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Z65-11792

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This report is issued pursuant to the Downey Weight and Balance Report, SID 63-143-9, and does not cancel the previous report.

62314-64

SID 63-143-9W

FINAL ACTUAL WEIGHT AND BALANCE REPORT

BOILERPLATE STACK NO. 12

HIGH "q" ABORT TEST VEHICLE

CONTRACT NAS 9-150

(U)

ISSUED 4 JUNE 1964

PARA. 8.10 EXHIBIT I

Prepared By
WEIGHT CONTROL GROUP

CLASSIFICATION CHANGE

To UNCLASSIFIED
By authority of GDS-EO 11652
Changed by [illegible] Date 12/31/72
Classified Document Master Control Station, NAS
Scientific and Technical Information Facility

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NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION

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ACTUAL WEIGHT AND BALANCE REPORT

BOILERPLATE STACK NO. 12

HIGH "q" ABORT TEST VEHICLE

INTRODUCTION

An actual weight and balance determination of Boilerplate Stack No. 12 components was conducted at the White Sands Missile Range just prior to launch. The weighings, performed in the Vehicle Assembly Building between March 11 and March 27, were accomplished by the use of A14-154 Quotentiometer with the H14-040 and H14-041 Revere load cells. The load cells were calibrated by the Army Standards Lab. at W.S.M.R. into the A14-154 direct millivolt/volt readout instrument. The millivolt/volt reading is converted to true pounds mass on the individual calculation sheets as well as corrections from standard gravity to local gravity and buoyancy corrections.

Attitudes of the module weighings along with the centers of gravity derived from each weighing are listed below:

Assembly	Center of Gravity
Launch Escape Tower (horz.)	X
Launch Escape System (horz.)	X
Command Module (horz.)	X
Command Module (vert.)	Y and Z
Command Module and L.E.S. (initial)	Y and Z
Command Module and L.E.S. (final)	Y and Z

Following each assembly weighing up to launch, all weight and/or center of gravity changes were monitored and are employed in the determination of the mass properties for the subject boilerplate at launch. At the time of each weighing, the vehicle was inventoried against the existing concept of the flight configuration for items that were not installed, and for non-flight items, other than tare, present at weighing. These corrections, along with the weight monitoring changes, are summarized on page 25 for the L.E. Tower, page 28 for the Launch Escape System, and page 34 for the Command Module.

Due to the S/M weight and balance fixtures not being provisioned for use at W.S.M.R., the Service Module weight and center of gravity was monitored for changes since the Downey weighing (refer to SID 63-143-9, issued 9 April 1964). At the time of shipment from Downey to W.S.M.R., the Service Module weight and center of gravity was corrected to reflect the anticipated beef-up of the shockwave barrier, and was included in the referenced Downey report. The modification, which consists of an additional 39.2 pounds to the S/M, was actually accomplished in the field. The majority of changes recorded in the W.S.M.R. weight log records have previously been accounted for in the original weight and balance report. All other entrees in the log have a negligible effect on the weight and center of gravity of the Service Module.

A summary of the weight, center of gravity, and inertia for Boilerplate No. 12 from total launch payload to Command Module touchdown is presented on pages 3 and 4. The mass properties for the Launch Escape Vehicle (L.E.S. and C/M) have been computed for 0.5 second intervals of main motor burning to burnout and also including the pitch motor burning within the cycle. Due to the failure to obtain the actual chamber pressures for the main motor, the data for the expended propellants were derived from weight rate information based on predicted performance values for ED 29 (test motor). The angles (measured in both the XY and XZ planes) between the L.E.S. less tower and C/M as determined from data obtained from the thrust vector alignment are also accounted for in the summary.

The Launch Escape System is ballasted (647 pounds) to meet a required longitudinal center of gravity (X_a 1121.5 $\pm$ 0.5 inches) for the combined L.E.S. and C/M at Launch Escape burnout. The mass properties for the Launch Escape System and the forward cover (C/M) with the jettison motor full, one half full, and empty is also presented in the summary. The center of gravity and inertia for the L.E.S. are referenced about the Command Module axes.

All inertia data presented in the summary are calculated. All weighings entailed three consecutive determinations, results of which were averaged to derive the reported mass properties, as shown in the summary. The reported weight for the Command Module is the result of averaging the average weights derived from the single cell and horizontal weighings.

Curves presenting weight versus center of gravity and inertia are also included. These curves present the L.E.V. at 0.5 second burning intervals, the deployment of drogue, pilot, and main chutes for the total Command Module to touchdown and the L.E.S. and forward cover for the jettison burning cycle.

The weight breakdown summaries present the functional groupings of structure and system weights of the various components. A manufacturing variation is shown to indicate the difference of the actual weight from the calculated weight.

The dimensional diagram, page 43, shows the relationship of the Apollo Spacecraft X_a stations, which have an origin 998.7 inches below the tangency of the Command Module structure mold line.

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

HIGH "q" ABORT TEST VEHICLE

BOILERPLATE NO. 12

ITEM	WEIGHT	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG FT.^{2})		
		X_a	Y_a	Z_a	ROLL (X)	PITCH (Y)	YAW (Z)
LAUNCH ESCAPE SYSTEM (initial)	6995	1304.6	0.1	0.1	236	10552	10554
COMMAND MODULE	9223	1042.8	0.3	7.1	5216	4679	4574
SERVICE MODULE	9133	934.0	-1.0	-7.5	10705	10848	9846
TOTAL LAUNCH PAYLOAD	25351	1075.8	-0.2	-0.1	16370	147174	145860
LESS: SERVICE MODULE	-9133	934.0	-1.0	-7.5	10705	10848	9846
TOTAL LEV (abort initial)	16218	1155.7	0.2	4.1	5494	74052	73907
LEV (t + 0.5)	15832	1152.2	0.2	4.2	5488	72131	71987
LEV (t + 1.0)	15437	1148.5	0.2	4.3	5480	70169	70027
LEV (t + 1.5)	15013	1144.4	0.2	4.5	5471	67963	67822
LEV (t + 2.0)	14622	1140.3	0.2	4.6	5461	65820	65681
LEV (t + 2.5)	14247	1136.2	0.2	4.7	5450	63659	63521
LEV (t + 3.0)	13890	1132.1	0.2	4.8	5439	61503	61367
LEV (t + 3.5)	13589	1128.5	0.3	4.9	5429	59602	59468
LEV (t + 4.0)	13396	1126.1	0.3	5.0	5422	58344	58211
LEV (t + 4.5)	13277	1124.6	0.3	5.0	5417	57550	57417
LEV (t + 5.0)	13190	1123.4	0.3	5.1	5414	56957	56825
LEV (t + 5.5)	13137	1122.7	0.3	5.1	5412	56597	56466
LEV (t + 6.0)	13099	1122.2	0.3	5.1	5410	56332	56201
LEV (t + 6.5)	13067	1121.8	0.3	5.1	5409	56114	55983
LEV (t + 7.0)	13049	1121.6	0.3	5.1	5409	55989	55858
LEV (t + 7.5)	13036	1121.4	0.3	5.1	5408	55898	55767
LEV (t + 8.0 - LES burnout)	13024	1121.2	0.3	5.1	5408	55815	55684

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WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

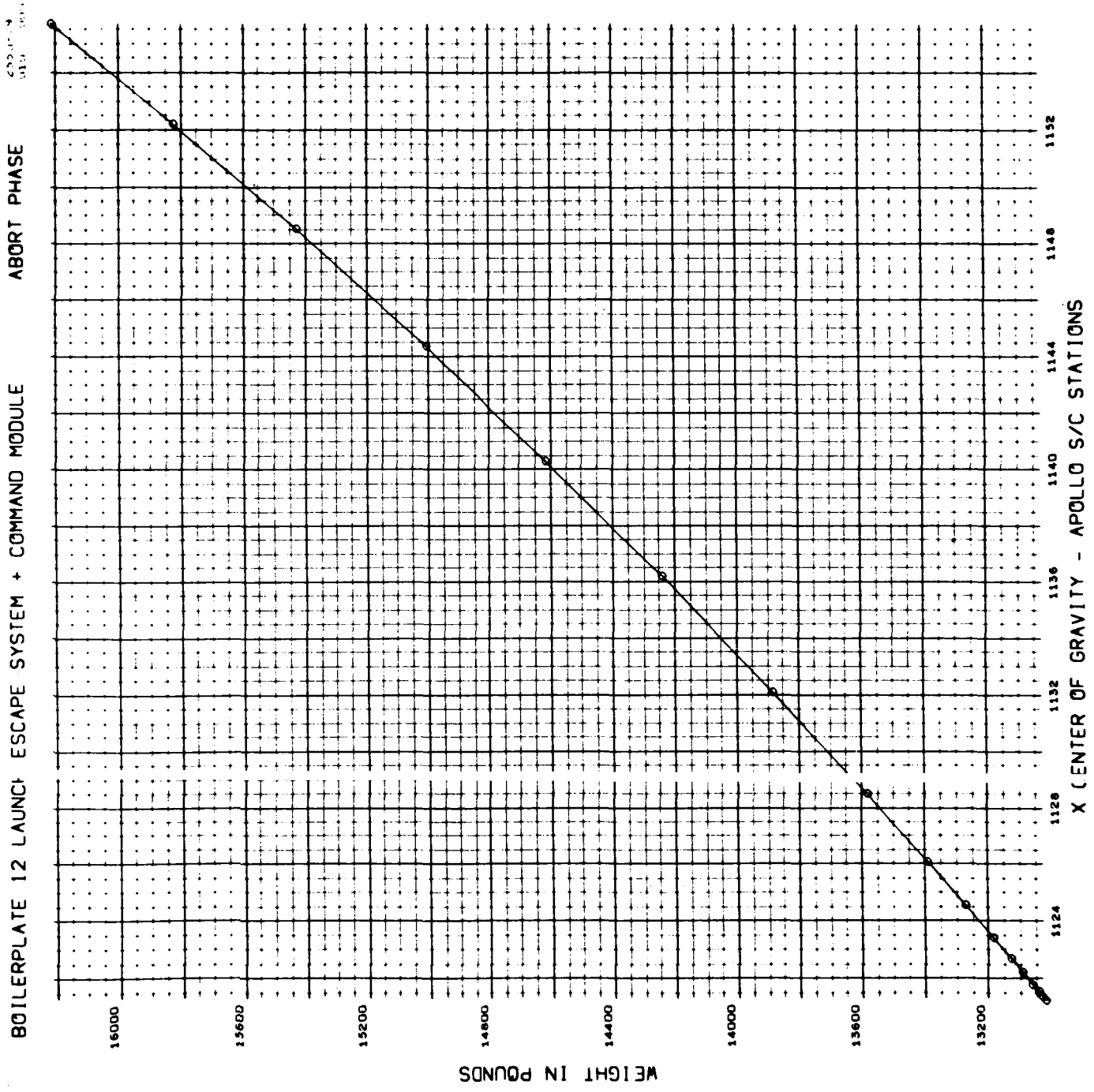
HIGH "q" ABORT TEST VEHICLE

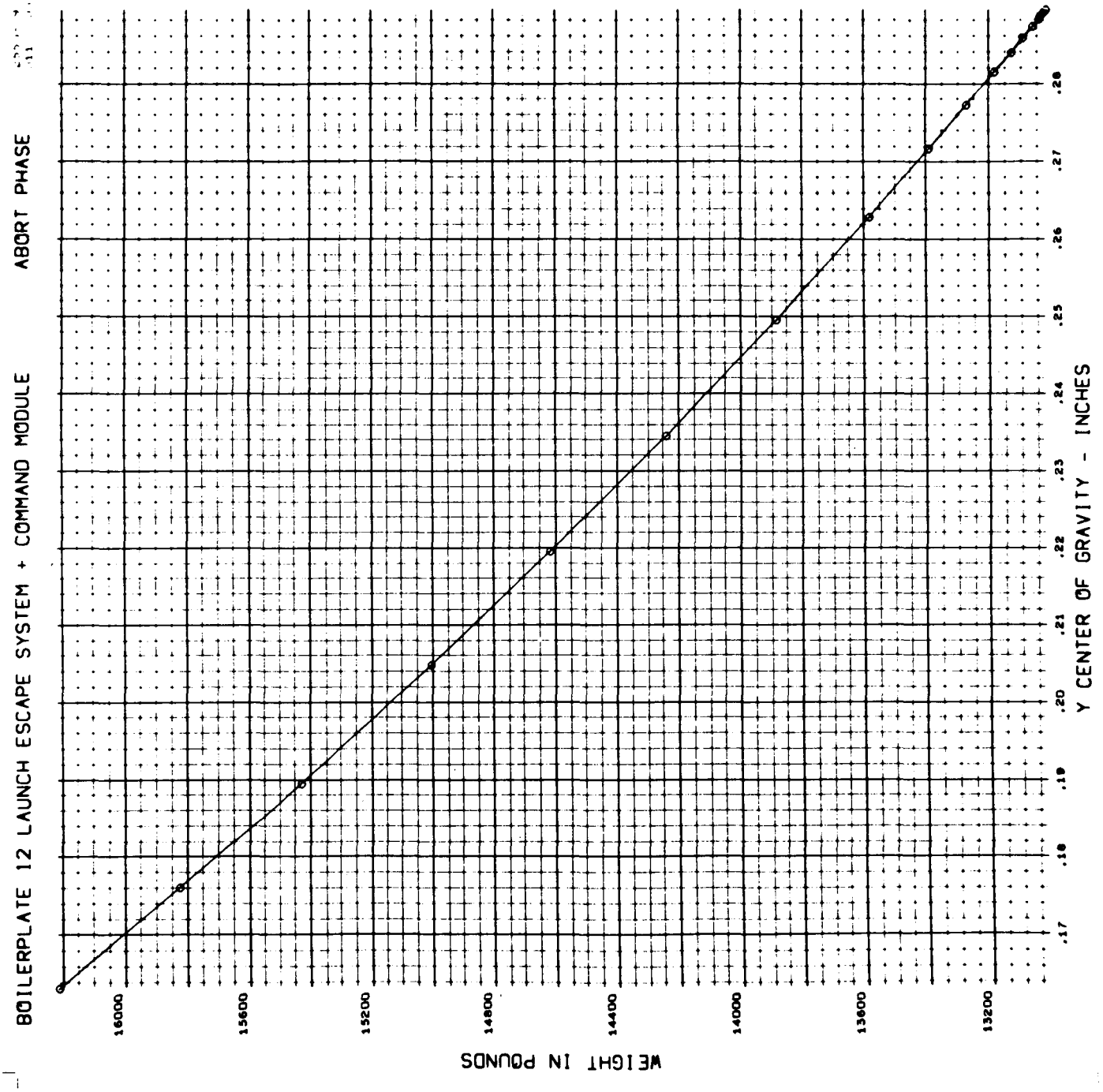
BOILERPLATE NO. 12

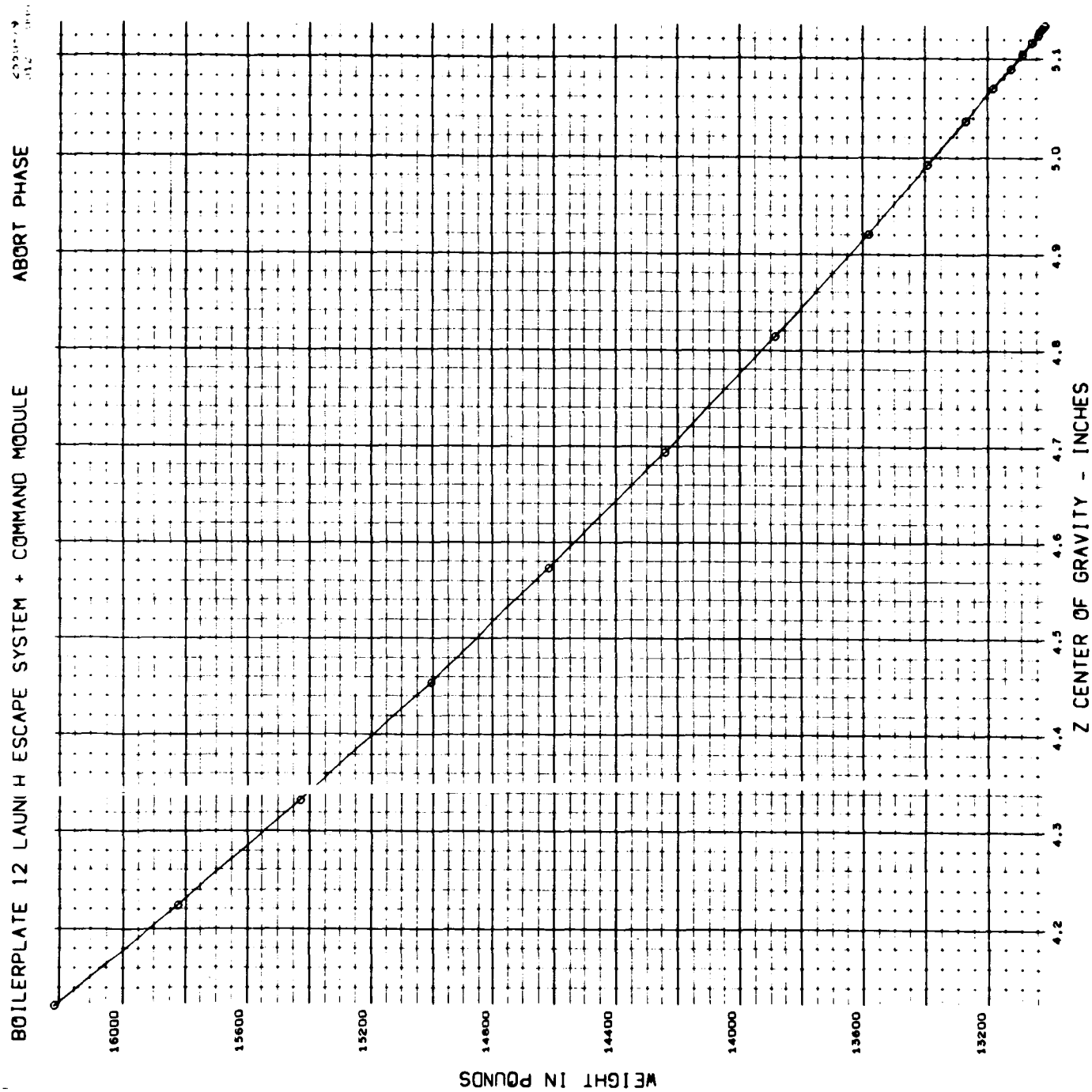
ITEM	WEIGHT	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT.^{2})		
		X_a	Y_a	Z_a	ROLL (X)	PITCH (Y)	YAW (Z)
LESS: L.E.S. (burnout) AND FWD. COVER	-4218	1290.7	0.3	0.5	246	12837	12833
TOTAL C/M PRIOR TO DROGUE DEPLOYMENT	8806	1040.0	0.3	7.3	5132	4308	4209
LESS: DROGUE CHUTE	-25	1090.8	9.6	-21.8	0	0	0
TOTAL C/M PRIOR TO PILOT CHUTE DEPLOYMENT	8781	1039.9	0.3	7.4	5127	4289	4195
LESS: PILOT CHUTES	-19	1085.8	4.3	6.8	2	1	1
TOTAL C/M PRIOR TO MAIN CHUTE DEPLOYMENT	8762	1039.8	0.3	7.4	5125	4279	4185
LESS: MAIN CHUTES	-411	1092.1	-0.6	8.0	43	15	37
TOTAL C/M AT TOUCHDOWN	8351	1037.2	0.3	7.4	5082	4010	3893

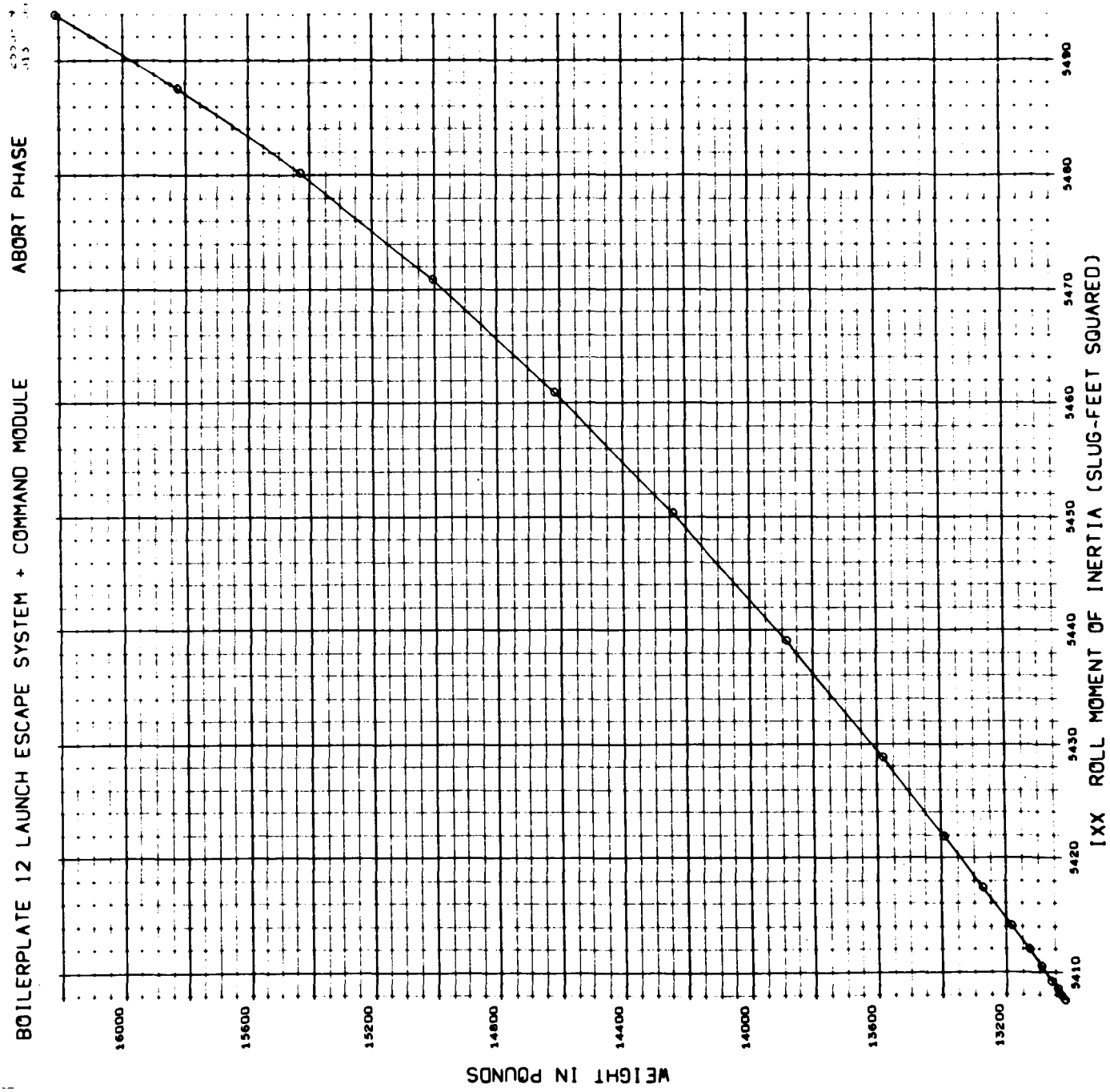
L.E.S. AND FWD. COVER (JETTISON FULL)	4218	1290.7	0.3	0.5	246	12837	12833
L.E.S. AND FWD. COVER (JETTISON 1/2 FULL)	4115	1287.7	0.3	0.5	245	12516	12512
L.E.S. AND FWD. COVER (JETTISON EMPTY)	4012	1284.6	0.3	0.5	243	12179	12175

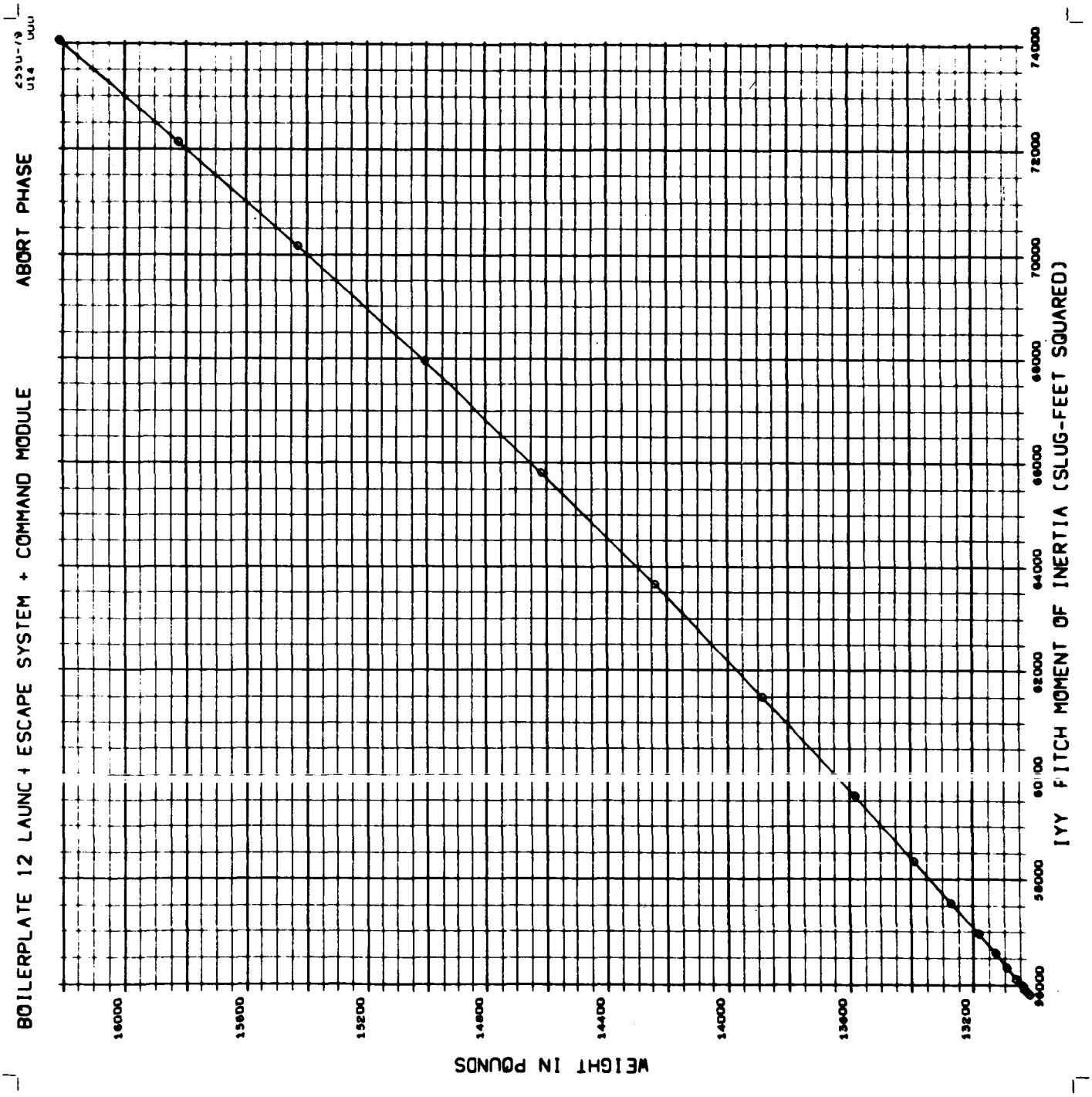
*Center of gravity is in the NASA reference system except that the longitudinal (X) has an origin 998.7 inches below the tangency of the Command Module structure mold line.

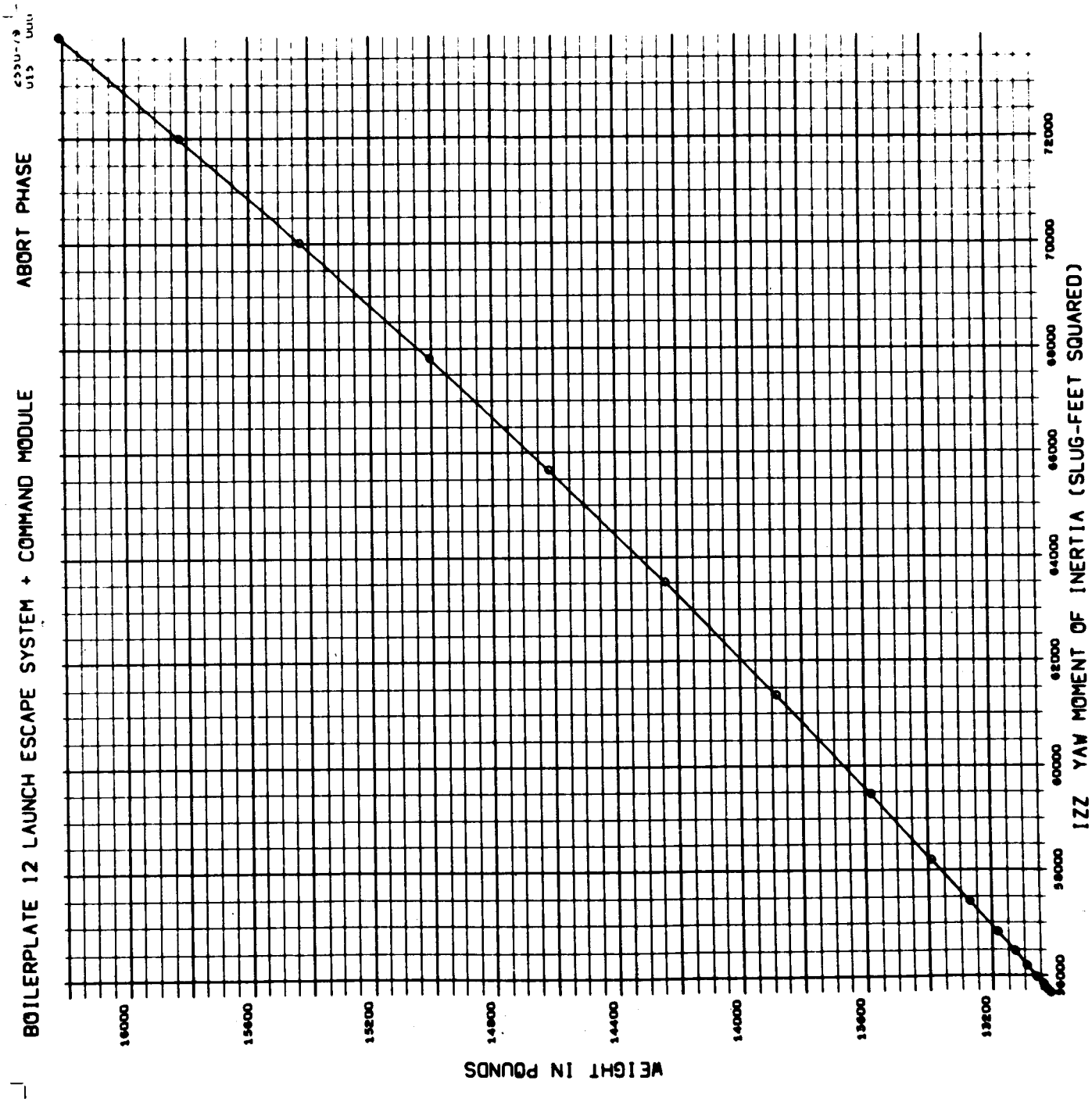

BOILERPLATE 12 LAUNCH ESCAPE SYSTEM + COMMAND MODULE
ABORT PHASE
WEIGHT IN POUNDS
16000
15600
15200
14800
14400
14000
13600
13200
X CENTER OF GRAVITY - APOLLO S/C STATIONS
1124
1128
1132
1136
1140
1144
1148
1152

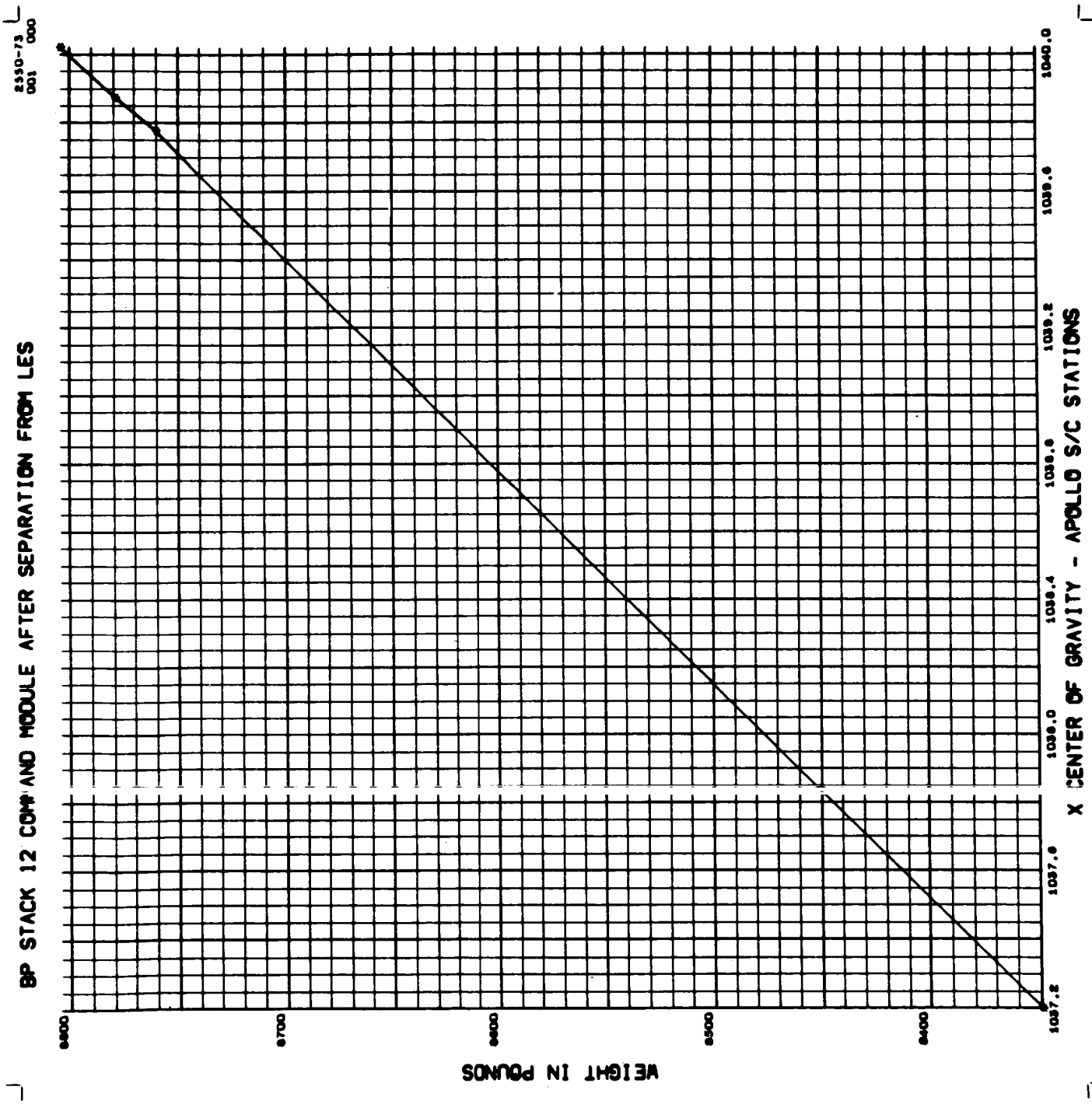

BOILERPLATE 12 LAUNCH ESCAPE SYSTEM + COMMAND MODULE
ABORT PHASE
WEIGHT IN POUNDS
16000
15600
15200
14800
14400
14000
13600
13200
Y CENTER OF GRAVITY - INCHES
.17
.18
.19
.20
.21
.22
.23
.24
.25
.26
.27
.28

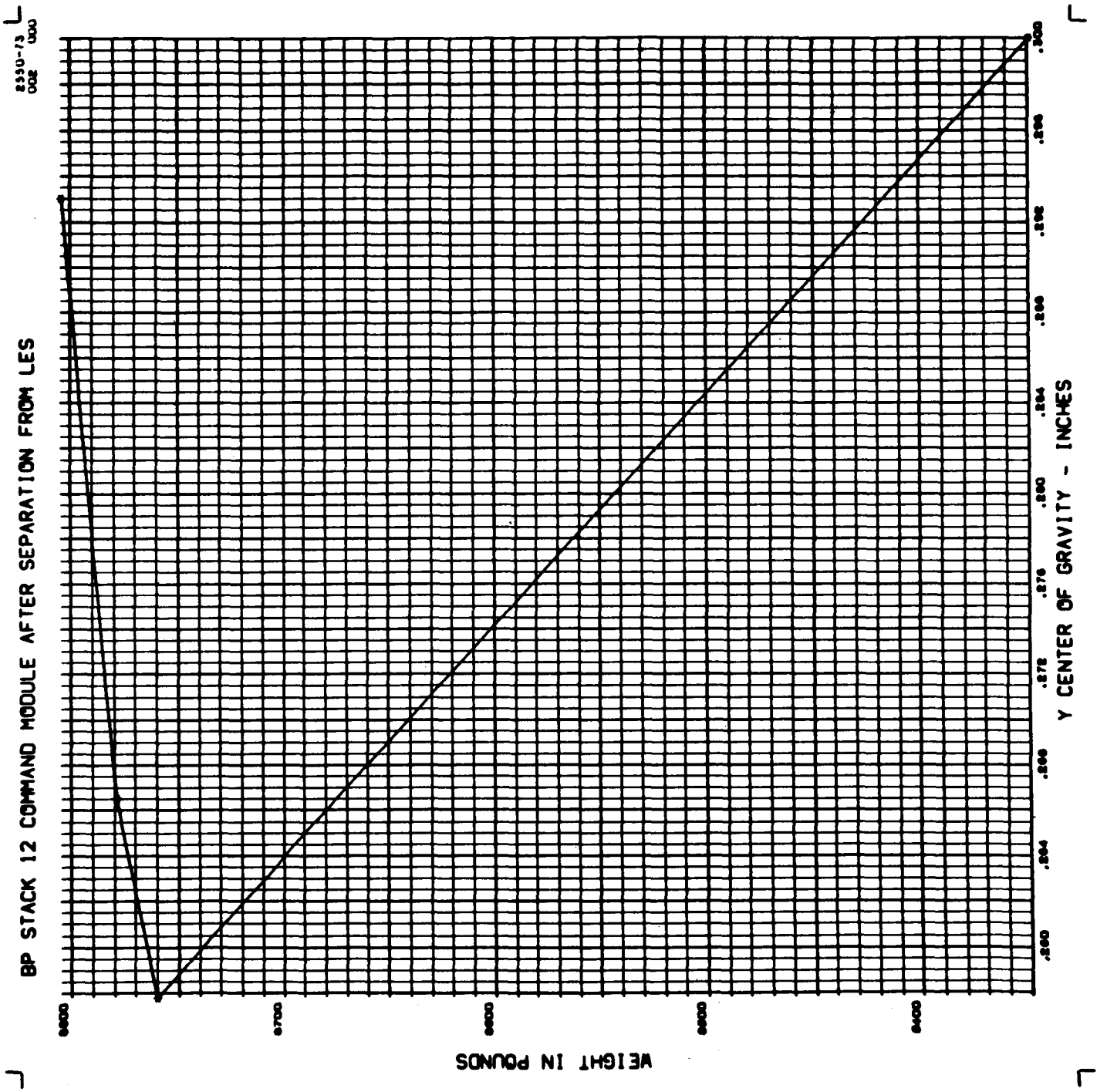

BOILERPLATE 12 LAUNCH ESCAPE SYSTEM + COMMAND MODULE
ABORT PHASE
WEIGHT IN POUNDS
16000
15600
15200
14800
14400
14000
13600
13200
Z CENTER OF GRAVITY - INCHES
4.2
4.3
4.4
4.5
4.6
4.7
4.8
4.9
5.0
5.1


BOILERPLATE 12 LAUNCH ESCAPE SYSTEM + COMMAND MODULE
ABORT PHASE
WEIGHT IN POUNDS
16000
15600
15200
14800
14400
14000
13600
13200
IXX ROLL MOMENT OF INERTIA (SLUG-FEET SQUARED)
5410
5420
5430
5440
5450
5460
5470
5480
5490


BOILERPLATE 12 LAUNCH ESCAPE SYSTEM + COMMAND MODULE
ABORT PHASE
WEIGHT IN POUNDS
16000
15600
15200
14800
14400
14000
13600
13200
IYY PITCH MOMENT OF INERTIA (SLUG-FEET SQUARED)
56000
58000
60000
62000
64000
66000
68000
70000
72000
74000


BOILERPLATE 12 LAUNCH ESCAPE SYSTEM + COMMAND MODULE
ABORT PHASE
WEIGHT IN POUNDS
16000
15600
15200
14800
14400
14000
13600
13200
IZZ YAW MOMENT OF INERTIA (SLUG-FEET SQUARED)
56000
58000
60000
62000
64000
66000
68000
70000
72000


8350-73
001 000
BP STACK 12 COMMAND MODULE AFTER SEPARATION FROM LES
WEIGHT IN POUNDS
8800
8700
8600
8500
8400
X CENTER OF GRAVITY - APOLLO S/C STATIONS
1037.2
1037.6
1038.0
1038.4
1038.8
1039.2
1039.6
1040.0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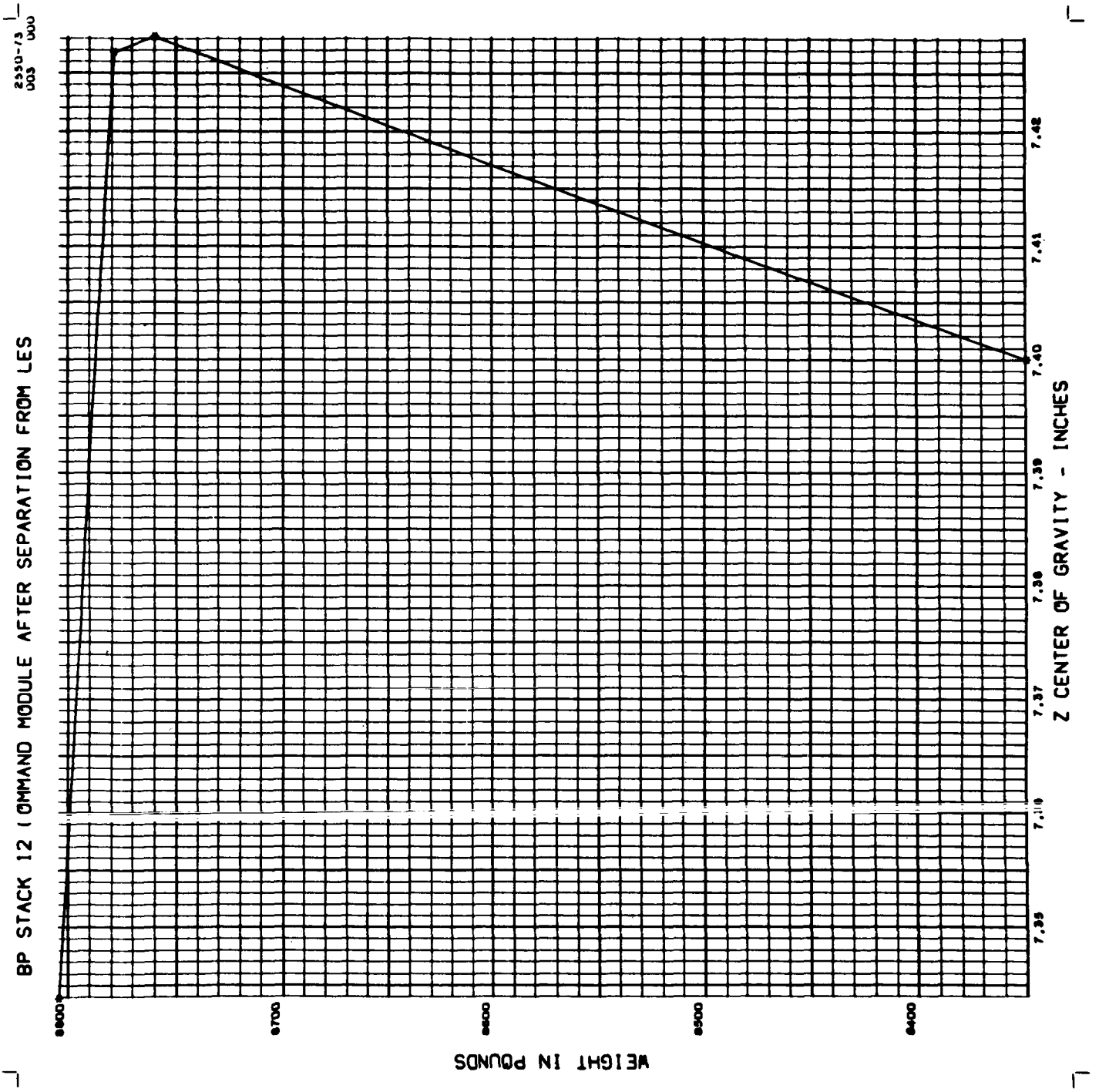
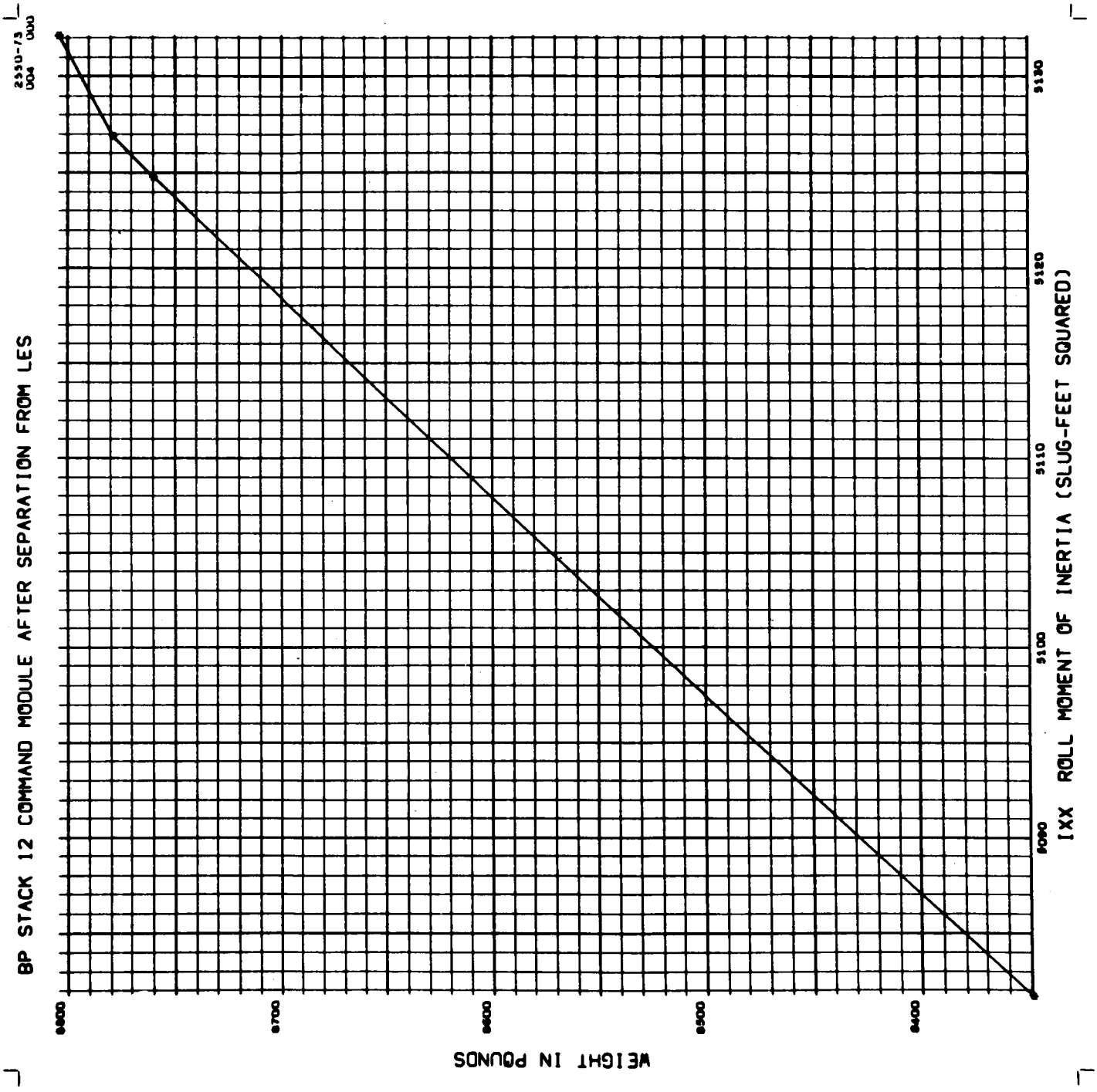
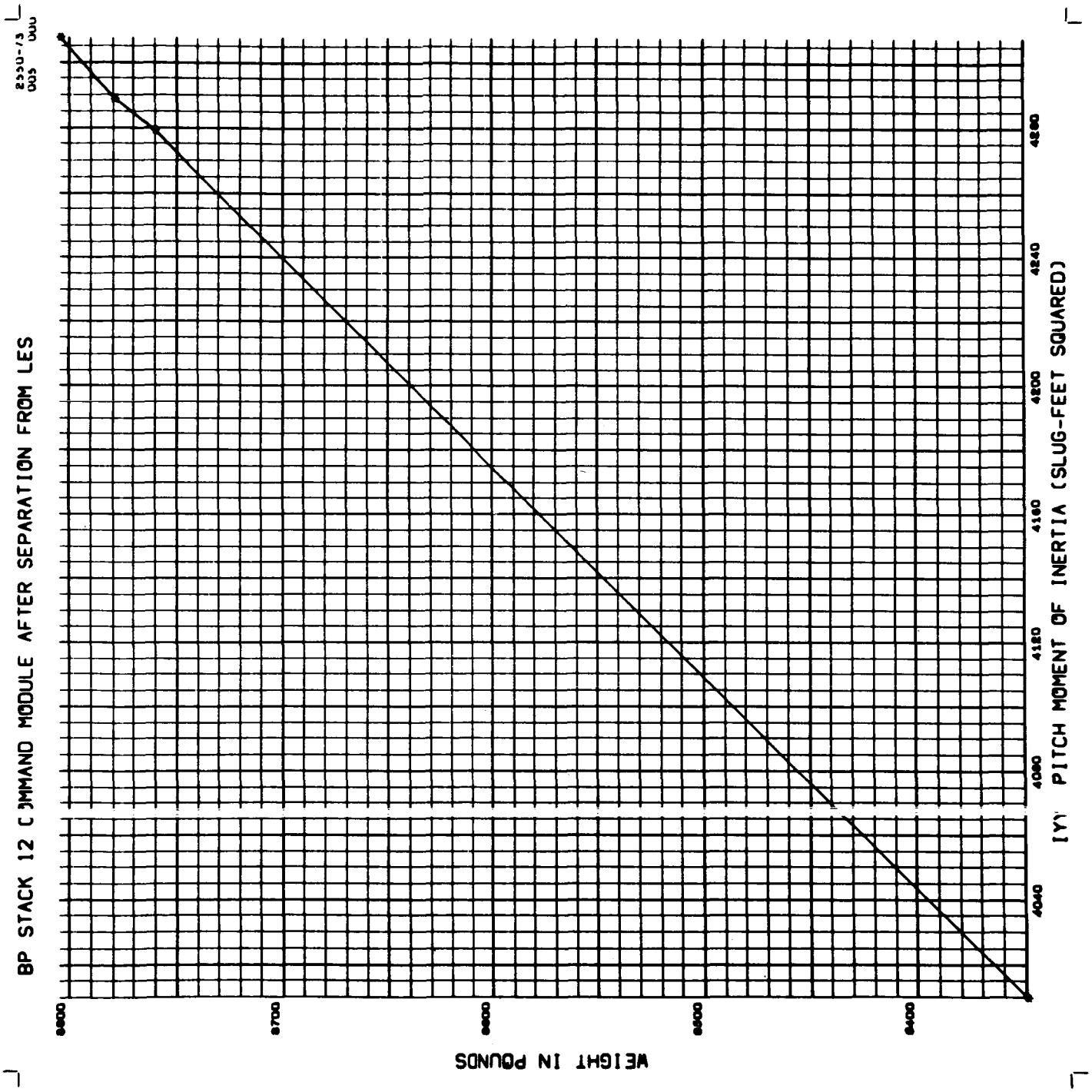
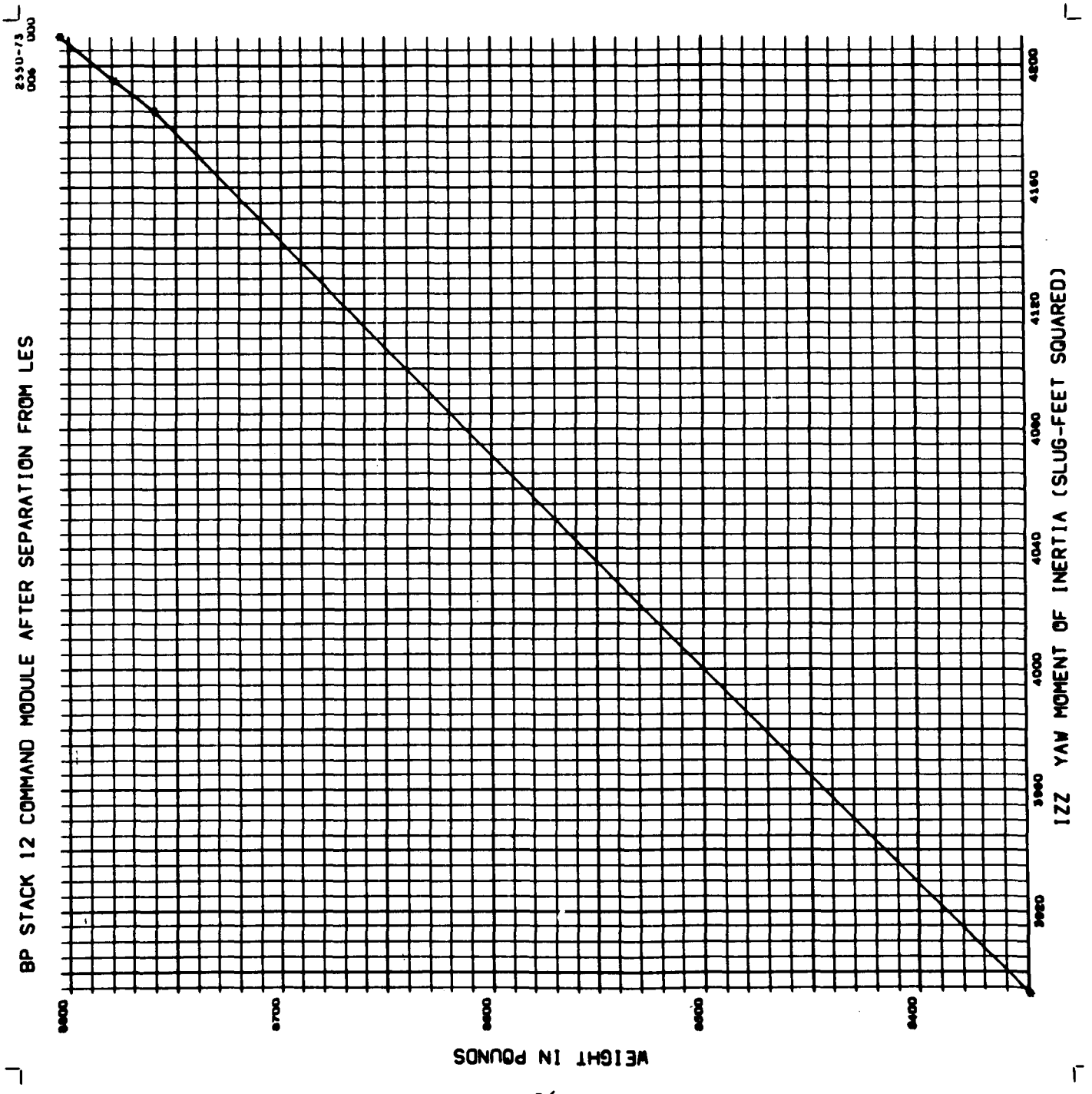
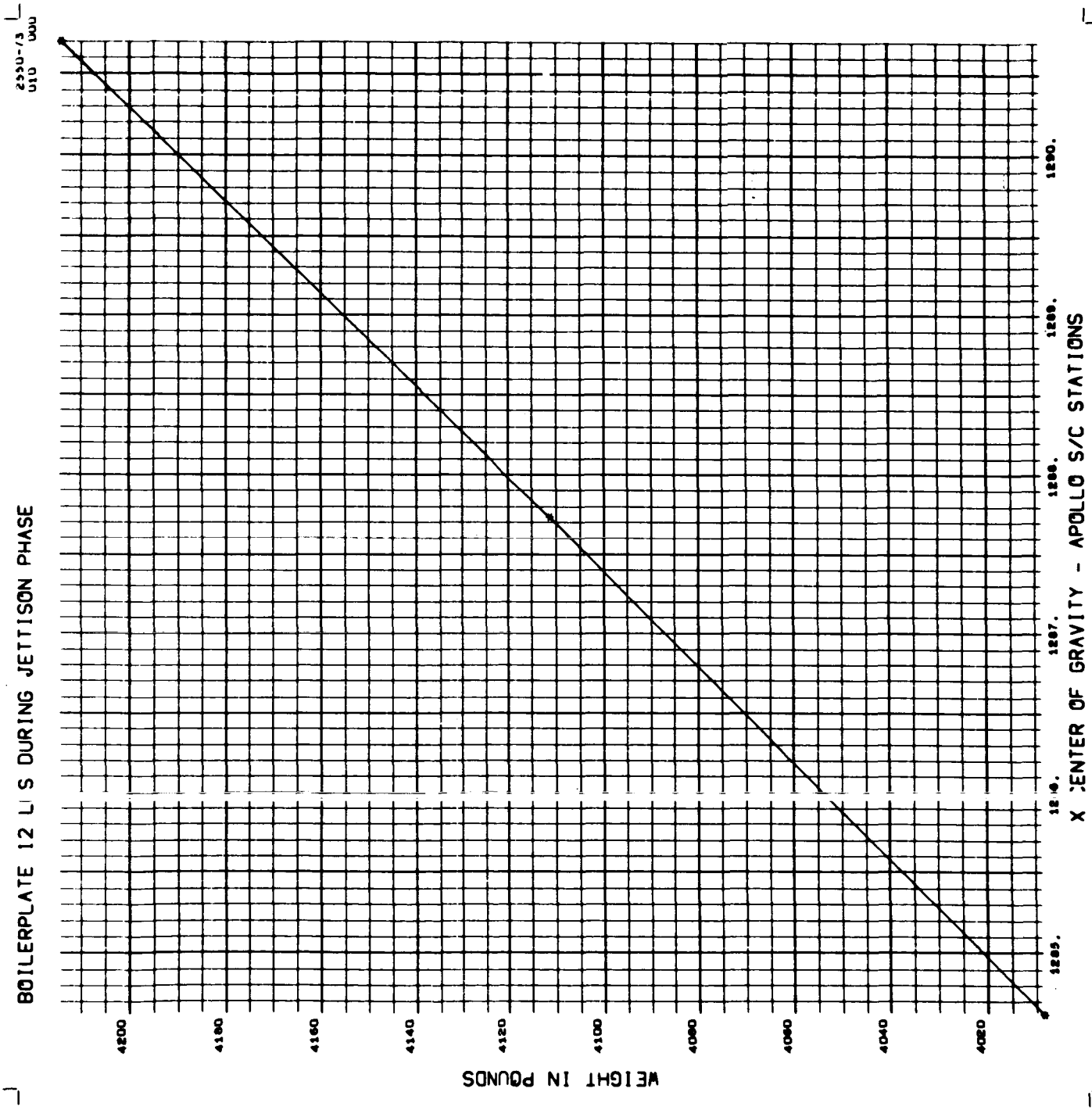
002 000
BP STACK 12 COMMAND MODULE AFTER SEPARATION FROM LES
WEIGHT IN POUNDS
8000
8200
8400
8600
8800
9000
Y CENTER OF GRAVITY - INCHES
.260
.264
.268
.272
.276
.280
.284
.288
.292
.296
.300

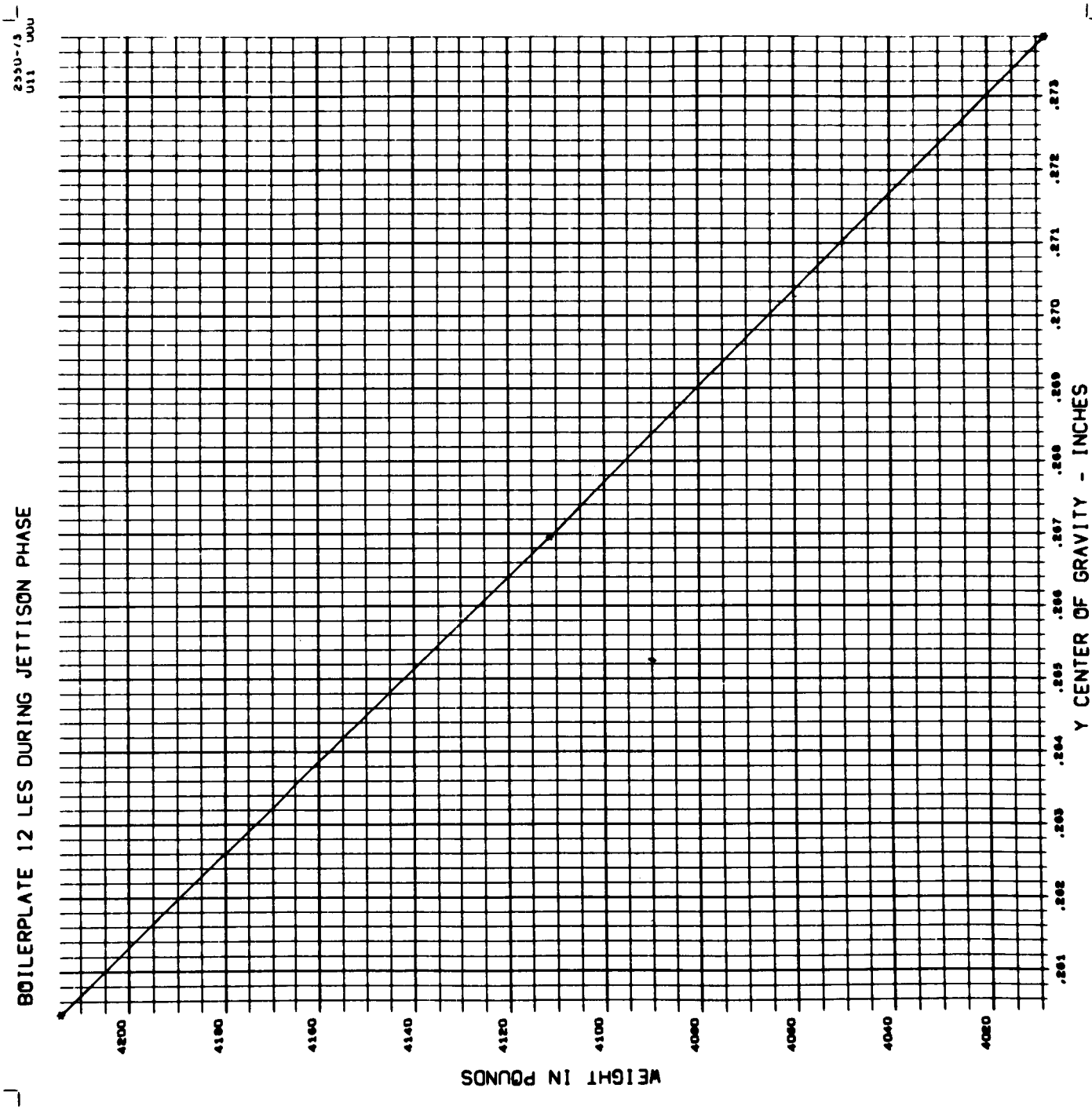

BP STACK 12 (COMMAND MODULE AFTER SEPARATION FROM LES
2550-73 003 000
WEIGHT IN POUNDS
8800
8700
8600
8500
8400
Z CENTER OF GRAVITY - INCHES
7.35
7.36
7.37
7.38
7.39
7.40
7.41
7.42

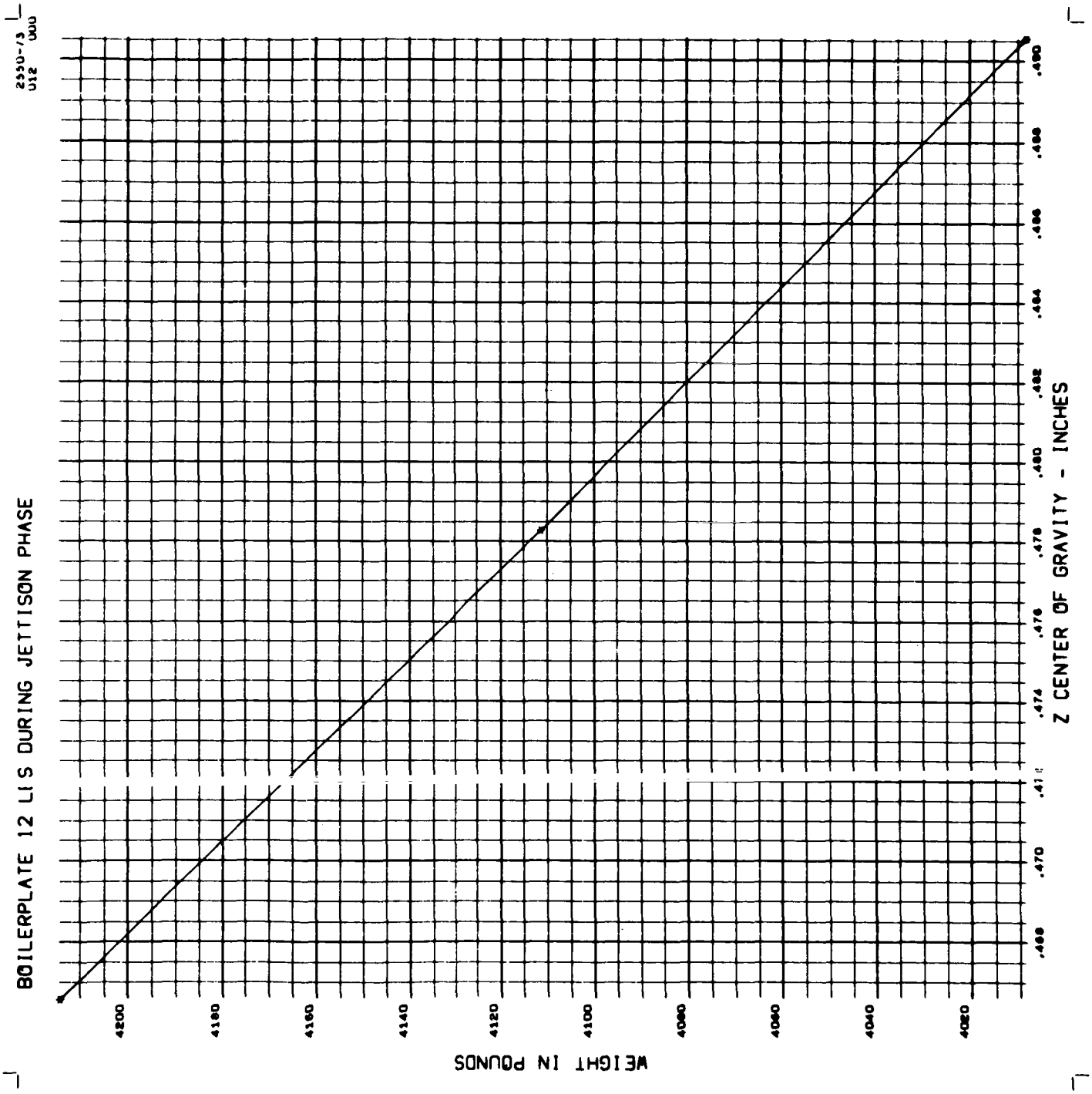

2350-73
004 000
BP STACK 12 COMMAND MODULE AFTER SEPARATION FROM LES
WEIGHT IN POUNDS
8800
8700
8600
8500
8400
IXX ROLL MOMENT OF INERTIA (SLUG-FEET SQUARED)
5090
5100
5110
5120
5130


BP STACK 12 COMMAND MODULE AFTER SEPARATION FROM LES
WEIGHT IN POUNDS
8800
8700
8600
8500
8400
IYY PITCH MOMENT OF INERTIA (SLUG-FEET SQUARED)
4040
4080
4120
4160
4200
4240
4280


2550-73
006 000
BP STACK 12 COMMAND MODULE AFTER SEPARATION FROM LES
WEIGHT IN POUNDS
9800
9700
9600
9500
9400
IZZ YAW MOMENT OF INERTIA (SLUG-FEET SQUARED)
3920
3960
4000
4040
4080
4120
4160
4200


BOILERPLATE 12 LIS DURING JETTISON PHASE
WEIGHT IN POUNDS
4200
4180
4160
4140
4120
4100
4080
4060
4040
4020
X CENTER OF GRAVITY - APOLLO S/C STATIONS
1285.
1286.
1287.
1288.
1289.
1290.


BOILERPLATE 12 LES DURING JETTISON PHASE
WEIGHT IN POUNDS
4200
4180
4160
4140
4120
4100
4080
4060
4040
4020
Y CENTER OF GRAVITY - INCHES
.261
.262
.263
.264
.265
.266
.267
.268
.269
.270
.271
.272
.273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U12 000
BOILERPLATE 12 LIS DURING JETTISON PHASE
WEIGHT IN POUNDS
4200
4180
4160
4140
4120
4100
4080
4060
4040
4020
Z CENTER OF GRAVITY - INCHES
.468
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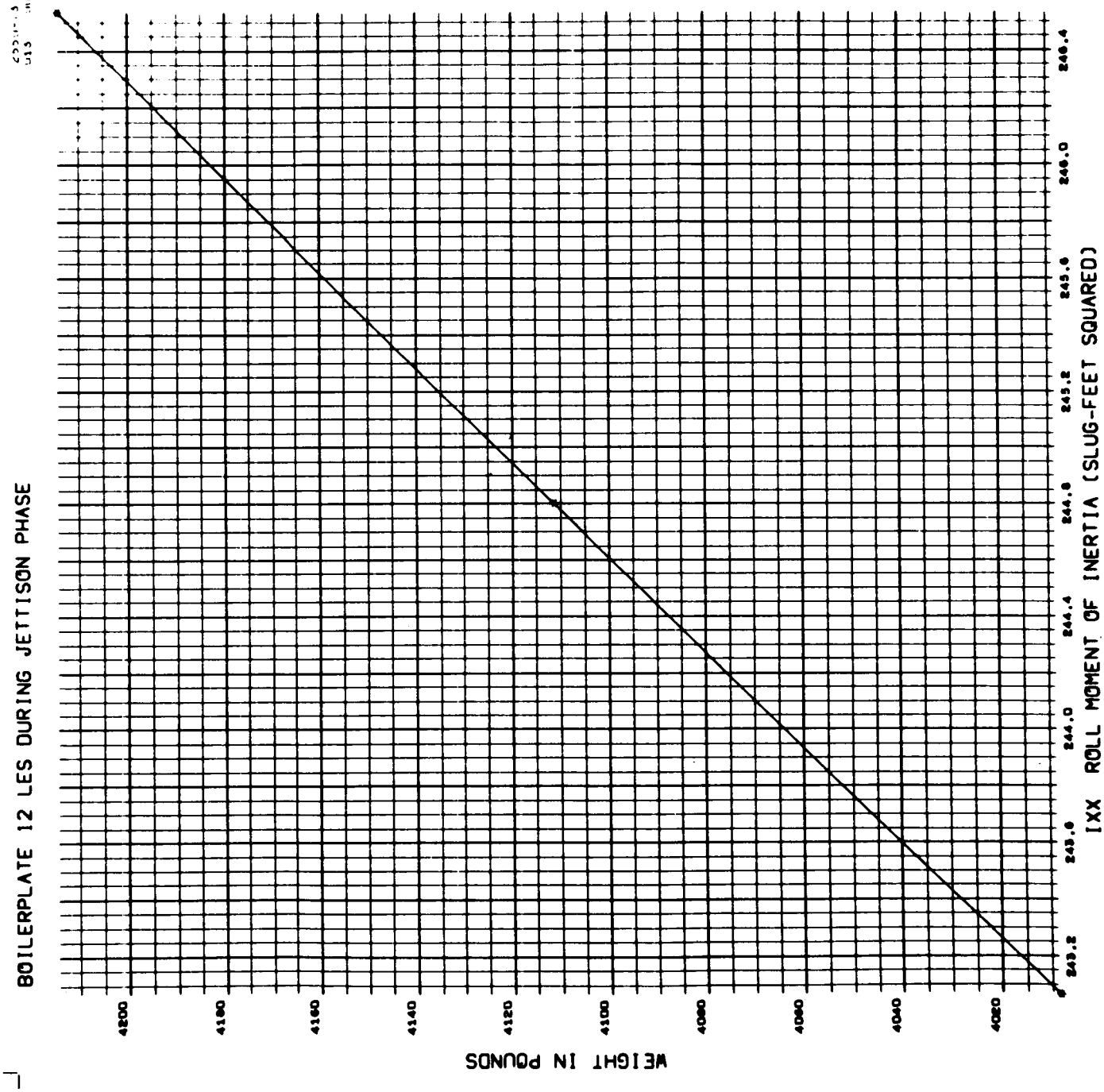
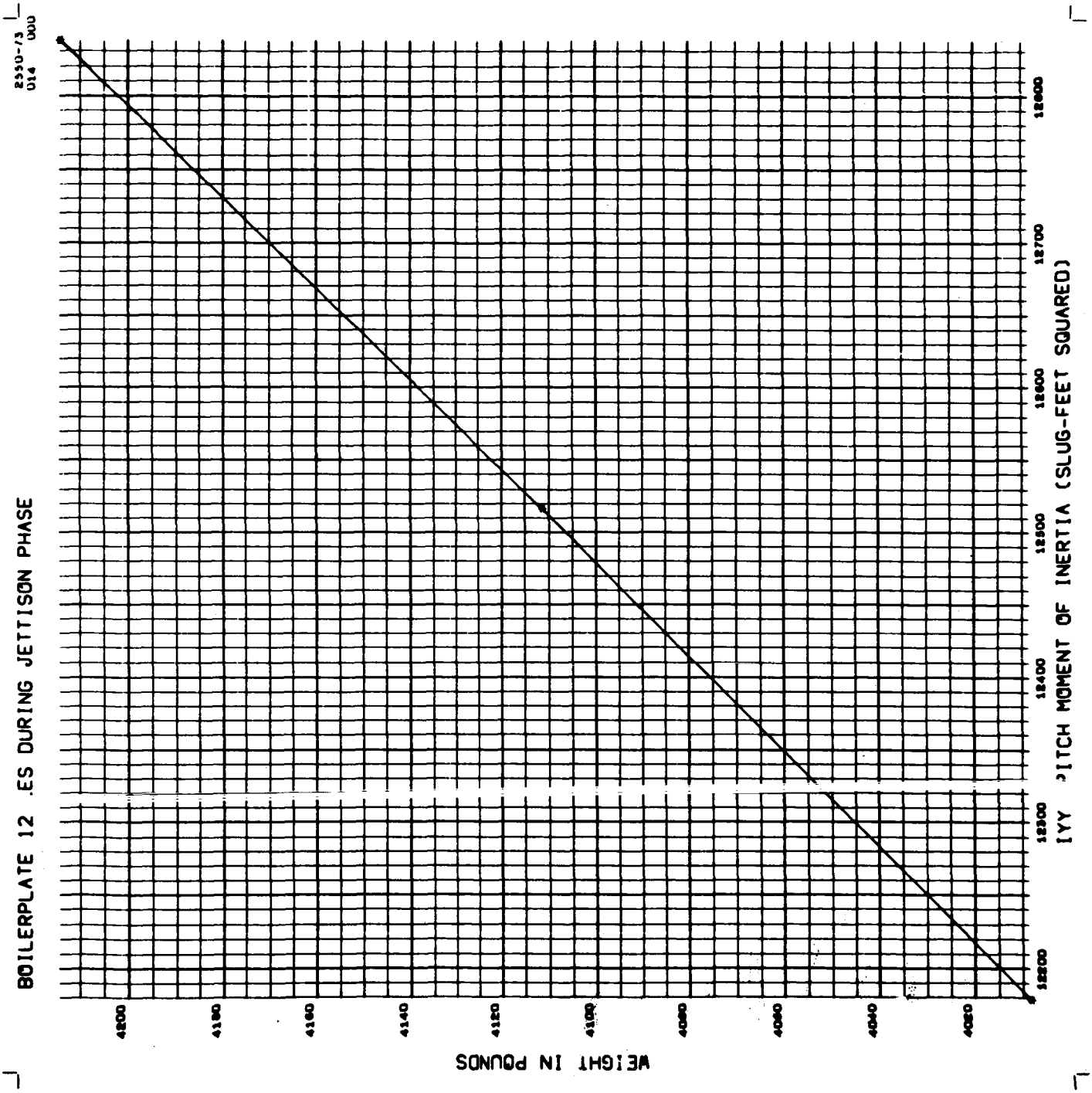
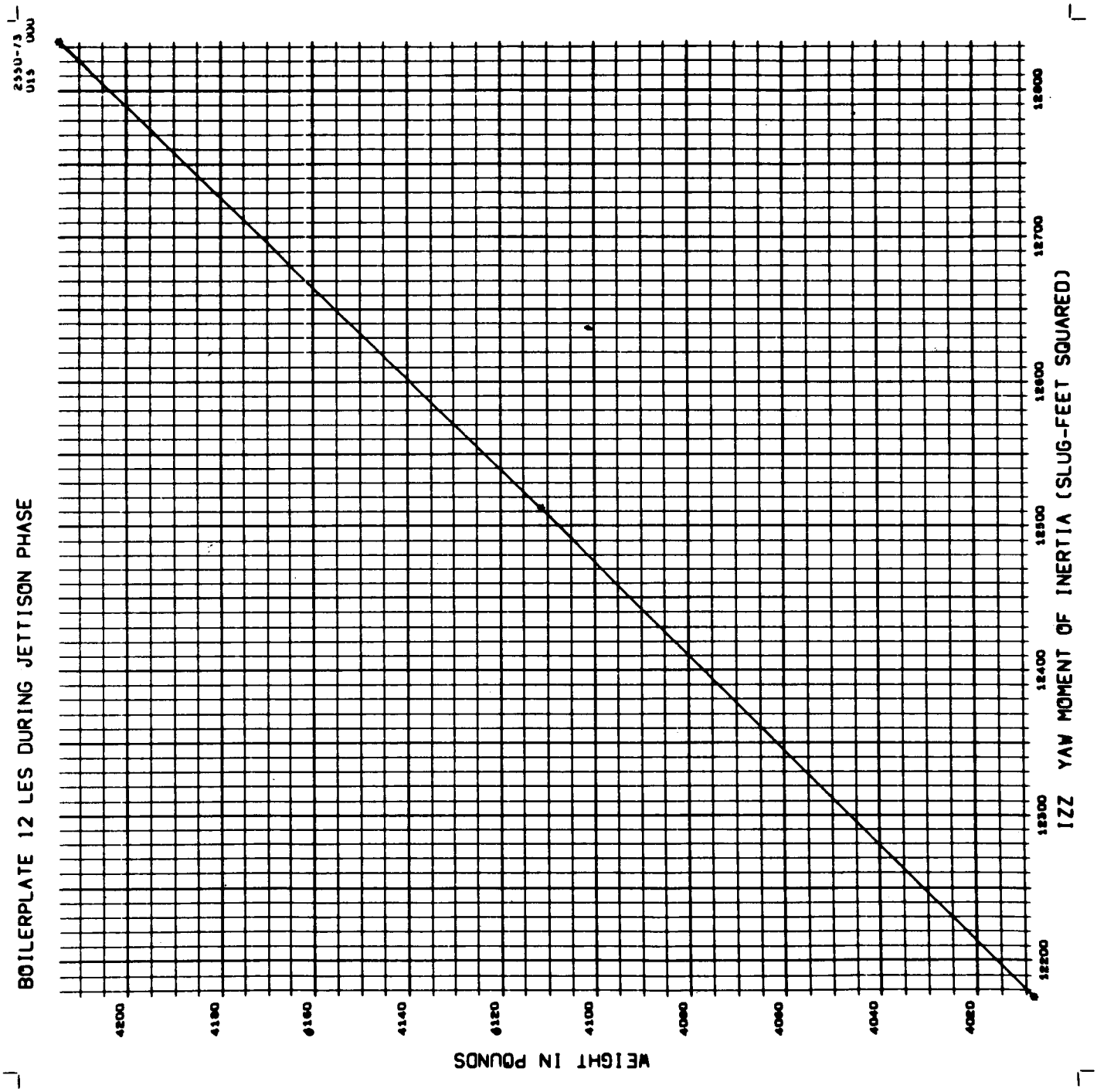
.474
.476
.478
.480
.482
.484
.486
.488
.490

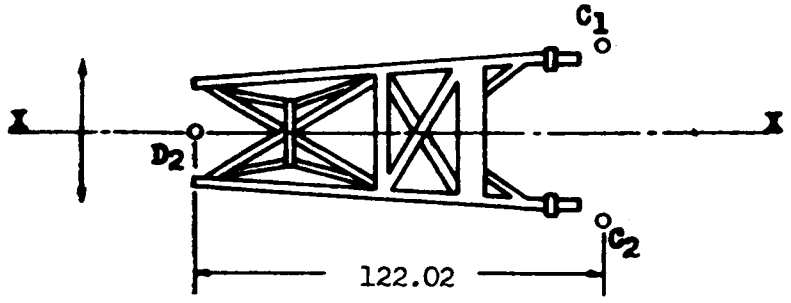

BOILERPLATE 12 LES DURING JETTISON PHASE
WEIGHT IN POUNDS
4200
4180
4160
4140
4120
4100
4080
4060
4040
4020
IXX ROLL MOMENT OF INERTIA (SLUG-FEET SQUARED)
243.2
243.6
244.0
244.4
244.8
245.2
245.6
246.0
246.4


BOILERPLATE 12 .ES DURING JETTISON PHASE
IYY PITCH MOMENT OF INERTIA (SLUG-FEET SQUARED)
12200
12300
12400
12500
12600
12700
12800
WEIGHT IN POUNDS
4200
4180
4160
4140
4120
4100
4080
4060
4040
4020


BOILERPLATE 12 LES DURING JETTISON PHASE
WEIGHT IN POUNDS
4200
4180
4160
4140
4120
4100
4080
4060
4040
4020
IZZ YAW MOMENT OF INERTIA (SLUG-FEET SQUARED)
12200
12300
12400
12500
12600
12700
12800

WEIGHT AND BALANCE DATA SHEET

LAUNCH ESCAPE SYSTEM - TOWER ASSEMBLY



PLAN VIEW

X_a 1083.29

Vehicle No. Boilerplate No. 12

Recorded By K. L. Beets

Location WSMR

Date Performed 11 March 1964

REACTION POINT C_1

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Red	10449.5	-11.0	10438.5	
2	S/N 20336	10524.0	-98.0	10426.0	
3		10537.0	-99.0	10438.0	
					10434.2

REACTION POINT D_2

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Yellow	8120.0	-7.0	8113.0	
2	S/N 20338	8198.0	-94.0	8104.0	
3		8202.0	-98.0	8104.0	
					8107.0

REACTION POINT C_2

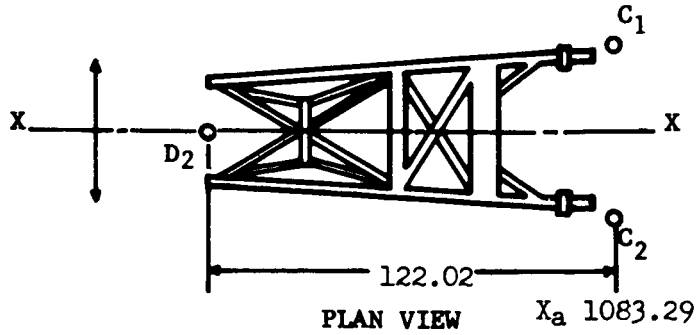
DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Blue	10541.5	-1.0	10540.5	
2	S/N 20341	10660.0	-98.0	10562.0	
3		10639.0	-98.5	10540.5	
					10547.7

VERIFIED BY: Phillips
NASA

MX9970-1018-2

WEIGHT AND BALANCE CALCULATION SHEET

LAUNCH ESCAPE SYSTEM - TOWER ASSEMBLY



PLAN VIEW

Vehicle No. Boilerplate No. 12 Recorded By G. W. Mann

Location WSMR Date Performed 18 March 1964

WEIGHT DERIVATION						
REACT POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
C_1	Red	10434.2	260.1	-	+0.3	260.4
D_2	Yellow	8107.0	202.4	-	+0.2	202.6
C_2	Blue	10547.7	262.2	-	+0.3	262.5

WEIGHT AND X - Y CENTER OF GRAVITY				
DESCRIPTION	REACT POINT	WEIGHT	X STA	X MOMENT
Cell Location	C_1	260.4	1083.29	282,089
Cell Location	D_2	202.6	1205.31	244,196
Cell Location	C_2	262.5	1083.29	284,364
GROSS (as weighed)		725.5	1117.37	810,649
Less: "X" Frame (G15-810013)		-320.7	1083.26	-347,401
Fwd. Tee		-9.6	1205.34	-11,571
Plus: Air Buoyancy Correction		0.2	1142.91	224
NET (as weighed)		395.4	1142.91	451,906
Plus: Corrections (Page 25)		20.1	1120.7	22,526
CORRECTED WEIGHT AND CG (X)		415.5	1141.83	474,432

CORRECTIONS TO ACTUAL WEIGHT AND BALANCE

BOILERPLATE NO. 12

LAUNCH ESCAPE TOWER

ITEM	WEIGHT	X_a C.G.
Cable Assy.	3.4	1187.5
Expl. Bolts	9.0	1085.5
Ordinance Installation	4.1	1085.5
Camera & Case	3.4	1185.4
Heat Refl. Tape - Camera Harness	0.2	1187.5
TOTAL CORRECTIONS	20.1	1120.7

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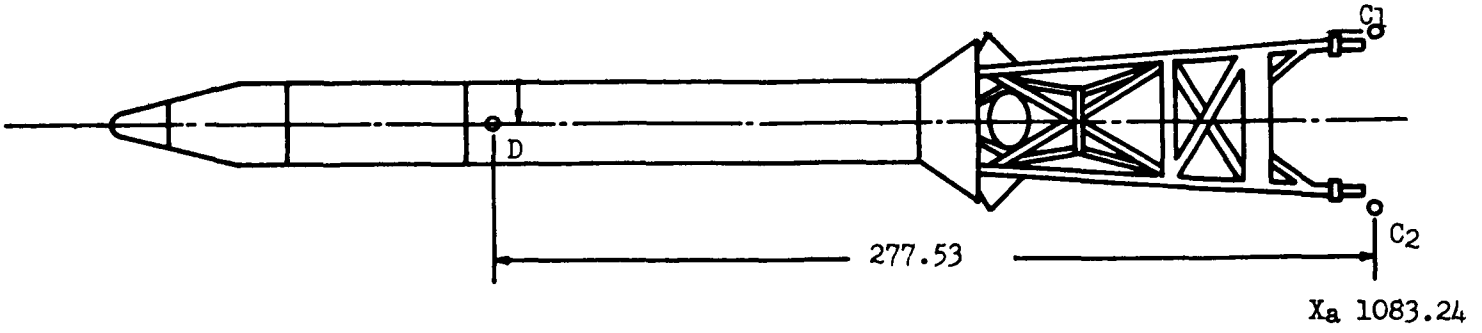
WEIGHT AND BALANCE DATA SHEET

LAUNCH ESCAPE SYSTEM



Vehicle No. Boilerplate No. 12 **Recorded By** K. L. Beets

Location WSMR **Date Performed** 16 March 1964

REACTION POINT C_2

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Blue	31937.0	-95.0	31842.0	
2	S/N 20341	31981.0	-100.0	31881.0	
3		31978.0	-99.0	31879.0	
					31867.3

REACTION POINT C_1

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Yellow	37457.5	-95.0	37362.5	
2	S/N 20338	37432.5	-100.0	37332.5	
3		37500.5	-98.0	37402.5	
					37365.8

REACTION POINT D

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Blue	22861.0	-97.5	22763.5	
2	S/N 34214	22865.0	-100.0	22765.0	
3		22858.0	-100.0	22758.0	
					22762.2

VERIFIED BY: [illegible]

NASA

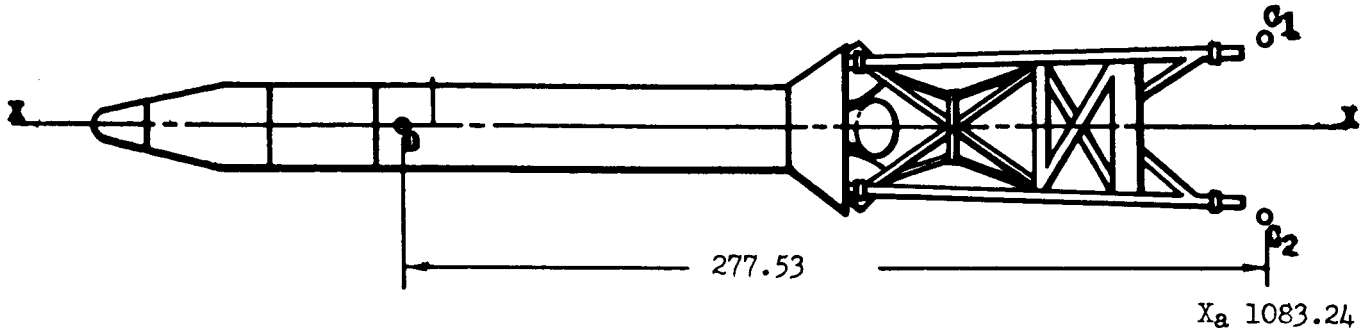
~~CONFIDENTIAL~~

SID 63-143-9W

MX9970-1018-6

WEIGHT AND BALANCE CALCULATION SHEET

LAUNCH ESCAPE SYSTEM



PLAN VIEW

Vehicle No. Boilerplate No. 12 **Recorded By** G. W. Mann

Location WSMR **Date Performed** 17 March 1964

WEIGHT DERIVATION						
REACT POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
C_2	Blue	31867.3	792.0	-0.1	-	791.9
C_1	Yellow	37365.8	928.2	-0.1	-	928.1
D	Blue	22762.2	5742.9	-0.9	-	5742.0

WEIGHT AND X CENTER OF GRAVITY				
DESCRIPTION	REACT POINT	WEIGHT	X STA	X MOMENT
Cell Location	C_2	791.9	1083.24	857,818
Cell Location	C_1	928.1	1083.24	1,005,355
Cell Location	D	5742.0	1360.77	7,813,541
GROSS (as weighed)		7462.0	1296.80	9,676,714
Less: "X" Frame (G15-810012)		[illegible]	[illegible]	[illegible]
Saddle (G15-810091)		-165.8	1359.03	-225,327
Plus: Air Buoyancy		+3.0	1317.80	3,953
NET (as weighed)		6978.5	1305.14	9,107,939
Plus: Corrections (Page 28)		16.2	1101.1	17,838
CORRECTED WEIGHT AND CG (X)		6994.7	1304.67*	9,125,777

*Although the X_a c.g. presented here is the measured value, due to maneuvering the motors for thrust vector alignment, the c.g. decreased 0.10 inches. Page reflects the c.g. decrease (X_a 1304.6).

MX9970-1018

CORRECTIONS TO ACTUAL WEIGHT AND BALANCE

BOILERPLATE NO. 12

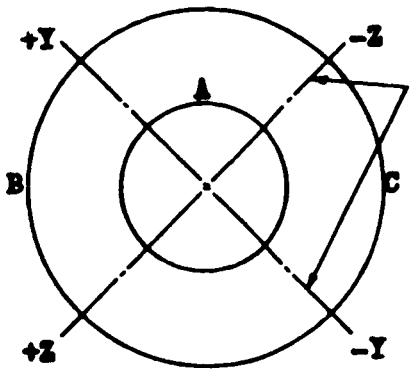
LAUNCH ESCAPE SYSTEM

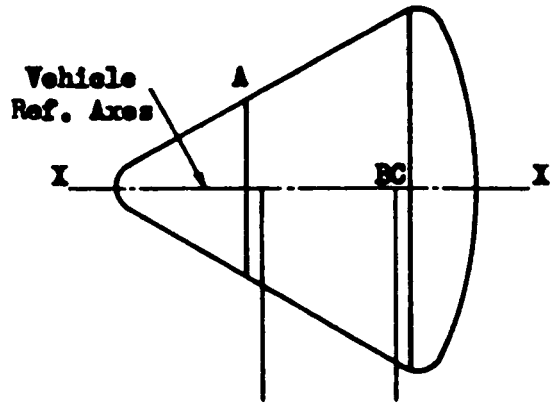
ITEM	WEIGHT	CENTER OF GRAVITY		
		X_a	Y_a	Z_a
Nozzle Covers	-3.8	1198.0	0.0	0.0
Plates (V15-452556-3)	3.0*	1206.5	0.0	-13.5
Expl. Bolts	9.0	1085.5	0.0	0.0
L.E. Tower Sequencers	-0.3*	1206.5	0.0	-13.5
Camera & Case	3.4*	1185.4	0.0	0.0
Bracket, Clamps (V15-300214)	0.9*	1206.5	0.0	-14.5
Heat Refl. Tape - Camera Harness	0.2*	1187.5	0.0	-17.0
"Q" Ball Replacement	-0.3*	1470.9	0.0	0.0
Ordinance Installation	4.1*	1085.5	0.0	0.0
TOTAL CORRECTIONS/L.E.S.	16.2	1101.1	0.0	-3.3
TOTAL CORRECTIONS/L.E.S. - STACK	11.0*	1147.3	0.0	-4.8

*These items are accounted for only in the L.E.S. - C/M Stack weighings.

WEIGHT AND BALANCE DATA SHEET

COMMAND MODULE - HORIZONTAL





Vehicle No. Boilerplate No. 12 **Recorded By** K. L. Beets

Location WSMR **Date Performed** 23 March 1964

REACTION POINT A

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Red	11689.5	-193.5	11496.0	
2	S/N 34215	11675.0	-201.0	11474.0	
3		11684.0	-200.0	11484.0	
					11484.7

REACTION POINT B

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Yellow	14137.5	-197.0	13940.5	
2	S/N 34210	14187.0	-195.5	13991.5	
3		[illegible]	[illegible]	[illegible]	
					13962.7

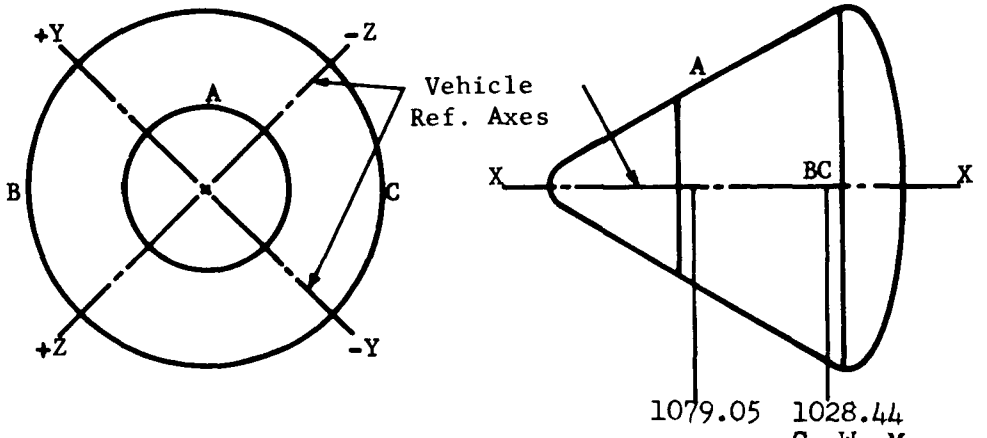
REACTION POINT C

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Blue	12542.5	-196.5	12346.0	
2	S/N 34214	12510.0	-199.5	12310.5	
3		12546.5	-199.0	12347.5	
					12334.7

VERIFIED BY: H. Miller
NASA

WEIGHT AND BALANCE CALCULATION SHEET

COMMAND MODULE - HORIZONTAL



Vehicle No. Boilerplate No. 12 Recorded By G. W. Mann

Location WSMR Date Performed 24 March 1964

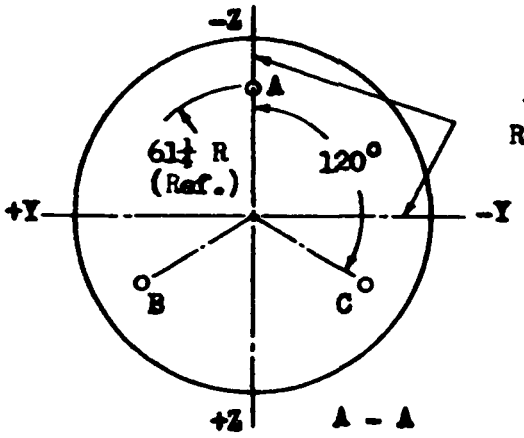
WEIGHT DERIVATION						
REACT POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
A	Red	11484.7	2900.9	-0.4	-	2900.5
B	Yellow	13962.7	3518.4	-0.5	-	3517.9
C	Blue	12334.7	3108.3	-0.5	-	3107.8

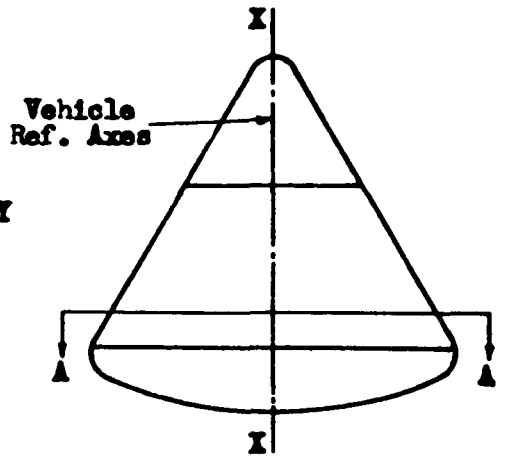
WEIGHT AND X CENTER OF GRAVITY				
DESCRIPTION	REACT POINT	WEIGHT	X STA	X MOMENT
Cell Location	A	2900.5	1079.05	3,129,785
Cell Location	B	3517.9	1028.44	3,617,949
Cell Location	C	3107.8	1028.44	3,196,186
GROSS (as weighed)		9526.2	1043.85	9,943,920
Less: Fwd. Sling & Trunnions		-288.1	1079.05	-310,874
Fwd. Jack Pad		-6.2	1079.05	-6,690
Aft Jack Pads		-37.3	1028.44	-38,361
Plus: Air Buoyancy Correction		+6.6	1042.79	6,882
NET (as weighed)		9201.2	1042.79	9,594,877
Plus: Corrections (Page 34)		22.8	1035.0	23,598
CORRECTED WEIGHT AND CG (X)		9224.0	1042.77	9,618,475

MX9970-1018-11

WEIGHT AND BALANCE DATA SHEET

COMMAND MODULE - VERTICAL





Vehicle No. Boilerplate No. 12

Recorded By K. L. Beets

Location WSMR

Date Performed 24 March 1964

REACTION POINT A

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Red	10383.0	-392.0	9991.0	
2	S/N 34215	10385.5	-395.0	9990.5	
3		10388.0	-397.0	9991.0	
					9990.8

REACTION POINT B

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Yellow	14658.0	-397.0	14261.0	
2	S/N 34210	14661.5	-397.0	14264.5	
3		14665.5	-400.5	14265.0	
					14263.5

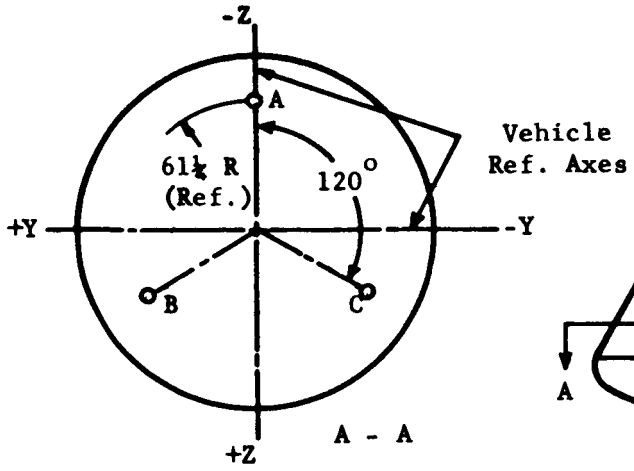
REACTION POINT C

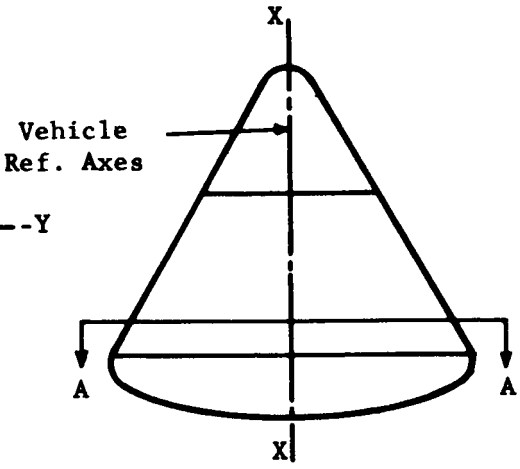
DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Blue	14411.0	-398.5	14012.5	
2	S/N 34214	14415.5	-400.0	14015.5	
3		14410.0	-400.5	14009.5	
					14012.5

VERIFIED BY: [signature] NASA

WEIGHT AND BALANCE CALCULATION SHEET

COMMAND MODULE - VERTICAL





Vehicle No. Boilerplate No. 12

Location WSMR

Recorded By G. W. Mann

Date Performed 24 March 1964

WEIGHT DERIVATION						
REACT POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
A	Red	9990.8	2512.8	-0.4	-	2512.4
B	Yellow	14263.5	3594.2	-0.5	-	3593.7
C	Blue	14012.5	3531.5	-0.5	-	3531.0

WEIGHT AND Y - Z CENTER OF GRAVITY						
DESCRIPTION	REACT POINT	WEIGHT	Y STA	Y MOMENT	Z STA	Z MOMENT
Cell Location	A	2512.4	0.00	0	-61.26	-153,910
Cell Location	B	3593.7	53.02	190,538	30.64	110,111
Cell Location	C	3531.0	-53.02	-187,214	-30.63	108,155
GROSS (as weighed)		9637.1	0.34	3,324	6.68	64,356
Less: Ring (G14-810009)		-470.4	0.62	-291	-0.50	235
Plus: Air Buoyancy Correction		+6.6	0.33	2	7.05	14
NET (as weighed)		9173.3	0.33	3,035	7.05	64,605
Plus: Corrections (Page 34)		22.8	0.1	2	32.0	730
CORRECTED WEIGHT AND CG (Y-Z)		9196.1	0.33	3,037	7.10	65,335

WEIGHT AND BALANCE DATA SHEET

COMMAND MODULE

SINGLE CELL TENSION WEIGHING

Vehicle No. Boilerplate No. 12 **Recorded By** K. L. Beets

Location WSMR **Date Performed** 24 March 1964

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING
1	Red	37378.5	-192.5	37186.0
2	S/N 34215	37387.5	-198.5	37189.0
3		37387.0	-199.0	37188.0

AVERAGE READING	37187.7
INDICATED WEIGHT	9319.6
BUOYANCY CORRECTION	5.2
GRAVITY CORRECTION	-
GROSS WEIGHT (as weighed)	9324.8
LESS: H14-9001 Sling & Ftgs.	-126.5
NET WEIGHT (as weighed)	[illegible]
PLUS: Corrections (Page 34)	22.8
CORRECTED WEIGHT	9221.1

VERIFIED BY: [signature]
NASA

MX9970-1018-1

CORRECTIONS TO ACTUAL WEIGHT AND BALANCE

BOILERPLATE NO. 12

COMMAND MODULE

ITEM	WEIGHT	CENTER OF GRAVITY		
		X_a	Y_a	Z_a
Tie Down (Fwd. Cover)	-5.9	1081.5	0.0	0.0
Tension Tie (C/M to S/M)	2.1	1009.7	0.0	0.0
Electrolyte (Main Battery)	7.3	1018.0	0.0	38.1
Apex Cover to Tower Tie Down	1.4	1087.4	0.0	0.0
Back-Up Timer	11.0	1045.7	0.0	39.6
Camera System Replacement	0.7	1043.6	0.0	-0.8
Tape Recorder Replacement	0.7	1043.6	-22.0	38.4
LES Sequencer Replacement	0.1	1043.0	-44.2	-19.0
C/M-LES Separation Hardware	1.5	1083.9	0.0	0.0
Main Battery Hardware	-0.4	1018.0	0.0	38.1
Pyro-Logic-C/M Camera Battery Replacements	-0.7	1025.3	2.4	13.2
Sealant and Teflon Covers (Hatch)	0.8	1064.1	0.0	-46.8
Angle B16-331096-9	-0.7	1038.4	-36.7	-26.1
Cork B16-320012-11, 13, 15, 17, 21, 23, 25,27	1.9	1053.7	0.0	0.0
C/M Camera Shroud Clamp	0.2	1073.0	20.0	-20.0
Glass Samples - Aft Heat Shield	-0.1	1019.3	-5.0	-9.8
Glass Samples - Main Body	-0.8	1066.2	7.0	-30.4
Cork Plugs & Covers B16-320012	0.7	1053.7	0.0	0.0
Hatch Handle	-0.3	1064.1	0.0	-46.8
Wiring & Hardware	1.1	1042.8	0.0	0.0
Cork Plugs for Lift Pad Holes	2.2	1083.5	0.0	0.0
TOTAL CORRECTIONS	22.8	1035.0	0.1	32.0

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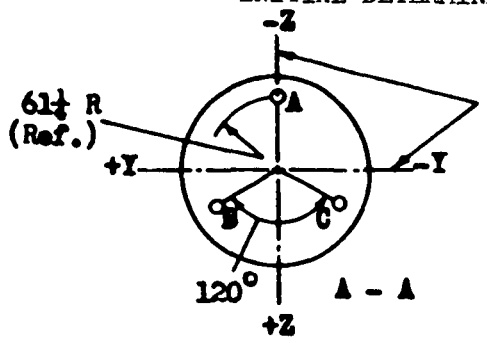
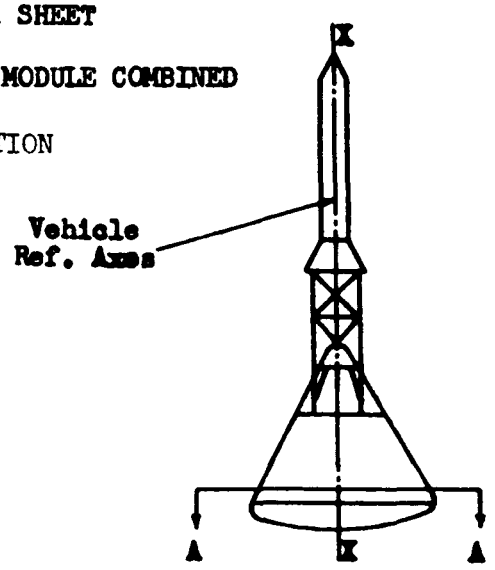
WEIGHT AND BALANCE DATA SHEET

LAUNCH ESCAPE SYSTEM-COMMAND MODULE COMBINED

INITIAL DETERMINATION





Vehicle No. Boilerplate No. 12 **Recorded By** K. L. Beets

Location WSMR **Date Performed** 26 March 1964

REACTION POINT A

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Red	19182.0	-2.0	19180.0	
2	S/N 34215	19175.0	-1.0	19174.0	
3		19185.0	0.0	19185.0	
					19179.7

REACTION POINT B

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Yellow	23750.0	-1.0	23749.0	
2	S/N 34210	23775.0	0.0	23775.0	
3		23764.0	0.0	23764.0	
					23762.7

REACTION POINT C

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Blue	22963.0	1.0	22964.0	
2	S/N 34214	22955.0	1.5	22956.5	
3		22955.0	0.0	22955.0	
					22958.5

VERIFIED BY: NASA

MX9970-1018-12

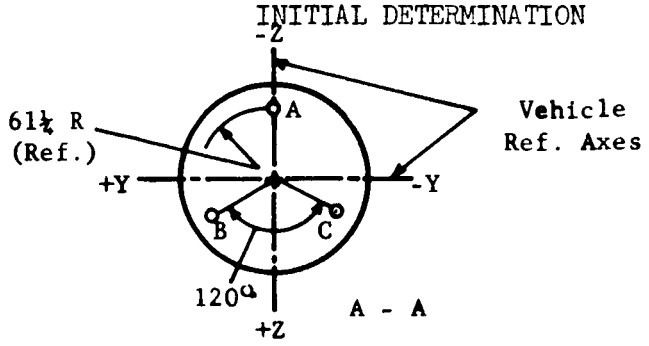
~~CONFIDENTIAL~~

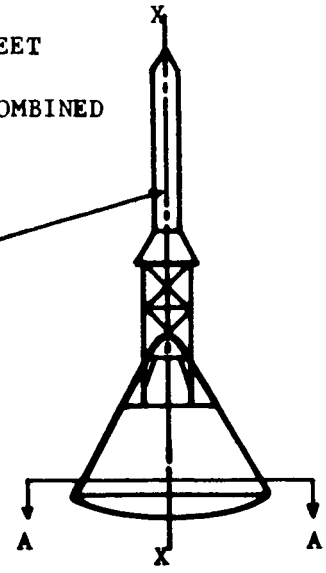
SID 63-143-9W

WEIGHT AND BALANCE CALCULATION SHEET

LAUNCH ESCAPE SYSTEM-COMMAND MODULE COMBINED

INITIAL DETERMINATION





Vehicle No. Boilerplate No. 12 Recorded By G. W. Mann

Location WSMR Date Performed 26 March 1964

WEIGHT DERIVATION						
REACT POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
A	Red	19179.7	4830.8	-0.7	-	4830.1
B	Yellow	23762.7	5995.6	-0.9	-	5994.7
C	Blue	22958.5	5792.7	-0.9	-	5791.8

WEIGHT AND Y - Z CENTER OF GRAVITY						
DESCRIPTION	REACT POINT	WEIGHT	Y STA	Y MOMENT	Z STA	Z MOMENT
Cell Location	A	4830.1	0.00	0	-61.26	-295,892
Cell Location	B	5994.7	53.02	317,839	30.64	183,678
Cell Location	C	5791.8	-53.02	-307,081	30.63	177,403
GROSS (as weighed)		16616.6	0.65	10,758	3.92	65,189
Less: Ring (G14-810009)		-470.4	0.62	-292	-0.50	235
Alignment Grid (A14-007)		-23.3	0.00	0	3.00	-70
Projector & Mount (A14-007)		-25.8	0.00	0	0.00	0
PLUS: Air Buoyancy Correction		9.6	0.65	6	4.06	39
NET (as weighed)		16106.7	0.65	10,472	4.06	65,389
Plus: Corrections (Page 34)		22.8	0.1	2	32.0	730
Corrections (Page 28)*		11.0	0.0	0	-4.8	-53
Camera & Case		40.1	0.0	0	0.0	0
CORRECTED WEIGHT AND CG (Y-Z)		16180.6	0.65	10,474	4.08	66,066

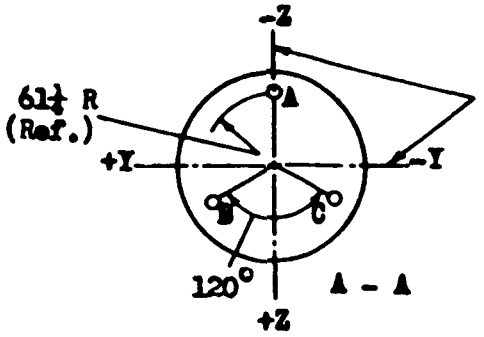
*Refer to Page

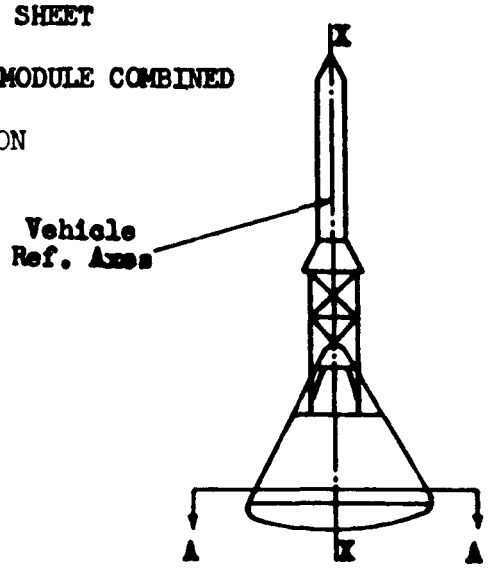
MX9970-1018-13

WEIGHT AND BALANCE DATA SHEET

LAUNCH ESCAPE SYSTEM-COMMAND MODULE COMBINED

FINAL DETERMINATION





Vehicle No. Boilerplate No. 12 **Recorded By** K. L. Beets

Location WSMR **Date Performed** 27 March 1964

REACTION POINT A

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Red	19161.5	-1.0	19160.5	
2	S/N 34215	19168.5	-1.0	19167.5	
3		19177.5	-1.0	19176.5	
					19168.2

REACTION POINT B

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Yellow	23489.0	0.0	23489.0	
2	S/N 34210	23484.0	0.0	23484.0	
3		23485.0	0.0	23485.0	
					23486.0

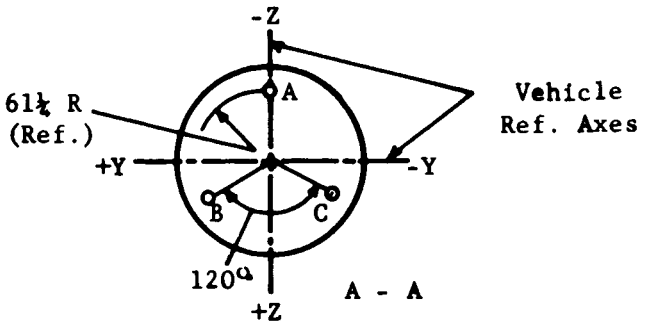
REACTION POINT C

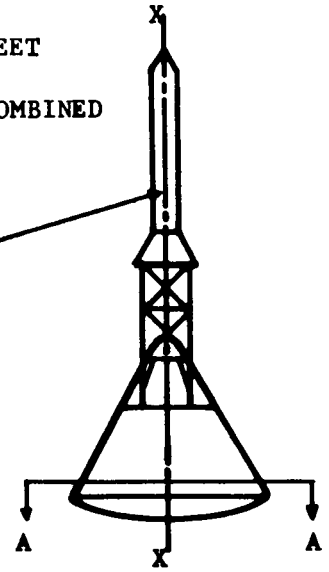
DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Blue	23251.5	0.0	23251.5	
2	S/N 34214	23255.0	0.0	23255.0	
3		23241.0	0.0	23241.0	
					23249.2

VERIFIED BY: [signature] NASA

WEIGHT AND BALANCE CALCULATION SHEET

LAUNCH ESCAPE SYSTEM-COMMAND MODULE COMBINED
FINAL DETERMINATION





Vehicle No. Boilerplate No. 12 Recorded By G. W. Mann

Location WSMR Date Performed 27 March 1964

WEIGHT DERIVATION

REACT POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
A	Red	19168.2	4827.9	-0.7	-	4827.2
B	Yellow	23486.0	5925.4	-0.9	-	5924.5
C	Blue	23249.2	5866.4	-0.9	-	5865.5

WEIGHT AND Y - Z CENTER OF GRAVITY

DESCRIPTION	REACT POINT	WEIGHT	Y STA	Y MOMENT	Z STA	Z MOMENT
Cell Location	A	4827.2	0.00	0	-61.26	-295,714
Cell Location	B	5924.5	53.02	314,117	30.64	181,527
Cell Location	C	5865.5	-53.02	-310,989	30.63	179,660
GROSS (as weighed)		16617.2	0.19	3,128	3.94	65,473
Less: Ring (G14-810009)		-470.4	0.62	-292	-0.50	235
Alignment Grid (A14-007)		-23.3	0.00	0	3.00	-70
Projector & Mount (A14-007)		-25.8	0.00	0	0.90	-23
Plus: Air Buoyancy Correction		9.6	0.18	2	4.08	39
NET (as weighed)		16107.3	0.18	2,838	4.08	65,654
Plus: Corrections (Page 34)		22.8	0.1	2	32.0	730
Corrections (Page 28)*		11.0	0.0	0	-4.8	-53
Camera & Case		40.1	0.0	0	0.0	0
CORRECTED WEIGHT AND CG (Y-Z)		16181.2	0.18	2,840	4.10	66,331

*Refer to Page

LAUNCH WEIGHT HISTORY

COMMAND MODULE

BOILERPLATE NO. 12

DOWNEY TO LAUNCH

ITEM	WEIGHT (POUNDS)
TOTAL C/M (Downey)	(9171.0)
Pyro Simulator Holders	-0.9
Drogue Chute System - R6133	-36.6
Pilot Chutes - R6134	-28.9
Disconnect - PDS 2548	-48.5
Main Chute - R6135-1	-121.5
Main Chute - R6135-3	-122.0
Main Chute - R6135-5	-122.0
Ripple Filter - B16-4515016	7.5
Antenna Covers	-15.0
Drogue Chute System	39.6
Pilot Chute System	29.3
Parachute Subsystem	411.3
Sequence Controller	10.2
Inertia Switch	5.0
Line Filters	3.3
Antenna Covers	15.0
Wire Harnesses and Raw Stock	1.4
TOTAL C/M (at time of WSMR weighing)	(9198.2)
Backup Timer	11.0
Camera System Replacement	0.7
Tape Recorder Replacement	0.7
LES Sequencer Replacement	0.1
C/M - LES Separation Hardware	1.5
Main Battery Hardware	-0.4
Pyro Logic - C/M Camera Battery Replacements	-0.7
Sealant and Teflon Covers (Hatch)	-0.8
Angle B16-331096-9	-0.7
Cork B16-320012-11, 13, 15, 17, 21, 23, 25, 27	1.9
C/M Camera Shroud Clamp	0.2
Glass Samples - Aft Heat Shield	-0.1
Glass Samples - Main Body	-0.8
Cork Plugs and Covers B16-320012	0.7
Hatch Handle	0.3
Wiring and Hardware	1.1
Cork Plugs for Lift Pad Holes	2.2
Unaccountable Variations	6.5
TOTAL C/M - LAUNCH*	(9222.6)

*Average between horizontal and single cell weighings at WSMR.

WEIGHT BREAKDOWN SUMMARY

LAUNCH ESCAPE SYSTEM

BOILERPLATE NO. 12

ITEM	WEIGHT POUNDS
Basic Structure	(780)
Tower Assy.	336
Escape Motor Skirt	209
Pitch Motor Support Structure	157
Ballast Enclosure	63
Attaching Parts	15
Explosive Bolts	(8)
Propulsion	(5367)
Escape Motor	4792
Jettison Motor & Interstage	528
Pitch Control Motor	47
Electrical	(91)
Instrumentation	(104)
Ballast Instl.	(663)
Ballast Plates	647
Ballast Studs & Nuts	10
Ballast Retaining Plate	6
Manufacturing Variation	(-18)
LAUNCH ESCAPE SYSTEM WEIGHT	(6995)

WEIGHT BREAKDOWN SUMMARY

COMMAND MODULE

BOILERPLATE NO. 12

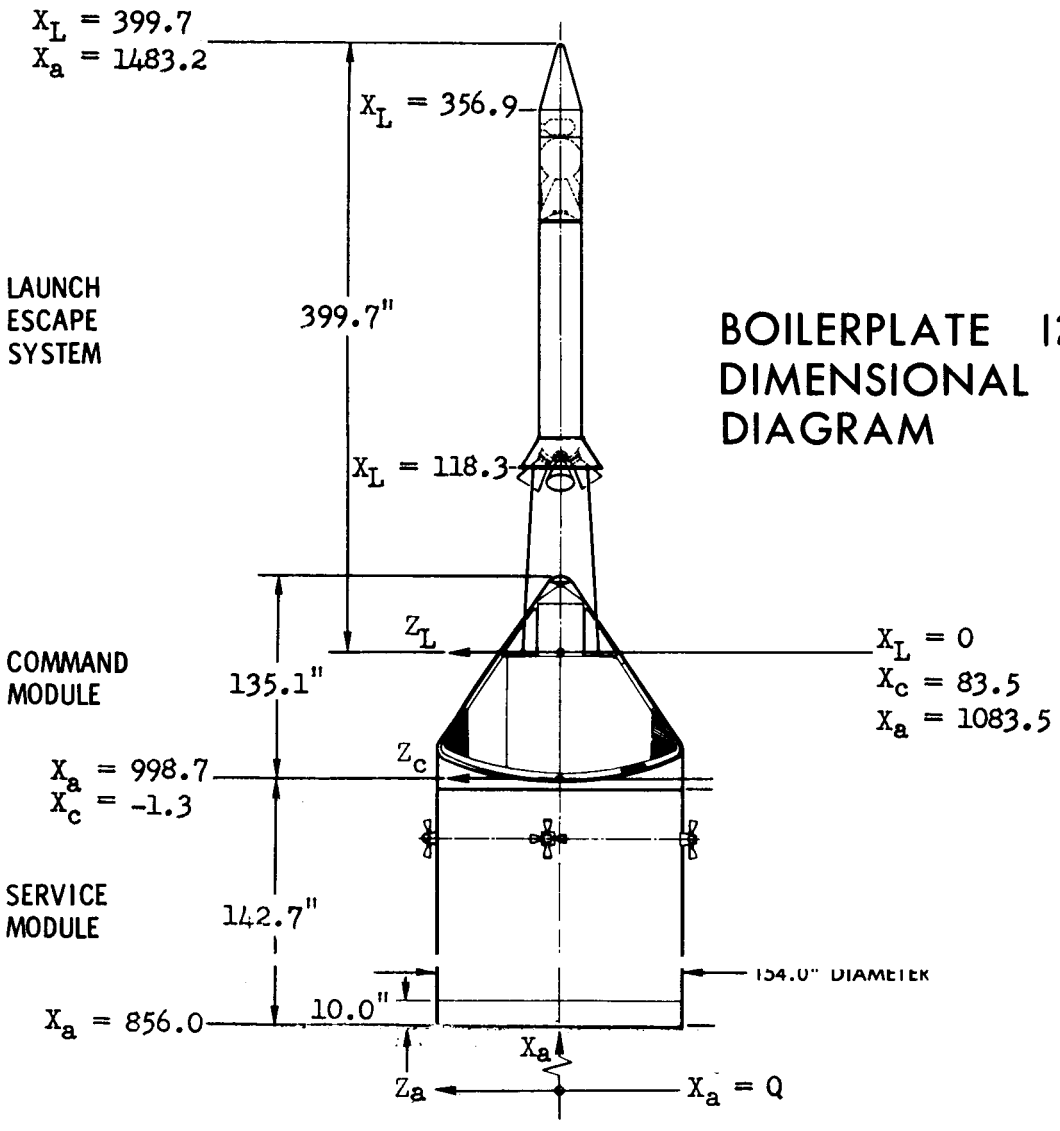
ITEM	WEIGHT POUNDS
Basic Structure	(5013)
Structure - Less Ablator	4853
Ablator	160
Secondary Structure	(2495)
Internal Ballast	1560
Forward Cover Ballast	90
Aft Heat Shield Ballast	617
Equipment Racks and Supports	137
Coldplates	61
Tension Ties (Partial)	30
Stabilization and Control	(51)
Environmental Control	(106)
Earth Landing System	(700)
Instrumentation	(288)
Electrical Power System	(341)
Communications	(193)
Manufacturing Variation	(36)
COMMAND MODULE WEIGHT	(9223)

WEIGHT BREAKDOWN SUMMARY

SERVICE MODULE

BOILERPLATE NO. 12

ITEM	WEIGHT POUNDS
Basic Structure	(7999)
Secondary Structure	(917)
Internal Ballast	902
Tension Ties (Partial)	15
Instrumentation	(177)
Electrical Power System	(56)
Manufacturing Variation	(-16)
SERVICE MODULE WEIGHT	(9133)



BOILERPLATE 12 DIMENSIONAL DIAGRAM