MY70	A03	SPO	X	48	4.1	-	10.6									
22MY70	A03	SPO	X	48	4.3	-	6.9	284	361			85.008				3.7
27MY70																
27MY70 NO FLUID TRANSIENTS APPARENT DURING GRAVITY TRANSIENT TEST.																
27MY70												929				
7JL70	IMU	S/N	48			SHIPPED FROM AC/MKE TO NR.										
13JL70	IMU	S/N	48			INSTALLED IN CM-112 (GEN 217).										
11AU70	NSC	G&N	X	48	217	4.5	-	6.3	-	8.5	659	498				
31AU70	NSC	G&N	X	48	217						1002					
31OC70	NSC	G&N	X	48	217						1008					
18NU70	NSC	G&N	X	48	217	5.1	-	4.7	-	9.3	666	516				
9DE70	IMU	S/N	48			SHIPPED FROM NR TO DELCO/MKE.										
4MR71	A03	SPO	X	48	0.9	-	10.9									
4MR71	A03	SPO	X	48	1.8	-	6.0									
5MR71	A03	SPO	X	48				761	741			85.017				
7MR71																
7MR71 NO FLUID TRANSIENTS DETECTED DURING GRAVITY TRANSIENT TEST.																
8MR71	IMU	S/N	48			SHIPPED FROM DELCO/MKE TO KSC.										
19MR71	IMU	48	G&N	217		INSTALLED IN CM-112.										
23MR71	KJB	G&N	X	48	217	1.0	-	10.4	-	5.5	976	480				4.2
13AP71	KJB	G&N	X	48	217	1.4	-	8.0	-	11.0	986	491				5.3
13AP71	KJB	G&N	X	48	217	1.7										4.1
19AP71	KJB	G&N	X	48	217	2.3										4.4
19AP71	KJB	G&N	X	48	217	2.0										4.4
19AP71	KJB	G&N	X	48	217	2.5										4.1
19MY71	K9A	G&N	X	48	217	-	0.1	-	6.9	-	12.1					4.5
10JE71	K9A	G&N	X	48	217	0.5	-	7.1	-	12.6						4.5
REFTEST DATA AFTER LAUNCH TOWER STRUCK BY LIGHTNING																
19JE71	K9A	G&N	X	48	217	2.8	-	7.4	-	11.5						4.4

G & N 217, CM 112, IMU 48, APOLLO IRIG 8A119, X AXIS



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LAST UPDATE

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NASA	TEMP	MAX	THERM	SUS	SUS	XFR	Avg	SD	WH	THERM	PAD	XFR	BIAS	TRQE	RES				
ACC	SENS	SD	R	CAP	SG	CAP	TG	FUNC	RDT	RDT	HRS	SG	TG	RES	R	+	-		
21MY69	0.6			723.6	.0500				154	2.6	459								
WHEEL																			
TST	IMU	G&N																	
DATE	LJC	Typ	ASSN	SYS					NBD	ADSRA	ADIA	DELSF+	DELSF-	RDT	HOURS	I+	I-	ID	ADUA
18AP69	A45	CSS																	
18AP69	A45	CSS			(15.3)	(2.6)	(- 2.2)												
18AP69	SG	84.6,	70.1,	56.0	TG	55.8,	69.2,	84.6											
REF	H5218																		
22AP69	A44	CSS			(14.1)	(0.3)	(- 3.8)												
29AP69	A44	CSS			(14.5)	(0.4)	(- 0.9)												
1MY69	A44	CSS																	
5MY69	COMP	SELECT																	
5MY69	A44	CSS																	
7MY69	COMP	VERIF	S/F		REPADDED DUE TO A HIGH IN SPEC														
7MY69	A44	CSS																	
7MY69	COMP	RESELECT																	
7MY69	A44	CSS																	
7MY69	COMP	REVERIF																	
7MY69	A44	CSS																	
7MY69	A44	CSS																	
7MY69	DEMO																		
7MY69	A44	CSS																	
8MY69	VIB																		
9MY69	EQUIPMENT	MALFUNCTION	- SERVO	ABORTED															
9MY69	A44	CA1	0.2	3.7	3.4														
9MY69	A44	CA2	0.2	3.6	4.4														
9MY69	A44	CA3	0.7	4.0	4.9														
12MY69	A44	CB1	1.4	3.2	1.3														
12MY69	A44	CB2	1.5	3.0	- 1.5														
12MY69	A44	CB3	1.4	3.0	- 0.5														
15MY69	A45	CC1	1.0	3.2	5.4														
15MY69	A45	CC2	0.9	3.1	4.6														
15MY69	A45	CC3	1.0	3.0	4.8														
UNIT INSTALLED IN IMU S/N 48Y, REPLACING TC-188																			
7AU69	A03	SPO Y 48	0.4	1.9						40	-	351							
7AU69	A03	SPO Y 48	1.2		- 0.1														
8AU69	A03	SPO Y 48																	
8AU69	A03	SPO Y 48																	
3SE69	A03	SPO Y 48	0.4	5.6						-	227	-	494						
3SE69	A03	SPO Y 48	0.9		2.4														
606																			
16OC69	IMU	S/N 48	SHIPPED	TO KSC															
18NO69	IMU	S/N 48	RETURNED	TO AC/MKE.															
20NO69	A01	SPO Y 48	2.2		6.1														
21NO69	A01	SPO Y 48	1.7	0.4						174	-	240	C110						
21NO69	A01	SPO Y 48	2.7																
C114																			
5FE70	A03	SPO Y 48	0.9		- 9.8														
5FE70	A03	SPO Y 48	1.5		- 7.7														
6FE70	A03	SPO Y 48	2.7		- 9.5														
6FE70	A03	SPO Y 48	2.3	0.7						-	160	-	528						
85.016																			
0.C																			
12FE70	NO	FLUID	TRANSIENTS	APPARENT	IN	GRAVITY	TRANSIENT	TEST.											
16FE70	DATA	AFTER	WEEKEND	STORAGE	WITH	Y	SRA	UP	FOLLOWS	(DIAG.	381).								

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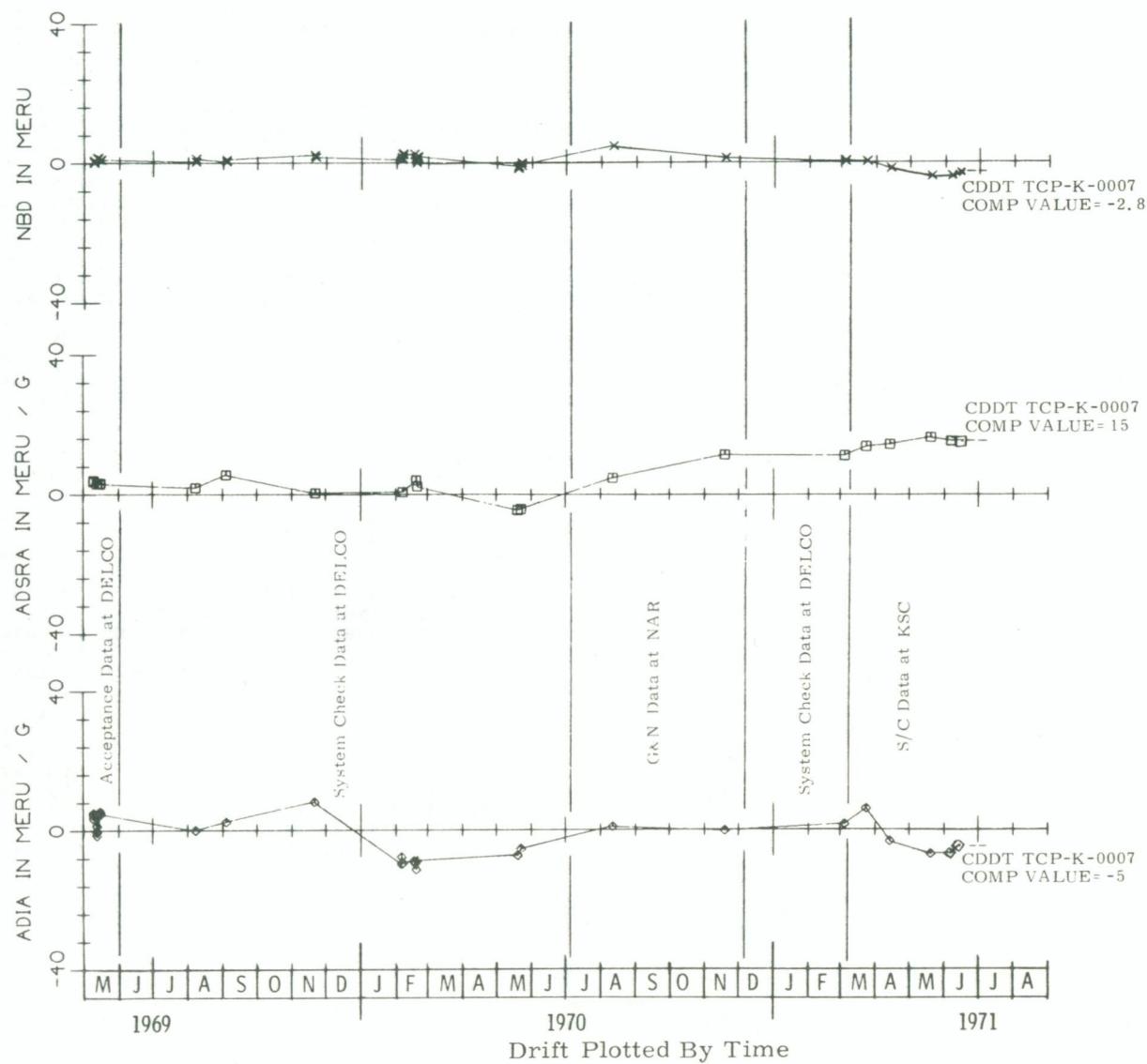
LAST UPDATE

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DATE	TST	IMU	GEN	WHEEL													
				LJC	TYP	ASSN	SYS	NBD	ADSRA	ADIA	DELSF+	DELSF-	RDT HOURS	I+	I-	ID	ADDA
16FE70	A03	SCK	Y 48		2.5		-	8.9									
17FE70	DATA AFTER OVERNIGHT STORAGE WITH Y SRA DOWN FOLLOWS.																
17FE70	A03	SCK	Y 48		1.3		-	9.5									
18FE70	DATA AFTER OVERNIGHT STORAGE WITH Y IA UP FOLLOWS.																
18FE70	A03	SCK	Y 48		0.0	4.1									1.3		
18FE70	A03	SCK	Y 48		0.7		-	11.4									
19FE70	DATA AFTER OVERNIGHT STORAGE WITH Y IA DOWN FOLLOWS.																
19FE70	A03	SCK	Y 48		1.5	2.3									1.3		
19FE70	A03	SCK	Y 48		1.9		-	8.8		811							
16MR70	IMU S/N 48 SHIPPED FROM AC/MKE TO KSC.																
12MY70	IMU S/N 48 SHIPPED FROM KSC TO AC/MKE.																
19MY70	A03	SPO	Y 48		-	1.1		-	7.4								
19MY70	A03	SPO	Y 48		-	1.7	-	4.5		C113					1.1		
22MY70	A03	SPO	Y 48		-	0.1		-	5.5								
22MY70	A03	SPO	Y 48		-	0.8	-	4.2							1.1		
25MY70	A03	SPO	Y 48				-	294 - 674		916	85.003						
27MY70	NO FLUID TRANSIENTS APPARENT DURING GRAVITY TRANSIENT TEST.																
7JL70	IMU S/N 48 SHIPPED FROM AC/MKE TO NR.																
13JL70	IMU S/N 48 INSTALLED IN CM-112 (GEN 217).																
11AU70	NSC	GEN	Y 48	217	4.7	4.7	0.9		15 - 485								
11AU70	ADIAY POSITION 8								-	7.0							
31AU70	NSC	GEN	Y 48	217						990							
31OC70	NSC	GEN	Y 48	217						995							
18NO70	NSC	GEN	Y 48	217	1.3	11.4	-	0.2	130 - 348								
18NO70	ADIAY POSITION 8								-	4.3							
9DE70	IMU S/N 48 SHIPPED FROM NR TO DELCO/MKE.																
4MR71	A03	SPO	Y 48		0.3		1.6										
4MR71	A03	SPO	Y 48		0.5	11.2									1.6		
5MR71	A03	SPO	Y 48				-	160 - 407			85.016						
7MR71	NO FLUID TRANSIENTS DETECTED DURING GRAVITY TRANSIENT TEST.																
8MR71	IMU S/N 48 SHIPPED FROM DELCO/MKE TO KSC.																
19MR71	IMU 48 GEN 217 INSTALLED IN CM-112.																
23MR71	KOB	GEN	Y 48	217	0.3	13.8	6.1	-	195 - 200						1.1		
23MR71	ADIAY POSITION 8									1.1							
13AP71	KOB	GEN	Y 48	217	-	1.7	14.4	-	3.3	172 - 114					1.1		
13AP71	ADIAY POSITION 8									1.5							
19MY71	K9A	GEN	Y 48	217	-	3.9	16.4	-	7.0						1.2		
19MY71	ADIAY POSITION 8									1.0							
10JE71	K9A	GEN	Y 48	217	-	3.8	15.1	-	6.9						1.1		
10JE71	ADIAY POSITION 8								-	1.3							
RETEST DATA AFTER LAUNCH TOWER STRUCK BY LIGHTNING																	
19JET71	K9A	GEN	Y 48	217	-	2.9	15.2	-	4.5						1.2		
19JET71	ADIAY POSITION 8								-	1.7							

TL

G & N 217, CM 112, IMU 48, APOLLO IRIG 8A117, Y AXIS



NASA	TEMP	MAX	THERM	SUS	SUS	XFR	Avg	SD	WH	THERM	PAD	XFR	BIAS	TRQE	RES		
ACC	SENS	SD	R	CAP	SG	CAP	TG	FUNC	RDT	RDT	HRS	SG	TG	RES	R	+	-
31JL69	0.7		681.0	.0505					172	1.8	701						
WHEEL																	
DATE	TST	IMU	G&N	NBD	ADSRA	ADIA	DELSF+	DELSF-	RDT	hours	I+	I-	ID	ADDA			
8JL69	A41	CSS									C112						
8JL69	A41	CSS		(- 1.5)	(- 1.0)	(0.1)					C121			- 0.4			
9JL69	SG	84.4,	69.2,	50.9	TG	54.4,	68.3,	90.4			REF H5210						
11JL69	A43	CSS		(- 3.2)	(- 2.4)	(1.1)					174			1.3			
15JL69	A43	CSS		(- 3.3)	(- 1.1)	(- 1.0)					171			- 1.5			
15JL69	A43	CSS									172						
18JL69	COMP	SELECT															
18JL69	A44	CSS							-	76	259	169		84.987	84.988		
22JL69	COMP	VERIF								-	18	99		84.987	84.988		
22JL69	A44	CSS															
22JL69	DEMO	T/F = 1196.3															
22JL69	A44	CSS								-	156	-	32	174	84.988	84.988	
22JL69	VIB	/ COLD SOLDER JOINTS REPAIRED															
22JL69	RE-VIB	DA AXIS ONLY	IA ALIGN = +2.75														
23JL69	A41	CA1		1.3	3.2	- 7.5											
23JL69	A41	CA2		1.4	3.1	- 9.3			759	823				84.988	84.988		
23JL69	A41	CA3		- 0.1	3.1	- 6.4					173						
25JL69	A45	CB1		- 0.2	2.5	- 10.3											
25JL69	A45	CB2		- 0.2	3.6	- 9.9			711	816				85.001	85.001		
25JL69	A45	CB3		- 0.9	2.9	- 8.5					174						
28JL69	A45	CC1		- 0.2	3.5	- 9.1											
28JL69	A45	CC2		- 0.2	3.5	- 10.2			521	734				85.001	85.000		
28JL69	A45	CC3		- 0.2	3.4	- 10.4					174	701					
31JL69	M/D	TO 08-14															
21AU69	UNIT	INSTALLED IN IMU S/N 48-REPLACING 8A-120															
3SE69	A03	SPO Z 48		- 0.7	3.4				517	227				85.002		0.4	
3SE69	A03	SPO Z 48		- 1.0		- 10.4											
9SE69	A03	SCK Z 48		- 1.3	3.0											0.8	
9SE69	A03	SCK Z 48		- 1.5		- 11.7					789						
16OC69	IMU	S/N 48 SHIPPED TO KSC															
18NO69	IMU	S/N 48 RETURNED TO AC/MKE.															
21NO69	A01	SPO Z 48		- 2.3		- 13.1											
21NO69	A01	SPO Z 48		- 2.5	- 3.5				975	651	C109			85.020		0.3	
21NO69	A01	SPO Z 48									C123	865					
21NO69	MILLIWATT IS LESS THAN 2 MW. THROUGHOUT, EXCEPT FOR TWO 4 MW. JOGS.																
6FE70	A03	SPO Z 48		- 2.3		- 12.0											
6FE70	A03	SPO Z 48		- 2.5	8.3				761	451				85.015		0.9	
12FE70	ND	FLUID TRANSIENTS APPARENT IN GRAVITY TRANSIENT TEST.															
16FE70	DATA AFTER WEEKEND STORAGE WITH Z IA UP FOLLOWS (DIAG. 381).																
16FE70	A03	SCK Z 48		- 4.5	8.3											0.2	
17FE70	DATA AFTER OVERNIGHT STORAGE WITH Z IA DOWN FOLLOWS.																
17FE70	A03	SCK Z 48		- 1.4	7.7											1.3	
18FE70	DATA AFTER OVERNIGHT STORAGE WITH Z SRA DOWN FOLLOWS.																
18FE70	A03	SCK Z 48		- 3.3		- 11.2											
18FE70	A03	SCK Z 48		- 2.7	7.9											0.7	
19FE70	DATA AFTER OVERNIGHT STORAGE WITH Z SRA UP FOLLOWS.																

NASA 8A-125

ACE H-5210

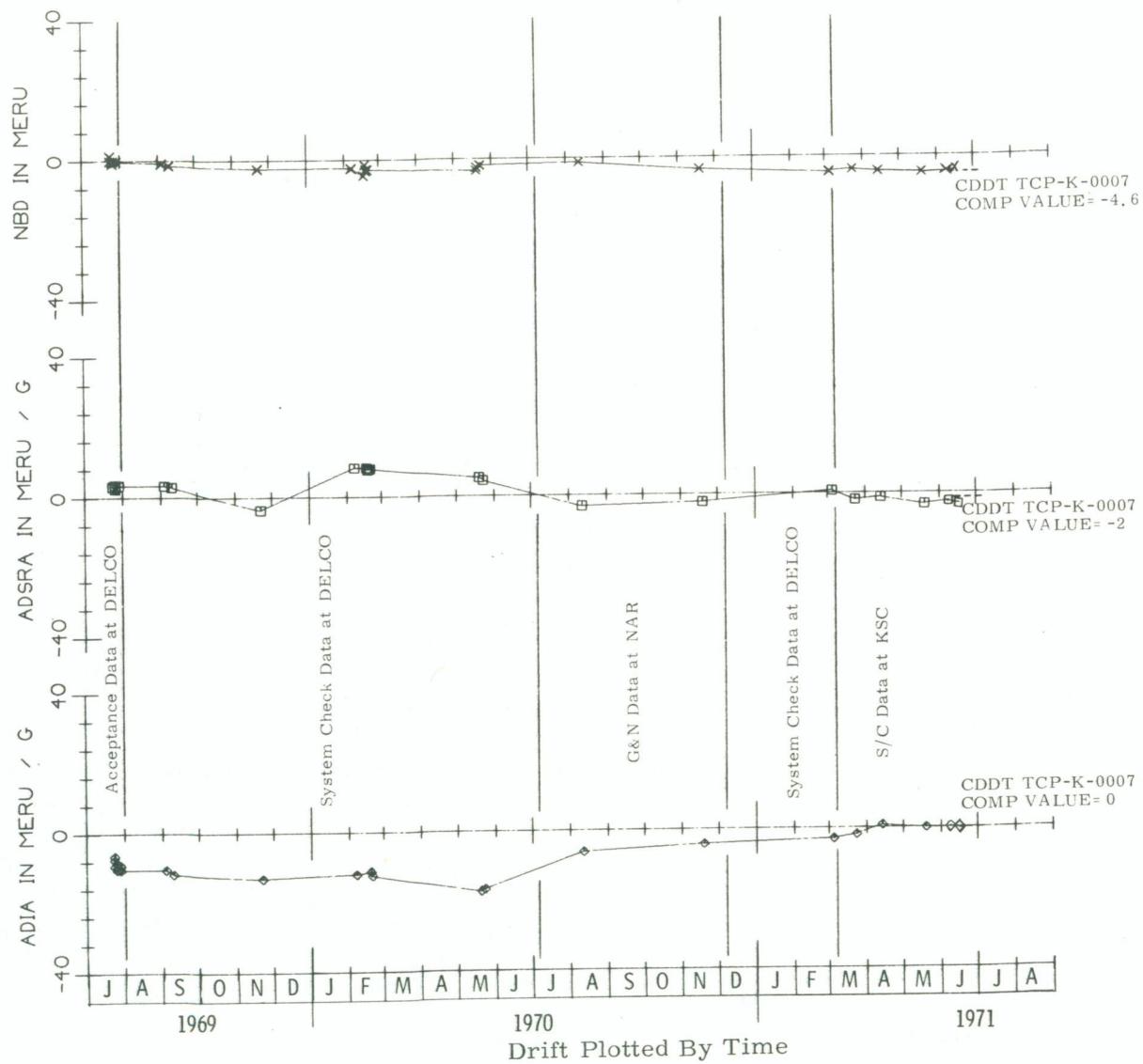
LAST UPDATE

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DATE	LJC	TST	IMU	GEN	WHEEL									
						NBD	ADSLRA	ADIA	DELSF+	DELSF-	RDT HOURS	I+	I-	ID
19FE70	A03	SCK	Z 48	-	2.8	-	12.4							
19FE70	A03	SCK	Z 48	-	2.8	8.0							0.6	
16MR70	IMU	S/N 48	SHIPPED FROM AC/MKE TO KSC.					994						
12MY70	IMU	S/N 48	SHIPPED FROM KSC TO AC/MKE.											
19MY70	A03	SPO	Z 48	-	3.4	-	17.2							
19MY70	A03	SPO	Z 48	-	2.5	5.2		C126					1.3	
22MY70	A03	SPO	Z 48	-	2.0	-	16.6							
22MY70	A03	SPO	Z 48	-	1.9	4.4							1.7	
25MY70	A03	SPO	Z 48				594	384						
27MY70	NO FLUID TRANSIENTS APPARENT DURING GRAVITY TRANSIENT TEST.									85.005				
27MY70									1099					
7JL70	IMU	S/N 48	SHIPPED FROM AC/MKE TO NR.											
13JL70	IMU	S/N 48	INSTALLED IN CM-112 (GEN 217).											
11AU70	NSC	GEN Z 48	217	-	1.3	-	3.2	-	6.2	979	962			
31AU70	NSC	GEN Z 48	217							1173				
31OC70	NSC	GEN Z 48	217							1178				
18NO70	NSC	GEN Z 48	217	-	3.5	-	2.3	-	4.3	1030	836			
9OE70	IMU	S/N 48	SHIPPED FROM NR TO DELCO/MKE.											
4MR71	A03	SPO	Z 48	-	4.7	-	3.1							
4MR71	A03	SPO	Z 48	-	4.5	0.6								
5MR71	A03	SPO	Z 48				1118	741		85.016			0.4	
7MR71	NO FLUID TRANSIENTS DETECTED DURING GRAVITY TRANSIENT TEST.													
8MR71	IMU	S/N 48	SHIPPED FROM DELCO/MKE TO KSC.											
19MR71	IMU	48 GEN	Z 48 217	INSTALLED IN CM-112.										
23MR71	KJB	GEN Z 48	217	-	3.9	-	2.0	-	1.9	887	869			
13AP71	KDB	GEN Z 48	217	-	4.5	-	1.3	0.7		790	872		1.1	
19MY71	K9A	GEN Z 48	217	-	4.8	-	3.3	-	0.1				1.8	
10JE71	K9A	GEN Z 48	217	-	4.5	-	3.0	0.0					0.6	
19.JE71	K9A	GEN Z 48	217	-	4.1	-	3.2	-	0.2				1.0	
	RETEST DATA AFTER LAUNCH TOWER STRUCK BY LIGHTNING													
										04				

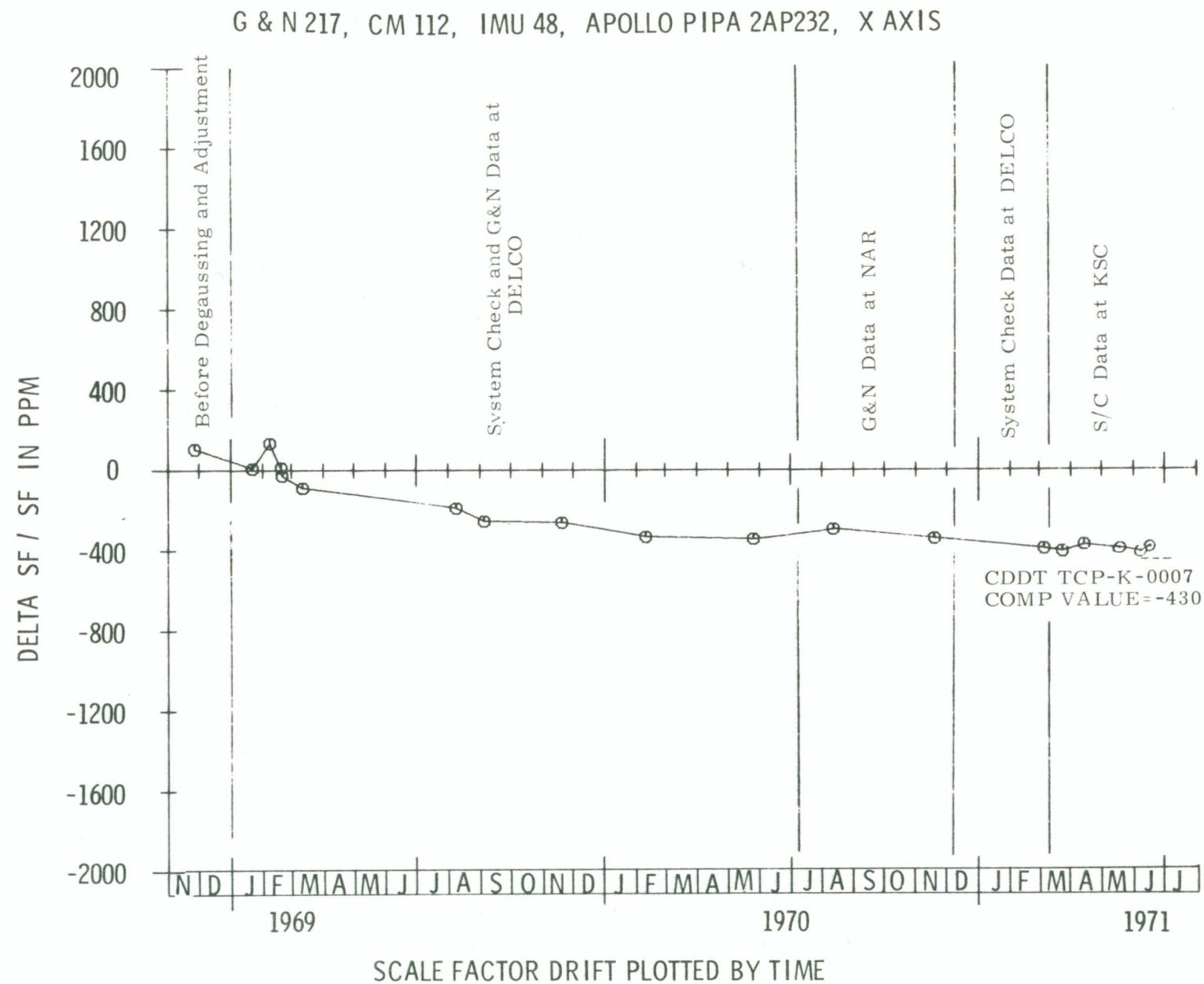
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G & N 217, CM 112, IMU 48, APOLLO IRIG 8A125, Z AXIS

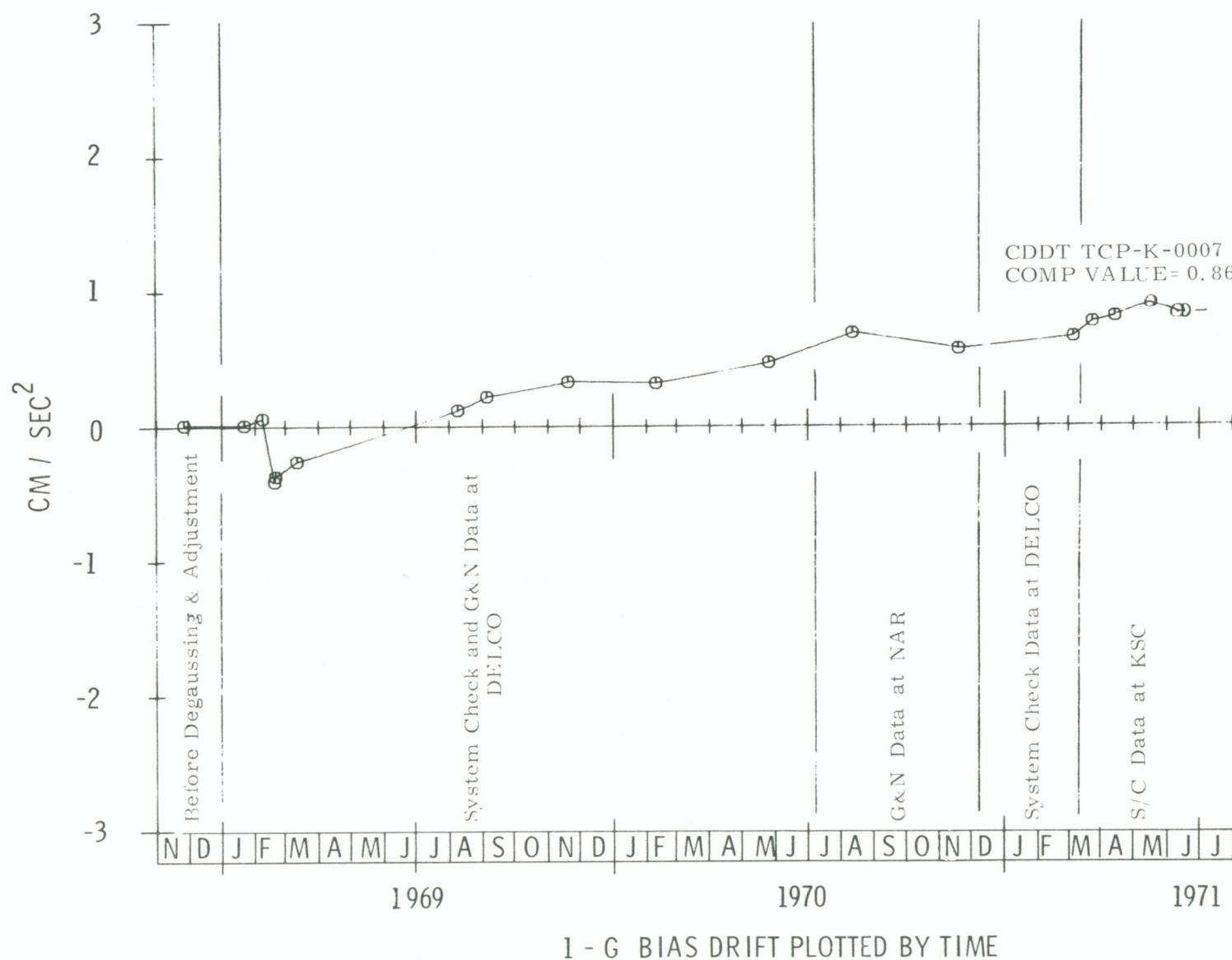


DATE	TST	IMU	GEN	DELTA	IG	NULL	ROT-AL-HUB	MAX.	TURQ MUN
	LOC	Typ	ASSN	SYS	SF	BIAS	BIAS	ANGLE	TRANS. CURRENT
7AP66	S41	ACC			- 154	0.00			103.0326
07DE66					RETURNED TO SPERRY-CAMAGED HARNESS				
17JA68					RETURNED TO AC-005 SENSOR				
26NU68	A48	FST			103	0.01	- 13 - 0		
16DE68					2AP232 ASSN TO IMU S/N 48, X				
20JA69	SPR	A03 X 48			(- 198) (0.44) (0.50)				103.2469
20JA69	SPR	A03 X 48			(- 206) (0.46) (0.47)				103.2469
21JA69	A03	SPR X 48			6	0.01	0.02		103.2420
21JA69					AFTER DEGAUSSING AND ADJUSTMENT				
7FE69	A03	SPD X 48			133	0.06	0.12		103.2470
1LFE69	A03	SAL X 48				(0.18)	12 56		
17FE69					INTERMITTENT OPEN IN A GSE CABLE CAUSED PIP GAUSSING				
17FE69	A03	SPD X 48			(257) (1.11) (1.12)				103.2375
18FE69	A03	SPD X 48			(257) (1.12) (1.14)				103.2372
18FE69	A03	SPU X 48			11	-0.41	-0.44		103.2369
18FE69					AFTER DEGAUSSING				
19FE69	A03	SPU X 48			- 29	-0.37	-0.38		103.2375
11MR69	A01	G&N X 48			- 90	-0.26			103.2266
12MR69	A01	G&N X 48					- 13 - 13		
BAU69	A03	SPD X 48			- 190	0.12	0.13		103.2406
8JL69					FD 3596. NULL COINCIDENCE CHECK				
11AU69	A03	SAL X 48				(0.15)	33 44		
4SE69	A03	SPU X 48			- 256	0.22	0.24		103.2468
4SE69	A03	SAL X 48				(0.21)	42 48		
16OC69					IMU S/N 48 SHIPPED TO KSC				
18NO69					IMU S/N 48 SHIPPED TO AC/MKE				
19NO69	A01	SPO X 48			- 262	0.33	0.32		103.2440
19NU69					RAN FD 3596 - NULL COINCIDENCE CHECK				
21NO69	A01	SAL X 48				(0.36)	13 41		
9FE70	A03	SPC X 48			- 334	0.32	0.31		103.2524
9FE70	A03	SAL X 48				(0.37)	20 43		
16MR70					IMU S/N 48 SHIPPED TO KSC				
12MY70					IMU S/N 48 RETURNED TO AC/MKE				
25MY70	A03	SPU X 48			- 346	0.47	0.48	0.05	103.2468
26MY70	A03	SAL X 48				(0.52)	14 44		
7JL70					IMU S/N 48 SHIPPED FROM AC/MKE TO NR.				
13JL70					IMU S/N 48 INSTALLED IN CM-112 (GEN 217)				
11AU70	NSC	G&N X 48 217			- 296	0.69			
11AU70	NSC	GAL X 48 217					0		
18NU70	NSC	GEN X 48 217			- 342	0.57			
9DE70					9M 48 SHIPPED TO MKE				
5MR71	A03	SPO X 48			- 393	0.56	0.70	0.08	103.2363
6MR71	A03	SAL X 48				(0.72)	11 45		
8MR71					8M 48 SHIPPED TO KSC				
19MR71					IMU 48, GEN 217, INSTALLED IN CM-112				
25MR71	K0H	G&N X 48 217			- 407	0.77			
13AP71	K0B	G&N X 48 217			- 373	0.81			
15MY71	K0A	GEN X 48 217			- 349	0.92			
10JE71	K0A	GEN X 48 217			- 404	0.85			
					RETEST DATA AFTER LAUNCH TOWER STRUCK BY LIGHTNING				
19JEN	K0A	GEN X 48 217			- 394	0.86			

9L

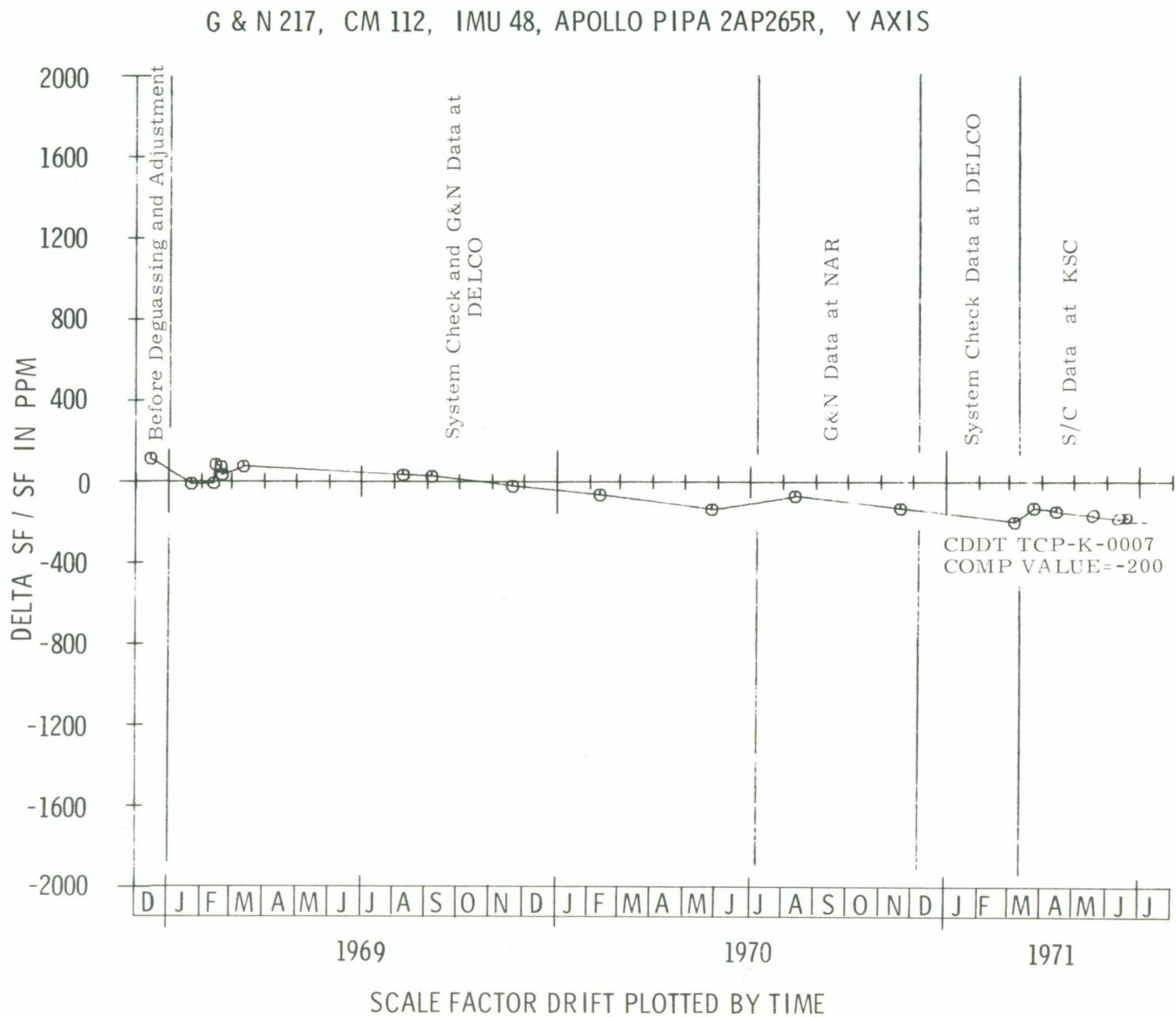


G & N 217, CM 112, IMU 48, APOLLO PIPA 2AP232, X AXIS

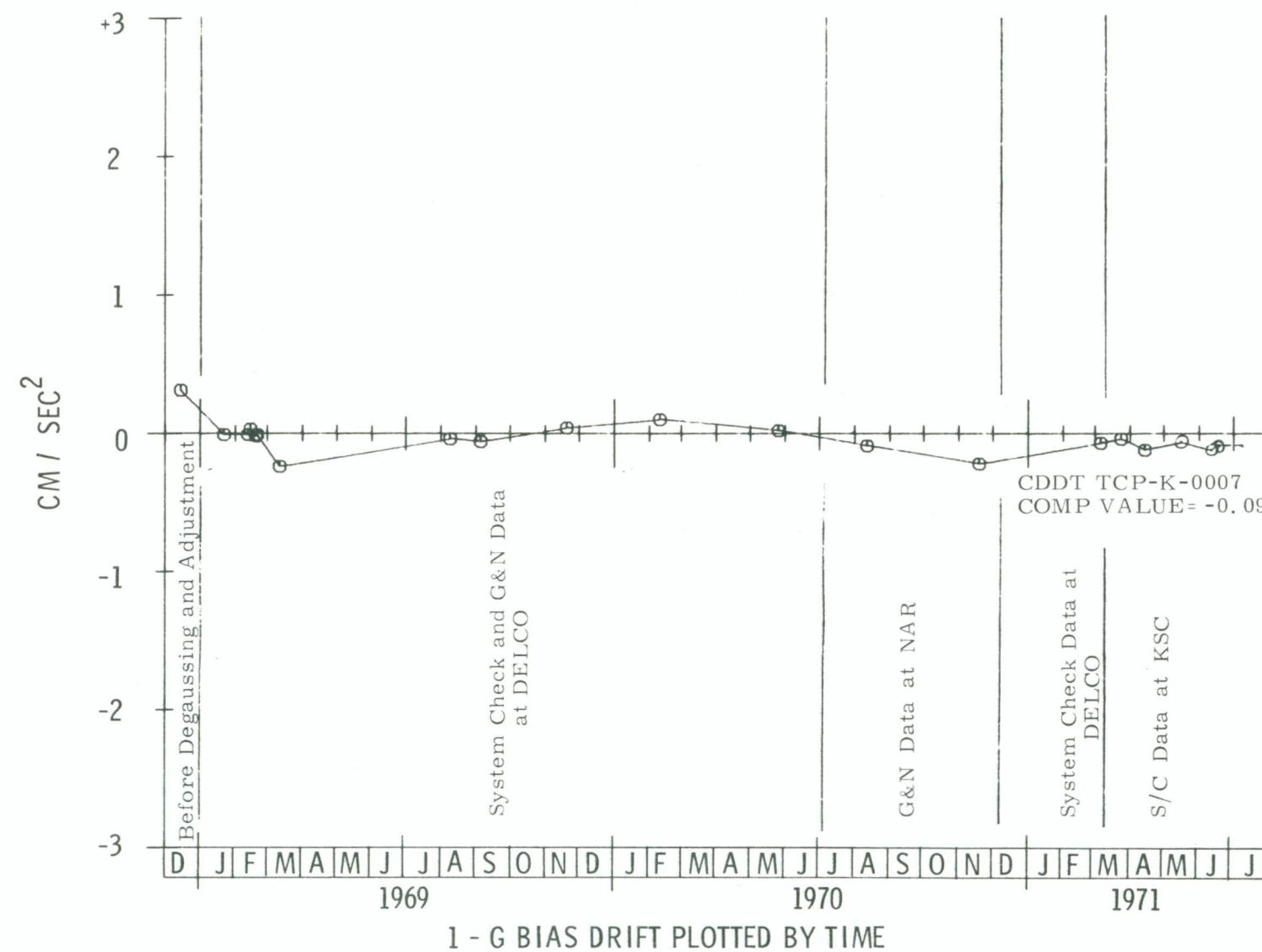


DATE	TST	IMU	GEN	DELTA	IG	MULL	ROT-AL-WOB	MAX. TORQ MGN	
	LOC	Typ	ASSN	SYS	SF	BIAS	BIAS	ANGLE	TRANS. CURRENT
	UNIT INTERNALLY REPAIRED, REBUILT TO P/N 2001730-2								
300C68	S42	ACC	-	122	0.00			0.05	104.3389
	REPAIRED UNIT DELIVERED TO AC/MKE								
14DE68	A44	FST		111	0.31		1	8	
16DE68	UNIT ASSIGNED TO IMU S/N 48 Y								
20JA69	A03	SPR	Y	48	(- 58) (0.32) (0.36)				104.3775
21JA69	A03	SPR	Y	48	- 12	-0.01	0.04		104.3709
21JA69	AFTER DEGAUSSING & ADJUSTMENT								
24JA69	RESELECTION OF R13 & K14 IN CALIBRATION MODULE								
7FE69	A03	SPD	Y	48		(-1.54)			
11FE69	A03	SPD	Y	48	- 10	-0.01	-0.04		104.3766
11FE69	PIP ADJUSTED								
12FE69	A03	SAL	Y	48		(-0.07)	- 34	- 10	
13FE69	A03	SPD	Y	48	83	0.03	-0.12		104.3720
17FE69	INTERMITTENT OPEN IN A GSE CABLE CAUSED PIP GAUSSING								
18FE69	A03	SPD	Y	48	(201) (-0.94) (-0.96)				104.3677
18FE69	A03	SPD	Y	48	(202) (-0.94) (-0.95)				104.3696
18FE69	A03	SPD	Y	48	71	-0.02	-0.07		103.6760
18FE69	AFTER DEGAUSSING								
19FE69	A03	SPD	Y	48	32	-0.01	-0.01		104.3685
11MR69	A01	GEN	Y	48	74	-0.24			104.3609
12MR69	A01	GEN	Y	48			- 56	- 34	
8AU69	A03	SPD	Y	48	32	-0.04	-0.03		104.3776
8JL69	EO 3596. NULL COINCIDENCE CHECK								
11AU69	A03	SAL	Y	48		(-0.12)	- 28	- 6	
4SE69	A03	SPD	Y	48	25	-0.06	-0.07		104.3760
5SE69	A03	SAL	Y	48			- 27	- 6	
16UC69	IMU S/N 48 SHIPPED TO KSC								
18NU69	IMU S/N 48 SHIPPED TO AC/MKE								
19NU69	A01	SPD	Y	48	- 23	0.04	-0.03		104.3810
19NU69	RAN EO 3596 - NULL COINCIDENCE CHECK								
24ND69	A01	SAL	Y	48		(0.04)	- 23	- 5	
9FE70	A03	SPD	Y	48	- 65	0.10	0.09		104.3891
9FE70	A03	SAL	Y	48		(0.04)	- 18		
10FE70	A03	SAL	Y	48			- 8		
16MR70	IMU S/N 48 SHIPPED TO KSC								
12MY70	IMU S/N 48 RETURNED TO AC/MKE								
25MY70	A03	SPD	Y	48	- 136	0.02	0.00	0.18	104.3826
26MY70	A03	SAL	Y	48		(-0.03)	- 14	- 12	
7JL70	IMU S/N 48 SHIPPED FROM AC/MKE TO NR.								
13JL70	IMU S/N 48 INSTALLED IN CM-112 (GEN 217)								
11AU70	NSC	GEN	Y	48	217	- 70	-0.00		
11AU70	NSC	GAL	Y	48	217			- 35	- 66
18AU70	NSC	GEN	Y	48	217	- 131	-0.22		
9DE70	IMU 48 SHIPPED TO MKE								
5MR71	A03	SPD	Y	48	- 198	-0.07	-0.39	0.06	104.3710
6MR71	A03	SAL	Y	48		(-0.76)	- 21	- 5	
8MR71	IMU-48 SHIPPED TO KSC								
19MR71	IMU 48, GEN 217, INSTALLED IN CM-112								
23MR71	K08	GEN	Y	48	217	- 127	-0.04		
13AP71	K08	GEN	Y	48	217	- 146	-0.12		
19MY71	K08	GEN	Y	48	217	- 175	-0.06		
10JE71	K08	GEN	Y	48	217	- 186	-0.12		
19JE71	RETEST DATA AFTER LAUNCH TOWER STRUCK BY LIGHTNING								
19JE71	K08	GEN	Y	48	217	- 182	-0.09		

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G & N 217, CM 112, IMU 48, APOLLO PIPA 2AP265R, Y AXIS



NASA ZAP-179

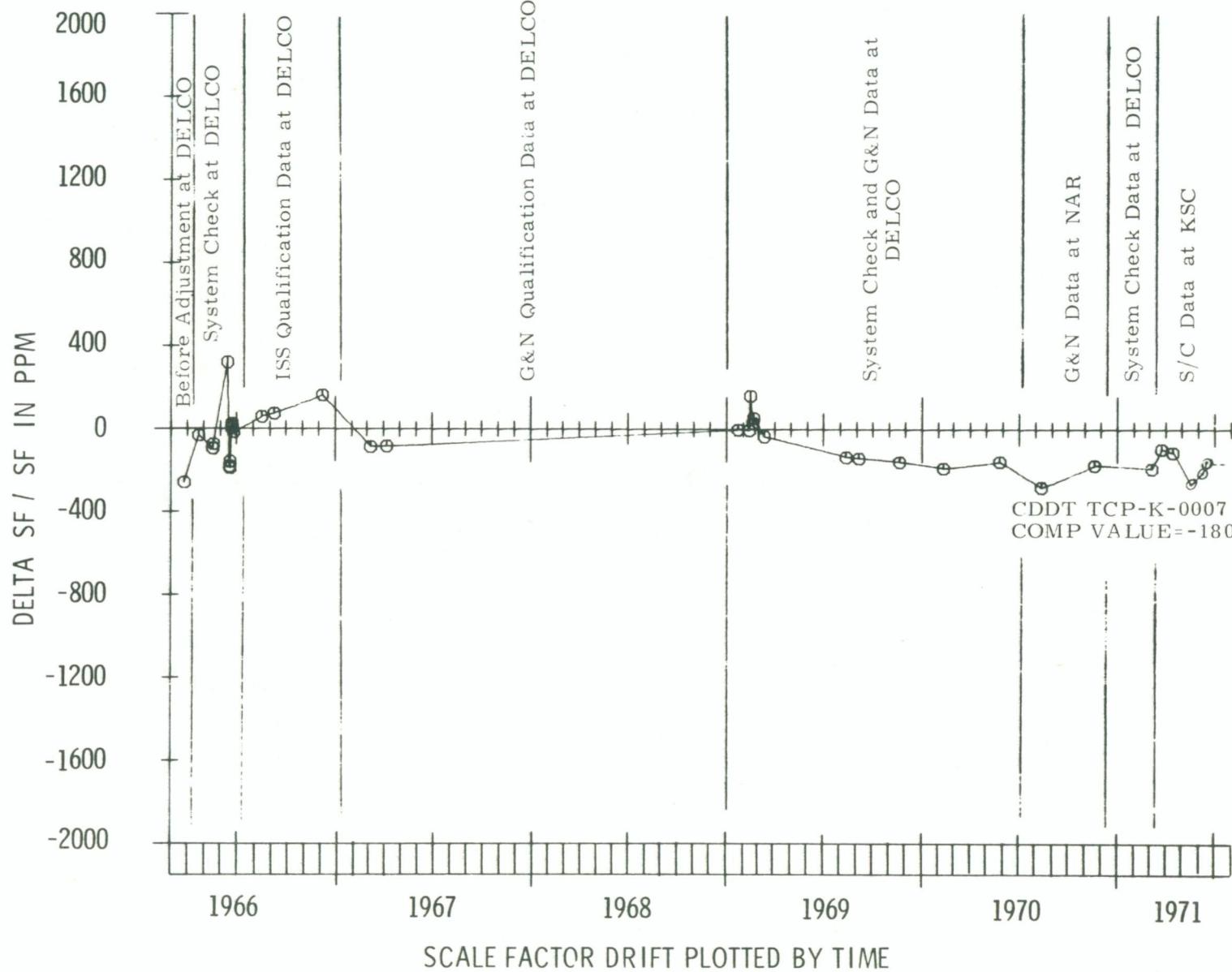
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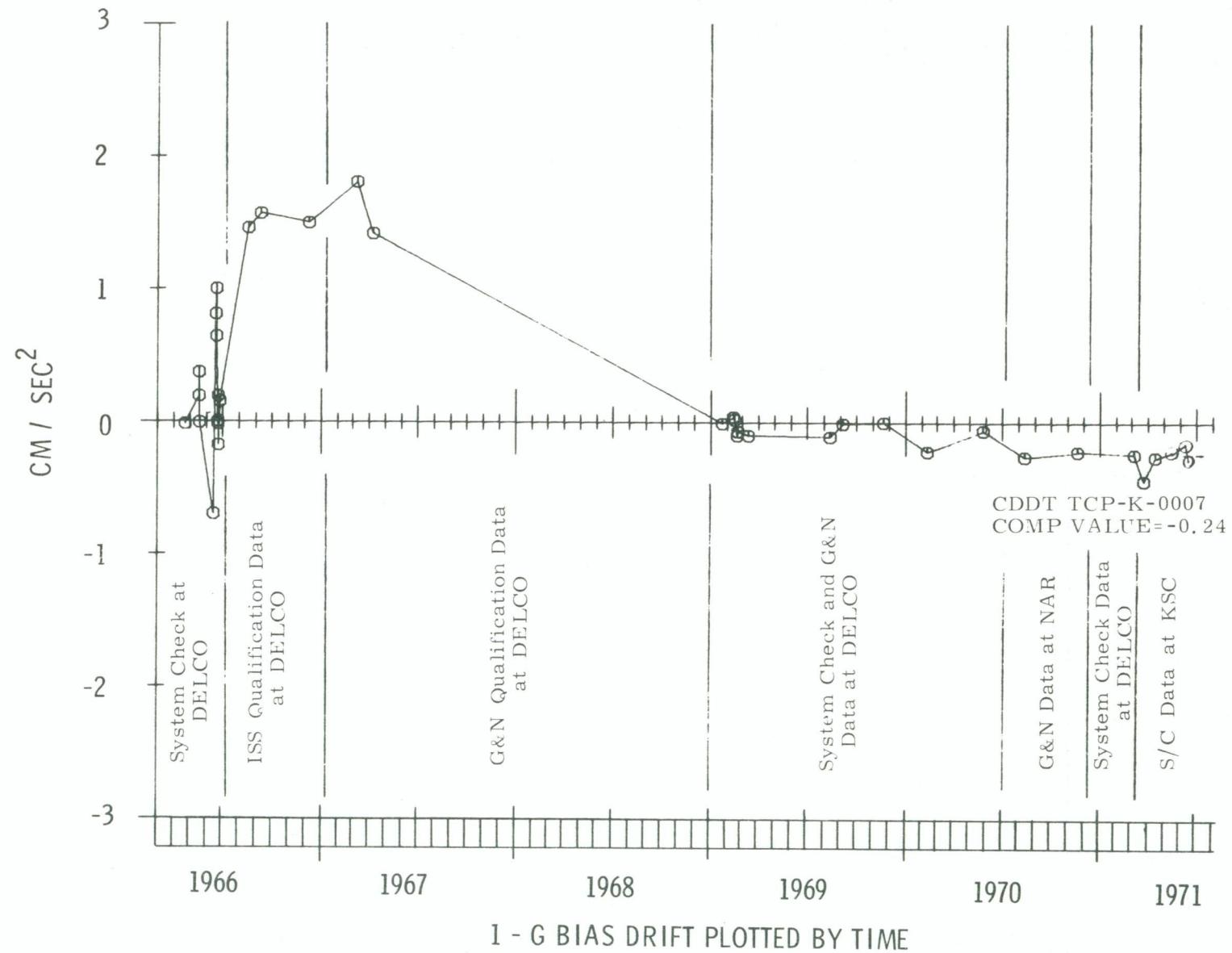
DATE	TST	IMU	GEN	DELTA	IG	NULL	ROT-AL-WOB	MAX.	TORQ MON
	LOC	Typ	ASSN	SYS	SF	BIAS	BIAS	ANGLE	TRANS. CURRENT
14JA66	S42	ACC		-	2	0.0			103.1018
MOu	C3	C4	K5	R6	R11	R12	R13	R14	
NO									
C11	.0180	.0180	116.25	83.75	58.57	18.1			249
22MR66	A48	I6A				2 - 8			
23MR66	A48	I6A				- 3 - 5			
25MR66	A48	I6A				1 - 12			
25MR66	A48	FST		- 261		-0.28	1 - 12		103.4389
18AP66	IMU S/N70Z IN GEN 203								
21AP66	A01	SPR Z	7	- 34	-0.02	-0.04			100.3390
21AP66	AFTER ADJUSTMENT								
17MY66	A04	SPD Z	7	- 95	0.19	0.17			103.3889
17MY66	A04	SPD Z	7	- 97	0.37	0.35			103.3925 LJ BUS
18MY66	A04	SPD Z	7	- 75	-0.01	0.01			103.3890 HI BUS
13JE66	A03	SAL Z	7		(-0.56)	- 5			
13JE66	A03	SPD Z	7	319	-0.70	-0.66			
17JE66	A03	SPD Z	7	- 183	0.81	0.84			103.3794
17JE66	AFTER DEGAUSSING								
18JE66	A03	SPD Z	7	- 192	1.00	1.00			103.3916 LU BUS
16JE66	A03	SPD Z	7	- 159	0.64	0.66			103.3939 HI BUS
21JE66	A03	SPD Z	7	0	0.00	-0.01			103.3913
21JE66	AFTER ADJUSTMENT. SCALE FACTOR & BIAS								
21JE66	A03	SPD Z	7	15	-0.02	-0.01			103.4046
22JE66	A03	SPD Z	7	2	0.19	0.20			103.4020 LU BUS
22JE66	A03	SPD Z	7	24	-0.18	-0.17			103.4057 HI BUS
25JE66	A04	SPD Z	7	- 17	0.15	0.15			103.4026
11JL66	LEM IMU 3 INSTALLED IN GEN 203 FOR SPECIAL TESTING								
11JL66	IMU 7 UNASSIGNED DURING THIS PERIOD								
11AU66	LEM IMU 3 RMVD FROM GEN 203, IMU 7 REINSTALLED								
16AU66	A21	SQL Z	7	57	1.66	1.41			
16AU66	PRE-ACCEL BASELINE DATA								
0SE66	A21	SQL Z	7	73	1.57	1.53			
0SE66	POST VIBRATION DATA								
7DE66	A22	SQL Z	7	162	1.50	1.47			
7DE66	POST CLIMATIC BASELINE								
7MR67	A21	GOL Z	7	- 87	1.81				103.3752
7MR67	PPE EMI BASELINE								
6AP67	A21	GOL Z	7	- 84	1.42				103.3754
3JA69	ZAP179 ASSN TO IMU S/N 48 Z								
20JA69	A03	SPR Z	48	(7)	(0.03)	(0.23)			103.3807
21JA69	A03	SPR Z	48	- 3	-0.01	0.02			103.3736
21JA69	AFTER DEGAUSSING AND ADJUSTMENT								
7FE69	A03	SPU Z	48		(1.10)				
24JA69	RESELECTION OF R13 AND R14 , IN CALIBRATION MODULE								
1UE69	A03	SAL Z	48		(0.63)	1			
11FE69	A03	SPD Z	48	- 6	0.04	0.00			103.3838
11FE69	PIP ADJUSTED								
13FE69	A03	SPU Z	48	160	0.02	0.01			103.3741
17FE69	INTERMITTENT OPEN IN A CSE CABLE CAUSED PIP GAUSSING								
18FE69	A03	SPD Z	48	(244)	(-0.81)	(-0.51)			103.3734
18FE69	A03	SPU Z	48	(246)	(-0.78)	(-0.50)			103.3735

TST DATE	IMU LOC	G&N TYP	DELTA ASSN	IG SYS	NULL BIAS	RUT-AL-WUB ANGLE	MAX. TRANS.	TURQ MUN CURRENT
18FE69	A03	SPO	Z 48		28	-0.10	-0.10	103.3724
18FE69			AFTER DEGAUSSING					
19FE69	A03	SPO	Z 48		53	-0.07	-0.08	103.3765
11MR69	A01	G&N	Z 48		- 36	-0.10		103.3616
12MR69	A01	G&N	Z 48				- 30 - 48	
11AU69	A03	SPO	Z 48		- 135	-0.11	-0.08	103.3822
11JL69			EO 3596. NULL COINCIDENCE CHECK					
11AU69	A03	SAL	Z 48			(-0.11)	- 4	
4SE69	A03	SPO	Z 48		- 141	-0.01	-0.01	103.3800
4SE69	A03	SAL	Z 48			(-0.01)	- 6	
16OC69		IMU S/N	48	SHIPPED TO KSC				
18NU69		IMU S/N	48	SHIPPED TO AC/MKE				
19NU69	A01	SPO	Z 48		- 158	0.00	-0.02	103.3842
19NO69			RAN EO 3596 - NULL COINCIDENCE CHECK					
24NO69	A01	SAL	Z 48			(0.01)	2	
9FE70	A03	SPO	Z 48		- 189	-0.22	-0.21	103.3928
9FE70	A03	SAL	Z 48			(-0.21)	5	
16MR70		IMU S/N	48	SHIPPED TO KSC				
12MY70		IMU S/N	48	RETURNED TO AC/MKE				
25MY70	A03	SPO	Z 48		- 157	-0.06	-0.06	0.04 103.3747
26MY70	A03	SAL	Z 48			(-0.07)	- 6	
7JL70		IMU S/N	48	SHIPPED FROM AC/MKE TO NR.				
13JL70		IMU S/N	48	INSTALLED IN CM-112 (G&N 217)				
11AU70	NSC	G&N	Z 48 217		- 281	-0.26		
11AU70	NSC	G&N	Z 48 217				- 62	
18NU70	NSC	G&N	Z 48 217		- 174	-0.22		
9DE70		IMU	48	SHIPPED TO MKE				
5MR71	A03	SPO	Z 48		- 190	-0.24	-0.23	0.04 103.3762
6MR71	A03	SAL	Z 48			(-0.22)	8	
8MK71		IMU-48		SHIPPED TO KSC				
19MR71		IMU	48, G&N 217,	INSTALLED IN CM-112				
23MR71	KOB	G&N	Z 48 217		- 96	-0.44		
13AP71	KOB	G&N	Z 48 217		- 112	-0.26		
19MY71	K9A	G&N	Z 48 217		- 235	-0.22		
10JE71	K9A	G&N	Z 48 217		- 202	-0.17		
RETEST DATA AFTER LAUNCH TOWER STRUCK BY LIGHTNING								
19JE71	K9A	G&N	Z 48 217		- 174	-0.28		

G & N 217, CM 112, IMU 48, APOLLO PIPA 2AP179, Z AXIS



G & N 217, CM 112, IMU 48, APOLLO PIPA 2AP179, Z AXIS



STANDARD DEVIATION (1σ) OF THE IRIG AND PIPA
PARAMETER UNCERTAINTIES USED FOR
MISSION PERFORMANCE SUMMARY
CM 112; IMU S/N 48

PARAMETER

	X	Y	Z
IMU Axis			
PIPAs			
Data Compilation Period (8/11/70 - 5/19/71)			
Accelerometer Bias (cm/sec ²)	0.11	0.06	0.08
Scale Factor (ppm)			
1) Sigma (ppm)	14	25	64 **
2) Slope (ppm/month)	-11	-10	
3) Linear Correlation	-0.931	-0.781	
IRIGs			
Data Compilation Period (8/11/70 - 5/19/71)			
Bias Drift (MERU)	1.5	2.4	1.1
ADSRA (MERU/g)	1.8	3.7	1.3
ADIA (MERU/g) (8/7/69 - 5/19/71)	2.2	4.1	2.4
ADOA (MERU/g)	0.5	0.4	0.5

Data is based upon performance in the IMU. Point-to-point stability in operation is much better than the above data.

Accelerometer data taken prior to degaussing or adjustment has been excluded. The sigma values for PIPA scale factor were obtained from a least squared fit of the KSC data.

PROPOSED GYRO AND ACCELEROMETER
PERFORMANCE COMPENSATIONS

PARAMETER

IMU Axis			
PIPAs			
Accelerometer Bias (cm/sec ²)	+0.86	-0.09	-0.24
Scale Factor ($\Delta SF/SF$ ppm)	-430	-200	-180
IRIGs			
Bias Drift	-2.3*	-2.8	-4.6
ADSRA (MERU/g)	-7	+15	-2
ADIA (MERU/g)	-12	-5	0

*NBDX compensation was selected as average NBD minus ADOA offset of 3.5.

**A positive slope and poor linear correlation coefficient indicate that a least square fit of the scale factor data is not the best estimator of scale factor uncertainty. Instead, the standard deviation of the data was obtained.

MISSION J1
AS-510/LM 10
G& N 614
IMU S/N 12

IRIGS
X = 8A201
Y = 8A203
Z = 8A202

PIPAS
X = 2AP172
Y = 2AP171
Z = 2AP292

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NASA	TEMP	MAX	THERM	SUS	SUS	XFR	Avg	SD	WH	THERM	PAD	XFR	BIAS	TRQE	RES	
ACC	SENS	SD	R	CAP	SG	CAP	FUNC	ROT	ROD	HRS	SG	TG	RES	R	+	-
5N069	0.6		683.5	.0510				135	5.0	470						
TST IMU GEN																
DATE	LJC	TYP	ASSN	SYS	NBD	ADSRA	ADIA	DELSF+	DELSF-	WHEEL REF H5402	ROD	HOURS	I+	I-	ID	ADCA
30SE69	A45	CSS								C 98						
30SE69	A45	CSS			(11.1)	(1.6)	(- 2.4)			C103						11.8
30SE69	SG	84.2,	70.9,	56.0	TG	58.2,	70.9,	87.9								
40C69	A41	CSS			(9.7)	(- 1.4)	(- 10.6)			138						10.1
80C69	A41	CSS			(8.5)	(0.2)	(- 8.9)			138						11.0
90C69	A41	CSS								138						
150C69	COMP SELECT															
150C69	A43	CSS						227	153	137						
160C69	COMP VERIF / IA ALIGN DOS - UNIT RE-ALIGNED															
160C69	A43	CSS						227	75							85.017 85.020
170C69	DEMO	T/F = 1191.5														
170C69	A43	CSS						231	116	141						85.016 85.018
170C69	VIB															
170C69	A43	CA1			0.1	-	2.3	-	10.9							
170C69	A43	CA2			0.1	-	2.7	-	11.1	51	-	96				85.010 85.010 10.6
170C69	A43	CA3			0.2	-	2.8	-	10.3				124			
200C69	A43	CB1			0.3	-	3.0	-	8.8							
200C69	A43	CB2			1.0	-	2.6	-	10.8	-	80	-	89			85.011 85.012 13.2
200C69	A43	CB3			1.0	-	2.6	-	9.3				138			
220C69	A43	CC1			0.8	-	3.1	-	9.6							
220C69	A43	CC2			0.9	-	3.1	-	10.6	-	270	-	441			84.999 84.998 13.3
220C69	A43	CC3			0.9	-	3.1	-	9.3				131	467		
5N069	ACC	E M/O TO 0014														
50E69	UNIT ASSIGNED TO IMU 12X REPLACING 4C-10.															
17DE69	A07	SPO X 12			-	0.5		-	4.5							
17DE69	A07	SPO X 12			0.4	-	2.8			C101						1.0
17DE69	NU FLUID TRANSIENTS IN GRAVITY TRANSIENT TEST.															
18DE69	A07	SPO X 12						-	274	24						85.017
19DE69	A07	SPO X 12			-	0.8		-	3.5							
19DE69	A07	SPO X 12			0.5	-	3.1						552			0.7
20MR70	A05	SPO X 12			-	2.6		-	4.8				C106			0.9
20MR70	A05	SPO X 12			-	1.5	-	1.6					C106			
23MR70	A05	SPO X 12								250	317	602	85.014			
24JE70	A07	SPO X 12			-	2.1		-	0.1							
24JE70	A07	SPO X 12			-	0.7	1.5									0.9
25JE70	A07	SPO X 12						107	417							85.020
1JL70 NO FLUID TRANSIENTS DETECTED DURING GRAVITY TRANSIENT TEST.																
6JL70	A07	SPO X 12								697						
8SE70	A07	GEN X 12 616						46	280							
9SE70	A07	GEN X 12 616			0.7	-	7.3		8.2							
11SE70	A07	GEN X 12 616			0.9	-	6.4		10.1							
24N070	A07	GEN X 12 616						166	336							
25N070	A07	GEN X 12 616			1.2	-	5.4		9.4							
9FE71	A05	SPO X 12			0.4				2.2							
9FE71	A05	SPO X 12			1.7	-	9.0						C105			
10FE71	A05	SPO X 12						394	718				85.016			0.8
11MR71 IMU S/N 12 SHIPPED FROM DELCO/MKE TO KSC.																

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LAST UPDATE

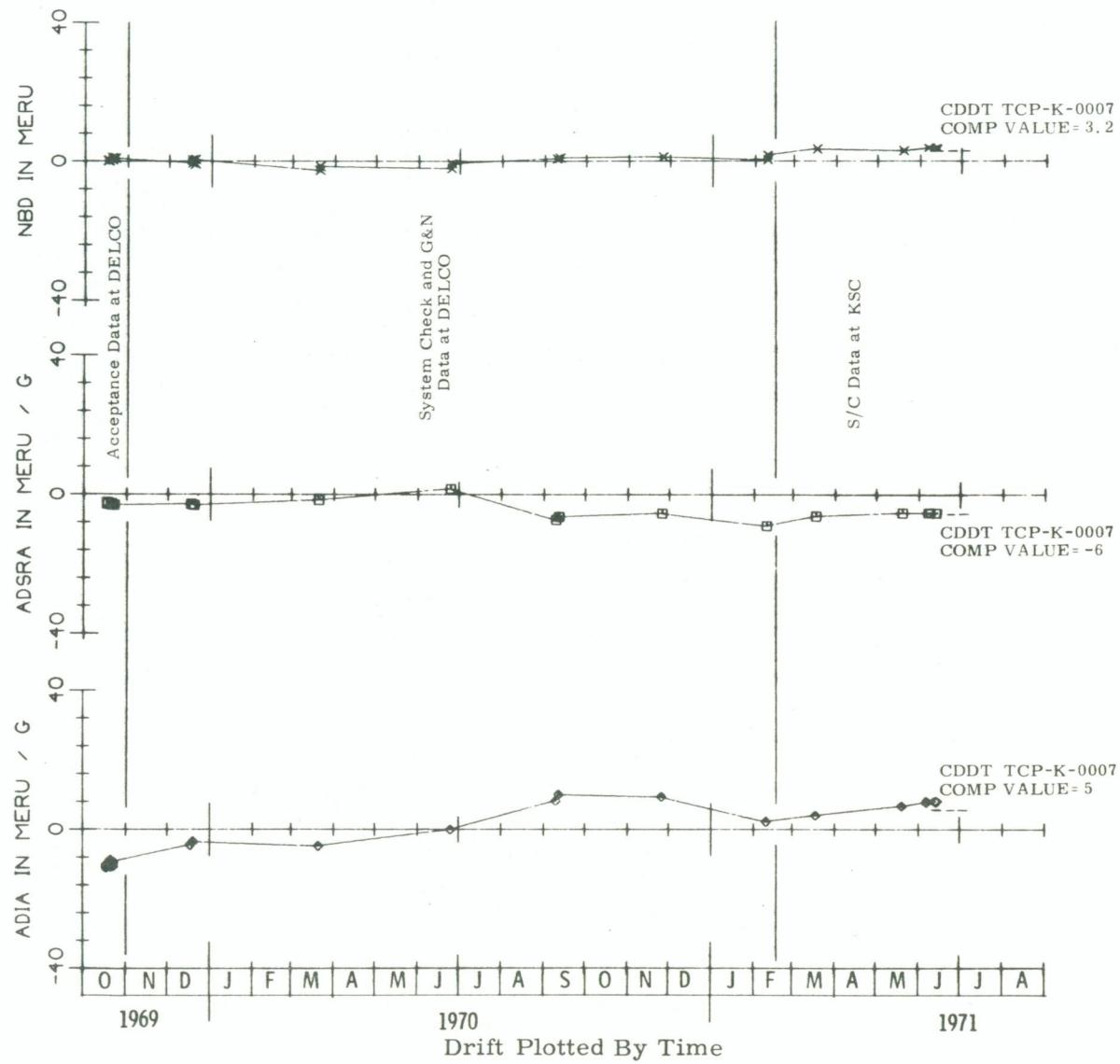
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TST IMU GEN					WHEEL										
DATE	LJC	TYP	ASSN	SYS	NBD	ADSRA	ADIA	DELSF+	DELSF-	RDT	HOURS	I+	I-	ID	ADOA
12MR71	IMU	12	GEN	614	INSTALLED IN LM 10.										
17MR71	KJB	GEN X	12	614	3.5	-	6.2	4.0	215	642					1.4
19MY71	K9A	GEN X	12	614	3.0	-	5.3	6.7							1.6
11JE71	K9A	GEN X	12	614	3.4	-	5.2	7.6							1.5
RETEST DATA AFTER LAUNCH					TOWER STRUCK BY LIGHTNING										
17JE71	K9A	GEN X	12	614	3.4	-	5.1	7.7							1.5

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1023-14=37

G & N 614, LM 10, IMU 12, APOLLO IRIG 8A201, X AXIS



DATE	LJC	TST	IMU	G&N	NBD	ADSRA	ADIA	DELSF+	DELSF-	WHEEL	RDT	HOURS	I+	I-	ID	ADDA	
ACC	SENS	TEMP	MAX	THERM	SUS R	SUS CAP SG	SUS CAP TG	XFR FUNC	Avg RDT	SD RDT	WH HRS	THERM SG	PAD TG	XFR RES	BIAS R	TRQE +	RES -
4DE69		0.9		683.4	.0505				163	5.3	412						
140C69		A45	CSS									C119					
140C69		A45	CSS		(- 14.1)	(0.4)	(7.0)					C121			- 8.7		
140C69		SG	84.7,	68.8,	54.7	TG 53.4,	67.9,	83.5									
170C69		A45	CSS		(- 14.1)	(- 1.0)	(4.3)				166				- 7.9		
200C69		A44	CSS		(- 11.2)	(- 0.1)	(1.4)				164				- 6.6		
210C69		A44	CSS								166						
240C69		COMP	SELECT														
240C69		A45	CSS						-	249	-	144	165		84.999	84.998	
280C69		COMP	VERIF							-	308	-	263		85.000	84.998	
280C69		A45	CSS														
280C69		DEMO	T/F = 1192														
280C69		A45	CSS							-	273	-	161	150	84.999	84.998	
310C69		VIB	IA ALIGN = +1.4														
3N069		A45	CA1		- 2.0	4.1	4.6										
3N069		A45	CA2		- 2.4	3.5	4.6		-	366	-	147			84.998	84.997	- 8.3
3N069		A45	CA3		- 2.4	3.4	4.9					164					
5N069		A45	CB1		- 2.6	3.1	5.3										
5N069		A45	CB2		- 2.1	3.5	4.0		-	308	-	120			84.999	84.998	- 6.6
5N069		A45	CB3		- 2.0	3.4	5.2					169					
6N069		A45	CC1		- 2.7	3.6	1.7										
6N069		A45	CC2		- 1.4	3.5	2.2		-	280	-	59			84.999	84.998	- 7.7
6N069		A45	CC3		- 1.9	2.9	2.9					160	412				
4DE69		ACC & M/O	TO 0814														
5DE69		UNIT	ASSIGNED TO IMU 12Y	REPLACING 4C-5.													
17DE69		A07	SPO Y 12		- 0.6		- 0.4										
17DE69		A07	SPO Y 12		- 1.4	2.1						C117			0.7		
17DE69		ND	FLUID TRANSIENTS	IN GRAVITY TRANSIENT TEST.													
18DE69		A07	SPO Y 12						-	3	350			85.014			
22DE69		A07	SPO Y 12		2.5		- 1.0						498			0.9	
22MR70		A05	SPO Y 12		0.6	1.4								C123			
20MR70		A05	SPO Y 12										C126				
23MR70		A05	SPO Y 12		5.1		- 4.8										
23MK70		A05	SPO Y 12		3.2	0.6			240	474		548	85.015			1.2	
24JE70		A07	SPO Y 12		- 0.5		- 1.8										
24JE70		A07	SPO Y 12		- 0.3		- 0.9									0.7	
24JE70		A07	SPO Y 12		- 1.0	3.2											
25JE70		A07	SPO Y 12		- 0.5		- 0.9		94	461			85.016				
1JL70		ND	FLUID TRANSIENTS	DETECTED DURING GRAVITY TRANSIENT TEST.													
6JL70		A07	SPO Y 12									643					
8SE70		A07	GEN Y 12	616					-	10	209						
9SE70		A07	GEN Y 12	616	1.0	3.9											
11SE70		A07	GEN Y 12	616	- 1.3	5.9	- 2.4										
24NU70		A07	GEN Y 12	616					54	369							
25NU70		A07	GEN Y 12	616	- 3.5	4.7	- 5.9										
9FE71		A05	SPO Y 12		- 0.6		- 1.5										
9FE71		A05	SPO Y 12		- 1.0	3.4						C125			1.0		

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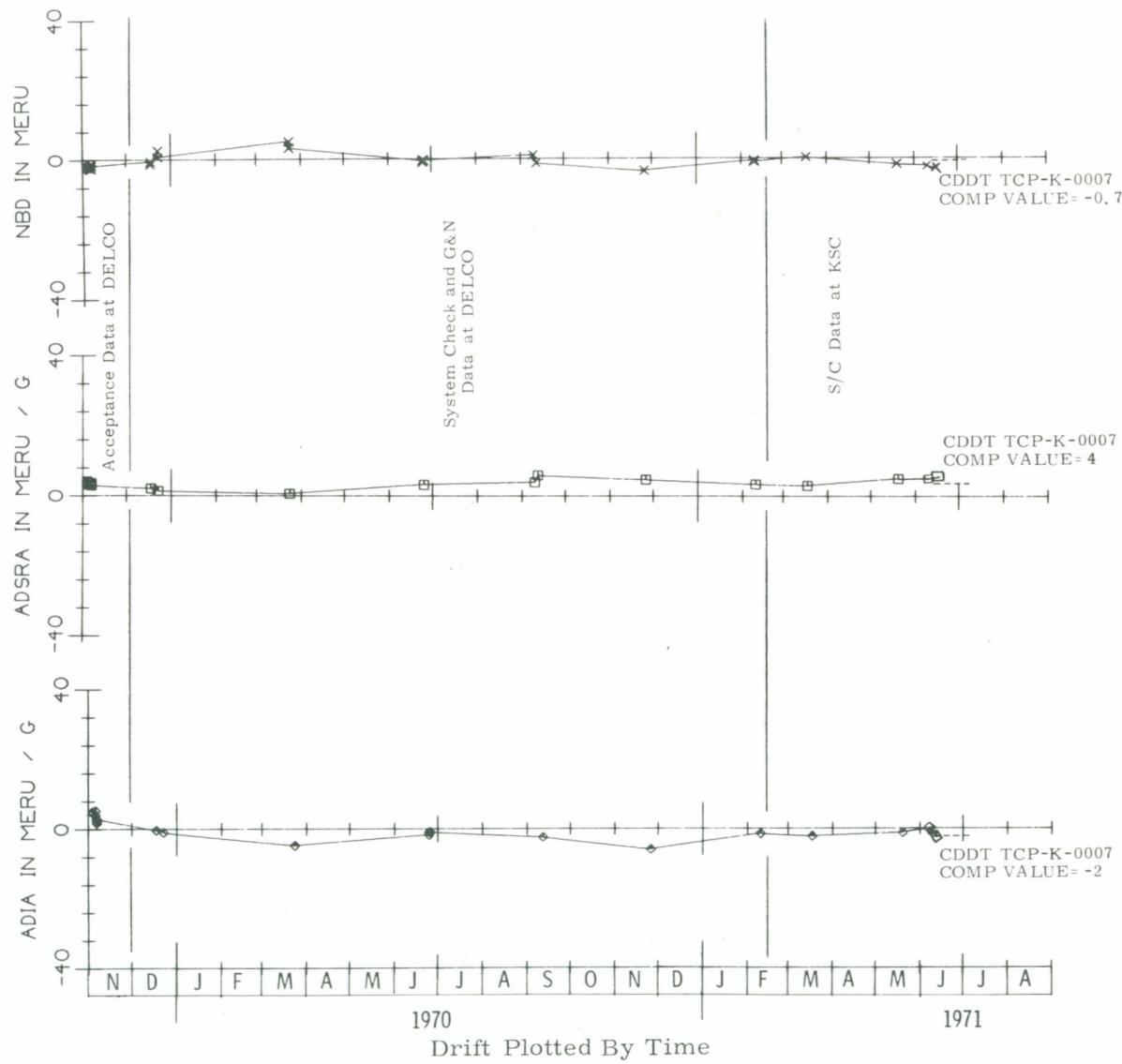
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DATE	TST	IMU	GEN	LOC	TYP	ASSN	SYS	NBD	ADSRA	ADIA	WHEEL		RDT HOURS	I+	I-	ID	ADOA
											DELSF+	DELSF-					
11FE71	A05	SPO	Y 12								340	561		85.016			
11MR71	IMU	S/N 12	SHIPPED FROM DELCO/MKE TO KSC.														
12MR71	IMU	12	GEN 614	INSTALLED IN LM 10.													
17MR71	K08	GEN	Y 12 614	0.3	3.0	-	2.2		320	595					1.0		
17MR71	ADIAY	POSITION	8								-	5.0					
19MY71	K9A	GEN	Y 12 614	-	1.7	5.0	-	1.2							0.9		
19MY71	ADIAY	POSITION	8									0.4					
11JE71	K9A	GEN	Y 12 614	-	2.6	4.7	-	1.0							1.0		
11JE71	ADIAY	POSITION	8								-	0.1					
													RETEST DATA AFTER LAUNCH TOWER STRUCK BY LIGHTNING				
17JE71	K9A	GEN	Y 12 614	-	3.1	5.1	-	2.2								0.9	
17JE71	ADIAY	POSITION	8								0.0						

01

G & N 614, LM 10, IMU 12, APOLLO IRIG 8A203, Y AXIS



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LAST UPDATE

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NASA	TEMP	MAX	THERM	SUS	SUS	XFR	Avg	SD	WH	THERM	PAD	XFR	Bias	TRQE	RES		
ACC	SENS	SD	R	CAP	SG	CAP	TG	FUNC	RDY	RDY	HRS	SG	TG	RES	R	+	-
3NU69	1.3		692.7	.0475					176	3.2	447						

TST	IMU	G&N	WHEEL													
DATE	LJC	TYP	ASSN	SYS	NBD	ADSRA	ADIA	DELSF+	DELSF-	RDY	HOURS	I+	I-	ID	ADDA	
80C69	A45	CSS										C118				
80C69	A45	CSS	(	8.8)	(	1.2)	(-	1.8)				C126				1.8
80C69	SG	79.8,	67.4,	53.5	TG	55.2,	66.8,	82.9								
130C69	A45	CSS	(	10.0)	(	0.0)	(-	0.2)				178				1.9
150C69	A45	CSS										178				3.3
170C69	A43	CSS	(	10.9)	(-	1.0)	(-	2.3)				178				
210C69	COMP	SELECT														
210C69	A43	CSS							-	287	-	117	174		85.009	85.009
220C69	COMP	VERIF								-	328	-	199		85.012	85.012
220C69	A43	CSS														
230C69	DEMO	T/F = 12/5														
230C69	A43	CSS							-	314		175		85.005	85.006	
230C69	VIB	IA ALIGN = -0.6														
240C69	A43	CA1			1.2	0.0	3.9									
240C69	A43	CA2			0.8	- 0.3	3.2	-	604	458				85.010	85.010	4.9
240C69	A43	CA3			0.8	- 0.4	7.8					171				
270C69	A43	CB1			- 1.0	- 1.0	4.7									
270C69	A43	CB2			- 1.0	- 0.6	5.3	-	539	- 263				85.011	85.011	3.0
270C69	A43	CB3			- 0.9	- 0.6	5.3					182				
290C69	A43	CC1			- 1.0	- 1.0	6.8									
290C69	A43	CC2			- 0.5	- 0.6	5.3	-	473	- 154				85.012	85.012	1.7
290C69		CC3			- 1.3	- 0.6	7.0					173	447			
3NU69	ACC & M/O TO 0814															
5DE69	UNIT ASSIGNED TO IMU 12Z REPLACING SC-13.															
17DE69	A07	SPO Z 12			0.4		5.5					C125				
17DE69	ND	FLUID TRANSIENTS IN GRAVITY TRANSIENT TEST.														
18DE69	A07	SPO Z 12			- 0.1	- 1.8		-	574	- 494				85.016		0.3
22DE69	A07	SPO Z 12			1.0		2.9									
22DE69	A07	SPO Z 12			- 0.3	- 1.4						532				0.5
20MR70	A05	SPO Z 12										C127				
20MR70	A05	SPO Z 12										C129				
23MR70	A05	SPO Z 12			2.2		1.7									
23MR70	A05	SPO Z 12			0.7	- 0.5		-	207	- 260			582	85.014		0.2
24JE70	A07	SPO Z 12			0.8		3.9									
25JE70	A07	SPO Z 12			0.5	- 3.8		-	184	- 250				85.018		0.2
1JL70	ND	FLUID TRANSIENTS DETECTED DURING GRAVITY TRANSIENT TEST.														
6JL70	A07	SPO Z 12										677				
8SE70	A07	GEN Z 12 616						-	401	- 381						
9SE70	A07	GEN Z 12 616			1.2	- 2.6	8.0									
11SE70	A07	GEN Z 12 616			0.6	- 2.0	8.3									
24NO70	A07	GEN Z 12 616										- 221	- 185			
25NO70	A07	GEN Z 12 616			2.1	0.7	5.3									
10FE71	A05	SPO Z 12			- 0.9		3.7									
10FE71	A05	SPO Z 12			- 1.2	- 5.6		-	93	40		C129			0.7	
11FE71	A05	SPO Z 12												85.017		
11MR71	IMU S/N 12	SHIPPED FROM DELCO/MKE TO KSC.														
12MR71	IMU 12	GEN 614 INSTALLED IN LM 10.														

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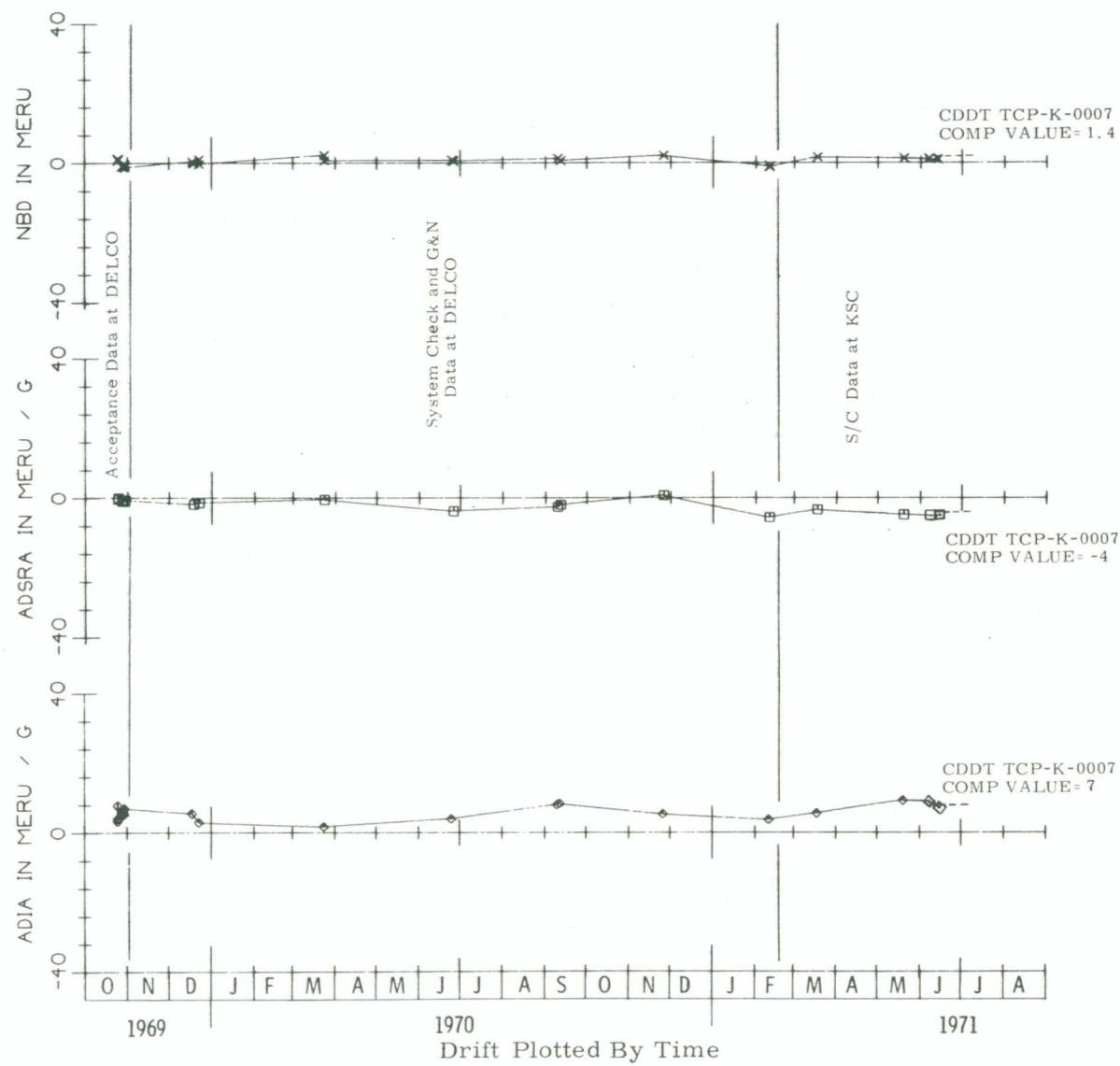
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LAST UPDATE

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DATE	TST	IMU	GEN	NBD	ADSRA	ADIA	DELSF+	DELSF-	WHEEL RDT HOURS	I+	I-	ID	ADDA
17MR71	KOB	GEN	Z 12 614	1.6	- 3.4	5.5	-	80 - 19					0.7
19MY71	K9A	GEN	Z 12 614	1.3	- 4.8	9.2							0.5
11JE71	K9A	GEN	Z 12 614	0.8	- 4.9	9.0							0.5
RETEST DATA AFTER LAUNCH TOWER STRUCK BY LIGHTNING													
17JUN71 K9A GEN Z 12 614 0.7 - 4.7 8.0													
0.5													

G & N 614, LM 10, IMU 12, APOLLO IRIG 8A202, Z AXIS



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SPERRY 103077-2

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DATE	TST	IMU	GEN	DELTA	IG	NULL	RUT-AL-WOB	MAX.	TORQ MON	
	LOC	TYP	ASSN	SYS	SF	BIAS	BIAS	ANGLE	TRANS.	CURRENT
30DE65	S48	ACL		-	39		0.0			41.2753
MOD	C3	C4		R5	R6	R11		R12	R13	R14
NO										
C14	.00348	.00348		96.25	103.75	140.725		29.209		
14AP66	A48	I&A						8	4	
15AP66	A48	I&A					-	3	2	
16AP66	A48	I&A					1	5		
17AP66	A48	FST	Z	6	- 132		0.00			43.2577
17AP66		R10	= 14.0	TURN	FROM CW	LIMIT				
25AP66		ASSN	IMU	S/N11,X	IN GEN	605				
12MY66		RMV	E ASSN	IMU	S/N12,X	IN LEM SPARE 1,	RPL BY	ZAP-196		
19MY66	A17	SPR	X	12	10	0.02	0.06			43.2287
19MY66	A17	SPR	LSIX	AFTER ADJUSTMENT						
28JE66	A17	SPO	X	12	30	0.44	0.47			43.2362
29JE66	A17	SPO	X	12	83	0.47	0.47			43.2353
29JE66	A17	SPO	X	12	124	0.44	0.46			HI BUS
29JE66	A17	SPO	X	12	170	0.44	0.42			HI BUS
6JL66	A17	SAL	X	12			0.33	- 5	18	
6SE66		IMU	12	ASSN	TO GEN	603	TC RPL	IMU	6	
8SE66	G20	GEN	X	12	603	- 212	.40			
22SE66	G20	GEN	X	12	603	- 196	0.46			43.2000
23SE66	G20	GEN	X	12	603	- 210	0.42			43.2377
24SE66	G20	GEN	X	12	603	- 211	0.50			43.2324
29SE66	G20	GEN	X	12	603	- 160	0.41			43.2336
29SE66	G20	GEN	X	12	603	- 233	0.50			
29SE66	G20	GEN	X	12	603	- 129	0.45			43.2341
29SE66	G20	GEN	X	12		- 114	0.47			43.2348
29SE66	G20	GEN	X	12		- 225	0.45			LO BUS
29SE66	G20	GEN	X	12		- 90	0.48			43.2346
29SE66	G20	GEN	X	12		- 303	0.41			LO BUS
29SE66	G20	GEN	X	12		- 81	0.46			43.2342
29SE66	G20	GEN	X	12		- 278	0.41			HI BUS
29SE66	G20	GEN	X	12		- 138	0.46			43.2340
10UC66	G20	GEN	X	12	603	- 363	0.49			43.2324
22UC66	G20	GEN	X	12	603	- 46	0.48			43.2320
24DC66	G20	GEN	X	12	603	- 200	0.57			
28DC66	G20	GEN	X	12	603	- 181	0.51			43.2334
19NJ66	G20	GEN	X	12	603	- 167	.52			43.2332
12JA67		IMU	12	ENTERED	LEM SPARE	1				
6FE67	A08	SAL	X	12		(0.41)	- 1			
6FE67	A08	SAL	X	12		(0.42)	0	18		
6FE67	A08	SAL	X	12		(0.36)				
7FE67	A08	SCK	X	12	- 200	.44	.44			43.2318
9FE67	A08	SAL	X	12		(0.30)	- 1			
9FE67	A08	SAL	X	12		(0.37)	- 4			
22FE67	A17	SAL	X	12		(0.40)	6	20		
9MR67	A08	SAL	X	12		(0.37)	- 5			
13MP67	A06	SCK	X	12	- 307	.3	.27			
31MR67	G20	SCK	X	12	- 198	.32	.39			
5AP67	G20	GEN	X	12	605	- 135	.36			
13AP67	G20	SAL	X	12		(0.33)	3	24		

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SPERRY 108077-2

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DATE	TST	IMU	G&N	DELTA	IG	NULL	RUT-AL-WOB	MAX.	TORQ MON
	LOC	Typ	ASSN	SYS	SF	BIAS	BIAS	ANGLE	CURRENT

29MY67 A08 SCK X 12 - 268 .54 .54 DGS
 1JE67 A08 SCK X 12 - 34 (-4.20) (-4.30) DGS
 01JE67 A08 SCK X 12 0 (-4.25) (-4.25)
 01JE67 A08 SCK LSIX BEFORE ADJUSTMENT
 1JE67 A08 SCK X 12 0 (1.56)
 01JE67 A08 SCK LSIX AFTER ADJUSTMENT
 08JE67 A08 SCK X 12 - 100 (-0.86) (-0.88)
 08JE67 A08 SCK LSIX BEFORE ADJUSTMENT
 8JE67 A08 SCK X 12 0 -.00 -.03
 08JE67 A08 SCK LSIX AFTER ADJUSTMENT
 13AU67 A08 SPU X 12 - 373 .03 -.02
 28AU67 A07 G&N X 12 605 - 311 -0.05
 5SE67 G16 G&N X 12 605 - 322 -0.02
 17OC67 GSC G&N X 12 605 - 476 -0.25
 25AP68 A08 SPR X 12 - 560 -0.02 0.02 43.2342
 7MY68 A08 SPO X 12 - 580 0.16 0.04 43.2331
 7MY68 A08 SAL X 12 (-0.16) 24 34
 22MY68 UNIT SHIPPED TO GAEC
 22MY68 IMU S/N 12 INSTALLED IN GEN 607
 29MY68 G20 G&N X 12 607 - 649 0.22
 IMU S/N 12 RETURNED TO AC MKE
 11JA69 A17 SPR X 12 (-2846) (0.38) (0.39) 43.2324
 13JA69 A17 SCK X 12 (-2938) (0.32) (0.32) 43.2351
 13JA69 THE ABOVE 2 RUNS MADE WITH PIP IN GAUSSIAN STATE DUE TO
 OPERATION IN C/M LOOP. REF. AFR 22015
 13JA69 A17 SCK X 12 - 18 -0.29 -0.35 43.2328
 14JA69 A17 SCK X 12 - 116 -0.25 -0.20 43.2326
 23JA69 A17 SPO X 12 - 305 -0.01 -0.05 43.2326
 3FE69 A08 SAL X 12 (-0.01) 0 28
 17FE69 IMU S/N 12 SHIPPED TO KSC
 19FE69 K11 SCK X 12 - 402 -0.18 -0.20 43.2348
 10AP69 K11 SCK X 12 - 526 -0.10 -0.11 43.2334
 30JE69 K11 SCK X 12 - 550 0.13 0.08 43.2324
 25AU69 K11 SCK X 12 - 588 -0.10 -0.13 43.2312
 IMU S/N 12 RETURNED TO AC/MKE
 16OC69 A05 SPU X 12 - 634 -0.15 -0.17 43.2316
 16OC69 RAN EO 3596- NULL COINCIDENCE CHECK
 17OC69 A05 SAL X 12 (-1.54) - 6 37
 21OC69 BIAS ADJUSTED TO +1.5 PLUS OR MINUS 0.1
 21OC69 A05 SPU X 12 - 513 1.60 1.60 43.2336
 18OE69 A07 SPO X 12 - 637 1.66 1.68 43.2323
 19OE69 A07 SAL X 12 (-1.58) 7 38
 24MR70 A05 SPO X 12 - 854 1.83 1.90 43.2315
 24MR70 A05 SAL X 12 (-1.80) 13 36
 25JE70 A07 SPO X 12 - 841 1.69 1.70 0.05 43.2320
 29JE70 A07 SAL X 12 (-1.49) 20 38
 9SE70 A07 G&N X 12 616 - 761 1.59
 11SE70 A07 G&N X 12 615 - 765 1.60
 25NO70 A07 G&N X 12 616 - 825 1.65
 11FE71 A05 SAL X 12 (-1.70) - 11 38
 12FE71 A05 SPO X 12 - 798 1.58 1.72 0.06 43.2320
 10MR71 IMU-12 SHIPPED TO KSC FOR LM-10 INSTALLATION
 17MR71 KUB G&N X 12 614 - 938 1.65

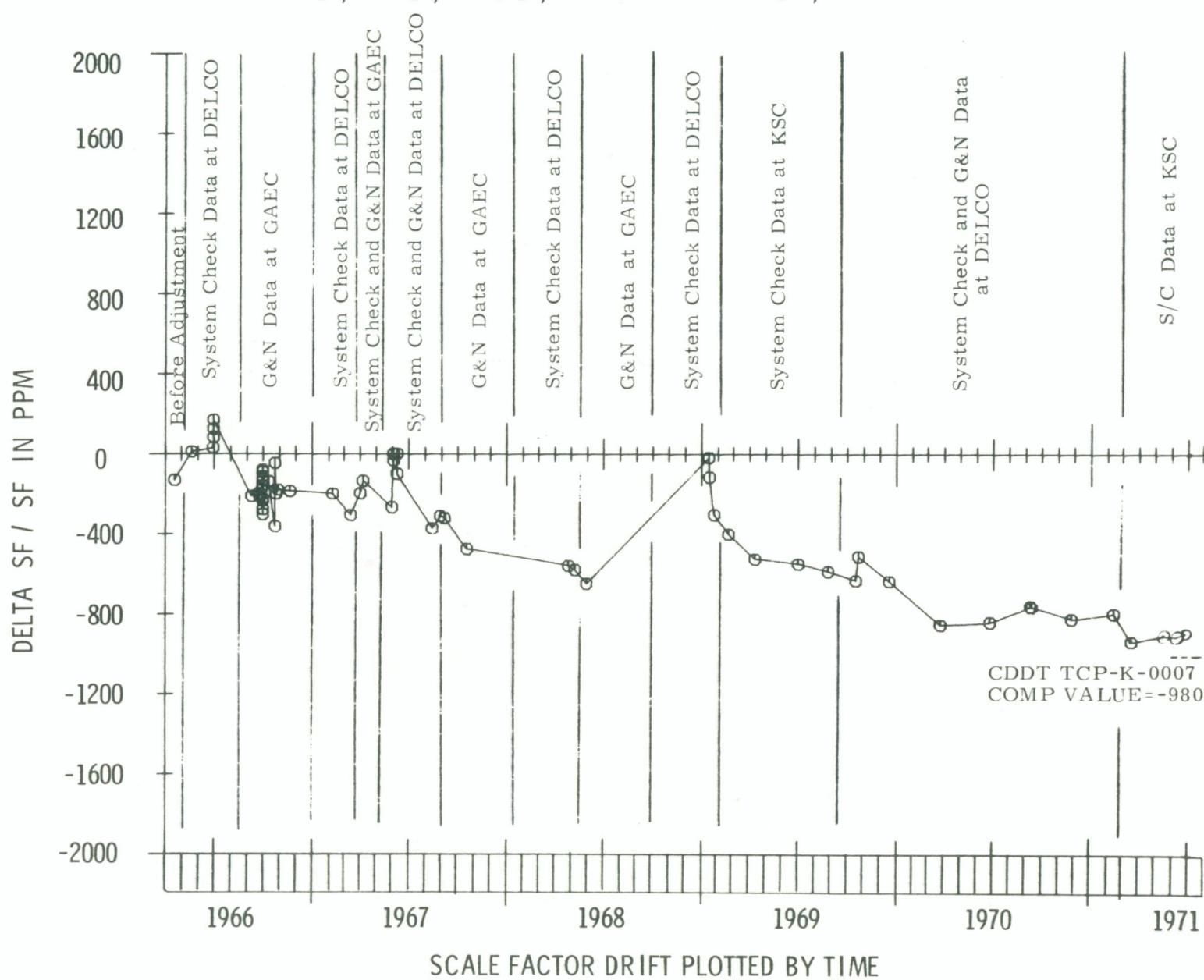
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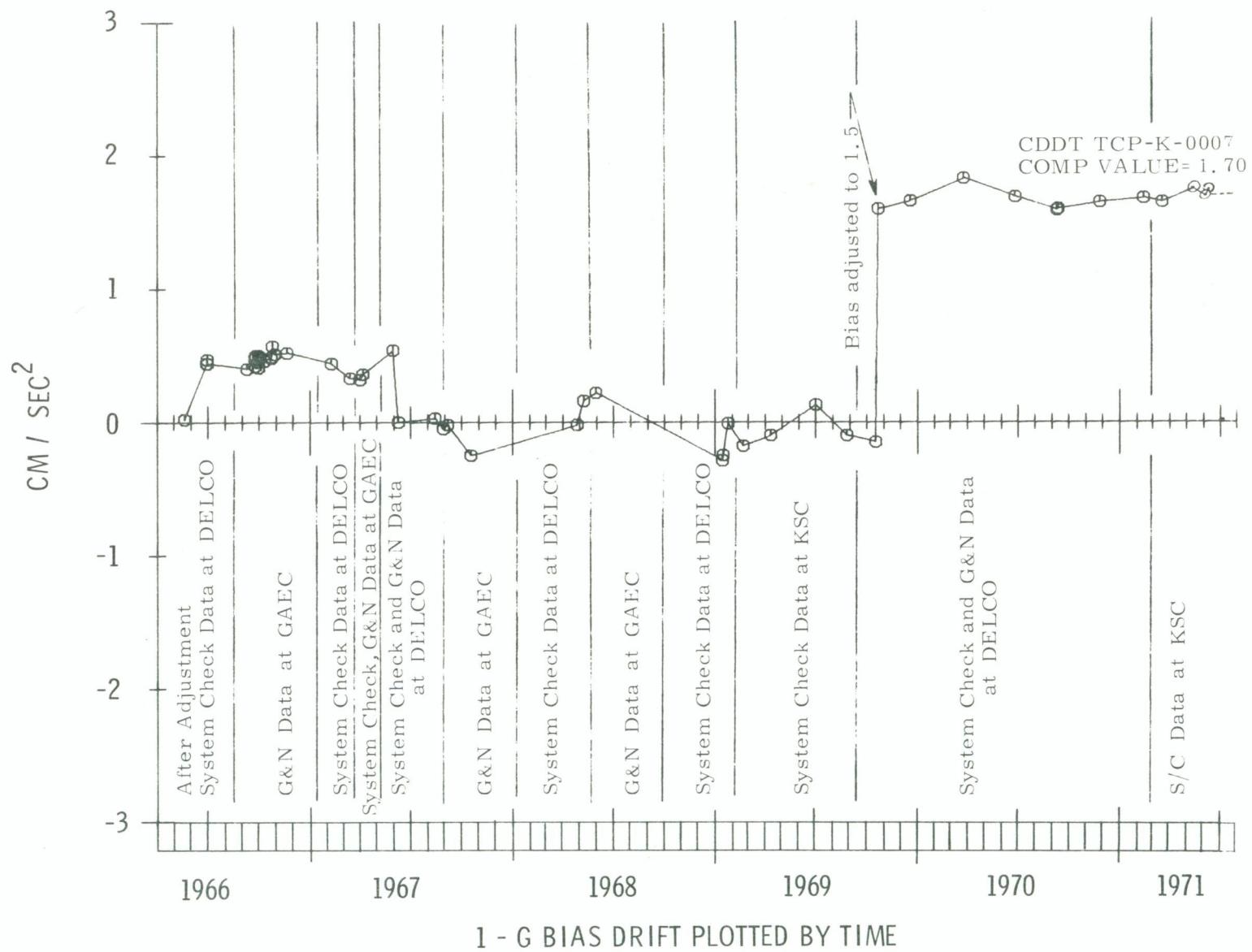
DATE	TST	IMU	GEN	DELTA	IG	NULL	FUT-AL-WOB	MAX.	TORQ MON
		LOC	TYP	ASSN	SYS	BIAS	BIAS	ANGLE	TRANS. CURRENT
19MY71	K9A	GEN X	12	614	- 914	1.76			
11JE71	K9A	GEN X	12	614	- 912	1.70			
					RATE TEST DATA AFTER LAUNCH		POWER	STRUCK BY LIGHTNING	
					17JE71 K9A GEN X 12 614	- 906	1.73		

G & N 614, LM 10, IMU 12, APOLLO PIPA 2AP172, X AXIS



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G & N 614, LM 10, IMU 12, APOLLO PIPA 2AP172, X AXIS



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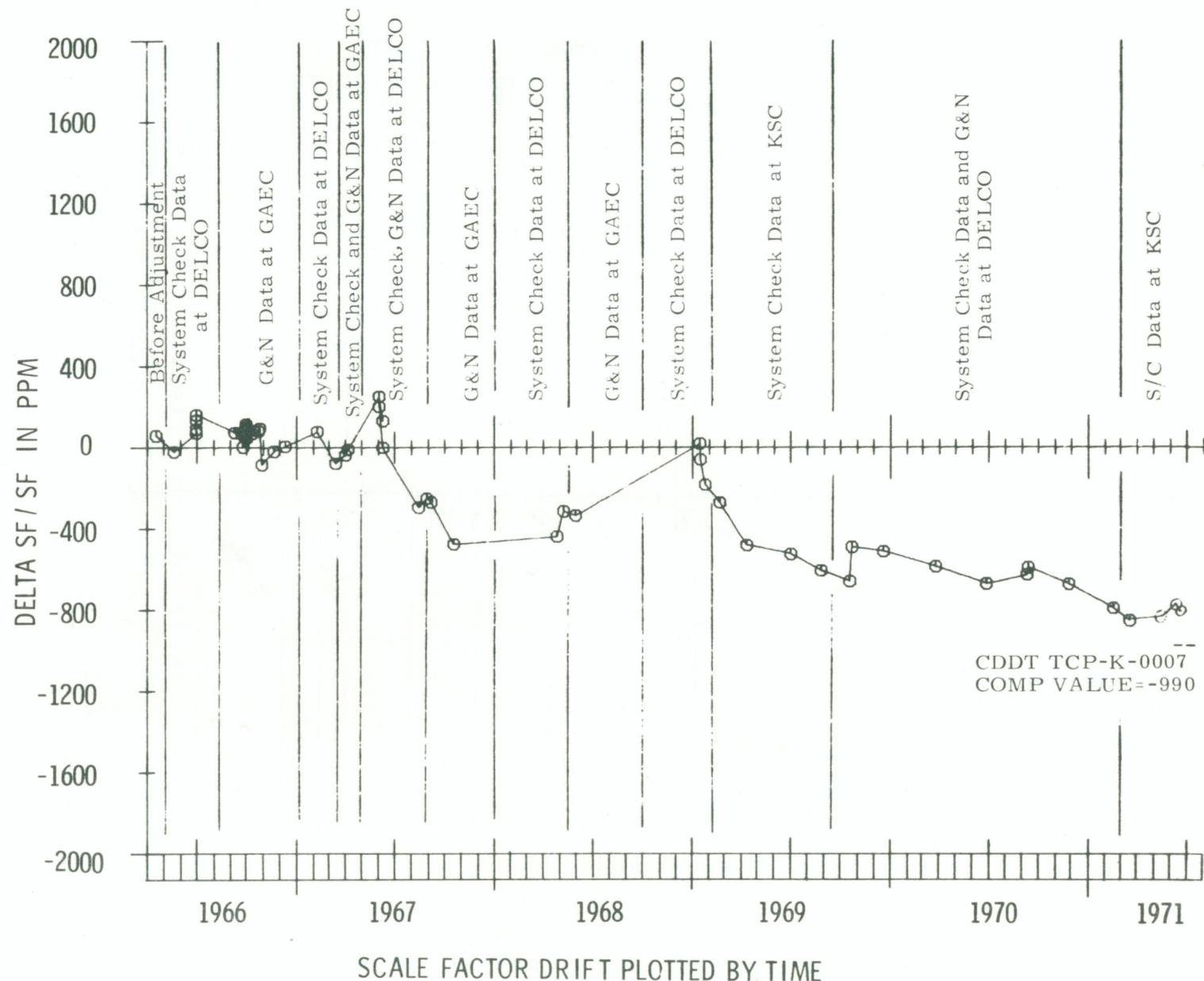
LAST UPDATE 06/17/71 PAGE 68

DATE	TST	IMU	GEN	DELTA	IG	MULL	ROT-AL-WOB	MAX.	TORQ MON	
	LOC	TYP	ASSN	SYS	SF	BIAS	BIAS	ANGLE	CURRENT	
28DE65	S46	ACC		- 161		0.0			41.3472	
MOD	C3	C4		R5	R6	R11	R12	R13	R14	
NO										
C16	.00348	.00348		98.75	101.25	140.725	19.473			
13AP66	A48	I6A					- 25	6		
15AP66	A48	I6A					39	21		
16AP66	A48	FST		57	0.05		- 19	20	43.3629	
16AP66	R7= 11.75 TURNS FROM CW LIMIT									
16AP66	15.50 TJRNS FROM LW LIMIT									
16AP66	ZAP-171 ASSN TO IMU S/N 11, Y									
12MY66	RMV & ASSN IMU S/N 12, Y									
19MY66	A17 SPR Y 12			- 22	0.00	0.02			43.3365	
19MY66	A17 SPR LSLY AFTER ADJUSTMENT									
29JE66	A17	SPU Y 12		70	0.51	0.52				
29JE66	A17	SPU Y 12		90	0.50	0.49			LJ BUS	
29JE66	A17	SPU Y 12		133	0.51	0.53			HI BUS	
29JE66	A17	SPU Y 12		160	0.52	0.53			HI BUS	
7JL66	A17	SAL Y 12			0.48		- 26	23		
8SE66	G20	GEN Y 12	603	72	.36					
8SE66	IMU S/N 12 ASSN TO GEN 603									
22SE66	G20	GEN Y 12	603	66	0.46				43.2000	
23SE66	G20	GEN Y 12	603	1	0.50				43.3458	
24SE66	G20	GEN Y 12	603	71	0.48				43.4404	
29SE66	G20	GEN Y 12	603	43	0.42				43.3414	
29SE66	G20	GEN Y 12	603	54	0.45					
29SE66	G20	GEN Y 12	603	96	0.45				43.3423	
29SE66	G20	GEN Y 12		69	0.46				43.3425 LJ BUS	
29SE66	G20	GEN Y 12		86	0.43				43.3425 LD BUS	
29SE66	G20	GEN Y 12		81	0.46				43.3427 LJ BUS	
29SE66	G20	GEN Y 12		107	0.45				43.3419 HI BUS	
29SE66	G20	GEN Y 12		84	0.50				43.3419 HI BUS	
29SE66	G20	GEN Y 12		115	0.46				43.3422 HI BUS	
10UC66	G20	GEN Y 12	603	67	0.47				43.3404	
220C66	G20	GEN Y 12	603	80	0.49				43.3405	
290C66	G20	GEN Y 12	603	93	0.49				43.3415	
280C66	G20	GEN Y 12	603	- 86	0.47				43.3418	
19NU66	G20	GEN Y 12	603	- 20	.74					
10DE66	G20	GEN Y 12	603	5	.76					
12JA67	IMU S/N 12 ASSIGNED TO LM/SP 1									
7FE67	A08	SAL Y 12			(0.67)	- 23	25			
7FE67	A08	SCK Y 12		77	0.68	0.70			43.4413	
29FE67	A17	SAL Y 12			(0.57)	- 23	24			
10MR67	A08	SAL Y 12			(0.58)	- 21	23			
15MR67	A17	SCK Y 12		- 80	.66	.54				
31MR67	G20	SAL Y 12			(0.57)	- 22	24			
31MR67	G20	SCK Y 12		- 38	.58	.55				
SAP67	G20	GEN Y 12	605	- 11	.71					
29MY67	A08	SCK Y 12			.57			DGS		
1JE67	A08	SCK Y 12		250	(4.30)	(4.37)				
1JE67	A08	SCK Y 12				(4.34)		ADJ		
1JE67	A08	SCK Y 12		200	(1.71)					
8JE67	A08	SCK Y 12		130	(- .96)	(- .99)		ADJ		

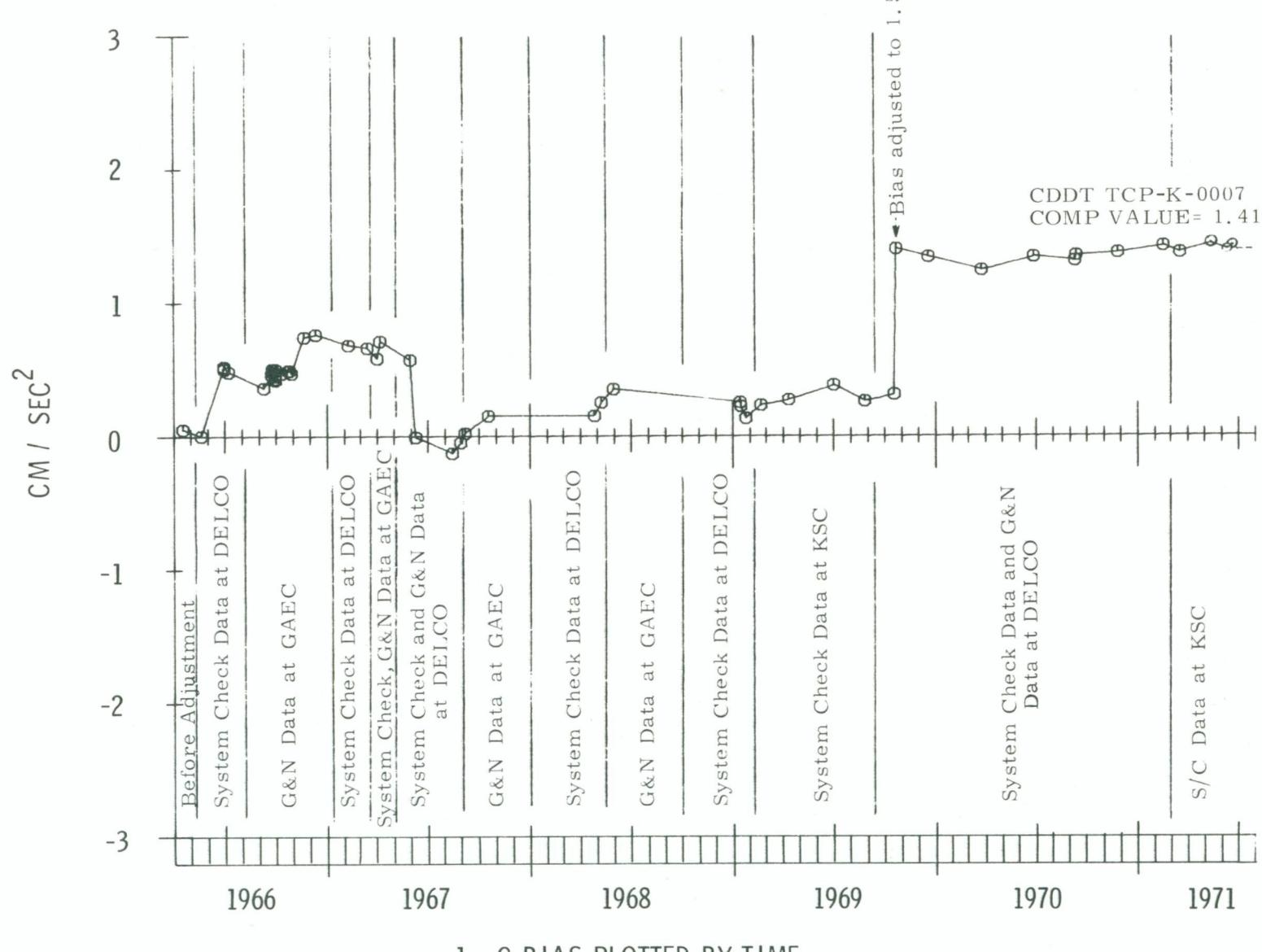
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DATE	TST	IMU	G&N	DELTA	IG	NULL	ROT-AL-WOB	MAX.	TURQ MUN
	LOC	TYP	ASSN	SYS	SF	BIAS	BIAS	ANGLE	TRANS. CURRENT
8JE67	A08	SCK	Y	12	- 2	- .01	.01		
12AU67		IMU	S/N	12	Y	+ENTERED	GEN 605		
13AU67	A08	SPD	Y	12	- 297	- .13	- .16		
28AU67	A07	G&N	Y	12	605	- 253	-0.05		
5SE67	G16	G&N	Y	12	605	- 271	0.02		
17OC67	GSC	G&N	Y	12	605	- 478	0.15		
25AP68	A08	SPR	Y	12	- 440	0.15	0.15		43.3380
7MY68	A08	SPD	Y	12	- 316	0.25	0.25		43.3374
7MY68	A08	SAL	Y	12	(0.28)	- 32	22		
22MY68		UNIT	SHIPPED	TO	GAEC				
22MY68		IMU	S/N	12	INSTALLED	IN	GEN 607		
29MY68	G20	G&N	Y	12	607	- 337	0.35		
		IMU	S/N	12	+ RETURNED	TO	AC MKE		
11JA69	A17	SPR	Y	12	(3934)	(0.52)	(0.50)		43.3336
13JA69		THE ABOVE	RUN	MADE	WITH	PIP	IN GAUSSSED STATE DUE TO		
		OPERATION	IN	C/M	L(OP. REF. AFR 22016				
13JA69	A17	SCK	Y	12		(0.48)			
13JA69	A17	SCK	Y	12	18	0.25	0.28		43.3360
14JA69	A17	SCK	Y	12	- 61	0.22	0.24		43.3366
23JA69	A17	SPD	Y	12	- 186	0.13	0.09		43.3368
3FE69	A08	SAL	Y	12		(0.15)	- 47	15	
3FE69	A08	SAL	Y	12				20	
17FE69		IMU	S/N	12	SHIPPED	TO	KSC		
19FE69	K11	SCK	Y	12	- 274	0.23	0.23		
10AP69	K11	SCK	Y	12	- 483	0.27	0.24		43.3364
30JE69	K11	SCK	Y	12	- 527	0.38	0.34		43.3362
25AU69	K11	SCK	Y	12	- 608	0.26	0.25		43.3341
		IMU	S/N	12	RETURNED	TO	AC/MKE		
17OC69	A05	SPD	Y	12	- 661	0.31	0.33		43.3352
17OC69		RAN	ED	3596-	NULL COINCIDENCE	CHECK			
17OC69	A05	SAL	Y	12		(1.38)	- 37	19	
21OC69		BIAS	ADJUSTED	TO	+1.5	PLUS OR MINUS 0.1			
21OC69	A05	SPD	Y	12	- 492	1.40	1.40		43.3378
18OE69	A07	SPD	Y	12	- 514	1.34	1.33		43.3365
19DE69	A07	SAL	Y	12		(1.30)	- 31	19	
24MR70	A05	SPD	Y	12	- 588	1.24	1.28		43.3368
25MR70	A05	SAL	Y	12		(1.33)	- 16	18	
26JE70	A07	SPD	Y	12	- 673	1.34	1.33	0.05	43.3376
29JE70	A07	SAL	Y	12		(1.23)	- 23	17	
9SE70	A07	G&N	Y	12	616	- 629	1.31		
11SE70	A07	G&N	Y	12	616	- 593	1.35		
25NC70	A07	G&N	Y	12	616	- 675	1.37		
11FE71	A05	SAL	Y	12		(1.40)	- 21	18	
15FE71	A05	SPD	Y	12	- 794	1.42	1.43	0.05	43.3366
10MR71		IMU-12	SHIPPED	TO	KSC	FOR	LM-1C INSTALLATION		
17MR71	K1B	G&N	Y	12	614	- 855	1.37		
19MY71	K9A	G&N	Y	12	614	- 852	1.45		
11JET71	K9A	G&N	Y	12	614	- 797	1.40		
		RETEST	DATA	AFTER	LAUNCH	TOWER	STRUCK	BY	LIGHTNING
		17JET71	K9A	G&N	Y	12	614	- 834	1.43

G & N 614, LM 10, IMU 12, APOLLO PIPA 2AP171, Y AXIS



G & N 614, LM 10, IMU 12, APOLLO PIPA, 2AP171, Y AXIS



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DATE	LUC	TST	IMU	GEN	DELTA	IG	NULL	ROT-AL-WOB	MAX.	TORQ MUN	
		Typ	ASSN	SYS	SF	BIAS	BIAS	ANGLE	TRANS.	CURRENT	
25JA67	S42	ACC			- 104		0.30			41.6771	
20AP67	A48	IGA						2	12		
21AP67	A48	IGA						12	3		
24AP67	A48	IGA						11	2		
10MY67	A48	FST			21	-0.02	-0.01	11	15		
29MY67	A08	SPR	Z	12	340	- .36	- .29				
2JE67	A08	SPR	Z	12	(588)	(.07)	(.04)			DGS ADJ	
2JE67	A08	SPR	Z	12	- 20	- .01	- .02				
02JE67	A08	SPR	LS1Z	AFTER ADJUSTMENT							
13AU67	A08	SPD	Z	12	- 555	- .04	- .04			D1	
13AU67	A08	SPD	Z	12	- 543	- .04	.30			D2	
13AU67	A08	SPD	Z	12	- 531	- .00	.01			D3	
28AU67	A07	GEN	Z	12	605M2	- 517	-0.21				
5SE67	G16	GEN	Z	12	605M2	- 600	-0.10				
17OC67	GSC	GEN	Z	12	605M2	- 755	-0.21				
25AP68	A08	SPR	Z	12	- 858	-0.02	0.00			43.5604	
7MY68	A08	SPD	Z	12	- 798	-0.17	-0.15			43.5599	
7MY68	A08	SAL	Z	12		(-0.16)	- 54				
22MY68	UNIT SHIPPED TO GAEC										
22MY68	IMU S/N 12 INSTALLED IN GEN 607										
29MY68	G20	GEN	Z	12	607	- 801	-0.16				
	IMU S/N 12 , RETURNED TO AC/MKE										
11JA69	A17	SPR	Z	12	(1978)	(0.36)	(0.44)			43.5593	
13JA69	THE ABOVE RUN WAS MADE WITH PIP IN GAUSSSED STATE DUE TO										
13JA69	OPERATION IN C/M LOOP. REF. AFR 22017										
13JA69	A17	SCK	Z	12	- 379	-0.09	-0.05			43.5594	
14JA69	A17	SCK	Z	12	- 385	0.02	0.04			43.5598	
23JA69	A17	SPD	Z	12	- 582	-0.02	-0.02			43.5599	
3FE69	A08	SAL	Z	12		(-0.09)	- 93				
3FE69	A08	SAL	Z	12		(-0.05)	- 97				
17FE69	IMU S/N 12 SHIPPED TO KSC										
17FE69	K11	SCK	Z	12	- 666	0.09	0.11			43.5586	
10AP69	K11	SCK	Z	12	- 903	0.12	0.10			43.5590	
3UJE69	K11	SCK	Z	12	- 988	0.06	0.02			43.5586	
25AU69	K11	SCK	Z	12	- 981	0.04	0.10			43.5572	
	IMU S/N 12 RETURNED TO AC/MKE										
17OC69	A05	SPD	Z	12	-1068	0.11	0.17			43.5600	
17OC69	RAN FD 3596-	NULL COINCIDENCE CHECK									
17OC69	A05	SAL	Z	12		(1.48)	- 89				
21OC69	GIAS ADJUSTED TO +1.5 PLUS OR MINUS 0.1										
21OC69	A05	SPD	Z	12	- 898	1.38	1.40			43.5605	
19DE69	A07	SPD	Z	12	-1022	1.37	1.37			43.5609	
19DL69	A07	SAL	Z	12		(1.39)	- 97				
24MR70	A05	SPU	Z	12	-1159	1.38	1.41			43.5587	
24MR70	A05	SAL	Z	12		(1.37)	- 92				
26JE70	A07	SPD	Z	12	-1204	1.34	1.35	0.06		43.5301	
29JE70	A07	SAL	Z	12		(1.40)	- 93				
9SE70	A07	GEN	Z	12	616	-1177	1.30				
11SE70	A07	GEN	Z	12	616	-1186	1.37				
25NL70	A07	GEN	Z	12	616	-1273	1.34				
11FE71	A05	SAL	Z	12		(1.41)	- 90				
15FE71	A05	SPD	Z	12	-1292	1.36	1.37	0.06		43.5594	
10MP71	IMU-12 SHIPPED TO KSC FOR LM-10 INSTALLATION										

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DATE	TST	IMU	G&N	DELTA	IG	NULL	ROT-AL-WOB	MAX.	TORQ MON
	LOC	TYP	ASSN	SYS	SF	BIAS	BIAS	ANGLE	TRANS. CURRENT

17MR71 KJB GEN Z 12 614 -1290 1.42

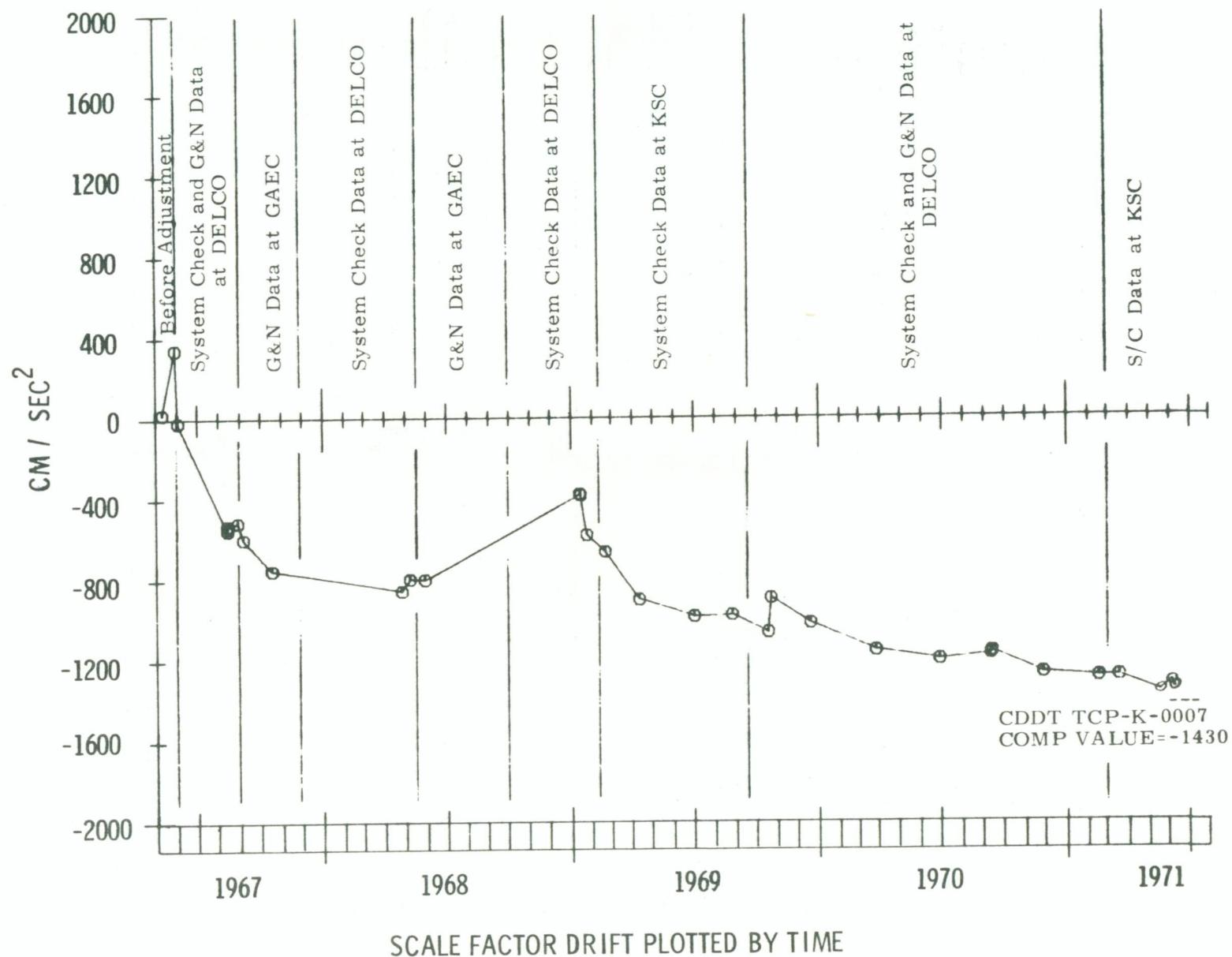
19MY71 K9A GEN Z 12 614 -1383 1.42

11JE71 K9A GEN Z 12 614 -1339 1.42

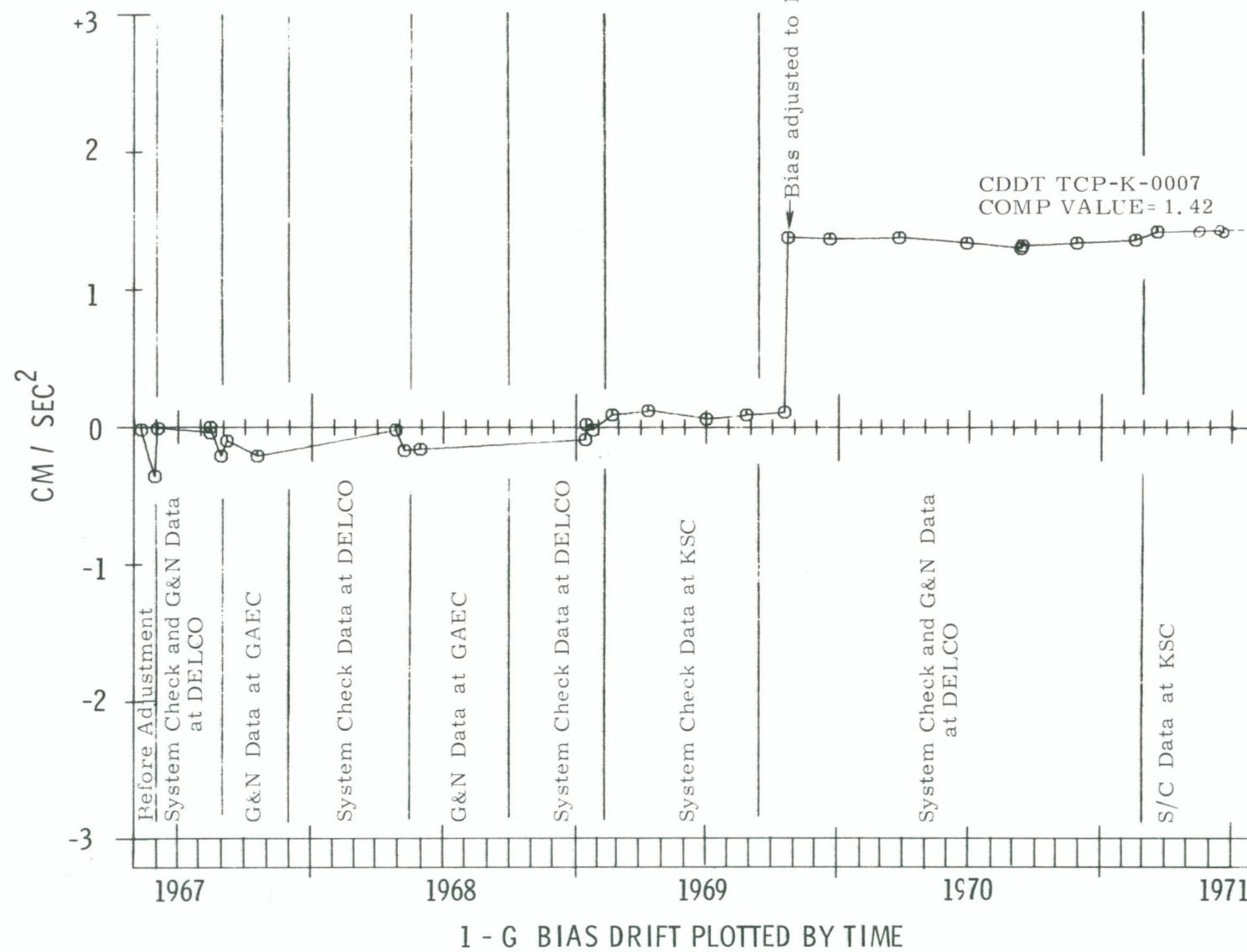
RETEST DATA AFTER LAUNCH TOWER STRUCK BY LIGHTNING
17JET71 K9A GEN Z 12 614 -1367 1.41

L01

G & N 614, LM 10, IMU 12, APOLLO IRIG 2AP292, Z AXIS



G & N 614, LM 10, IMU 12, APOLLO IRIG 2AP292, Z AXIS



STANDARD DEVIATION (1σ) OF THE IRIG AND PIPA
 PARAMETER UNCERTAINTIES USED FOR
 MISSION PERFORMANCE SUMMARY
 (IRIGs Drifts Corrected for ADOA)
 LM 10, IMU S/N 12

PARAMETER

IMU Axis PIPAs	X	Y	Z
Data Compilation Period (9/29/70 - 5/19/71)			
Accelerometer Bias (cm/sec ²)	0.06	0.04	0.05
Scale Factor (ppm)			
1) Sigma (ppm)	34	19	25
2) Slope (ppm/month)	-21	-36	-24
3) Linear Correlation	-0.868	-0.984	-0.939

IRIGs

Data Compilation Period
(9/8/70 - 5/19/71)

Bias Drift (MERU)	1.1	1.3	1.2
ADSRA (MERU/g)	1.3	1.0	2.0
ADIA (MERU/g)	2.8	1.7	2.0
(12/17/71 - 5/19/71)			
ADOA (MERU/g)	0.3	0.2	0.2

Data is based upon performance in the IMU. Point-to-point stability in operation is much better than the above data.

Accelerometer data taken prior to degaussing or adjustment has been excluded. The sigma values for PIPA scale factor were obtained from a least squared fit of the KSC data.

**PROPOSED GYRO AND ACCELEROMETER
 PERFORMANCE COMPENSATIONS**

PARAMETER

IMU Axis	X	Y	Z
PIPAs			
Accelerometer Bias (cm/sec ²)	+1.70	+1.41	+1.42
Scale Factor (Δ SF/SF ppm)	-980	-990	-1430
IRIGs			
Bias Drift (MERU)	+3.2	-0.7	+1.4
ADSRA (MERU/g)	-6	+4	-4
ADIA (MERU/g)	+5	-2	+7

Dictionary of Terms

ACC	Acceptance of Data
ACD	After Cooldown
ACE	A.C. Electronics
ADJ	Adjusted
ADOA	Acceleration Sensitive Drift Due to Acceleration along the OA
BCSW	Binary Current Switch
BIA	Bias Adjusted
BUSS	High, Low, or Nominal Direct Current Test
CDN	Post Cooldown
CQL	Component Qualification
CRQ	Component Requalification
CRR	Retest After MUMET Cap and/or Resistor Changes
CRT	Retest Data
CSS	Short Servo Test
CVR	Component Verification
DGI	Degaussed IRIG
DGS	Degaussed
F/F	Float Freedom
FST	Final Stability
GAL	Guidance & Navigation PIPA Alignment
G&N	Guidance & Navigation System Measurement
GP	Gauussed PIPAs
HBS	Hi Bus Voltage
I&A	Inspection and Acceptance
ISS	Inertial Sub-system Data
KSC	Kennedy Space Center
LBS	Lo Bus Voltage
MW	Milliwatt
NAR	North American Rockwell
NBS	Nominal Bus Voltage
OOS	Out of Spec
RDT	Wheel Rundown Time, Seconds

APPENDIX

ELECTRICAL POWER REQUIREMENTS

This section was extracted from the MIT/IL report E-1142 (Rev. 59) "SYSTEM STATUS REPORT". It is included in this report for convenience.

Electrical power and energy reporting is based upon the inflight spacecraft sequence of events for the Design Reference Mission as developed by the Apollo Mission Planning Task Force (AMPTF). (Reference GAEC Report Volume III - LED-540-12, dated 30 October 1964).

The accompanying diagrams present the power drawn through the spacecraft circuit breakers. It is assumed that power is drawn from the spacecraft's primary +28VDC supply and a 400 cps-115 VAC single phase inverter.

Intermittent power peaks can exist, particularly during operation of displays and controls at random times. The energy content in these peaks is considered negligible.

All values (except those mentioned above) are actual expected levels of power at 28.0 VDC. They are based on measured values on G&N systems 207 and 208 for the Block II Command Module and G&N systems 608, 600, and LM learner for the LM. No margin factor has been applied to protect against possible differences between G&N systems and spacecrafts. Thus, these values should not be taken as "not to exceed" extremes.

The following Interface Control Documents serve as the guidelines for reporting power figures.

CM Block II MH01-01327-216 "G&N Electrical Input Power" signed 15 July 1965.

LM LIS-390-10002 "PGNCS Prime Power Requirements and Characteristics" signed 30 July 1965.

LUNAR MODULE GUIDANCE & NAVIGATION LOAD ON PRIMARY +28 VDC

BASED UPON 106.02 HOURS (4.42 DAY) LUNAR LANDING MISSION
DESIGN REFERENCE MISSION

REFERENCE GAEC REPORT - LED 540-12, 30 OCTOBER 1964
STATUS OCTOBER 1967

APOLLO MISSION PLANNING TASK FORCE

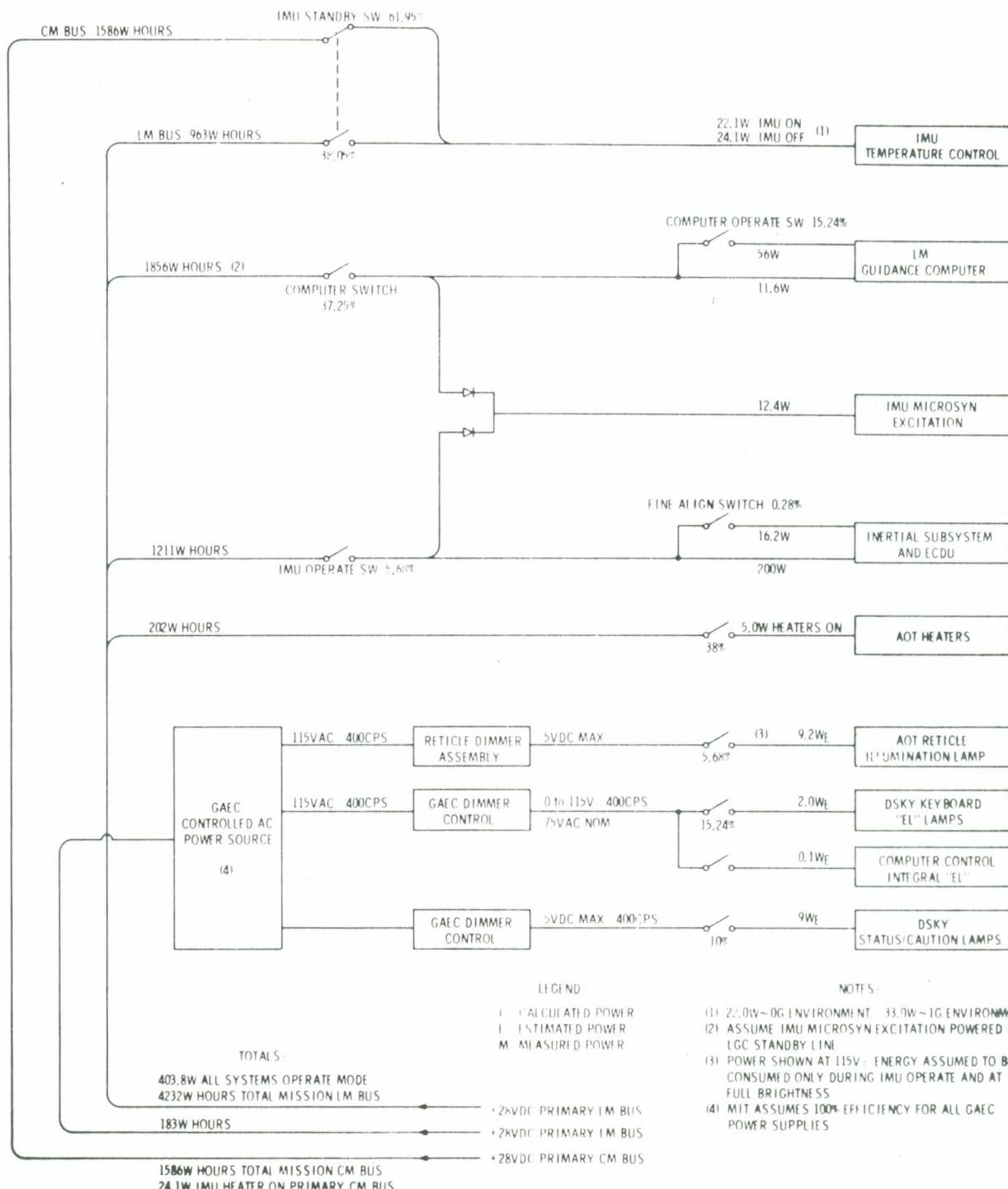


Figure A-1

BLOCK II GUIDANCE & NAVIGATION LOAD ON PRIMARY +28 VDC COMMAND MODULE

BASED UPON 198.5 HOURS (8.27 DAY) LUNAR ORBIT MISSION

DESIGN REFERENCE MISSION

STATUS OCTOBER 1967

REFERENCE GAEC REPORT - LED 540-12, 30 OCTOBER 1964

APOLLO MISSION PLANNING TASK FORCE

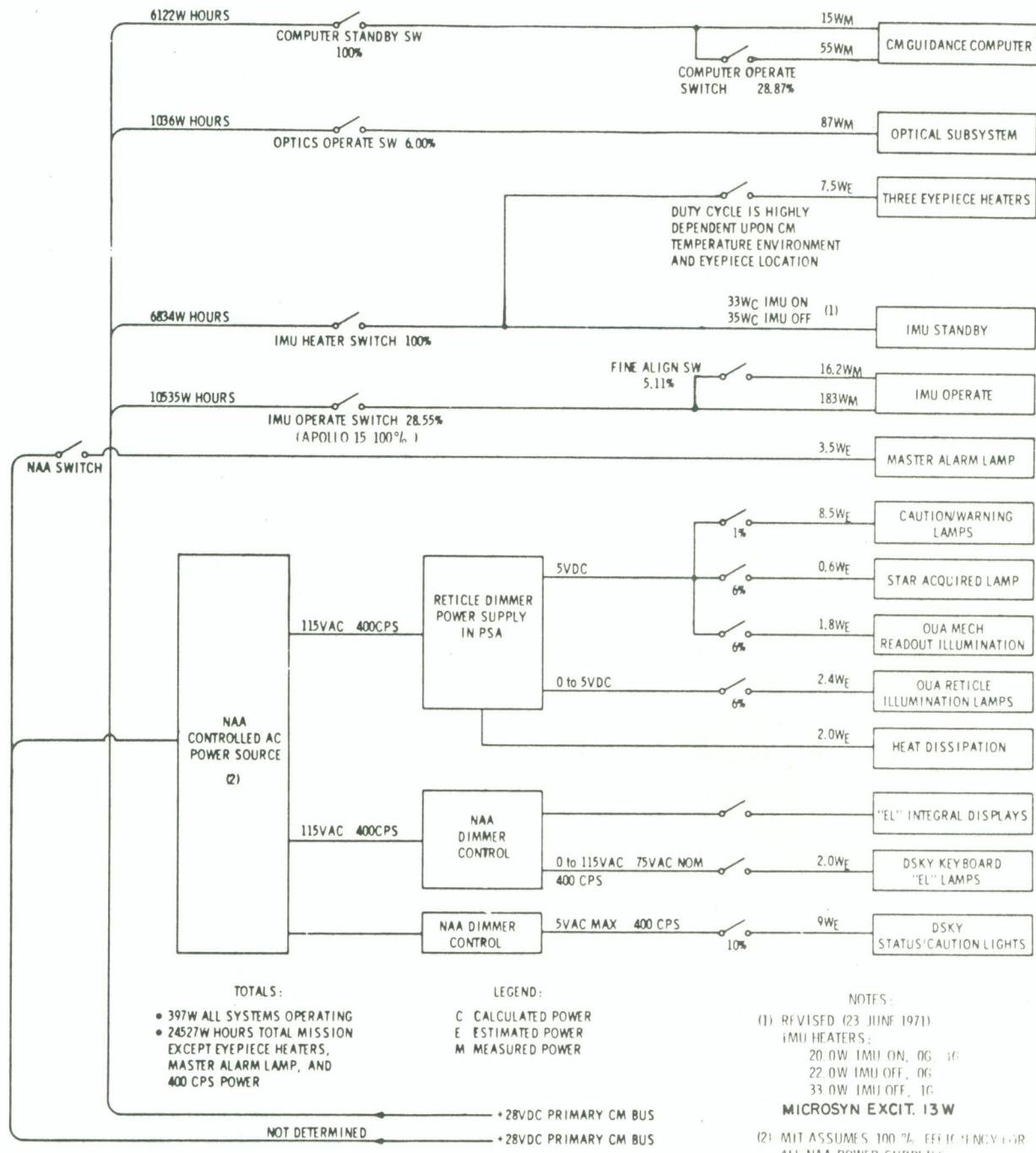


Figure A-2

E-2587

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