JM86

NASA CR: 150930

SD73-CS-0004

POSTFLIGHT REPORT FOR CSM END ITEM SPACECRAFT 114 MASS PROPERTY DATA

FEBRUARY 1, 1973

THIS DOCUMENT HAS BEEN PREPARED AS TYPE II DATA IN COMPLIANCE WITH LINE ITEM NUMBER 183 OF SD69-700B, CONTRACT NAS9-150.

PREPARED BY:

STRUCTURES AND DYNAMICS GROUP

APPROVED BY:

R. J. HANFIN
MANAGER
CSM STRUCTURAL AND MECHANICAL DESIGN

Space Division
North American Rockwell

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(NASA-CR-150930) POSTFLIGHT REPORT FOR CSM END ITEM SPACECRAFT 114 MASS PROPERTY DATA (North American Rockwell Corp.) 80 p

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SD73-CS-0004

POSTFLIGHT REPORT
FOR CSM END ITEM
SPACECRAFT 114
MASS PROPERTY DATA

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PREPARED BY:

STRUCTURES AND DYNAMICS GROUP

APPROVED BY:

P. J. Hanlin

P. J. HANLIN
MANAGER
CSM STRUCTURAL AND MECHANICAL DESIGN

Space Division
North American Rockwell

SPACECRAFT 114

INTRODUCTION

This Postflight Report is for CSM End Item Spacecraft 114 and is submitted per paragraph 2.3.3 of the NASA Requirements Document ASPO-PS5-13-12, as amended.

The specification weights reported in the summary weight statements, pages 37 through 41, are the weights of SID64-1345D (SCN No. 1131A), as amended by the Specification Change Notices approved by North American Rockwell. The subsystem weight breakdowns are based on the contractors' calculations and do not represent the actual weighing of each subsystem.

The mass property data, summarized on page 6, are based on the actual weight and balance determinations conducted at the Kennedy Space Center and North American Rockwell's Downey and Tulsa facilities; and include the weight changes, defined on page 5, which were incorporated for the Apollo 17 mission.

The Launch Escape System (LES) mass properties are included in this postflight report as reference data and all cases with the center of gravity off-sets that were required for Thrust Vector Alignment. The LES had 1064.5 pounds of ballast installed. The resulting Launch Escape Vehicle (LEV) burnout center of gravity was 1122.2 inches which was within the limits defined on page 80.

The Command Module (CM), Service Module (SM), Spacecraft LM Adapter (SLA), and Lunar Module (LM) injected weight of 107161.0 pounds includes an actual loading of 40539.8 pounds of tanked Service Propulsion System (SPS) propellant. The mass property data for the SPS fuel and oxidizer sump tank propellants reflects an overfill of 47.2 and 75.2 pounds respectively. The storage tanks are decreased by this same amount. The LM weight is 36276.8 pounds, as defined per reference (7) on page 4.

The Command Module launch weight of 12954.0 pounds includes ballasting of 190.6 pounds. This ballast resulted in the lift to drag (L/D) ratio of .294 at CM-SM separation. See reference (9) on page 4 for water configurations and page 80 for L/D limits.

SPACECRAFT 114

NOTES AND REFERENCES

(1) Centers of gravity are given in the Apollo Reference System as defined by the MD-V14-14-10.

(2) Moments and products of inertia are about the centers of gravity of the items shown.

(3) The tanked SPS Residuals, 581.1 pounds, have been removed and reported as part of the tanked SPS Propellant.

(4) The potable water tank capacity is 40 pounds.

(5) The waste water tank capacity is 60 pounds.

(6) The 26 CO_2 absorber units include the 2 units in the Environmental Control Unit.

(7) Lunar Module LM-12 is defined by the NASA CSM/LM Spacecraft Operational Data Book, Volume III, Revision 3, Section 3.3, Mission J-3, Amendment 134 and revised during mission support updates.

(8) The tanked SPS Propellant is defined by the NASA CSM/LM Spacecraft Operational Data Book, Volume III, Revision 3, Section 3.3, Mission J-3, Amendment 135.

(9) Water Configuration - Command Module

Pre-Launch	Potable Tank	36.9 Pounds Usable, 1 Pound Trapped
	Waste Tank	0.0 Pounds Usable, 1 Pound Trapped
Launch	Potable Tank	36.9 Pounds Usable, 1 Pound Trapped
	Waste Tank	18.5 Pounds Usable, 1 Pound Trapped
Separation	Potable Tank	40.0 Pounds Usable, 1 Pound Trapped
	Waste Tank	60.0 Pounds Usable, 1 Pound Trapped

SPACECRAFT 114

ACTUAL WEIGHT DELTA SUMMARY

The following weight adjustments have occurred since the date of weighing and form the launch weights reported in this document.

		WEIGHT (LB.)
LAUNCH ESCAPE SYSTEM	Page 7	9104.4
No change		0.0
	REPORT WEIGHT	9104.4
COMMAND MODULE	Page 14	12770.0
Addition of Crew Compartment Door Ballast per MCR A13903R1		+106.4
Additional Crew Equipment Requirements per MCR A13911R9		+ 51.0
Additional Equipment Stowage per MCR A13986R1		+ 4.5
Potable Water at Launch - Actual Loading Data		+ 7.9
Waste Water at Launch - Actual Loading Data		- 15.5
Miscellaneous MCR Changes & Actual Weight of Shortage Items in Lieu of Calculated Weights		+ 29.7
	REPORT WEIGHT	12954.0
SERVICE MODULE	Page 22	13316.5
J-Mission Mapping Camera ICD Changes per MCR A13405		+ 21.0
Increase Pan Camera Spec Weight per MCR A13462		+ 18.0
EPS Hydrogen at Launch - Actual Data		- 3.5
EPS Oxygen at Launch - Actual Data		- 26.3
Miscellaneous MCR Changes & Actual Weight of Shortage Items in Lieu of Calculated Weights		+ 5.8
	REPORT WEIGHT	13331.5
SPACECRAFT LM ADAPTER (AVERAGE WEIGHT BASED ON SLA 18 S/C 111)		4021.5
Addition of Access Hole in Aft Panel per MCR A12285R5		+ 28.6
J-Mission Studies to Determine Impact of LMMP Mods on NR GSE SLA Platforms per MCR A13038R4		+ 6.7
Miscellaneous MCR Changes & Actual Weight of Shortage Items in Lieu of Calculated Weights		+ 2.1
	REPORT WEIGHT	4058.9

The mass properties for the above weights are summarized on the following page.

SPACECRAFT 114

MODULE MASS PROPERTY SUMMARY

ITEM	WEIGHT (LB.)	CENTERS OF GRAVITY (1) (INCHES)			MOMENTS OF INERTIA (2) (SLUG-FT^2)			PRODUCTS OF INERTIA (2) (SLUG-FT^2)		
		X_a	Y	Z	I_{xx}	I_{yy}	I_{zz}	I_{xy}	I_{xz}	I_{yz}
Launch Escape System	9104.4	1298.7	0.6	0.3	850	28399	28374	137.8	727.7	2.3
Command Module (9) - Launch *	12954.0	1040.9	-0.1	5.6	5903	5425	4904	43.6	-407.2	10.5
Service Module (3) - Launch *	13331.5	917.5	1.4	1.7	9559	14418	13178	-156.0	415.0	-1579.0
Spacecraft LM Adapter	4058.9	643.6	0.6	-0.3	10109	13557	13526	-79.4	49.7	37.5
Lunar Module LM-12 (7)	36276.8	583.7	0.4	-1.0	25890	27352	26201	63.0	558.0	163.0
SPS Tanked Propellant (3)	40539.8	905.3	7.7	5.7	20476	22627	25630	9.4	-0.1	3900.9

* See Page 53 for Command Module and Service Module Pre-Launch to Launch Data

Space Division
North American Rockwell

SPACECRAFT 114

WEIGHT AND BALANCE CALCULATION SHEET

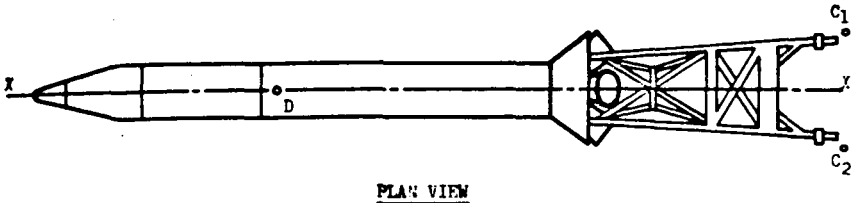
SPACECRAFT LAUNCH ESCAPE SYSTEM DETERMINATION

ACTUAL WEIGHT SUMMARY

ITEM	WEIGHT	CENTER OF GRAVITY		
		X_a	Y	Z
HORIZONTAL - CORRECTED WEIGHT AND CENTER OF GRAVITY (X_a) Page 8	9105.5	1298.7	--	--
VERTICAL - CORRECTED WEIGHT AND CENTER OF GRAVITY (Y-Z) Page 33	9103.3	--	0.6	0.3
AVERAGE - CORRECTED WEIGHT AND CENTER OF GRAVITY	9104.4	1298.7	0.6	0.3

WEIGHT AND BALANCE CALCULATION SHEET

LAUNCH ESCAPE SYSTEM - HORIZONTAL



PLAN VIEW

Vehicle No. S/C 114 Calculated By J. P. Clifford

Location PIB/FF Date 10 July 1972

WEIGHT DERIVATION						
REACTION POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
C_1	S/N 20515	24282	604.8	-	-	604.8
C2	S/N 20514	32641	811.9	-	-	811.9
D	S/N 34298	28386	7185.6	-	-	7185.6

WEIGHT AND X CENTER OF GRAVITY				
DESCRIPTION	REACTION POINT	WEIGHT	X STA	X MOMENT
Load Cell Location	C_1	604.8	1083.03	655016
Load Cell Location	C_2	811.9	1083.03	879312
Load Cell Location	D	7185.6	1360.66	9777158
GROSS (as weighed)		8602.3	(1314.9)	11311486
LESS: Extraneous Items		- 439.2		- 498074
NET (as weighed)		8163.1	(1324.7)	10813412
PLUS: Shortage Items		942.4	1073.7	1011855
CORRECTED WEIGHT AND X CG		9105.5	(1298.7)	11825267

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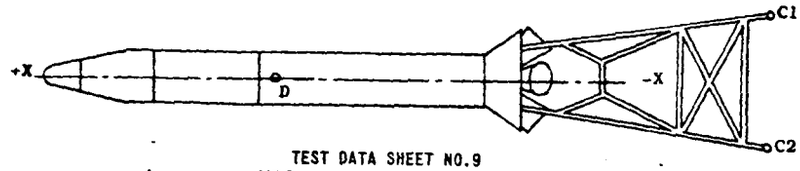
North American Rockwell



TEST DATA SHEET NO.9
WEIGHT AND BALANCE FORM
LAUNCH ESCAPE SYSTEM - HORIZONTAL WEIGHING

VEHICLE NO. 114 RECORDED BY [illegible]

LOCATION P18 AI4-154 DC DIGITAL READOUT SERIAL NO. 004

DATE 7-10-72

REACTION POINT C1

WEIGHING	LOAD CELL SERIAL	LOAD CELL TARE	NO LOAD READING	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	20515	E	200	24499	200	24299	24281.8
2	20515	E	200	24496	200	24296	
3	20515	E	199	24487	200	24287	
4	20515	E	201	24455	200	24255	
5	20515	E	201	24472	200	24272	

REACTION POINT C2

WEIGHING	LOAD CELL SERIAL	LOAD CELL TARE	NO LOAD READING	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	20514	E	200	32820	200	32620	32641.0
2	20514	E	200	32824	200	32624	
3	20514	E	199	32827	200	32627	
4	20514	E	200	32872	200	32672	
5	20514	E	201	32862	200	32662	

REACTION POINT D

WEIGHING	LOAD CELL SERIAL	LOAD CELL TARE	NO LOAD READING	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	34298	F	198	28587	200	28386	28386.0
2	34298	F	200	28589	200	28389	
3	34298	F	198	28585	200	28385	
4	34298	F	197	28583	200	28383	
5	34298	F	198	28587	200	28387	

ILLUS # 380A

7-10-72

SPACECRAFT 114

WEIGHT AND BALANCE CALCULATION SHEET

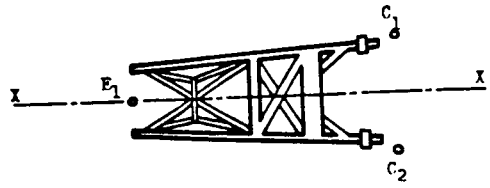
LAUNCH ESCAPE SYSTEM

CORRECTION TO NET (AS WEIGHED) CONDITION

ITEM	WEIGHT	X_a
SHORTAGES		
Boost Protective Cover	911.9	1061.8
"Q" Ball	25.0	1475.4
Frangible Nut & Washer (4 ea.)	2.9	1085.7
Ordnance F01-100406	0.7	1394.9
Ordnance F01-100403	0.5	1085.5
Canard Ordnance F01-590230	1.4	1436.6
TOTAL SHORTAGES	942.4	1073.7

WEIGHT AND BALANCE CALCULATION SHEET

LAUNCH ESCAPE SYSTEM - TOWER ASSEMBLY - HORIZONTAL



PLAN VIEW

Vehicle No. S/C 114

Location PIB/FF

Calculated by J. P. Clifford

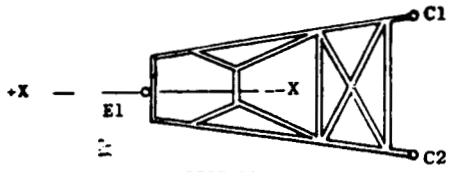
Date 18 May 1972

WEIGHT DERIVATION						
REACTION POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
C_1	S/N 18381	22143	276.4	-	-	276.4
C_2	S/N 18375	24476	305.1	-	-	305.1
E_1	S/N 18379	15832	197.4	-	-	197.4

WEIGHT AND X CENTER OF GRAVITY				
DESCRIPTION	REACTION POINT	WEIGHT	X STA	X MOMENT
Load Cell Location	C_1	276.4	1083.03	299349
Load Cell Location	C_2	305.1	1083.03	330432
Load Cell Location	E_1	197.4	1205.01	237869
GROSS (as weighed)		778.9	(1113.9)	867650
LESS: Extraneous Items		-365.7	1085.5	-396967
G15-810005 Adapters &				
G15-810013 Frame		(-350.8)	1083.02	
G14-810207 Adapters		(- 7.5)	1083.03	
G15-810155 Frame		(- 7.4)	1205.01	
NET: (as weighed)		413.2	(1139.1)	470683
PLUS: Shortages		3.4	1085.7	3691
CORRECTED WEIGHT AND X CG		416.6	(1138.7)	474374

FORM FTE-A-1343-2

Space Division
North American Rockwell



TEST DATA SHEET NO.5

LAUNCH ESCAPE TOWER - HORIZONTAL WEIGHING

VEHICLE NO. LES S/C 114 RECORDED BY D. Montgomery

LOCATION PIB A14-154 DC DIGITAL READOUT SERIAL NO. 1

REACTION POINT C1 DATE 5-18-72

WEIGHING	LOAD CELL SERIAL	LOAD CELL TARE	NO LOAD READING	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	18381	E	200	22335	200	22135	22142.6
2	18381	E	200	22344	194	22150	
3	18381	E	200	22336	200	22136	
4	18381	E	200	22344	200	22144	
5	18381	E	200	22348	200	22148	

REACTION POINT C2

WEIGHING	LOAD CELL SERIAL	LOAD CELL TARE	NO LOAD READING	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	18375	F	200	24674	200	24474	24476.2
2	18375	F	200	24668	196	24472	
3	18375	F	200	24682	203	24479	
4	18375	F	200	24670	200	24470	
5	18375	F	200	24684	198	24486	

REACTION POINT E1

WEIGHING	LOAD CELL SERIAL	LOAD CELL TARE	NO LOAD READING	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	18379	E	200	16037	200	15837	15831.6
2	18379	E	200	16036	200	15836	
3	18379	E	200	16029	200	15829	
4	18379	E	200	16034	200	15834	
5	18379	E	200	16020	203	15817	

ILLUS # 379A

LVO 4.e.
Reviewed by [illegible] Supervisor
5/18/72

SPACECRAFT 114

WEIGHT AND BALANCE CALCULATION SHEET

LAUNCH ESCAPE TOWER

CORRECTION TO NET (AS WEIGHED) CONDITION

ITEM	WEIGHT	X_a
SHORTAGES		
F01-100402 Frangible Nuts and Washers	2.9	1085.7
F01-100403 FSI Ordnance Frangible Nut	0.5	1085.5
TOTAL SHORTAGES	3.4	1085.7

SPACECRAFT 114

WEIGHT AND BALANCE CALCULATION SHEET

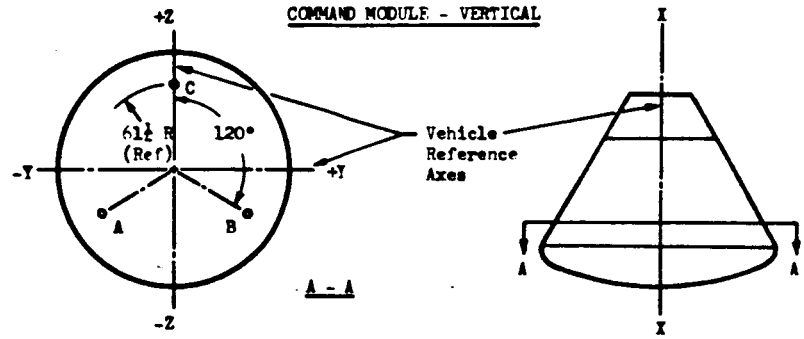
COMMAND MODULE DETERMINATION

ACTUAL WEIGHT SUMMARY

ITEM	WEIGHT	CENTER OF GRAVITY		
		X_a	Y	Z
VERTICAL - CORRECTED WEIGHT AND CENTER OF GRAVITY (Y-Z) Page 15	12773.8	-	- 0.20	5.25
HORIZONTAL - CORRECTED WEIGHT AND CENTER OF GRAVITY (X_a) Page 17	12766.2	1041.05	-	-
AVERAGE - CORRECTED WEIGHT AND CENTER OF GRAVITY	12770.0	1041.05	- 0.20	5.25

WEIGHT AND BALANCE CALCULATION SHEET

COMMAND MODULE - VERTICAL



Vehicle No. S/C 114 Calculated By C.A.Moore & A.E.Fry

Location Bldg 290 - Downey Date 13 March 1972

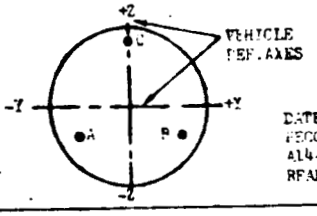
WEIGHT DERIVATION						
REACTION POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
A	S/N 32323	27684	3495.3	-	-	3495.3
B	S/N 32324	28026	3540.6	-	-	3540.6
C	S/N 32325	36573	4619.4	-	-	4619.4

WEIGHT AND Y - Z CENTER OF GRAVITY						
DESCRIPTION	REACTION POINT	WEIGHT	Y STA	Y MOMENT	Z STA	Z MOMENT
Load Cell Location	A	3495.3	- 53.08	-185531	- 30.74	-107446
Load Cell Location	B	3540.6	53.14	188147	- 30.61	-108378
Load Cell Location	C	4619.4	0.00	0	61.28	283077
GROSS (as weighed)		11655.3	(0.22)	2616	(5.77)	67253
LESS: GSE - Vertical		-1109.1	0.27	- 299	3.37	- 3738
Umbilical - SM Portion		- 156.0	3.00	- 468	77.00	- 12012
NET (as weighed)		10390.2	(0.18)	1849	(4.96)	51503
PLUS: Shortage Items						
Systems Installations		2077.7	- 0.17	- 353	0.38	790
Fluids and Gases		305.9	- 13.15	- 4023	48.42	14812
CORRECTED WEIGHT AND CG (Y - Z)		12773.8	(- 0.20)	- 2527	(5.25)	67105

FORM F-T-A-1343-6

	REVISION LETTER	PAGE 17
NAS701-3038-490	A	

TEST DATA SHEET 3
WEIGHT AND BALANCE FORM
VERTICAL WEIGHING



DATE MAR 13 1972
RECORDED BY C.E. DALTON
A14-154 DC DIGITAL
READOUT SERIAL NO. 006

REACTION POINT A							
WEIGHING	LOAD CELL SERIAL	LOAD CELL COLOR	ZERO READING	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	32323	RED	100	27,784	-102	27,682	
2			"	27,784	-099	27,685	
3			"	27,784	-100	27,684	
4							
5							27,683.6

REACTION POINT B							
WEIGHING	LOAD CELL SERIAL	LOAD CELL COLOR	ZERO READING	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	32324	YELLOW	100	28,128	-101	28,027	
2			"	28,127	-100	28,027	
3			"	28,127	-104	28,023	
4							
5							28,025.6

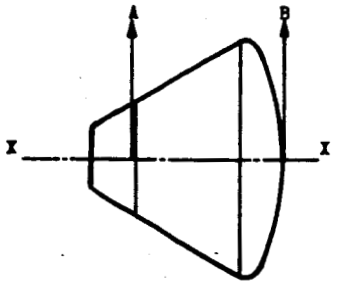
REACTION POINT C							
WEIGHING	LOAD CELL SERIAL	LOAD CELL COLOR	ZERO READING	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	32325	BLUE	100	36,671	-100	36,571	
2			"	36,674	-100	36,574	
3			"	36,674	-100	36,574	
4							
5						MAR 13 72	36,573

C.E. DALTON
NR INSPECTION
P. Bryan MAR 13 72
NASA INSPECTION

MAR 13 1972

WEIGHT AND BALANCE CALCULATION SHEET

COMMAND MODULE - HORIZONTAL



Vehicle No. S/C 114 Calculated By A.E.Fry & P.A.Moy

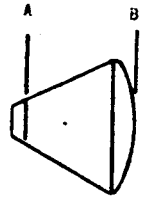
Location Bldg 290 - Downey Date 13 March 1972

WEIGHT DERIVATION						
REACTION POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
A	S/N 34307	22757	5704.5	-	-	5704.5
B	S/N 34306	24318	6094.5	-	-	6094.5

WEIGHT AND X CENTER OF GRAVITY				
DESCRIPTION	REACTION POINT	WEIGHT	X STA	X MOMENT
Load Cell Location	A	5704.5	1085.5	6192235
Load Cell Location	B	6094.5	996.4	6072560
GROSS (as weighed)		11799.0	(1039.48)	12264795
LESS: GSE - Horizontal		-1260.4	1023.9	-1290524
Umbilical - SM Portion		- 156.0	1019.0	- 158964
NET (as weighed)		10382.6	(1041.68)	10815307
PLUS: Shortage Items				
Systems Installation		2077.7	1040.61	2162034
Fluids and Gases		305.9	1022.79	312871
CORRECTED WEIGHT AND X CG		12766.2	(1041.05)	13290212

FORM FYC-A-1343-8

TEST DATA SHEET 4
WEIGHT AND BALANCE FORM
HORIZONTAL WEIGHING



DATE MAR 1 3 1972
RECORDED BY C. E. DALTON
A14-15A DC DIGITAL
HEAD UNIT SERIAL NO. 006

REACTION POINT A

WEIGHING	LOAD CELL SERIAL	LOAD CELL COLOR	ZERO READING	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	34307	YELLOW	22858	-106	22752	22,752	
2			22856	-97	22759	22,759	
3			22863	-103	22760	22,760	
4							
5				--			22757.0

REACTION POINT B

WEIGHING	LOAD CELL SERIAL	LOAD CELL COLOR	ZERO READING	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	34306	RED	24419	-102	24317	24,317	
2			24413	-096	24317	24,317	
3			24418	-099	24319	24,319	
4							
5							24,317.6

C. E. DALTON — MAR 13 72 NR INSPECTION
P. Bryan — MAR 13 72 NASA INSPECTION

MAR 13 1972

PREPARED BY: P. A. Moy

DATE: 14 March 1972

APOLLO CM WEIGHT CHECK LIST

VEHICLE NO. S/C 114

PAGE NO. 1 OF 3

QUADRANT AND ITEM NO.	ITEM	PART NUMBER	ITEM ✓ IN	ITEM ✓ OUT	WEIGHT (POUNDS)	CENTER OF GRAVITY X_a	Y_a	Z_a
	ITEMS TO BE REMOVED							
	GSE - Vertical Weighing				(1109.1)	-	(0.27)	(3.37)
	GSE - Horizontal Weighing				(1260.4)	(1023.9)	-	-
	Support Ring	H14-017			791.1	996.4	0.43	3.91
	Truss & Rods (Horiz. Only)	H14-017			34.8	996.4	-	-
	Lifting Ring	H14-059			293.3	1085.5	-0.01	-0.48
	Lifting Ring Yoke (Horiz. Only)	H14-059			29.7	1085.5	-	-
	Lifting Ring Link (Horiz. Only)	H14-059			27.0	1085.5	-	-
	Balance Bracket (Horiz. Only)	H14-059			2.5	991.8	-	-
	Umbilical Support Tool (2)	MK396-10277			2.5	1028.0	3.00	70.00
	GSE Flight Ropes				11.1	1037.3	-4.20	43.50
	Sextant Cover - Small				1.0	1074.1	0.00	43.00
	Sextant Cover - Large				1.9	1074.1	0.00	43.00
	Misc. Protective Covers, Tape, Safety Locks, Etc.				8.2	1024.0	0.00	0.00
	Flexure & Linkage Weight - Point A (Horiz. Only)				28.4	1085.5	-	-
	Flexure & Linkage Weight - Point B (Horiz. Only)				28.9	996.4	-	-
	Umbilical - SM Portion	V36-321758-102			(156.0)	(1019.0)	(3.00)	(77.00)

FORM NAC-A-1264

SDT3-68-0004

APOLLO CM WEIGHT CHECK LIST

PREPARED BY: P. A. Moy

DATE: 14 March 1972

VEHICLE NO. S/C 114

PAGE NO. 2 OF 3

QUADRANT AND ITEM NO.	ITEM		ITEM ✓ IN	ITEM ✓ OUT	WEIGHT (POUNDS)	CENTER OF GRAVITY X_a	Y_a	Z_a
	SHORTAGE ITEMS	PART NUMBER						
	Systems Installation				(2077.7)	(1040.59)	(- 0.17)	(0.38)
	Forward Hatch Cover & Mechanism	V36-326601			80.5	1100.0	0.0	0.0
	Docking Probe	V36-575001			85.7	1113.2	0.0	0.0
	Translation Controller	ME901-0702-0602			5.7	1058.0	- 22.5	- 10.5
	Rotation Controllers (2)	ME901-0704-0702			18.4	1058.0	- 2.5	- 10.5
	PIPA	2007201-031			8.5	1061.6	- 13.0	37.5
	IMU	2018601-231			45.2	1053.5	- 0.2	40.8
	Battery Installation	F01-100013			94.4	1015.8	- 0.5	40.0
	Ordnance Installation	F01-1004XX			8.4	1060.9	- 1.7	- 0.4
	CC Ablator Plugs	F01-100460			6.4	1050.0	0.0	- 2.5
	Stowable Equipment	F01-100514			1158.3	1030.0	0.0	0.6
	Spacecraft Crew	F01-100514-114			524.5	1043.0	- 0.6	- 10.4
	EVA Handles	F01-100525			22.1	1079.3	10.1	- 23.5
	Aux. Dump Nozzle	F01-612000			1.5	1057.6	- 8.7	- 49.3
	Dosimeter	F01-750015-21			3.3	1044.0	43.4	- 29.6
	Flight Ropes	F01-750018			12.0	1037.2	- 4.2	43.5
	Dust Covers & Retainers	F01-750018			2.1	1073.8	0.0	39.8
	Camera Fitting Instl	F01-750019-41			0.7	1051.6	24.8	- 40.2

FORM FNC-A-1261

APOLLO CM WEIGHT CHECK LIST

PREPARED BY: P. A. Moy

DATE: 14 March 1972

VEHICLE NO. S/C 114

PAGE NO. 3 OF 3

QUADRANT AND ITEM NO.	ITEM	ITEM ✓ IN	ITEM ✓ OUT	WEIGHT (POUNDS)	CENTER OF GRAVITY X_a	Y_a	Z_a
	SHORTAGE ITEMS (Continued)						
	Fluids and Gases			(305.9)	(1022.79)	(-13.15)	(48.42)
	Non-Expendable						
	RCS Residual Propellant - Oxidizer			23.1	1022.6	14.6	62.6
	- Fuel			13.3	1022.6	-45.5	46.0
	RCS Helium			1.0	1022.6	- 3.1	25.8
	RCS Residual Water - Potable			1.0	1022.6	-63.5	-16.4
	- Waste			1.0	1022.6	-19.9	62.4
	ECS Oxygen			6.7	1031.1	-26.9	-34.2
	Expendable						
	RCS Propellant - Oxidizer			133.5	1022.6	14.4	62.7
	- Fuel			63.3	1022.6	-45.8	45.7
	ECS Water - Potable			29.0	1022.6	-63.5	-16.4
	- Waste/Pre-Launch			34.0	1022.6	-19.7	62.5

FORM FNG-A-1261

SD73-CS-0004

SPACECRAFT 114

WEIGHT AND BALANCE CALCULATION SHEET

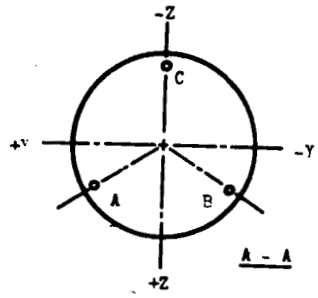
SERVICE MODULE DETERMINATION

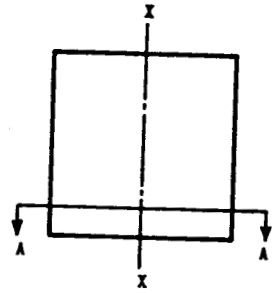
ACTUAL WEIGHT SUMMARY

ITEM	WEIGHT	CENTER OF GRAVITY		
		X_a	Y	Z
VERTICAL - CORRECTED WEIGHT AND CENTER OF GRAVITY (Y-Z) Page 23	13314.2	-	1.34	1.74
HORIZONTAL - CORRECTED WEIGHT AND CENTER OF GRAVITY (X_a) Page 25	13318.7	917.43	-	-
AVERAGE - CORRECTED WEIGHT AND CENTER OF GRAVITY	13316.5	917.43	1.34	1.74

WEIGHT AND BALANCE CALCULATION SHEET

SERVICE MODULE - VERTICAL





Vehicle No. S/C 114

Calculated By C.A.Moore & P.A.Moy

Location Bldg 290 - Downey

Date 4 March 1972

WEIGHT DERIVATION						
REACTION POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
A	S/N 32323	30797.3	3889.6	-	-	3889.6
B	S/N 32324	28558.0	3608.0	-	-	3608.0
C	S/N 32325	27622.0	3483.1	-	-	3483.1

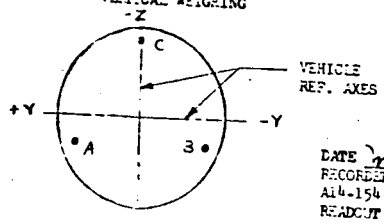
WEIGHT AND Y - Z CENTER OF GRAVITY						
DESCRIPTION	REACTION POINT	WEIGHT	Y STA	Y MOMENT	Z STA	Z MOMENT
Load Cell Location	A	3889.6	53.08	206460	30.74	119566
Load Cell Location	B	3608.0	-53.14	-191729	30.61	110441
Load Cell Location	C	3483.1	0.00	0	-61.28	-213444
GROSS (as weighed)		10980.7	(1.34)	14731	(1.51)	16563
LESS: GSE - Vertical		-2254.4	1.19	- 2683	- 1.87	4216
NET (as weighed)		8726.3	(1.38)	12048	(2.38)	20779
PLUS: Shortage Items		1905.3	7.22	13756	- 7.91	- 15071
Useful Load		2682.6	- 2.96	- 7940	6.52	17491
CORRECTED WEIGHT AND CG (Y - Z)		13314.2	(1.34)	17864	(1.74)	23199

FORM EWT-A-1343-12

Space Division
North American Rockwell

NUMBER	REVISION LETTER	PAGE
MA0701-3019-490		50

TEST DATA SHEET 3
WEIGHT AND BALANCE FORM
VERTICAL WEIGHING



DATE Mar 4-1972
RECORDED BY: C. DALTON
AI4-154 DC DIGITAL
READOUT SERIAL NO. 006

REACTION POINT A

WEIGHING	LOAD CELL SERIAL	LOAD CELL COLOR	ZERO READING	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	32323	RED	100	30,898	-103	30,795	
2			100	30,898	-99	30,799	
3			100	30,898	-100	30,798	
4							
5							30,797.3

REACTION POINT B

WEIGHING	LOAD CELL SERIAL	LOAD CELL COLOR	ZERO READING	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	32324	YELLOW	100	28,662	-104	28,558	
2			100	28656	-98	28,558	
3			100	28661	-103	28,558	
4							
5							28,558.0

REACTION POINT C

WEIGHING	LOAD CELL SERIAL	LOAD CELL COLOR	ZERO READING	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	32325	BLUE	100	27,720	100	27,620	
2			100	27,723	-99	27,624	
3			100	27,723	-101	27,622	
4							
5							27,622.0

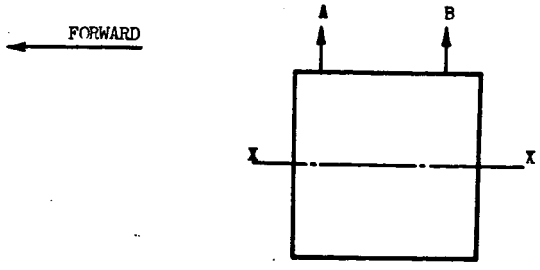
C. E. DALTON NR INSPECTION
Hilmer J. Gilbert NASA INSPECTION
3-4-72

FORM M 181-H-2 REV 11-67

MAR 4 - 1972

WEIGHT AND BALANCE CALCULATION SHEET

SERVICE MODULE - HORIZONTAL



Vehicle No. S/C 114 Calculated By C.A.Moore & P.A.Moy

Location Bldg 290 - Downey Date 4 March 1972

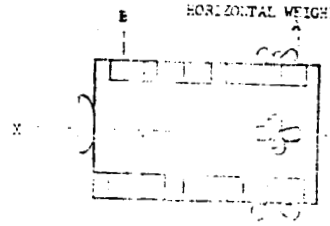
WEIGHT DERIVATION						
REACTION POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
A	S/N 34307	18728.0	4696.2	-	-	4696.2
B	S/N 34306	19208.3	4817.0	-	-	4817.0

WEIGHT AND X CENTER OF GRAVITY				
DESCRIPTION	REACTION POINT	WEIGHT	X STA	X MOMENT
Load Cell Location	A	4696.2	976.3	4584900
Load Cell Location	B	4817.0	858.4	4134913
GROSS (as weighed)		9513.2	(916.60)	8719813
LESS: GSE - Horizontal		- 782.4	895.48	- 700624
NET (as weighed)		8730.8	(918.49)	8019189
PLUS: Shortage Items		1905.3	897.89	1710750
Useful Load		2682.6	927.82	2488970
CORRECTED WEIGHT AND X CG		13318.7	(917.43)	12218909

FORM F'T-A-1343-14

NUMBER	REVISION LETTER	PAGE
MA0701-3019-490		51

TEST DATA SHEET 4
WEIGHT AND BALANCE FORM
HORIZONTAL WEIGHING



DATE May 4, 1972

WEIGHING							
1	34307	YELLOW	100	18833	-100	18729	
2			100	18832	-100	18732	
3			100	18834	-95	18726	
4							
5							18728.0

WEIGHING							
1	34306	RED	100	19305	-100	19205	
2			100	19205	-100	19205	
3			100	19206	-100	19206	
4							
5							

FORM M 131 H 2 REV 11-67

APOLLO SM WEIGHT CHECK LIST

PREPARED BY: P. A. Moy

DATE: 6 March 1972

VEHICLE NO. S/C 114

PAGE NO. 1 OF 4

SECTOR AND ITEM NO.	ITEM		ITEM ✓ IN	ITEM ✓ OUT	WEIGHT (POUNDS)	CENTER OF GRAVITY X_a	Y_a	Z_a
	ITEMS TO BE REMOVED	PART NUMBER						
	GSE - Vertical Weighing				(2254.4)	-	(1.19)	(- 1.87)
	GSE - Horizontal Weighing				(782.4)	(895.48)	-	-
	Support Frame Assy. (Vert. Only)	H14-017			1749.1	-	1.46	- 0.75
	RCS Engine Nozzle Covers (12)				9.6	959.5	26.66	- 3.33
	Gimbal Locking Links - Yaw				51.5	844.0	13.50	- 6.50
	- Pitch				47.5	844.0	-10.00	13.50
	N_2 in Fuel & Oxidizer Tanks				145.7	893.0	0.00	0.00
	SPS Nozzle Cover, Attachment Ring & (3) Moisture Bags				36.5	818.0	- 0.60	0.30
	RCS Tank Covers				21.4	947.9	24.32	- 3.33
	Quad D Shipping Door				64.0	945.0	-72.00	13.00
	Rendezvous Radar Transponder Tool				3.2	997.0	33.00	41.00
	Flex Lines (4) to ECS Compensator (Vert. Only)				16.5	-	72.00	-22.00
	Flex Lines (4) to ECS Compensator (Horiz. Only)				14.4	992.5	-	-
	Scimitar Antenna Covers (2)	9EH-2248			4.2	923.0	0.00	0.00
	Protective Covers (14)	9EH-2161			20.3	1014.0	0.00	0.00
	Far UV Spectrometer Simulator	T-7121199			22.9	856.5	23.70	-52.20
	Infrared Scanning Radiometer Simulator	T-7121198			42.8	855.9	43.90	-56.40
	Plastic & Tape on Aft Heat Shield				8.1	828.0	0.00	0.00
	Miscellaneous Protective Covers, Tape, Etc.				9.4	919.0	0.00	0.00
	Forward Saddle (Horiz. Only)	H34-237			77.2	976.3	-	-
	Aft Saddle (Horiz. Only)	H34-237			144.5	858.4	-	-
	Flexure & Linkage Weight - Point A (Horiz. Only)				28.9	976.3	-	-
	Flexure & Linkage Weight - Point B (Horiz. Only)				28.6	858.4	-	-
	SLA Connector Tool	T-7120688-S			1.7	831.0	23.00	-64.00

SD73-CS-0004

FORM MC-1-1267

APOLLO SM WEIGHT CHECK LIST

PREPARED BY: P. A. Moy

DATE: 6 March 1972

VEHICLE NO. S/C 114

PAGE NO. 2 OF 4

SECTOR AND ITEM NO.	ITEM		ITEM ✓ IN	ITEM ✓ OUT	WEIGHT (POUNDS)	CENTER OF GRAVITY X_a	Y_a	Z_a
	SHORTAGE ITEMS	PART NUMBER			(1905.3)	(897.89)	(7.22)	(- 7.91)
	CM-SM Separation System (less Deflector)	V17-590122			12.1	1005.2	1.4	3.0
	Thermal Paint	V37-000010			19.5	926.0	0.0	0.0
	Quad D Modular Assy	V37-400110			230.0	951.0	- 71.0	17.0
	Aux. Battery Control Box	V37-458080			10.8	846.5	- 20.0	56.0
	Ordnance	F01-100406-102			1.2	995.0	- 54.5	38.2
	CM-SM Separation	F01-100407-201			3.5	1007.4	1.4	3.3
	High Gain Antenna	F01-100447-21			70.3	793.4	- 40.8	52.7
	High Gain Antenna Deploy Mech.	F01-100458			24.0	826.5	- 43.6	53.8
	CM-SM Umbilical Boom	F01-100490			15.2	1000.3	1.7	41.3
	SIM Door Ordnance	F01-100496			12.7	897.2	43.7	- 56.5
	EVA Handhold Instl - SIM Door	F01-300000			17.1	928.2	38.3	- 59.8
	SPS Nozzle Extension	F01-410004			170.5	773.3	- 1.1	- 2.0
	Aux. Battery Instl	F01-440003			139.5	847.0	- 22.6	60.5
	Nuclear Particle Detection System	F01-750013			5.0	993.0	56.0	35.0
	Pan Camera Instl (Incl. MCR 13462)	F01-756001			341.2	910.3	44.0	- 47.0
	Map. Camera/Laser Alt. (Incl. MCR 13405)	F01-756002			280.1	945.5	34.5	- 52.5
	CM-SM Umbilical - SM Portion	V36-321578-102			156.0	1019.0	3.0	77.0
	Rendezvous Radar Transponder	LSC-370-500-3-4			14.8	997.0	33.0	41.0
	Cork Strips	V37-370679 & V37-370680			2.0	839.5	45.0	- 59.5
	Optical Recorder	ME435-0045-0002			107.2	862.2	45.7	- 38.2
	Coherent Synthetic Aperture Radar	ME478-0098-0002			46.3	880.3	26.7	- 61.9
	Hybrid Module	ME481-0061-0002			1.7	847.0	20.0	- 64.0
	Shields, Insulation, Supports, Etc.	F01-300003			7.6	871.7	44.5	- 51.7
	HF Antennas & Jettison Mech.	F01-552600			96.5	820.5	0.0	0.0
	VHF Antenna & Deployment Mech.	F01-552650			19.0	810.8	24.4	- 67.1
	Lunar Sounder Cutter Assy	F01-100423			1.6	817.0	0.0	0.0
	Infrared Scanning Radiometer	F01-756007			36.9	855.9	43.4	- 56.3
	Far Ultraviolet Spectrometer	F01-756008			39.0	859.2	22.5	- 48.0

FORM MC-A-1267

SD73-CS-0004

APOLLO SM WEIGHT CHECK LIST

PREPARED BY: P. A. Moy

DATE: 6 March 1972

VEHICLE NO. S/C 104

PAGE NO. 3 OF 4

SECTOR AND ITEM NO.	ITEM		ITEM ✓ IN	ITEM ✓ OUT	WEIGHT (POUNDS)	CENTER OF GRAVITY X_a	Y_a	Z_a
	SHORTAGE ITEMS (CONTINUED)	PART NUMBER						
	Pan Camera Cover Instl	F01-300001			12.3	908.0	46.0	- 49.0
	Mapping Camera Cover Instl	F01-300002-11			7.0	949.5	37.0	- 54.0
	RCS Plume Barrier IR Thermal Bag	F01-300005			0.3	855.9	42.4	- 56.3
	Lunar Sounder Recorder Thermal Control	F01-300006			0.5	862.2	45.7	- 38.2
	SIM Experiments Electrical Systems	F01-440004			2.2	880.3	26.7	- 61.9
	Lunar Sounder HF Antennas Electrical	F01-440005			1.7	816.6	0.0	0.0

FORM MC-1-1267

SD73-69-0004

APOLLO SM WEIGHT CHECK LIST

PREPARED BY: P. A. Moy

DATE: 6 March 1972

VEHICLE NO. S/C 114

PAGE NO. 4 OF 4

SECTOR AND ITEM NO.	ITEM	ITEM ✓ IN	ITEM ✓ OUT	WEIGHT (POUNDS)	CENTER OF GRAVITY X_a	Y_a	Z_a
	USEFUL LOAD			(2682.6)	(927.82)	(- 2.96)	(6.52)
	RCS - Fuel			440.8	972.2	0.0	0.0
	- Oxidizer			901.6	926.9	0.0	0.0
	- Helium			6.0	983.9	0.0	0.0
	EPS - Hydrogen Sector 1 - Tank 3			29.3	974.6	37.0	- 46.0
	- Hydrogen Sector 4 - Tank 1			29.3	859.4	- 40.7	41.2
	- Hydrogen Sector 4 - Tank 2			29.3	892.9	- 40.7	41.2
	- Hydrogen Sector 1 - Tank 3 Pre-Launch to Launch			- 1.7	974.6	37.0	- 46.0
	- Hydrogen Sector 4 - Tank 1 Pre-Launch to Launch			- 1.7	859.4	- 40.7	41.2
	- Hydrogen Sector 4 - Tank 2 Pre-Launch to Launch			- 1.7	892.9	- 40.7	41.2
	- Oxygen Sector 1 - Tank 3			254.6	938.0	22.5	- 30.0
	- Oxygen Sector 4 - Tank 1			254.6	920.8	- 20.9	26.9
	- Oxygen Sector 4 - Tank 2			254.6	920.8	- 27.4	54.5
	- Oxygen Sector 1 - Tank 3 Pre-Launch to Launch			- 16.5	938.0	22.5	- 30.0
	- Oxygen Sector 4 - Tank 1 Pre-Launch to Launch			- 16.5	920.8	- 20.9	26.9
	- Oxygen Sector 4 - Tank 2 Pre-Launch to Launch			- 16.5	920.8	- 27.4	54.5
	ECS - Oxygen Sector 1 - Tank 3			75.5	938.0	22.5	- 30.0
	- Oxygen Sector 4 - Tank 1			75.5	920.8	- 20.9	26.9
	- Oxygen Sector 4 - Tank 2			75.5	920.8	- 27.4	54.5
	SPS Residuals - Outside Tank						
	- Fuel			78.6	836.9	- 22.2	- 15.2
	- Oxidizer			123.7	835.4	21.5	15.8
	- Helium			93.0	956.0	0.2	0.5
	- Nitrogen			1.3	874.0	0.0	0.0
	Scientific Equipment - Nitrogen for Pan Camera			14.0	908.5	31.0	- 28.5

FORM NC-A-1267

Space Division
North American Rockwell

NASA/MANNED SPACECRAFT CENTER
RESIDENT APOLLO SPACECRAFT PROGRAM OFFICE
NORTH AMERICAN ROCKWELL CORPORATION
12214 LAKEWOOD BOULEVARD
DOWNEY CALIFORNIA 90241

8510MA

REFER TO PC2/69-12-461
Contract NAS 9-150

Mr. D. F. Graham
Manager, CSM Business Operations
Space Division
North American Rockwell Corporation
Downey, California 90241

Dear Mr. Graham:

NR/NASA deviation approval request CSM 0199, S/C 114, has been approved and is returned herewith pursuant to your letter 69MA11012 dated December 12, 1969.

Sincerely yours,

W. H. Gray
Resident Manager
Apollo Spacecraft Program

Enclosure

Enclosure on file to D-107

SD73-CS-0004

Space Division
North American Rockwell

SPACE DIVISION OF NORTH AMERICAN ROCKWELL CORPORATION
12214 LAKEWOOD BOULEVARD • DOWNEY, CALIFORNIA 90241

NR/NASA WAIVER DEVIATION APPROVAL REQUEST

*REQUESTER Name	Location	Dept.	Ext.
G. E. Sakai	AB87	191	3851

CONTROL NUMBER
CSM 0199 GSE
☐ WAIVER ☒ DEVIATION
EFFECTIVITY: SLA #21 (CSM 114)
IDENTIFICATION:
MODEL # V24-3
PART # V24-008002
SERIAL #
REFERENCES: ABPO-PS5-13-12
MAO208-827
NR/NASA Waiver/ Deviation Action No. CSM 0196

SUMMARY:
Deviation Not to Perform Horizontal and Vertical Weight and Balance Determination

*(CHECK ONE) DOES ____ DOES NOT X INVOLVE SAFETY, DURABILITY, RELIABILITY, PERFORMANCE, WEIGHT, OR BASIC OBJECTIVES OR THE CONTRACT. IF "DOES" IS CHECKED, EXPLAIN (TO BE ATTACHED).

SPECIFIED REQUIREMENTS: What specification (paragraph) or dwg. or other document.
Paragraph 3.1.2.18.1 and 4.2.4.18.1, titled "SLA Delivery Weight and Center of Gravity" of CSM Master End Item Specification, SID 64-1345B, Part II Product Configuration and Acceptance Requirements.

DESCRIPTION OF NONCONFORMANCE:

Horizontal and vertical actual weight and balance determination will not be accomplished.

REASON FOR REQUEST (JUSTIFICATION)

A comparison of Actual Weights vs. Calculated Weights of SLA's No's. 14, 15, 16, 17 and 18 have shown an approximate ± 13 pounds excursion. As the SLA Mass Properties are only utilized for launch, trans lunar injection and transposition and docking, calculated data is sufficient.

Deletion of the Actual Weight and Balance Determination will not affect mission performance.

APPROVALS:

APOLLO PROJECT ENGINEERING ____ DATE 12-11-69
APOLLO CSM SAFETY ____ DATE 12-12-69
APOLLO PROGRAM CONTRACTS ____ DATE 12-12-69
NASA ____ DATE 12-15-69

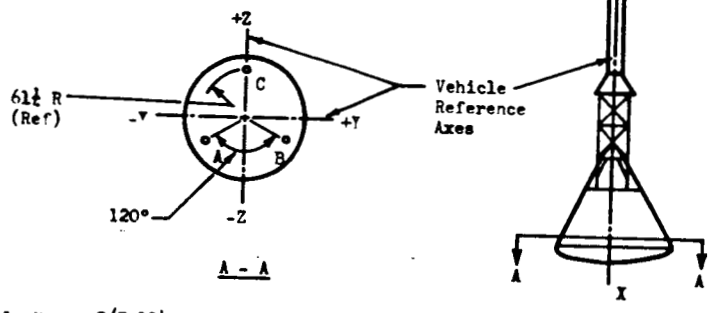
If disapproved, statement shall be attached explaining:

APPROVED ☒ DISAPPROVED ☐

NA 2974-U Rev. 2-68

WEIGHT AND BALANCE CALCULATION SHEET

LAUNCH ESCAPE SYSTEM-COMMAND MODULE COMBINED



A - A

Vehicle No. S/C 114

Location PIB/FF

Calculated By V. Sheeley

Date 16 August 1972

WEIGHT DERIVATION						
REACTION POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
A	S/N 32322	21650	2736.2	-	-	2736.2
B	S/N 32321	22540	2843.7	-	-	2843.7
C	S/N 32320	23689	2989.0	-	-	2989.0

WEIGHT AND Y - Z CENTER OF GRAVITY						
DESCRIPTION	REACTION POINT	WEIGHT	Y STA	Y MOMENT	Z STA	Z MOMENT
Load Cell Location	A	2736.2	-53.02	-145073	-30.66	- 83892
Load Cell Location	B	2843.7	53.08	150944	-30.61	- 87046
Load Cell Location	C	2989.0	0.0	0	61.25	183076
GROSS (as weighed)		8568.9	(0.69)	5871	(1.42)	12138
LESS: 8G14-810007 Frame		-359.0	-0.20	72	4.89	- 1756
A14-007 Alignment Set		- 49.0	0.0	0	0.0	0
NET (as weighed)		8160.9	(0.73)	5943	(1.27)	10382
PLUS: LES Shortages		942.4	(-0.7)	- 660	(-8.1)	- 7633
SUB TOTAL: LES		9103.3	(0.58)	5283	(0.30)	2749
PLUS: CM S/C 114 - LAUNCH		12876.5	-0.2	- 2575	5.6	72108
CORRECTED WEIGHT AND CG (Y - Z)		21979.8	(0.12)	2708	(3.41)	74857

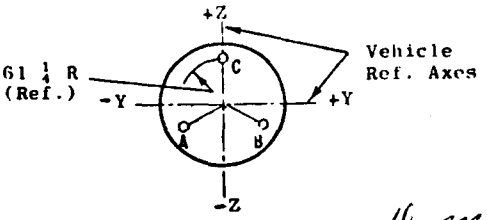
FORM F-F-A-1343-1C

Space Division
North American Rockwell

TEST DATA SHEET NO. 16

WEIGHT AND BALANCE FORM

LAUNCH ESCAPE SYSTEM - SECOND VERTICAL WEIGHING



VEHICLE NO. LES S/C 114

LOCATION PIB

RECORDED BY W. Montgomery

A14-154 DC DIGITAL READOUT SERIAL NO. 001

DATE 8/16/72

REACTION POINT A

WEIGHING	LOAD CELL SERIAL	LOAD CELL TARE	NO LOAD READING	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	32322	F	200	21821	200	~~21621~~ VS	
2	32322	F	200	21844	196	21648	
3	32322	F	200	21849	204	21645	21650 *
4	32322	F	200	21852	199	21653	
5	32322	F	200	21854	200	21654	

REACTION POINT B

WEIGHING	LOAD CELL SERIAL	LOAD CELL TARE	NO LOAD READING	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	32321	F	200	22761	200	~~22561~~ VS	
2	32321	F	200	22735	198	22547	
3	32321	F	200	22743	203	22542	22538.5 *
4	32321	F	200	22737	200	22537	
5	32321	F	200	22732	200	22532	

REACTION POINT C

WEIGHING	LOAD CELL SERIAL	LOAD CELL TARE	NO LOAD READING	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	32320	F	200	23882	200	~~23682~~ VS	
2	32320	F	200	23886	191	23695	
3	32320	F	200	23890	204	23686	23688.75 *
4	32320	F	200	23886	199	23687	
5	32320	F	200	23887	200	23687	

ILLUS # 385A

* ONLY LAST FOUR WEIGHINGS

VS. INCLUDED IN AVERAGE

SPACECRAFT 114

WEIGHT AND BALANCE CALCULATION SHEET

LAUNCH ESCAPE SYSTEM - COMMAND MODULE COMBINED

CORRECTION TO NET (AS WEIGHED) CONDITION

ITEM	WEIGHT	Y	Z
SHORTAGES - LES			
Boost Protective Cover	911.9	-0.7	-8.4
"Q" Ball	25.0	0.0	0.0
Frangible Nut & Washer (4 ea.)	2.9	0.0	0.0
Ordnance F01-100406	0.7	0.0	2.6
Ordnance F01-100403	0.5	0.0	0.0
Canard Ordnance F01-590230	1.4	1.8	0.8
TOTAL SHORTAGES - LES	(942.4)	(-0.7)	(-8.1)
TOTAL SHORTAGES - CM (LAUNCH)	(12876.5)	(-0.2)	(5.6)

SPACECRAFT 114

SPACECRAFT WEIGHT DERIVATION

ITEM	SCN NO. 1131A WEIGHT (LB.)	DELTA WEIGHT (LB.)	SPEC. WEIGHT (LB.)
LAUNCH ESCAPE SYSTEM	9160.0	0.0	9160.0
COMMAND MODULE	12734.0	+275.0	13009.0
SERVICE MODULE	13161.0	+399.6	13560.6
SPACECRAFT LM ADAPTER	4110.0	+1.0	4111.0

The baseline for the Apollo Lunar Exploration Missions (ALEM) is the weights of SID64-1345D, as amended by the NASA-approved Specification Change Notice No. 1131A. The delta weight column above is the North American Rockwell approved SCN's, and together with SCN No. 1131A form the Spacecraft 114 specification weights for this report.

SPACECRAFT 114

SUMMARY WEIGHT STATEMENT

MODULE WEIGHT COMPARISON
SPECIFICATION VERSUS ACTUAL

ITEM	SPEC. WEIGHT (LB.)	DELTA WEIGHT (LB.)	ACTUAL WEIGHT (LB.)
LAUNCH ESCAPE SYSTEM	9160.0	-55.6	9104.4
COMMAND MODULE	13009.0	-55.0	12954.0
SERVICE MODULE	13560.6	-229.1	13331.5
SPACECRAFT LM ADAPTER	4111.0	-52.1	4058.9
LUNAR MODULE LM-12 (7)	36276.8	0.0	36276.8
SPS PROPELLANT - TANKED (8)	40539.8	0.0	40539.8

SPACECRAFT 114

SUMMARY WEIGHT STATEMENT

LAUNCH ESCAPE SYSTEM
WEIGHT COMPARISON
SPECIFICATION VERSUS ACTUAL

ITEM	SPEC. WEIGHT (LB.)	DELTA WEIGHT (LB.)	ACTUAL WEIGHT (LB.)
Structure	2447.4	+20.4	2467.8
Electrical Power	67.0	+7.9	74.9
Main Propulsion	2061.2	+1.0	2062.2
Ballast	1155.1	-90.6	1064.5
Government Furnished Equipment	26.0	0.0	26.0
Main Propulsion - Expendables	3184.0	+8.0	3192.0
Pitch Motor Propellant - Expendables	8.9	0.0	8.9
Jettison Motor Propellant - Expendables	210.4	-2.3	208.1
GROSS WEIGHT	9160.0	-55.6	9104.4

SPACECRAFT 114

SUMMARY WEIGHT STATEMENT

COMMAND MODULE
WEIGHT COMPARISON
SPECIFICATION VERSUS ACTUAL

ITEM	SPEC. WEIGHT (LB.)	DELTA WEIGHT (LB.)	ACTUAL WEIGHT (LB.)
Structure	6381.0	-82.0	6299.0
Stabilization and Control	201.8	0.0	201.8
Crew Systems	527.8	-46.4	481.4
Environmental Control	559.3	+14.0	573.3
Earth Landing	679.5	0.0	679.5
Instrumentation	37.4	-0.2	37.2
Electrical Power	1416.2	+3.6	1419.8
Reaction Control	294.8	0.0	294.8
Communications	300.0	+7.4	307.4
Controls and Displays	428.7	+21.8	450.5
Government Furnished Equipment	1491.0	+100.2	1591.2
Reaction Control - Residuals	37.4	0.0	37.4
Environmental Control - Residuals	146.7	-8.0	138.7
Reaction Control - Expendables	196.0	0.0	196.0
Environmental Control - Expendables	55.4	0.0	55.4
Ballast - CG Uncertainty	256.0	-256.0	0.0
Ballast - CG Control	0.0	+190.6	190.6
GROSS WEIGHT	13009.0	-55.0	12954.0

SPACECRAFT 114

SUMMARY WEIGHT STATEMENT

SERVICE MODULE
WEIGHT COMPARISON
SPECIFICATION VERSUS ACTUAL

ITEM	SPEC. WEIGHT (LB.)	DELTA WEIGHT (LB.)	ACTUAL WEIGHT (LB.)
Structure	5131.9	-29.0	5102.9
Environmental Control	221.0	-0.9	220.1
Instrumentation	117.5	+178.1	295.6
Electrical Power	2220.5	-197.4	2023.1
Main Propulsion	1256.1	0.0	1256.1
Reaction Control	432.9	0.0	432.9
Communications	134.3	-0.7	133.6
Scientific Equipment	529.0	-184.7	344.3
Government Furnished Equipment	844.9	+5.5	850.4
Reaction Control - Residuals	32.4	0.0	32.4
Electrical Power - Residuals	17.4	0.0	17.4
Environmental Control - Residuals	6.0	0.0	6.0
Main Propulsion - Residuals	296.6	0.0	296.6
Reaction Control - Expendables	1315.5	0.0	1315.5
Electrical Power - Expendables	784.1	0.0	784.1
Environmental Control - Expendables	220.5	0.0	220.5
GROSS WEIGHT - LESS TANKED SPS RESIDUALS	13560.6	-229.1	13331.5

SPACECRAFT 114

SUMMARY WEIGHT STATEMENT

SPACECRAFT LM ADAPTER (SLA)
WEIGHT COMPARISON
SPECIFICATION VERSUS ACTUAL

ITEM	SPEC. WEIGHT (LB.)	DELTA WEIGHT (LB.)	ACTUAL WEIGHT (LB.)
Structure	4050.7	-53.5	3997.2
Electrical Power System	59.9	+1.4	61.3
Government Furnished Equipment	0.4	0.0	0.4
GROSS WEIGHT	4111.0	-52.1	4058.9

SPACECRAFT 114

EXPENDABLE LOADING DATA

	WEIGHT (LB.)		
LAUNCH ESCAPE SYSTEM			
Main Motor Propellant			3192.0
Pitch Motor Propellant			8.9
Jettison Motor Propellant			208.1
TOTAL - LAUNCH ESCAPE SYSTEM EXPENDABLES			3409.0
COMMAND MODULE			
Environmental Control			64.1
Potable Water Tank (4)		37.9	
Trapped	1.0		
Expendable	36.9		
Waste Water Tank (5)		19.5	
Trapped	1.0		
Expendable	18.5		
Oxygen		6.7	
Reaction Control			233.4
Fuel		76.6	
Trapped	13.3		
Deliverable	63.3		
Oxidizer		155.8	
Trapped	23.1		
Deliverable	132.7		
Helium		1.0	
Food			113.9
CO_2 Absorbers (26 required) (6)			130.0
TOTAL - COMMAND MODULE EXPENDABLES			541.4

SPACECRAFT 114

EXPENDABLE LOADING DATA

	WEIGHT (LB.)			
SERVICE MODULE				
Environmental Control				226.5
Oxygen			226.5	
Residual		6.0		
Usable		220.5		
Electrical Power				801.5
Oxygen			722.5	
Residual		13.8		
Usable		708.7		
Hydrogen			79.0	
Residual		3.6		
Usable		75.4		
Reaction Control				1347.9
Fuel			439.3	
Trapped		8.4		
Deliverable		430.9		
Oxidizer			902.6	
Trapped		18.0		
Deliverable		884.6		
Helium			6.0	
Service Propulsion				40836.4
Fuel			15668.7	
Residual - System		78.6		
Transfer Lines	19.5			
Engine Lines	29.5			
Engine	29.6			
Propellant - Tanked		15590.1		
Oxidizer			25073.4	
Residual - System		123.7		
Transfer Lines	31.6			
Engine Lines	44.7			
Engine	47.4			
Propellant - Tanked		24949.7		
Helium			93.0	
Bottles		87.6		
Fuel Tanks		2.2		
Oxidizer Tanks		3.2		
Nitrogen - SPS Engine			1.3	
Scientific Equipment				14.0
Nitrogen			14.0	
TOTAL - SERVICE MODULE EXPENDABLES				43226.3

SPACECRAFT 114

GOVERNMENT FURNISHED EQUIPMENT

ITEM	WEIGHT (LB.)		
LAUNCH ESCAPE SYSTEM			26.0
"Q" Ball		25.0	
Pyrotechnic Initiators		1.0	
COMMAND MODULE			1591.2
Guidance and Navigation		392.9	
Inertial Measurement Unit	45.2		
Apollo Guidance Computer	70.7		
Navigation Base and Mount	17.4		
Power Servo Assy.	49.2		
Caution Detection Unit Assy.	36.5		
PIPA Electronic Assy.	8.5		
Signal Conditioner Assy.	5.8		
DSKY (2)	36.0		
G&N Indicator Control Panel	14.4		
Bellows Assy.	10.7		
Optical Subsystem	60.7		
Loose Stowed Items	12.4		
G&N Interconnect Harness Group	25.4		
Ordeal		6.9	
Pyrotechnic Initiators		3.3	
Crew		524.0	
Crew Equipment		664.1	
EV Pressure Garment Assy. - LMP	58.4		
EV Pressure Garment Assy. - CDR	57.6		
IV Pressure Garment Assy. - CMP	51.5		
Constant Wear Garment (13)	10.4		
CWG Harness (4)	1.6		
Liquid Cooled Garment (2)	8.8		
Food Package (3)	113.9		
Camera Equipment	63.7		
Medical Accessory Kit	3.4		
Flight Data File	29.1		
Helment Bag (3)	2.7		
Coveralls - In-Flight (4)	18.0		
Towels (12)	9.6		
Tissue Dispensers (8)	11.2		
Voice Recorder, Tape, Batteries & Bag	4.6		
TV Equipment	18.5		
Panel Indicator	0.2		
Personal Hygiene Kit	3.0		
Auxiliary Drug Kit	1.7		

SPACECRAFT 114

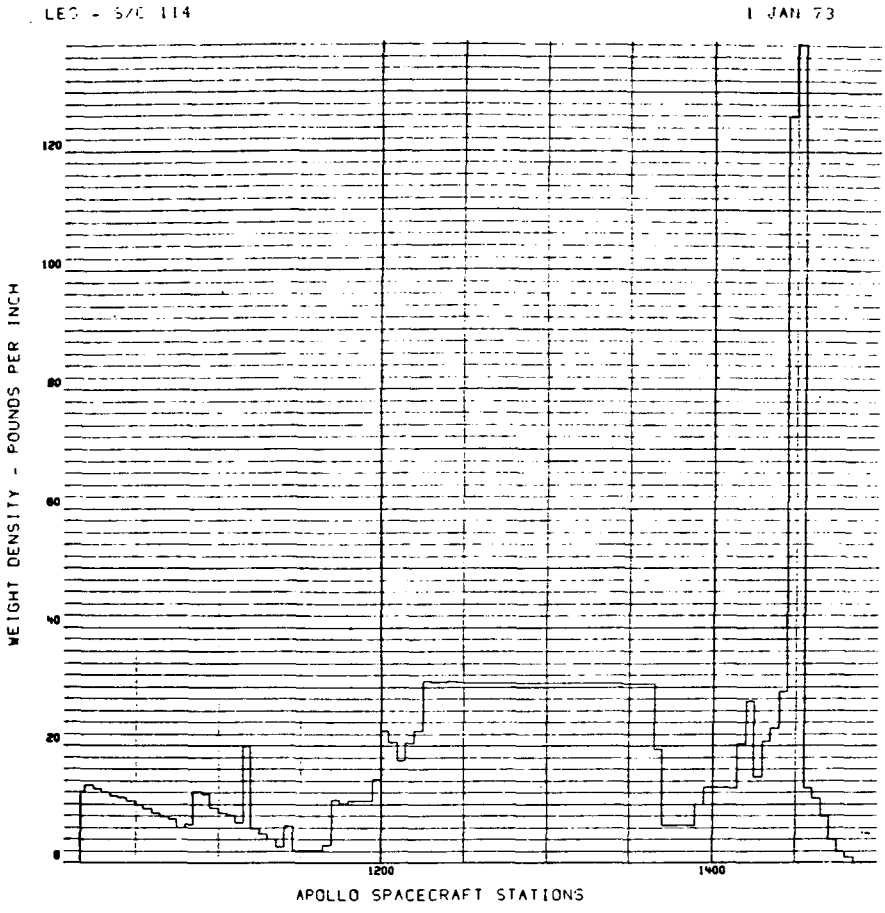
GOVERNMENT FURNISHED EQUIPMENT

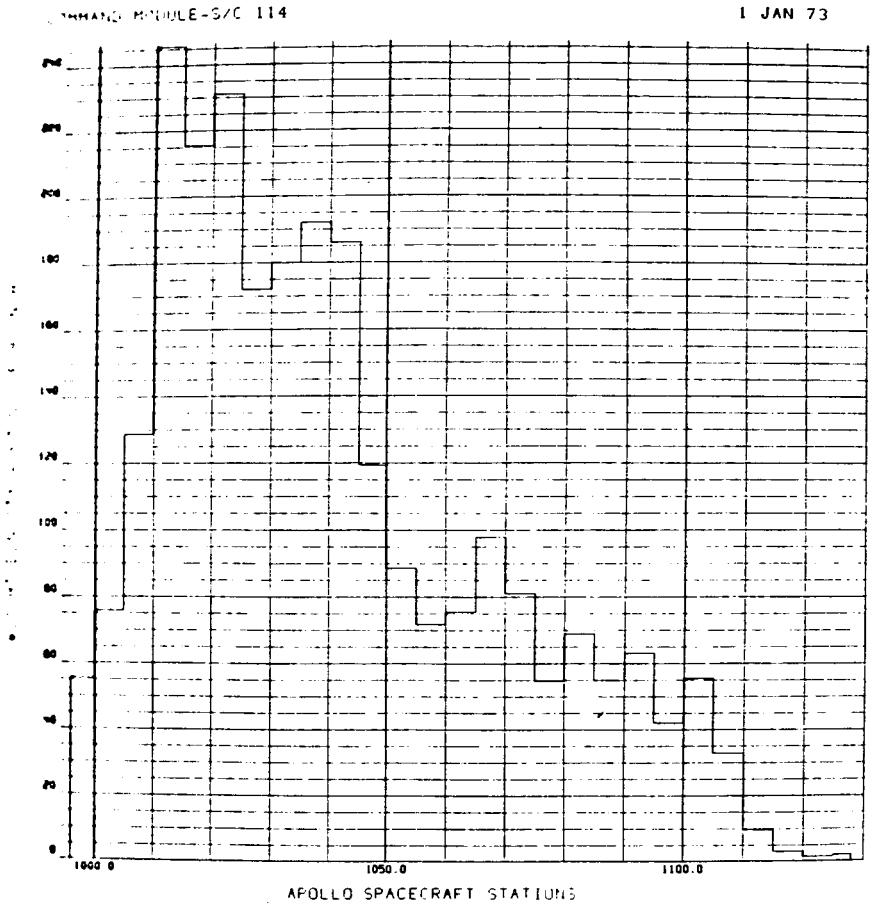
ITEM	WEIGHT (LB.)
COMMAND MODULE (Continued)	
Crew Equipment (Continued)	
Batteries (11) for D.C. Converter	2.2
HZE Dosimeter	0.5
Survival Kit (2)	50.0
EMU Maintenance Kit	0.6
Binoculars	1.2
Tape	0.7
Oxygen Mask & Hose (3)	8.8
Dosimeter-Personal (3) & Passive (11)	1.2
Inflight Exerciser	1.3
Headset - Lightweight (3)	1.5
Penlight (8)	2.4
Water Dispenser	0.7
Urine Collection Bag, Clamp & Misc.	7.0
Sunglasses & Pouch (3)	0.3
Dual Life Vest (3)	7.2
Chronograph (3)	0.3
Scissors (3 pairs)	1.5
Bioinstrumentation & Belt (3)	4.2
Pen - Data (3) & Pen-Marker (3)	0.3
Pencil (3)	0.3
Data Card Kit	2.9
Accessory Bag (3)	0.9
Radiation Meter & Instl	2.1
Fecal Containment (3)	1.2
Roll-on Cuffs Bag (3)	0.3
Helmet Shield	1.0
Belt Dosimeter	3.3
Sun Filter (2)	0.6
Timer	0.4
Headrest (3)	3.3
Heel Restraint (6)	3.3
Bag - Motion Sickness (3)	0.3
Vacuum Brush	0.3
Monocular	0.7
Jettison Bag (3)	2.7
Hydrogen Separator	0.7
Misc. Screwdriver, Pliers, Bag, etc.	1.0
Misc. H_2O Plugs (2), Eyeshields (3), OPS Straps (4), PGA Adapter & Valve	1.7

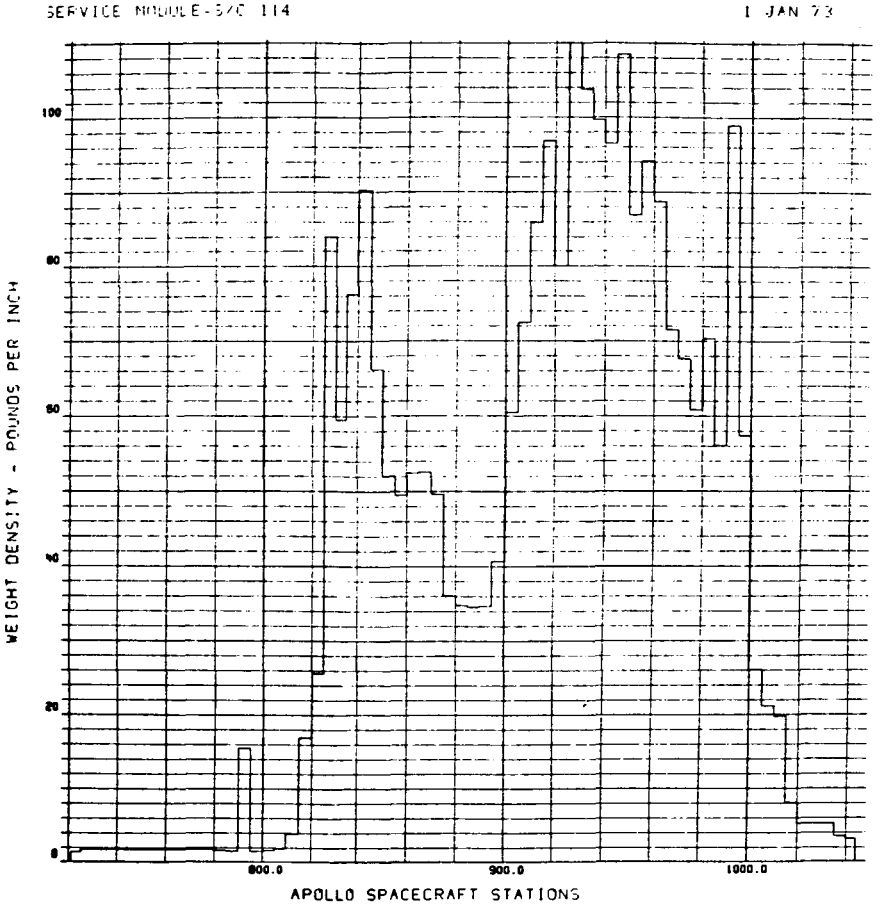
SPACECRAFT 114

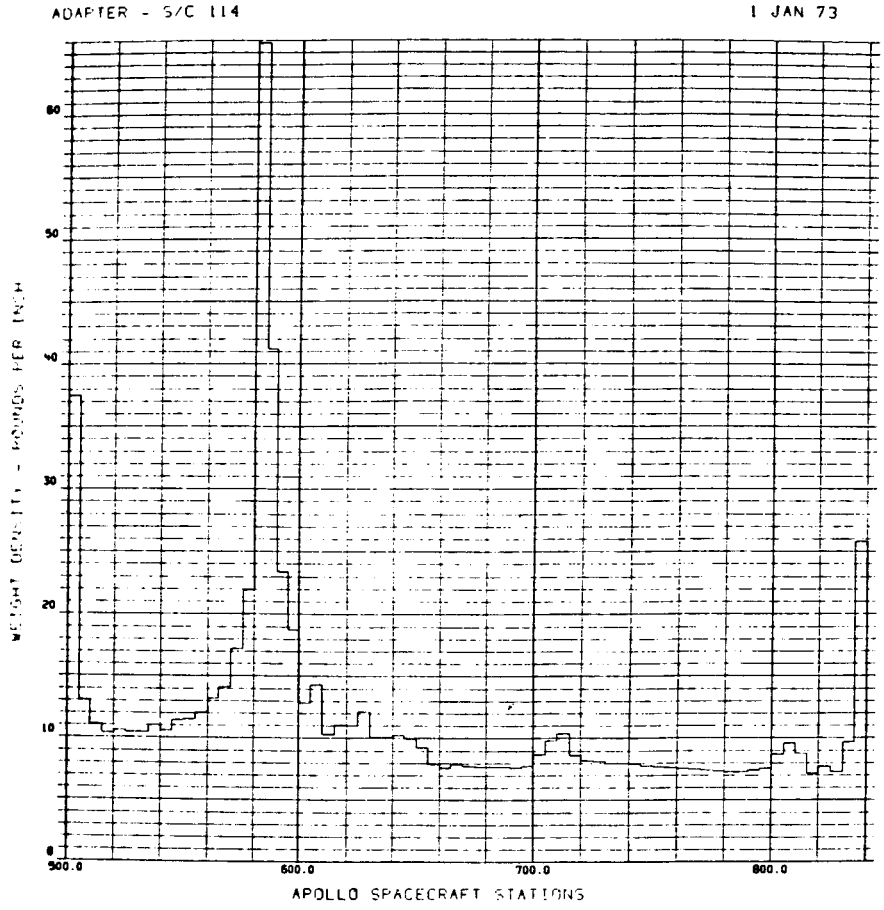
GOVERNMENT FURNISHED EQUIPMENT

ITEM	WEIGHT (LB.)		
COMMAND MODULE (Continued)			
Crew Equipment (Continued)			
Sextant Adapter	1.3		
EV Gloves	2.8		
Wrist Tether	0.3		
Waist Tether	0.6		
Gamma Ray Experiment (S-160)	3.5		
Biomed Urine Sample System (Buss)	17.5		
Biostack (M-211)	5.3		
Biocore (M-212)	13.5		
Hypotensive Protective Press. Garment	3.2		
Heat Flow & Convection Demo	8.0		
Official Flight Kit (10 bags)	12.0		
Astronaut Preference Kit	2.0		
Alfmed	7.3		
SERVICE MODULE			850.4
Rendezvous Radar		17.5	
Waveguide	1.5		
Antenna Kit	1.2		
Transponder	14.8		
Pan Camera Installation		341.2	
Mapping Camera/Laser Altimeter		280.1	
Infrared Scanning Radiometer		36.9	
Far Ultraviolet Spectrometer		39.0	
ISR Thermal Bag - RCS Barrier		0.3	
Pyrotechnic Initiators		0.4	
Auxiliary Battery		135.0	
SPACECRAFT LM ADAPTER			0.4
Pyrotechnic Initiators		0.4	
TOTAL - GOVERNMENT FURNISHED EQUIPMENT			2468.0

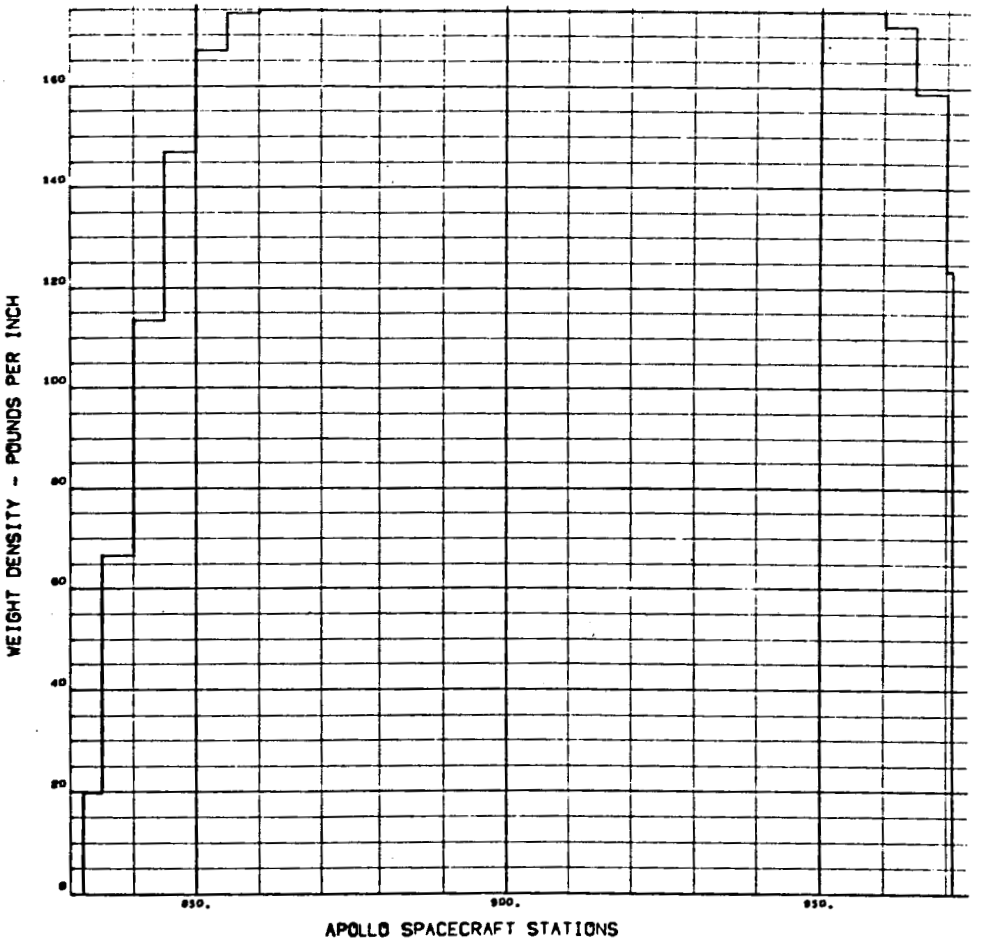

LEC - S/C 114
1 JAN 73
WEIGHT DENSITY - POUNDS PER INCH
120
100
80
60
40
20
0
1200
1400
APOLLO SPACECRAFT STATIONS


COMMAND MODULE-S/C 114
1 JAN 73
1000.0
1050.0
1100.0
APOLLO SPACECRAFT STATIONS

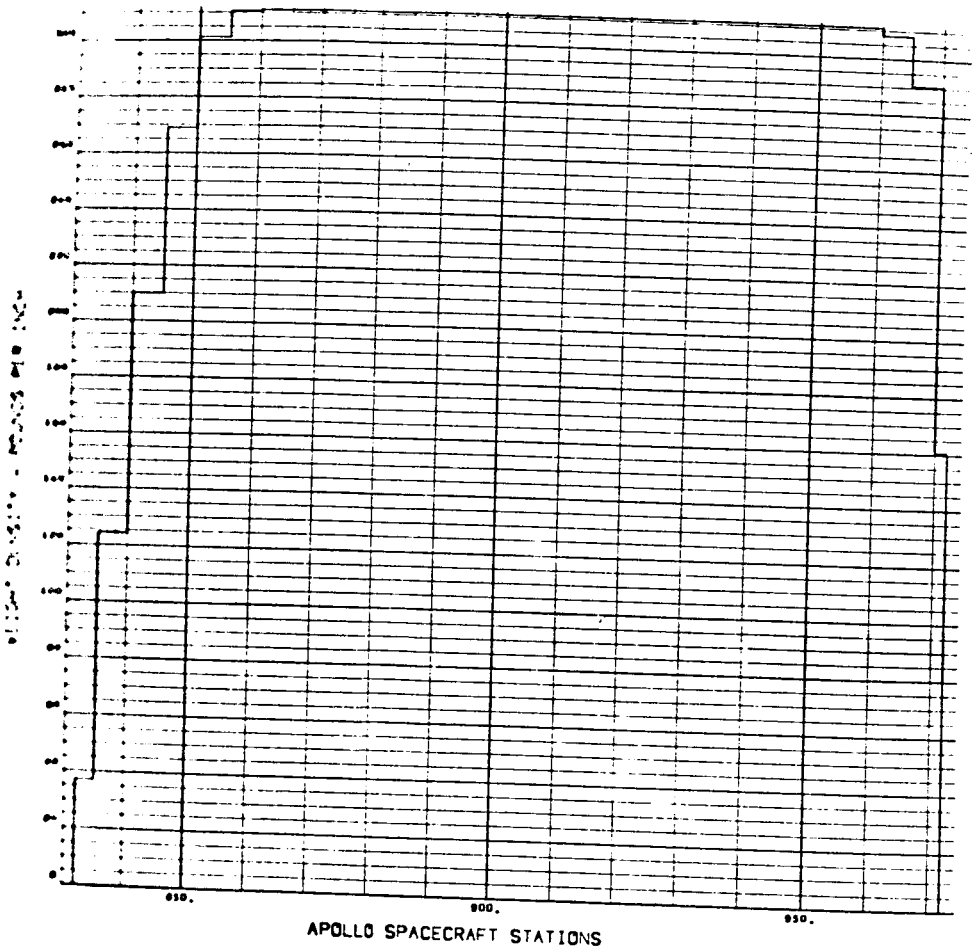

SERVICE MODULE-S/C 114
1 JAN 73
WEIGHT DENSITY - POUNDS PER INCH
100
80
60
40
20
0
800.0
900.0
1000.0
APOLLO SPACECRAFT STATIONS


ADAPTER - S/C 114
1 JAN 73
60
50
40
30
20
10
0
500.0
600.0
700.0
800.0
APOLLO SPACECRAFT STATIONS

SPACECRAFT 114 SPS SUMP TANK PROPELLANT 22669.8 LB. JAN 73



SPACECRAFT 114 SPS TANKED PROPELLANT 40539.8 LB. JAN 73



APOLLO SPACECRAFT STATIONS

SPACECRAFT 114

CM AND SM PRE-LAUNCH TO LAUNCH CONFIGURATION
MASS PROPERTY SUMMARY

ITEM	WEIGHT (LB.)	CENTERS OF GRAVITY (1) (INCHES)			MOMENTS OF INERTIA (2) (SLUG-FT^2)			PRODUCTS OF INERTIA (2) (SLUG-FT^2)		
		X_a	Y	Z	I_{xx}	I_{yy}	I_{zz}	I_{xy}	I_{xy}	I_{yz}
Command Module - Pre-Launch (9)	12935.5	1040.93	-0.07	5.52	5889	5411	4901	42.2	-403.0	15.0
PLUS: H_2O Generated - Waste Tank	18.5	1022.60	-19.70	62.50	0	0	0	0.0	0.0	0.0
TOTAL - COMMAND MODULE AT LAUNCH	12954.0	1040.90	-0.10	5.60	5903	5425	4904	43.6	-407.2	10.5
Service Module - Pre-Launch	13379.3	917.51	1.33	1.80	9583	14438	13190	-153.7	412.7	-1589.8
LESS: H_2 Sec. 1 - Tank 3	-1.5	974.60	37.00	-46.00	0	0	0	0.0	0.0	0.0
H_2 Sec. 4 - Tank 1	-2.6	859.40	-40.70	41.20	0	0	0	0.0	0.0	0.0
H_2 Sec. 4 - Tank 2	-2.4	892.90	-40.70	41.20	0	0	0	0.0	0.0	0.0
O_2 Sec. 1 - Tank 3	-4.4	938.00	22.50	-30.00	0	0	0	0.0	0.0	0.0
O_2 Sec. 4 - Tank 1	-20.6	920.80	-20.90	26.90	0	0	0	0.0	0.0	0.0
O_2 Sec. 4 - Tank 2	-16.3	920.80	-27.40	54.50	0	0	0	0.0	0.0	0.0
TOTAL - SERVICE MODULE AT LAUNCH	13331.5	917.50	1.40	1.70	9559	14418	13178	-156.0	415.0	-1579.0

Space Division
North American Rockwell

SPACECRAFT 114

LAUNCH CONFIGURATION
MASS PROPERTY SUMMARY

ITEM	WEIGHT (LB.)	CENTERS OF GRAVITY (1) (INCHES)			MOMENTS OF INERTIA (2) (SLUG-FT^2)			PRODUCTS OF INERTIA (2) (SLUG-FT^2)		
		X_a	Y	Z	I_{xx}	I_{yy}	I_{zz}	I_{xy}	I_{xz}	I_{yz}
Command Module-Launch	12954.0	1040.90	-0.10	5.60	5903	5425	4904	43.6	-407.2	10.5
Service Module-Launch	13331.5	917.50	1.40	1.70	9559	14418	13178	-156.0	415.0	-1579.0
SLA Attachment Ring	98.0	835.70	2.00	-6.60	120	65	56	-0.4	1.6	-2.5
TOTAL	26383.5	977.78	0.67	3.58	15609	41954	40164	-378.9	721.0	-1577.1
SPS Tanked Propellant (3)	40539.8	905.30	7.70	5.70	20476	22627	25630	9.4	-0.1	3900.9
TOTAL	66923.3	933.88	4.93	4.87	36271	82721	84089	-2128.4	191.8	2375.2
SLA Less Attach. Ring	3960.9	638.85	0.57	-0.14	9988	12692	12670	-85.2	75.9	37.7
Lunar Module LM-12 (7)	36276.8	583.70	0.40	-1.00	25890	27352	26201	63.0	558.0	163.0
TOTAL - INJECTED	107161.0	804.43	3.23	2.69	72442	769924	770048	6290.6	11672.9	2717.4
Launch Escape System	9104.4	1298.70	0.60	0.30	850	28399	28374	137.8	727.7	2.3
TOTAL - LAUNCH	116265.4	843.13	3.03	2.51	73315	1240828	1240929	4071.1	10256.6	2731.1

Space Division
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SPACECRAFT 114

COMMAND MODULE - LAUNCH TO CM-SM SEPARATION
MASS PROPERTY SUMMARY

ITEM	WEIGHT (LB.)	CENTERS OF GRAVITY (1) (INCHES) X_a	Y	Z	MOMENTS OF INERTIA(2) (SLUG-FT^2) I_{xx}	I_{yy}	I_{zz}	PRODUCTS OF INERTIA(2) (SLUG-FT^2) I_{xy}	I_{xz}	I_{yz}
COMMAND MODULE - LAUNCH	12954.0	1040.90	-0.10	5.60	5903	5425	4904	43.6	-407.2	10.5
LESS: Food Consumed/Transferred	-95.4	1033.38	-12.84	18.20	-24	-12	-27	11.1	-3.4	3.5
Docking Mechanism Transferred	-199.3	1110.30	0.00	0.00	-5	-4	-4	0.0	0.0	0.0
Heat Flow/Conv. & Bag	-8.6	1011.00	22.00	8.00	0	0	0	0.0	0.0	0.0
CWG, Fecal Cont., Jet. Bag, Tools & Misc.	-13.4	1014.83	1.41	0.72	-2	-1	-2	0.0	0.1	0.1
12 CO_2 Cart./Cont.(Wet)	-115.4	1026.51	1.88	33.26	-5	-4	-4	-0.2	-1.9	-0.3
PLUS: CO_2 Absorbed (26 Cart.)	50.0	1020.60	-4.64	29.28	3	2	3	0.0	0.5	0.3
DSEA, Maps, EMU Kit & Bag	11.1	1012.35	-17.05	3.55	1	1	1	0.0	0.0	-0.4
EV Gloves, Helmet Bag & Cover	9.2	1015.00	0.00	-3.50	0	0	0	0.0	0.0	0.0
Valve, Tether & Recorder	4.1	1011.00	22.00	8.00	0	0	0	0.0	0.0	0.0
Jettison Bags	27.2	1011.00	22.00	8.00	0	0	0	0.0	0.0	0.0
OPS & LEVA	45.9	1013.35	22.78	0.16	2	2	0	0.1	-0.5	-0.2
Pan Camera Mag A2	72.0	1011.00	-22.00	8.00	1	1	1	0.0	0.0	0.0
Mapping Camera Mag B1	22.3	1050.00	-27.00	39.00	0	0	0	0.0	0.0	0.0
Lunar Sounder Mag A7	9.4	1011.00	22.00	8.00	0	0	0	0.0	0.0	0.0
Biomed Urine Samples L3	11.8	1048.00	-47.00	12.00	0	0	0	0.0	0.0	0.0
Sample Return - On A1	71.0	1017.00	-21.00	-22.00	1	0	0	0.0	0.0	0.0
Sample Return - On A2	55.5	1019.00	-22.00	8.00	1	0	0	0.0	0.0	0.0
Sample Return - Front A3 - A6	13.0	1017.00	1.00	23.00	0	0	0	0.0	0.0	0.0
Sample Return - On A7	45.0	1019.00	22.00	8.00	0	0	0	0.0	0.0	0.0
Sample Return - PGA & A9	32.0	1014.00	0.00	8.00	0	0	0	0.0	0.0	0.0
Sample Return - In A9	35.0	1013.00	0.00	16.00	0	0	0	0.0	0.0	0.0
Sample Return - In B5	32.0	1031.00	-8.00	39.00	0	0	0	0.0	0.0	0.0
Sample Return - In B6	41.5	1031.00	13.00	39.00	0	0	0	0.0	0.0	0.0
Fecal Waste	5.7	1039.00	47.00	12.00	0	0	0	0.0	0.0	0.0
Potable Water Generated	3.1	1022.60	-63.50	16.40	0	0	0	0.0	0.0	0.0
Waste Water Generated	41.5	1022.60	-19.70	62.50	0	0	0	0.0	0.0	0.0
Unsuited Entry - Relocate	-186.0	1039.86	-1.86	-15.50	-10	-10	-6	-0.7	-1.1	-0.6
Unsuited Entry - Relocate	186.0	1018.38	0.91	-4.53	2	4	4	0.1	-0.6	-0.1
Misc. Items Relocated - Launch	-98.3	1017.67	-0.52	-4.22	-12	-7	-11	-2.3	-0.4	1.2
Misc. Items Relocated - Entry	98.3	1022.11	-4.02	-0.99	18	9	17	-5.2	-0.1	-3.0
TOTAL - CM AT SM SEPARATION *	13160.2	1038.78	-0.28	5.97	5960	5303	4790	55.6	-390.7	4.7

* L/D = .294

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SPACECRAFT 114

COMMAND MODULE - CM-SM SEPARATION TO IMPACT
MASS PROPERTY SUMMARY

ITEM	WEIGHT (LB.)	CENTERS OF GRAVITY (1) (INCHES)			MOMENTS OF INERTIA(2) (SLUG-FT^2)			PRODUCTS OF INERTIA(2) (SLUG-FT^2)		
		X_a	Y	Z	I_{xx}	I_{yy}	I_{zz}	I_{xy}	I_{xz}	I_{yz}
COMMAND MODULE AT SERVICE MODULE SEPARATION	13160.2	1038.78	-0.28	5.97	5960	5303	4790	55.6	-390.7	4.7
LESS: RCS Propellant/Pre-Entry	-11.6	1022.60	-5.00	57.20	-4	0	-4	0.0	0.0	0.0
TOTAL - CM AT ENTRY	13148.6	1038.79	-0.28	5.93	5949	5295	4786	55.4	-388.6	5.4
LESS: RCS Propellant/Entry	-30.7	1022.60	-5.00	57.20	-4	0	-4	0.0	0.0	0.0
Ablator Burnoff	-150.0	1013.10	0.00	7.40	-103	-81	-78	0.0	0.0	0.0
Entry Coolant Water	-2.0	1022.60	-19.70	62.50	0	0	0	0.0	0.0	0.0
Forward Heatshield	-310.0	1094.30	-0.50	0.80	-64	-26	-23	0.0	0.0	0.0
TOTAL - CM AT RECOVERY THRESHOLD	12655.9	1037.78	-0.26	5.90	5758	4934	4449	55.8	-362.5	7.3
LESS: Drogue Chutes & Disconnects	-80.8	1089.00	0.00	-23.90	-1	-1	0	0.0	0.0	0.0
Pilot Chutes/Main Risers	-44.5	1089.90	5.90	-5.80	-2	-2	-1	0.0	0.0	0.0
Main Chutes	-401.4	1089.10	-0.40	8.50	-62	-22	-44	0.0	0.0	0.0
TOTAL - CM AT IMPACT	12129.2	1035.55	-0.28	6.06	5675	4580	4090	53.0	-340.7	8.2

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SPACECRAFT 114

LAUNCH ESCAPE VEHICLE ABORT AND COMMAND MODULE IMPACT (REFERENCE DATA)
MASS PROPERTY SUMMARY

ITEM	WEIGHT (LB.)	CENTERS OF GRAVITY (1) (INCHES)			MOMENTS OF INERTIA (2) (SLUG-FT2)			PRODUCTS OF INERTIA (2) (SLUG-FT2)		
		X_a	Y	Z	I_{xx}	I_{yy}	I_{zz}	I_{xy}	I_{xz}	I_{yz}
Command Module-Launch	12954.0	1040.90	-0.10	5.60	5903	5425	4904	43.6	-407.2	10.5
Launch Escape System	9104.4	1298.70	0.60	0.30	850	28399	28374	137.8	727.7	2.3
TOTAL LAUNCH ESCAPE VEHICLE	22058.4	1147.30	0.19	3.41	6786	110555	109977	387.2	-1261.8	3.3
LESS: LES Main & Pitch Propellant	-3200.9	1295.20	0.42	1.04	-73	-1293	-1294	-6.7	-12.8	-0.1
TOTAL - LEV AT LES BURNOUT	18857.5	1122.20	0.15	3.82	6708	91581	91007	353.4	-990.7	3.6
LESS: LES Tower, etc.	-5903.5	1300.60	0.70	-0.10	-776	-27092	-27067	-130.4	-717.7	-2.3
Docking Mechanism	-199.3	1110.30	0.00	0.00	-5	-4	-4	0.0	0.0	0.0
Forward Heatshield	-310.0	1094.30	-0.50	0.80	-64	-26	-23	0.0	0.0	0.0
Drogue Chutes & Disconnects	-80.8	1089.00	0.00	-23.90	-1	-1	0	0.0	0.0	0.0
TOTAL - CM PRIOR TO MAIN CHUTE DEPLOYMENT	12363.9	1038.13	-0.09	6.00	5815	4918	4418	42.2	-351.1	5.2
LESS: Pilot Chutes & Main Risers	-44.5	1089.90	5.90	-5.80	-2	-2	-1	0.0	0.0	0.0
Main Chutes	-401.4	1089.10	-0.40	8.50	-62	-22	-44	0.0	0.0	0.0
TOTAL - CM AT ABORT IMPACT	11918.0	1036.22	-0.10	5.96	5748	4632	4113	40.5	-356.5	6.0

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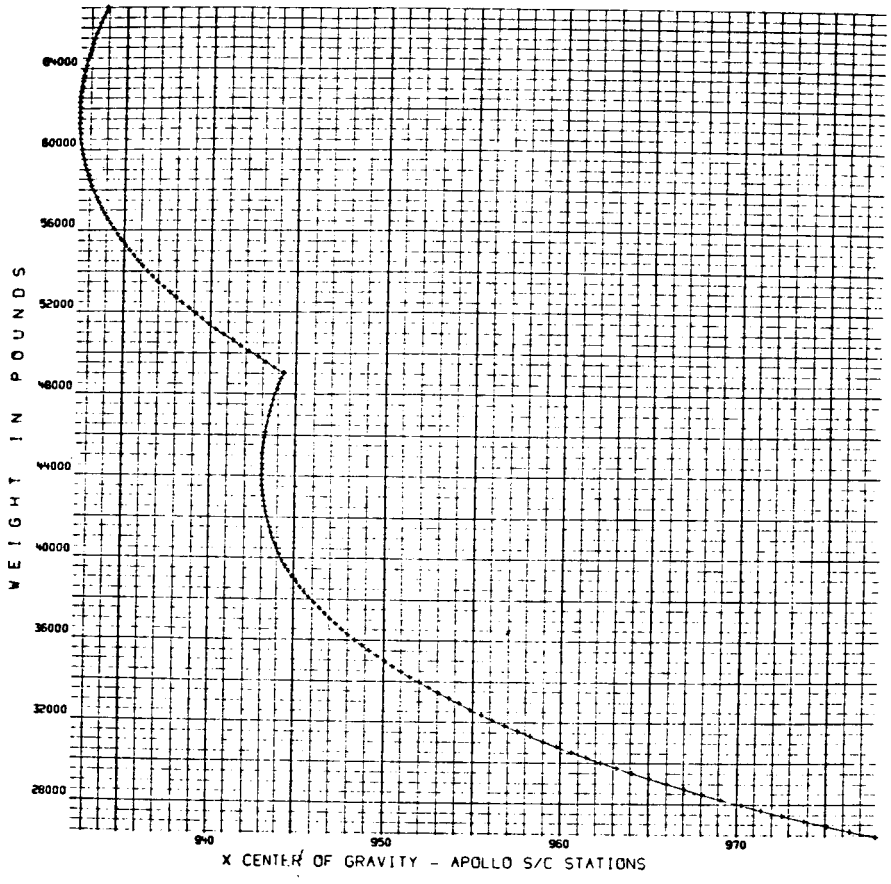
SPACECRAFT 114 POSTFLIGHT REPORT TANKED SPS PROPELLANT JAN 1973



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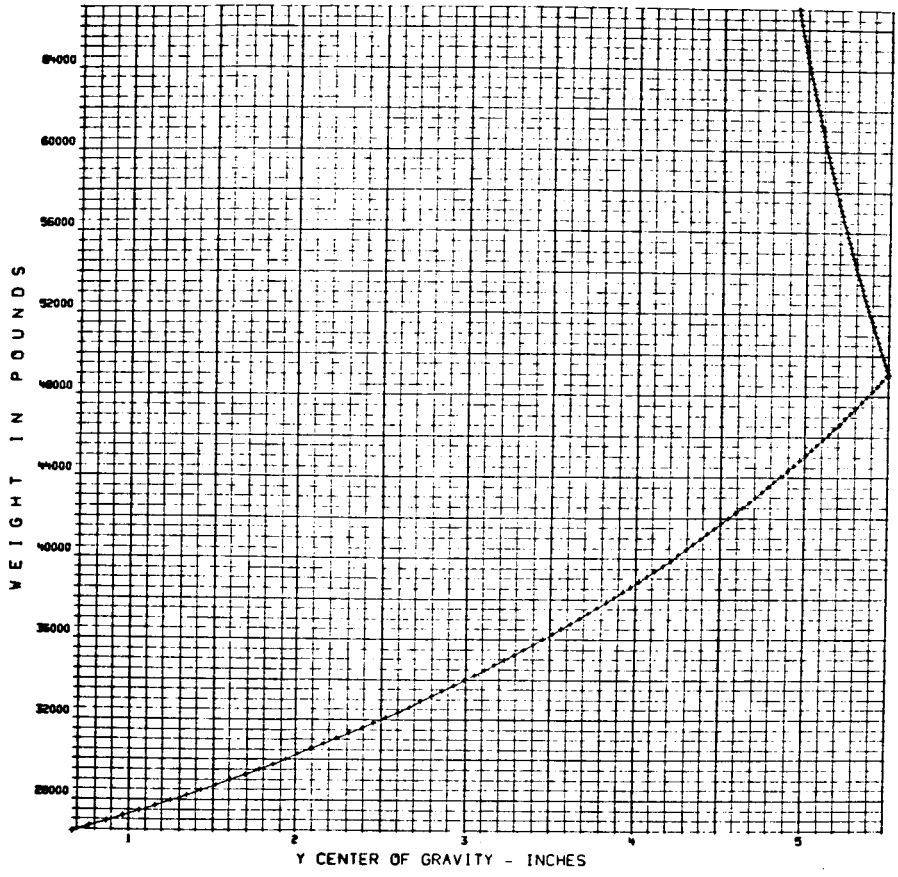

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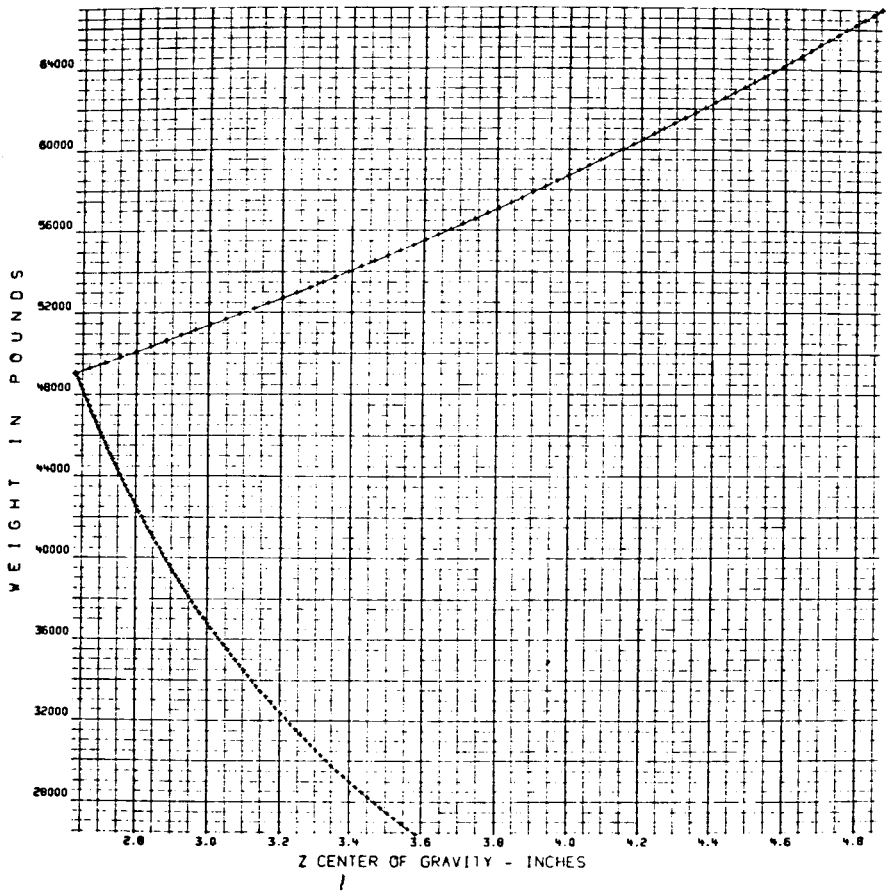

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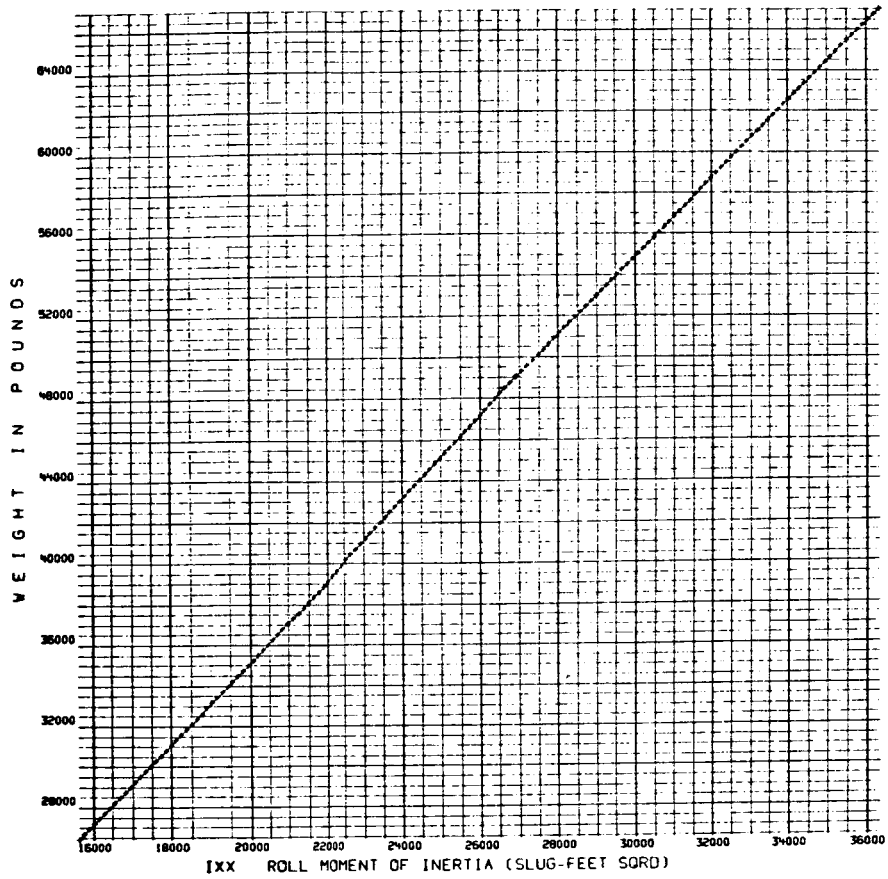

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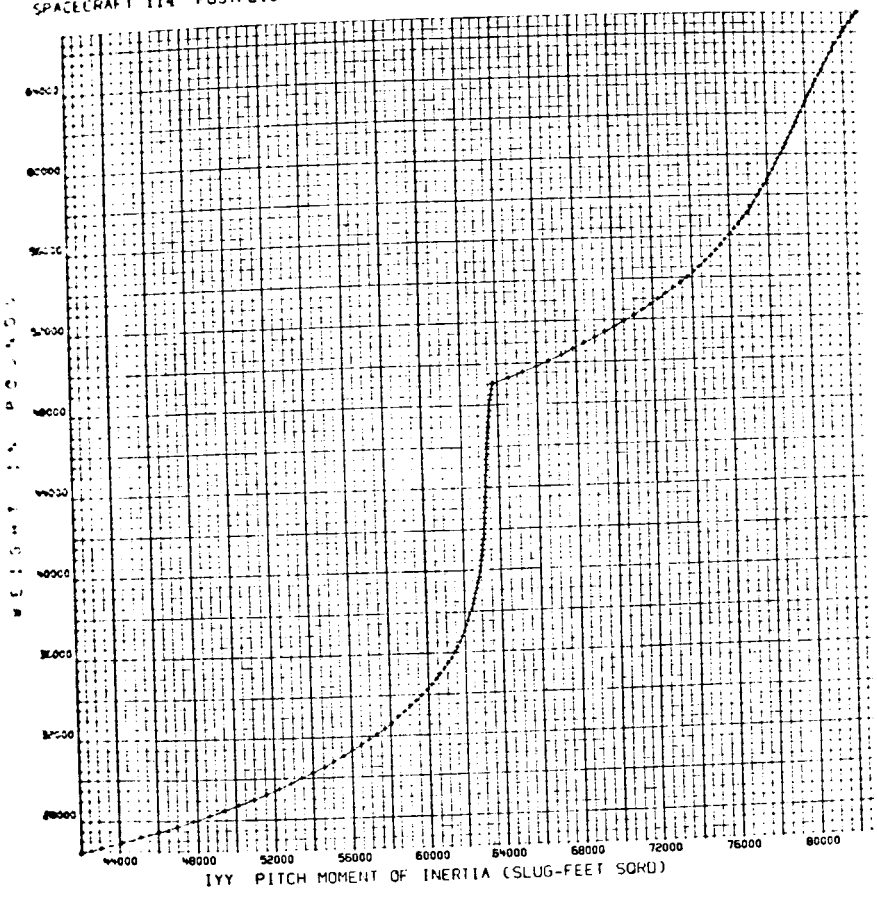

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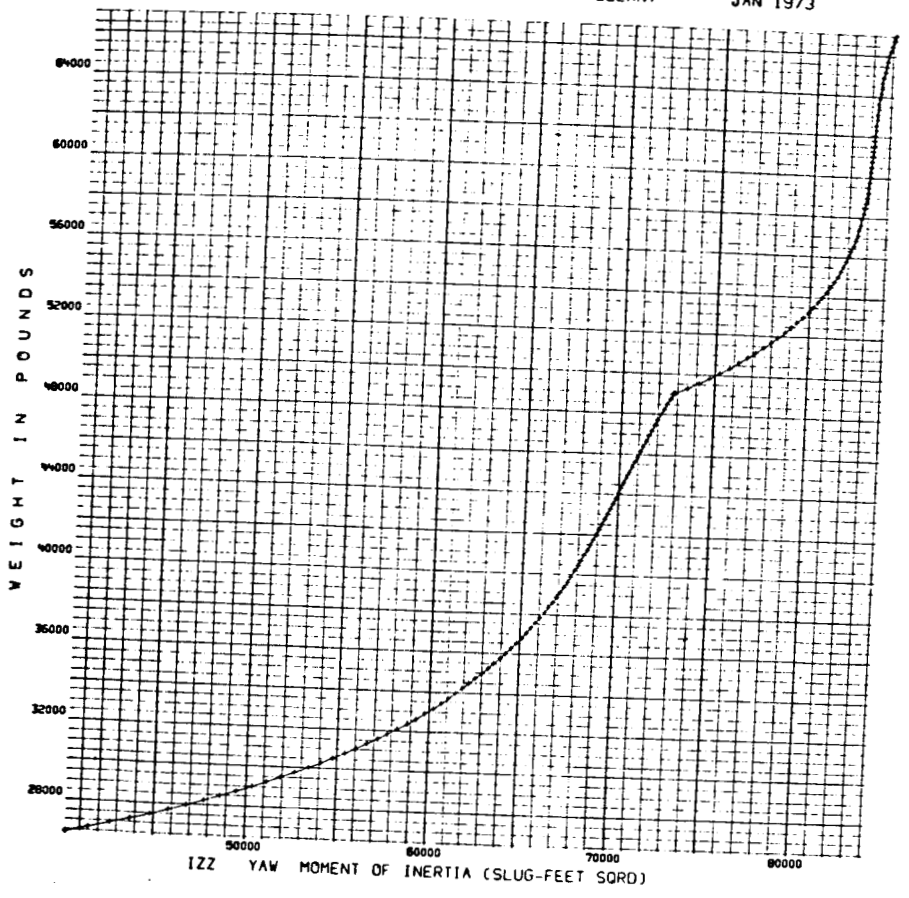

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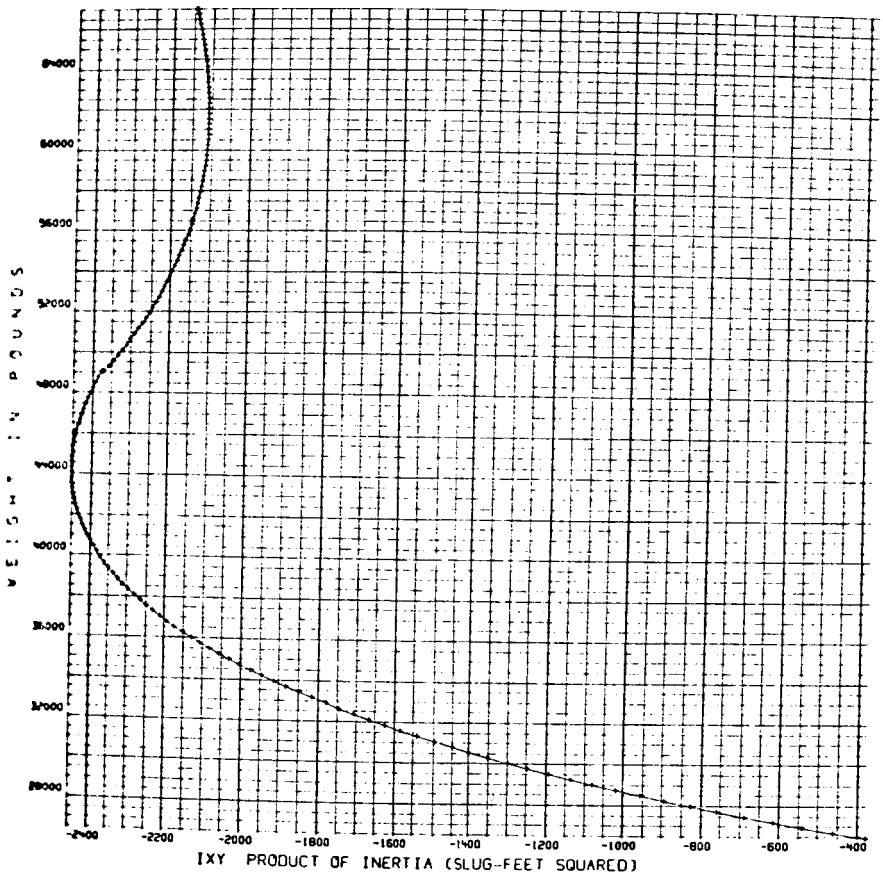

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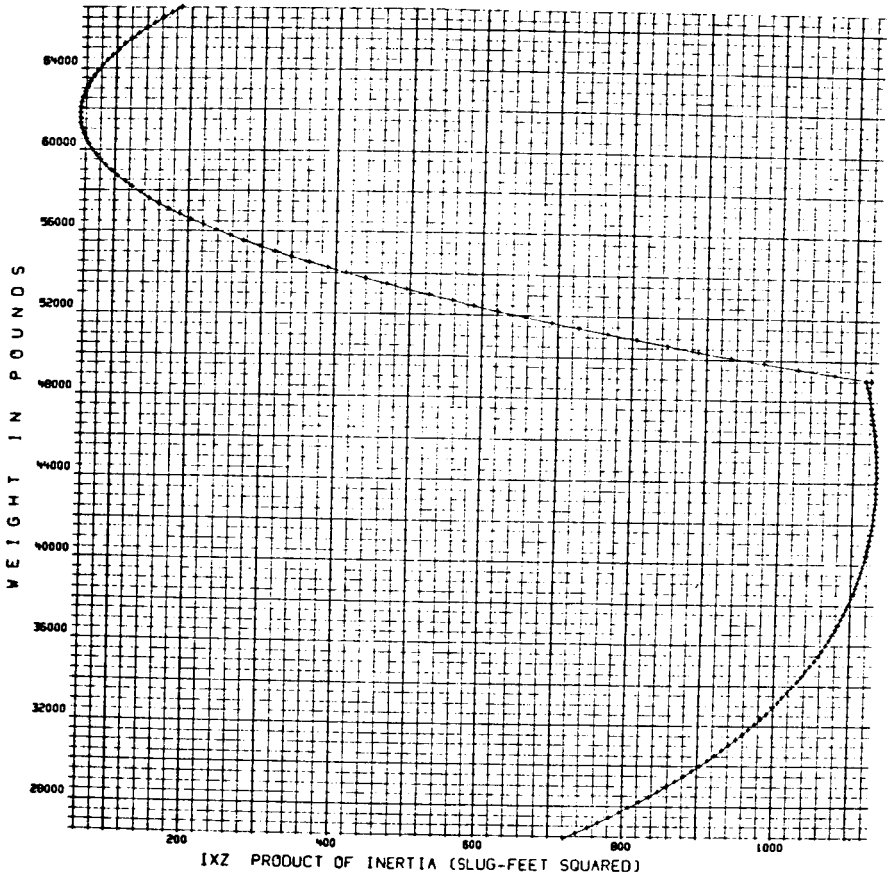

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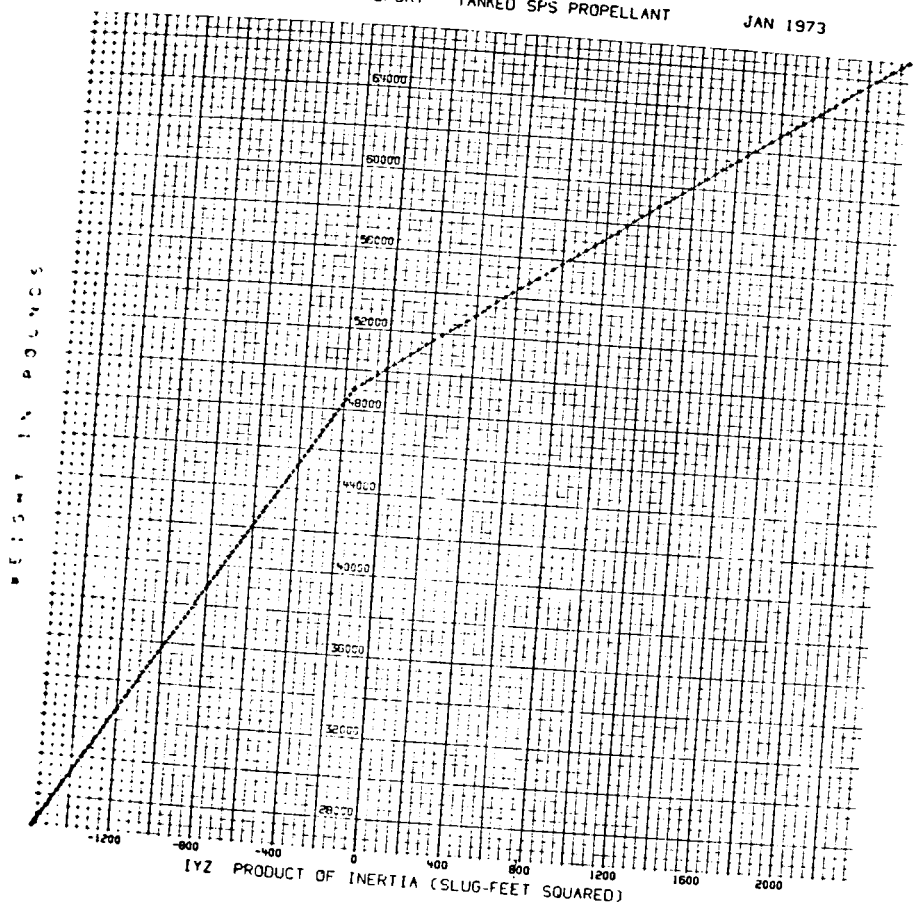

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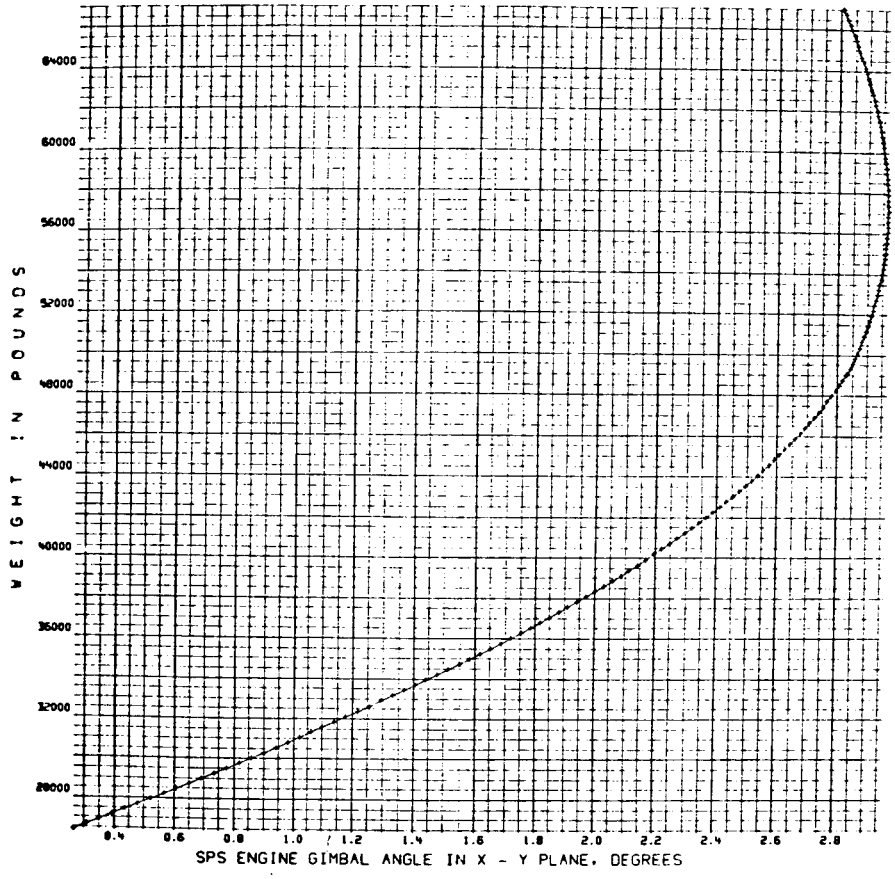

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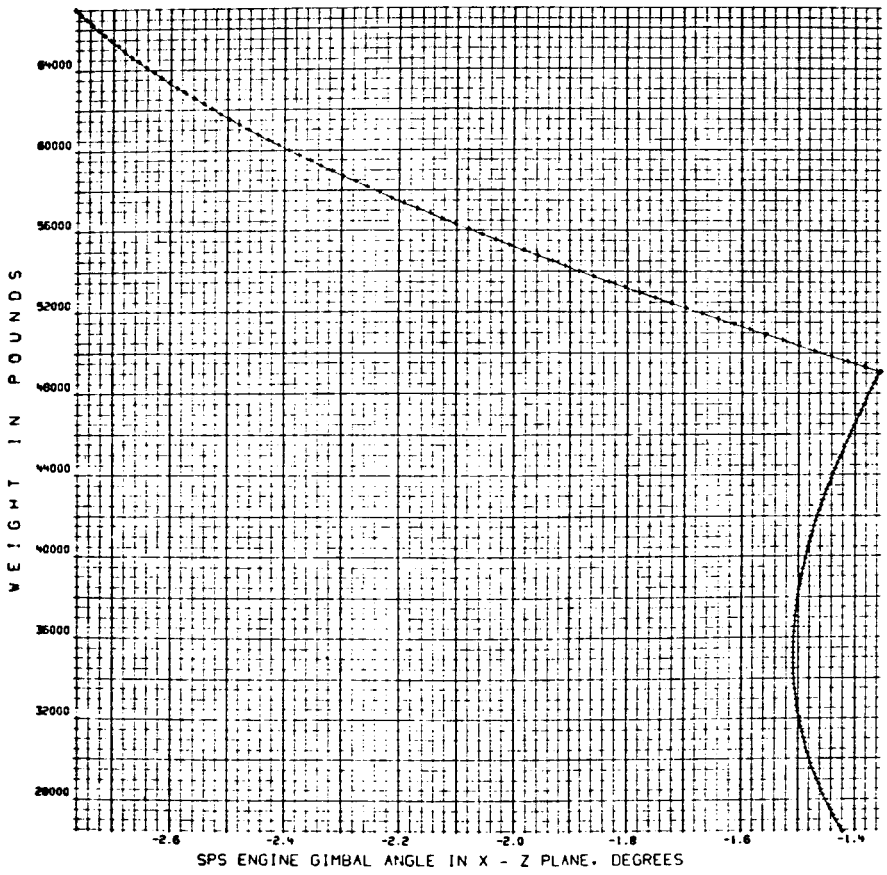

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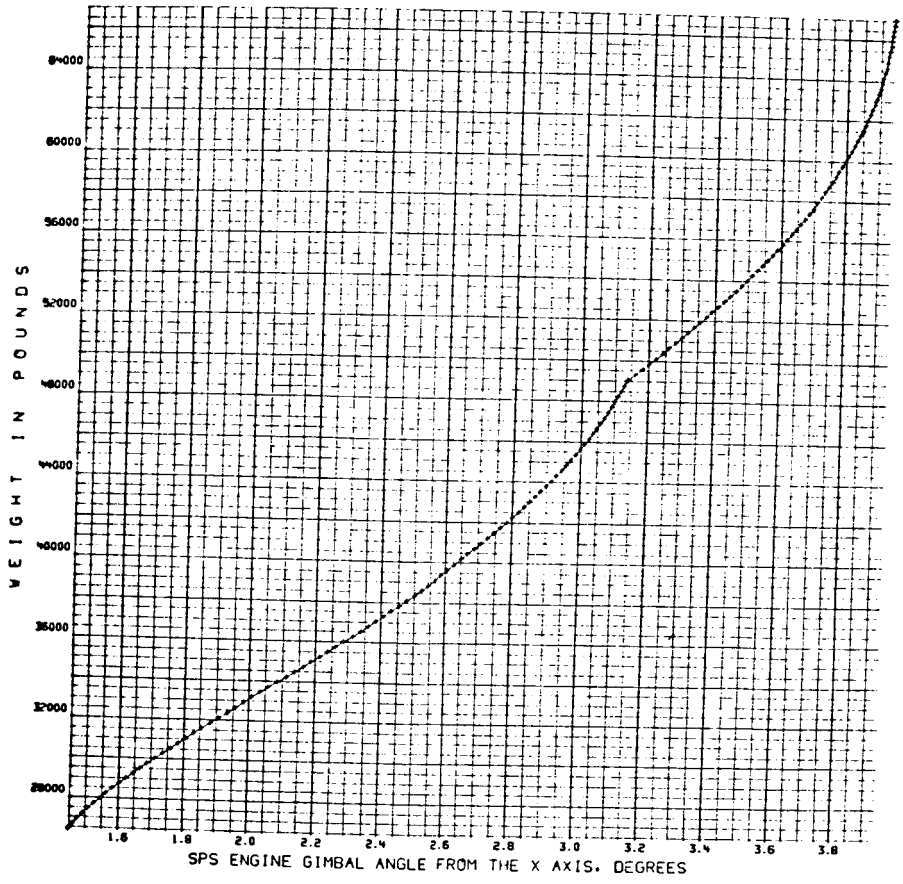

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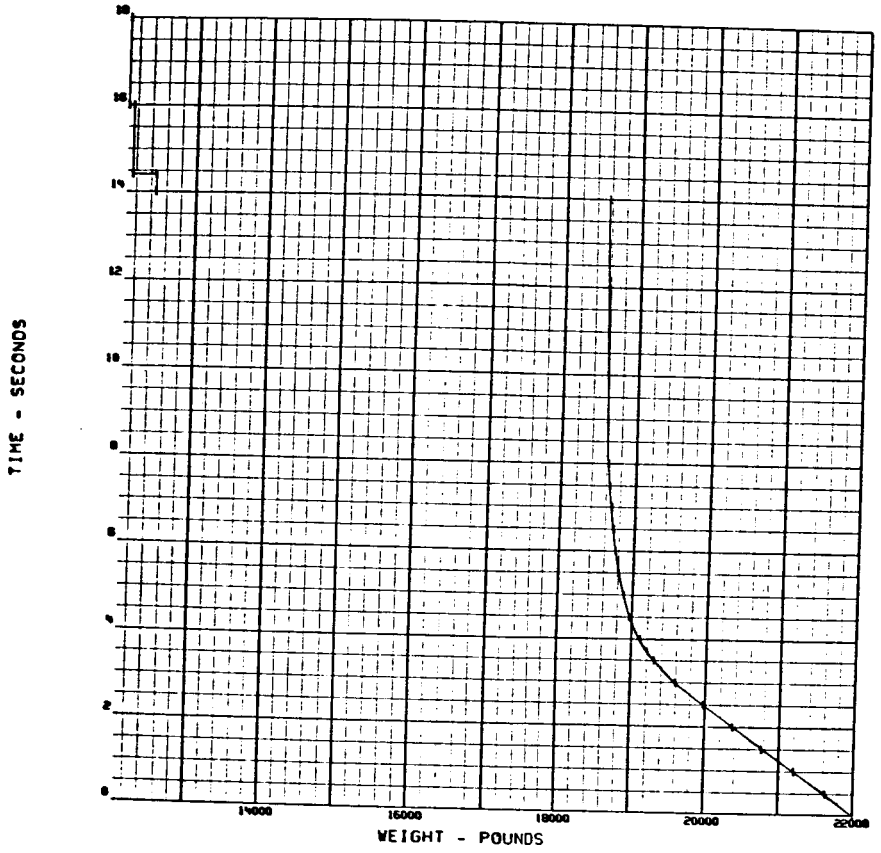
(REFERENCE ONLY)



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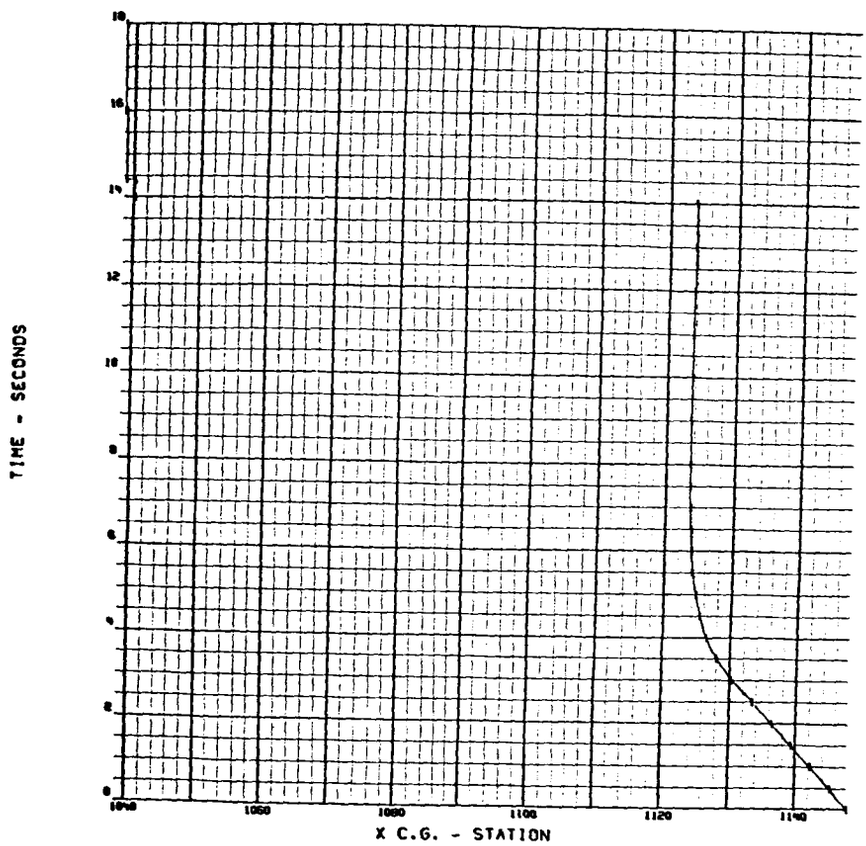

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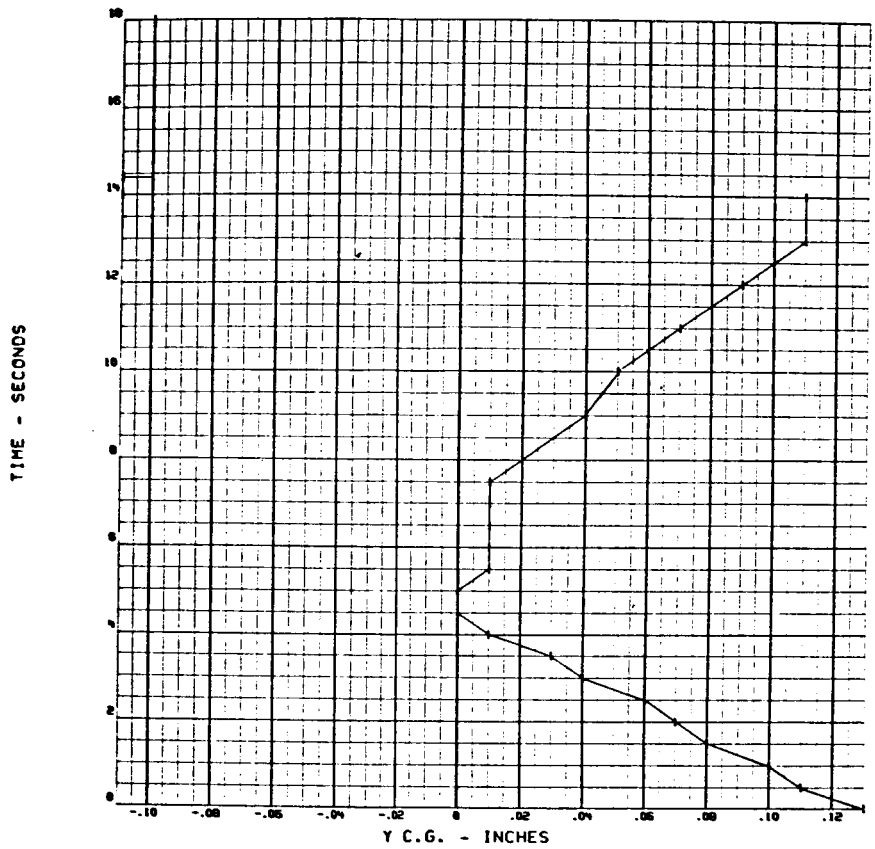

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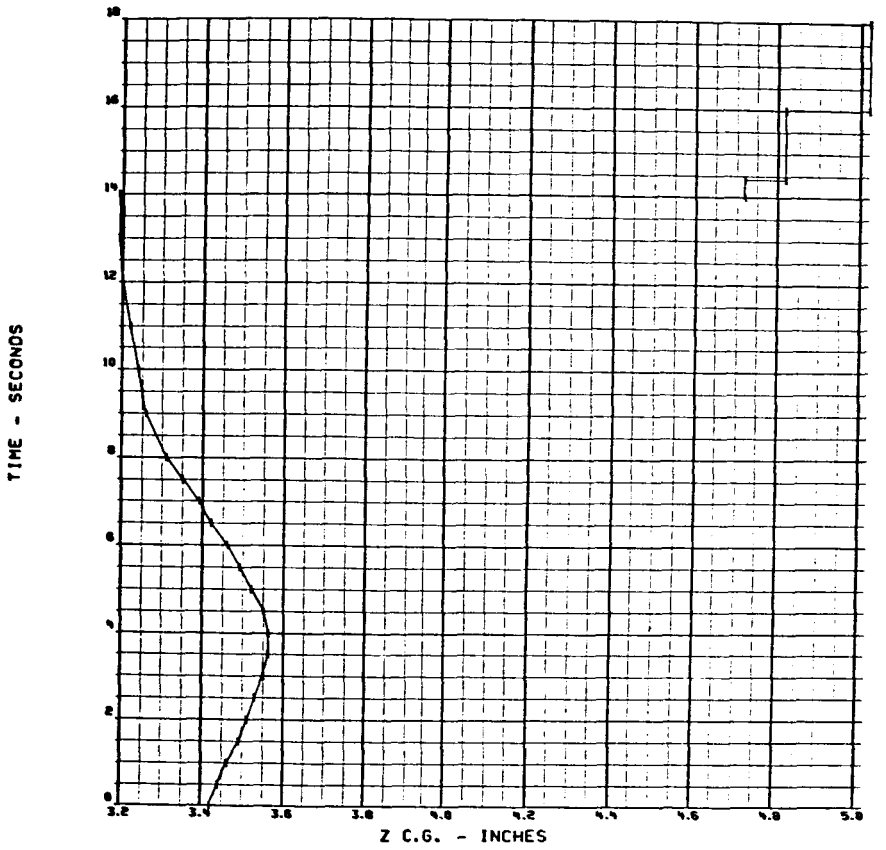

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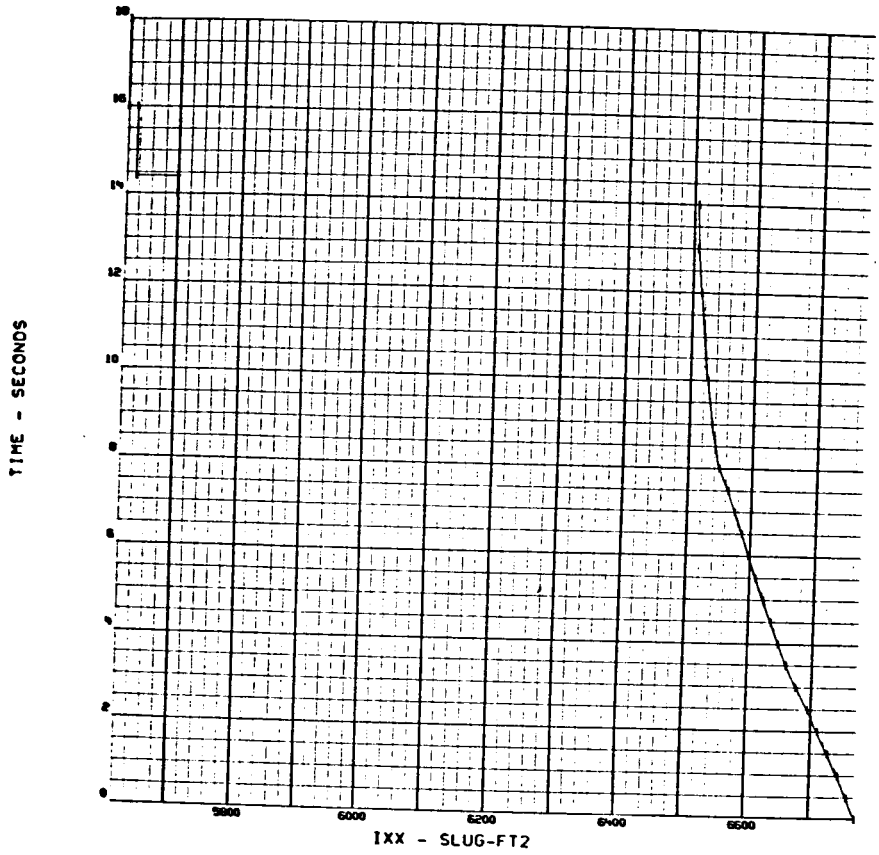

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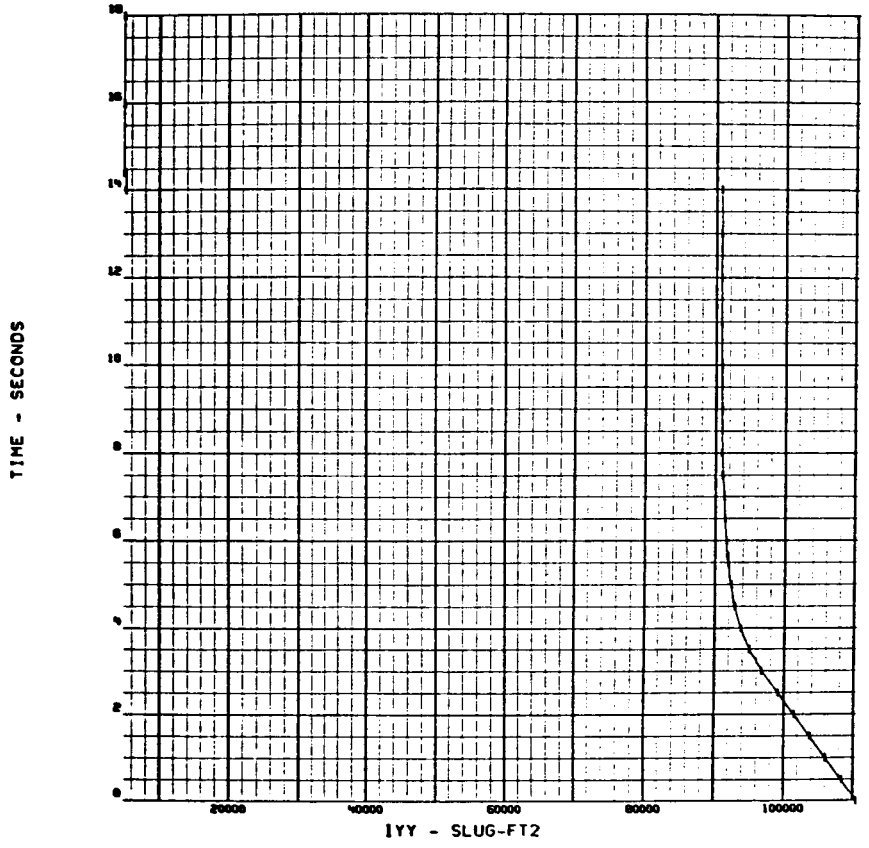

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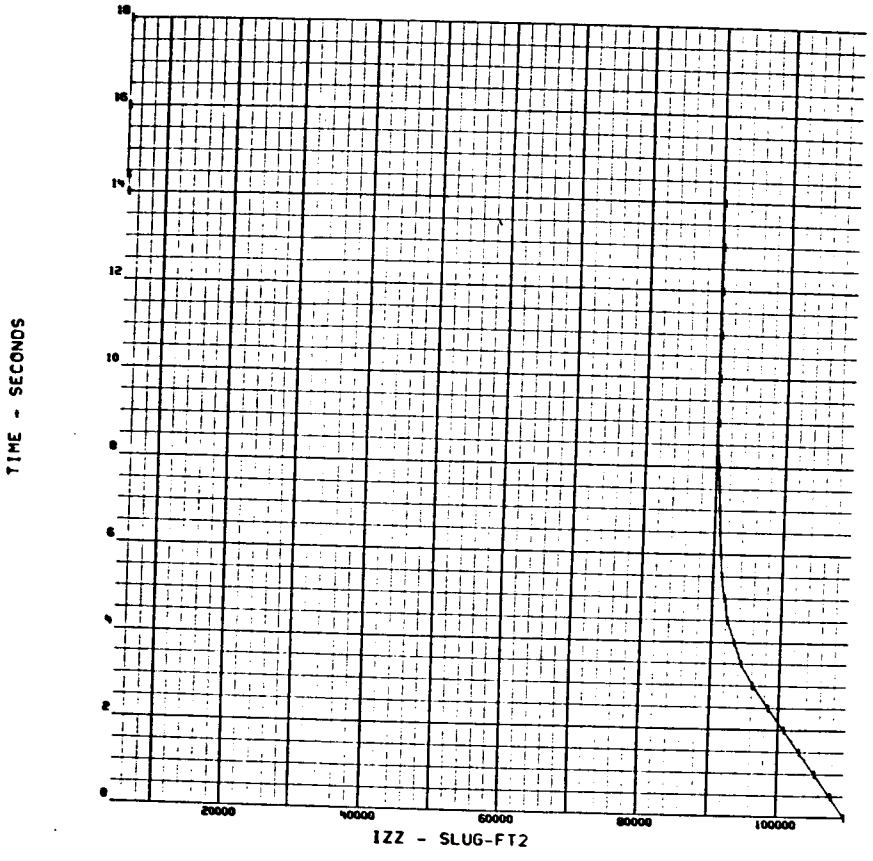

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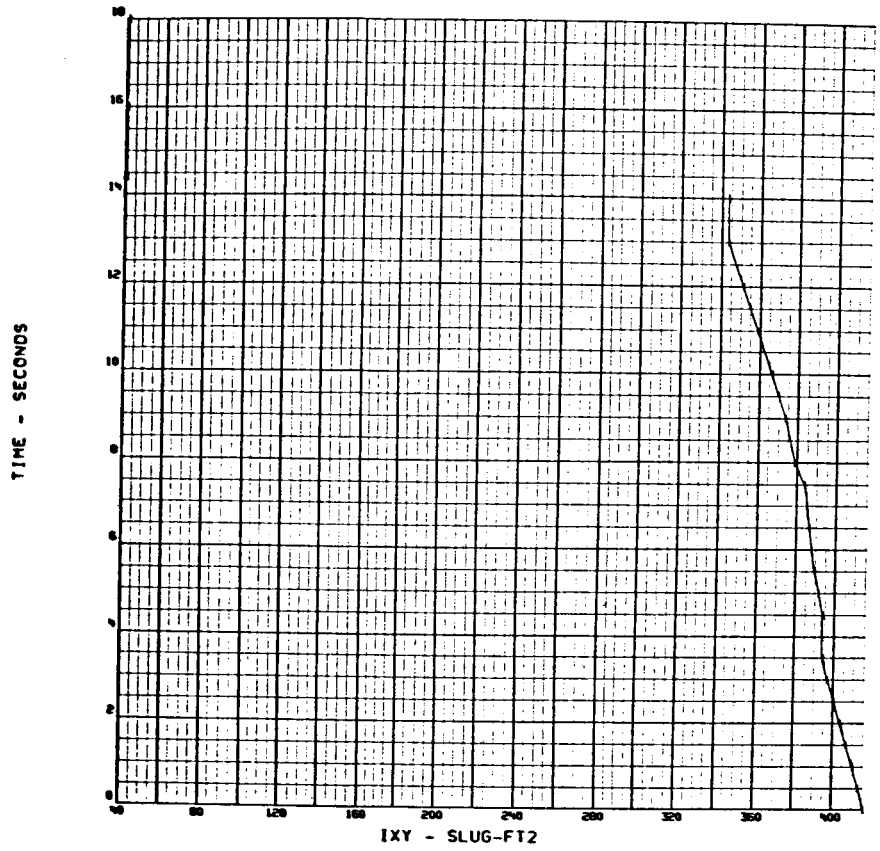

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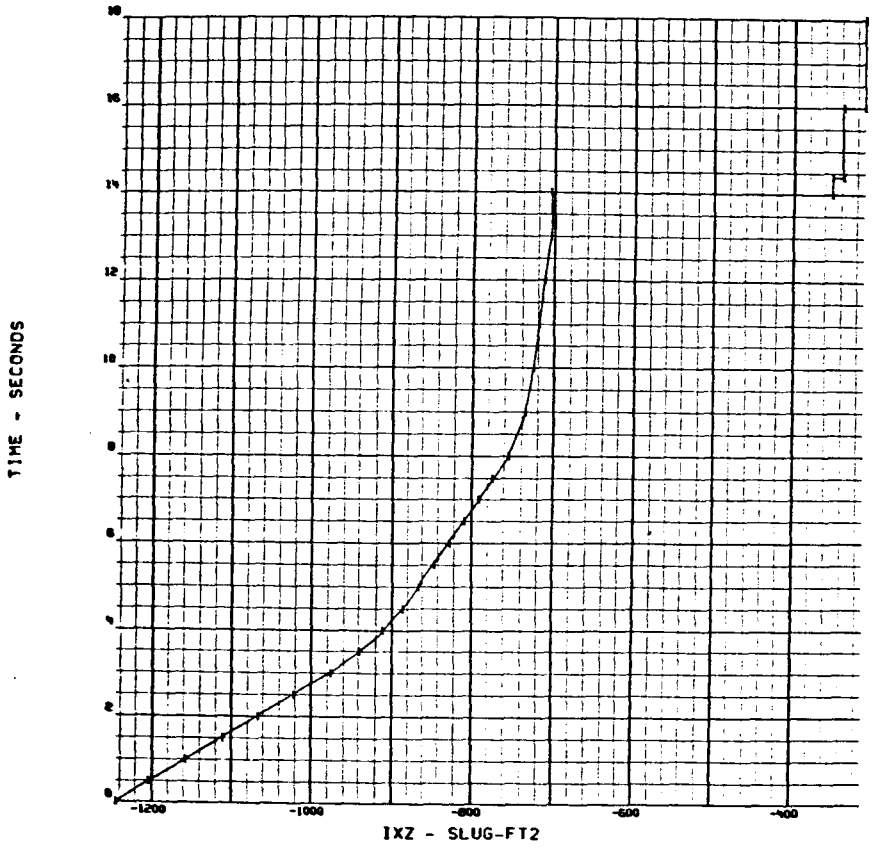

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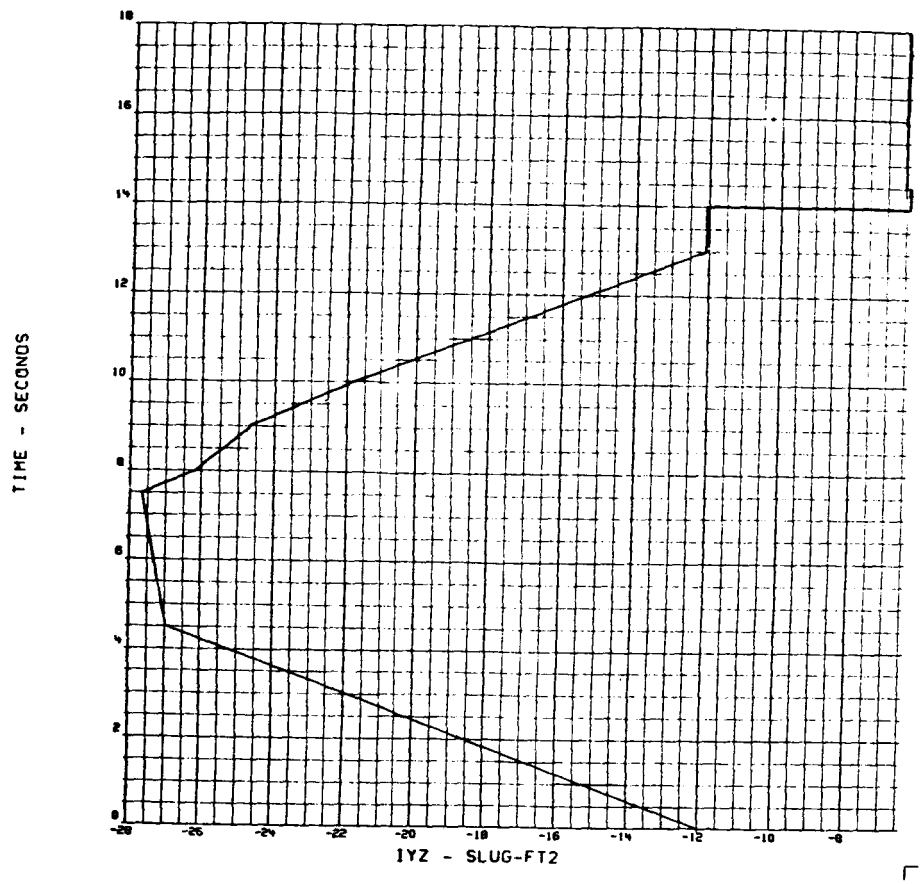

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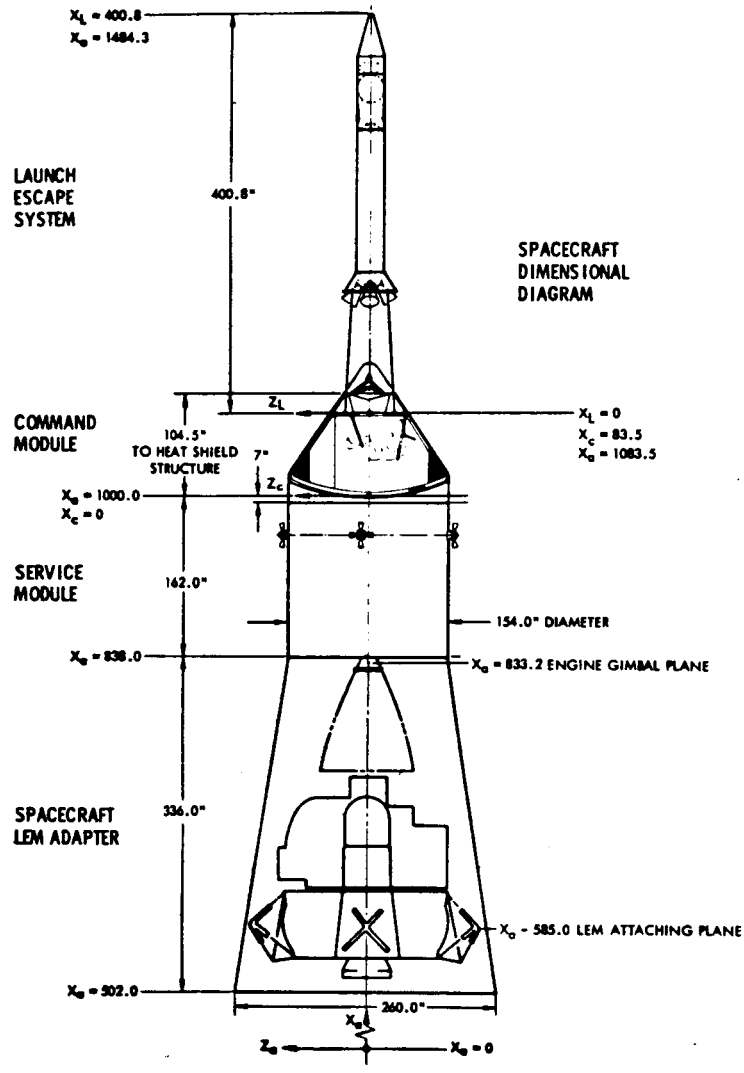
LIMITS AND TOLERANCES

A. The Launch Escape Vehicle Center of Gravity at LES Burnout is $1123.5 \begin{smallmatrix} +1.5 \\ -1.5 \end{smallmatrix}$ inches.

B. The Command Module Lift/Drag Ratio, $L/D = .280 \begin{smallmatrix} +.100 \\ -.000 \end{smallmatrix}$ at Command and Service Module Separation, with 45 pounds in the CM Waste Water Tank.

C. Service Module - None.

D. Spacecraft LM Adapter - None.

VEHICLE DIAGRAM