

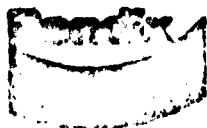
APOLLO LUNAR SURFACE EXPERIMENTS PACKAGE

ALSEP SYSTEM MASS PROPERTIES

5 December 1972



Prepared for
NASA/Manned Spacecraft Center



by
**Aerospace
Systems Division**



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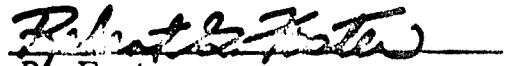
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FOREWORD

This Revision supersedes the revision issued 3 April 1972

This report covers mass property information on all ALSEP Flight hardware.

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J. L. McNaughton



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ALSEP Weight Report

1.0 WEIGHT

The weight of the ALSEP Flight Systems are summarized in Table 1. All weight values shown are based on actual measured weight data.

TABLE 1 ALSEP WEIGHT STATUS SUMMARY

	FLIGHT 1	FLIGHT 3	FLIGHT 4	ARRAY A-2	FLIGHT 5	FLIGHT 6
SUBPACKAGE#1	122.60	124.45	125.43	125.11	145.80	137.77
SUBPACKAGE#2	<u>95.82</u>	<u>91.45</u>	<u>98.17</u>	<u>104.77</u>	<u>88.38</u>	<u>99.40</u>
SUBTOTAL	218.42	215.90	223.60	229.88	234.18	237.17
ACA	<u>59.18</u>	<u>58.67</u>	<u>59.46</u>	<u>58.72</u>	<u>57.65</u>	<u>54.28</u>
TOTAL	277.60	274.57	283.06	288.60	291.83	291.45

NOTATION: All weights are in earth pounds.



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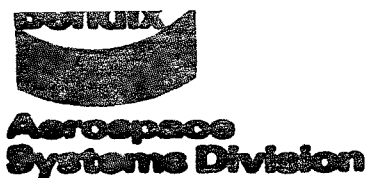
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1.1 ALSEP FLIGHT 6

Detailed weight status breakdowns are presented in Tables 1-1 and 1-2. The total values shown with the double asterisk (**) are actual flight weight values as noted below. The tabulated weight values shown are the up-to-date computed weight status based on actual component and assembly weight values and estimated values when actuals were not available.

The weight of 137.77 lbs. for subpackage #1 and 99.40 lbs for subpackage #2 are based on actual measured flight weight data received from KSC. The ACA weight of 54.28 lbs is actual weight information received from BxA/KSC.



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TABLE 1-1
ALSEP FLIGHT 6 WEIGHT STATUS

<u>SUBPACKAGE #1</u>		<u>SUBPACKAGE #2</u>		<u>ACA</u>	
C/S and LSP/CSE	42.22*	Pallet Assy.	13.47*	Fuel Capsule	15
Primary Structure/PDM	10.28*	Structure Carrier	7.14*	Fuel Cask	25
Sunshield Assy.	9.59*	Shield Assy/RTG Cable	1.88*	Thermal Shield	
Support Structure, LSG	1.37*	RTG & Cable	28.15*	Structure Assy.	
Rear Shield	1.78*	Shorting Plug	1.36*	Band Assy.	13
TC Curtains	2.00	ALSEP Tools	3.27*	Astronaut Protect.	
Handling Assy.	0.48	Aiming Mechanism	1.91*		
Subpackage Dust Cover	.25	Aim. Mech. Box	1.92*	ACA Total	<u>54</u>
Sunshield Extenders	0.90	Carry Bar	2.78		
Antenna & Cable	1.30	HFE Subpallet	6.74*		
Antenna Mast/Support Struc.	1.40	HFE Probes & Electronics	11.90*		
LSG/Cable	28.09*	LEAM/Cable & Spool	16.31*		
LSP/Geo/Ant/Cable	11.93*	Miscellaneous/Fasteners	2.00		
LMS/Cable	21.42*	Dust Covers	.50		
Miscellaneous/Fasteners	3.00	Strain Reliefs	.50		
Dust Covers	.40	Thermal Modifications	.30		
Strain Reliefs	.70	SP#2 Total	<u>100.13</u>		
Thermal Modifications	.70				
S/P #1 Total (137.77**)	<u>137.81</u>			(99.40**)	
S/P #2 Total	100.13				
SEQ Bay Total	<u>237.94</u>				
ACA Total	54.28**				
FLIGHT 6 TOTAL	<u>292.22 (291.45**)</u>				

The present weight of the Explosive Package Transport Module (Stowed In SEQ #3) is 41.24 lbs. *

* Actual Weight (BxA)

** Actual Flight Weight as Measured at KSC



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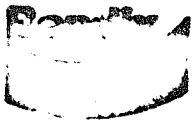
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ALSEP FLIGHT 6 CENTRAL STATION ASSEMBLY DETAILED WEIGHT BREAKDOWN (ESTIMATE)

Data Process/Multiplexer	3.71
CMD Receiver	2.56
Diplexer Filter	0.90
Diplexer Switch	1.30
Transmitters (2)	2.75
CMD Decoder	3.14
PCU/PDU	7.74
Thermal Plate & Hardware	9.35
Harness Assy	2.97
Thermal Bag	2.03
LSP Elect.	4.21
Miscellaneous Cable Hardware	1.56
	<hr/>
	42.22 lb.

TABLE 1-2



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2.0 CENTER OF GRAVITY (c. g.) LOCATION

Table 2 contains the c. g. locations measured on all Flight subpackages during the mass properties tests. Flight 6 is within the specification limits shown in Table 3C.

3.0 REQUIREMENTS

The LM SEQ Bay mass property constraints on ALSEP are shown in Table 3.

Table 3A shows the variation in weight limitations with the different ALSEP Models.

The reference c. g. locations are shown in Table 3B and the c. g. envelope requirements are defined in Table 3C.

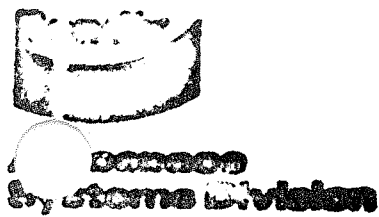
4.0 COORDINATE RELATIONSHIP

Figures 1 through 5 define the orientation of the ALSEP axes and the LM axes, the origin of the ALSEP axes in terms of LM coordinates, and the specified c. g. reference location for point A in both ALSEP and LM coordinates.

CENTER OF GRAVITY LOCATIONS (IN ALSEP COORDINATES)

		Subpackage #1		Subpackage #2		
		C. G. Inches	Delta(Δ) Inches	C. G. Inches	Delta (Δ) Inches	
Flight 1 (Measured)	X	8.46	(A) -2.53 (B) +0.48	9.20	(A) -1.79 (B) +1.22	
	Y	-12.61	-0.16	12.97	+0.52	
	Z	10.57	-1.48	11.94	-0.10	
Flight 3 Measured 6-69 S/P #2 Revised 2-23-70 S/P #1 Revised 3-17-70	X	7.92	(A) -3.07 (B) -0.07	8.48	(A) -2.50 (B) +0.50	
	Y	-14.10	-1.98	13.17	+0.73	
	Z	9.97	-2.17	12.42	-0.38	
Flight 4 S/P #2 Measured 6-16-70 S/P #1 Measured 6-18-70	X	7.58	(A) -3.41 (B) -0.41	9.18	(A) -1.81 (B) +1.20	
	Y	-13.18	-1.37	12.55	+0.11	
	Z	10.42	-1.63	12.51	+0.47	
Array A-2 S/P #1 Measured 11-6-70 S/P #2 Measured 1-12-71	X	8.36	(A) -2.63 (B) +.37	9.61	(A) -1.38 (B) +1.62	
	Y	-12.86	-.42	13.19	+0.74	
	Z	10.91	-1.14	11.97	-0.08	
Flight 5 S/P #1 Measured 6-11-71 S/P #2 Measured 4-22-71	X	8.46	(A) -2.53 (B) +.47	9.60	(A) -1.39 (B) +1.61	
	Y	-13.44	-1.00	15.94	+3.49	
	Z	10.65	-1.40	10.65	-1.40	
Flight 6 S/P #1 Measured 6-7-72 S/P #2 Measured 6-1-72	X	8.62	(A) -2.37 (B) +.63	9.38	(A) -1.60 (B) +1.40	
	Y	-14.77	-2.32	14.13	+1.68	
	Z	11.02	+1.02	10.48	+1.56	
Offset RMS Δ = $\sqrt{\Delta X^2 + \Delta Y^2 + \Delta Z^2}$	Flight 1		Offset-Inches		Offset-Inches	
	Flight 3		1.57		1.33	
	(A)	4.25	(B)	2.90	(A)	2.63
	(B)		(A)		(B)	0.96
	Flight 4		(A)	4.02	(B)	2.15
	(A)		(A)		(B)	1.29
	Array A-2		(A)	2.89	(B)	1.26
(A)		(A)		(B)	1.79	
Flight 5		(A)	3.06	(B)	1.79	
(A)		(A)		(B)	4.09	
Flight 6		(A)	3.47	(B)	2.62	
(A)		(A)		(B)	2.69	

TABLE 2



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LM SEQ BAY MASS PROPERTY CONSTRAINTS

3A.

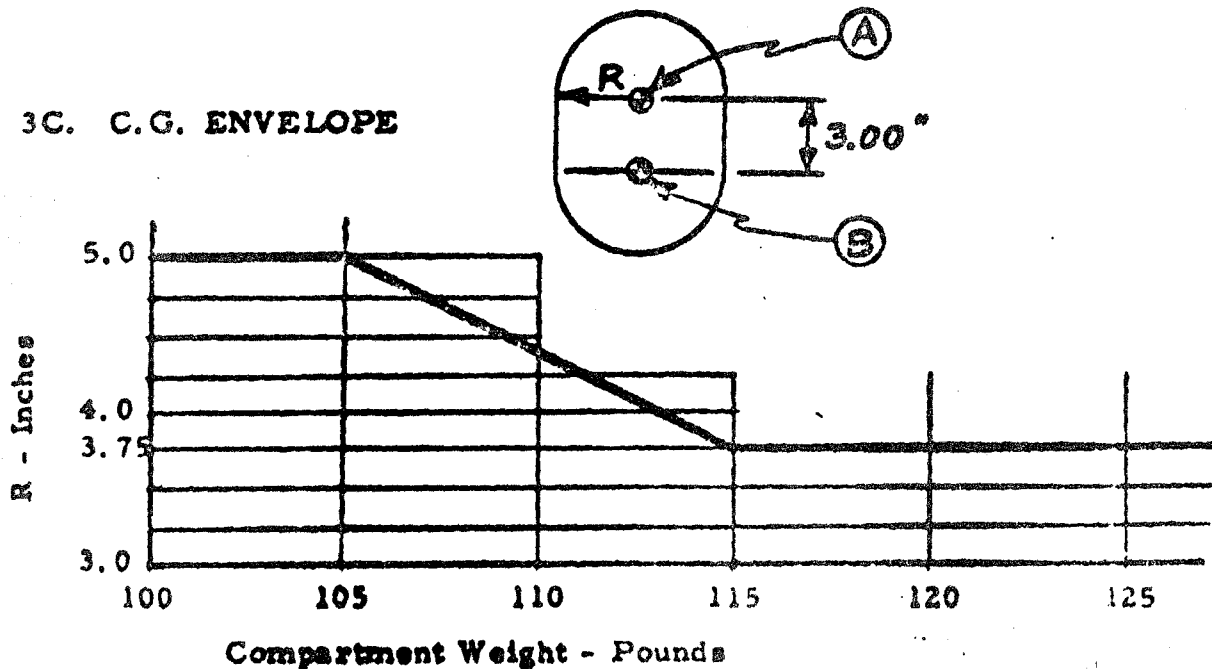
Specified Weight Limitations - lbs.	Flts 1 - 4	Array A-2	Flight 5	Flight 6
Per Compartment	125.0	155.0	145.0	155.0
Both Compartments	215.0	266.0	226.0	266.0
Total System	-	293.35	293.0	293.0

3B.

CENTER OF GRAVITY-REFERENCE LOCATIONS (INCHES)

	COMPARTMENT 1			COMPARTMENT 2		
	X	Y	Z	X	Y	Z
<u>Upper Hemisphere (A)</u>						
ALSEP Coordinates	10.985	-12.445	12.045	10.985	12.445	12.045
LM Coordinates	141.7	-62.0	-44.4	141.7	-44.4	-62.0
<u>Lower Hemisphere (B)</u>						
ALSEP Coordinates	7.985	-12.445	12.045	7.985	12.445	12.045
LM Coordinates	138.7	-62.0	-44.4	138.7	-44.4	-62.0

3C. C.G. ENVELOPE





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**ALSEP Plane $X = 0$,
Equivalent to LM Plane
 $X = 130.715$**

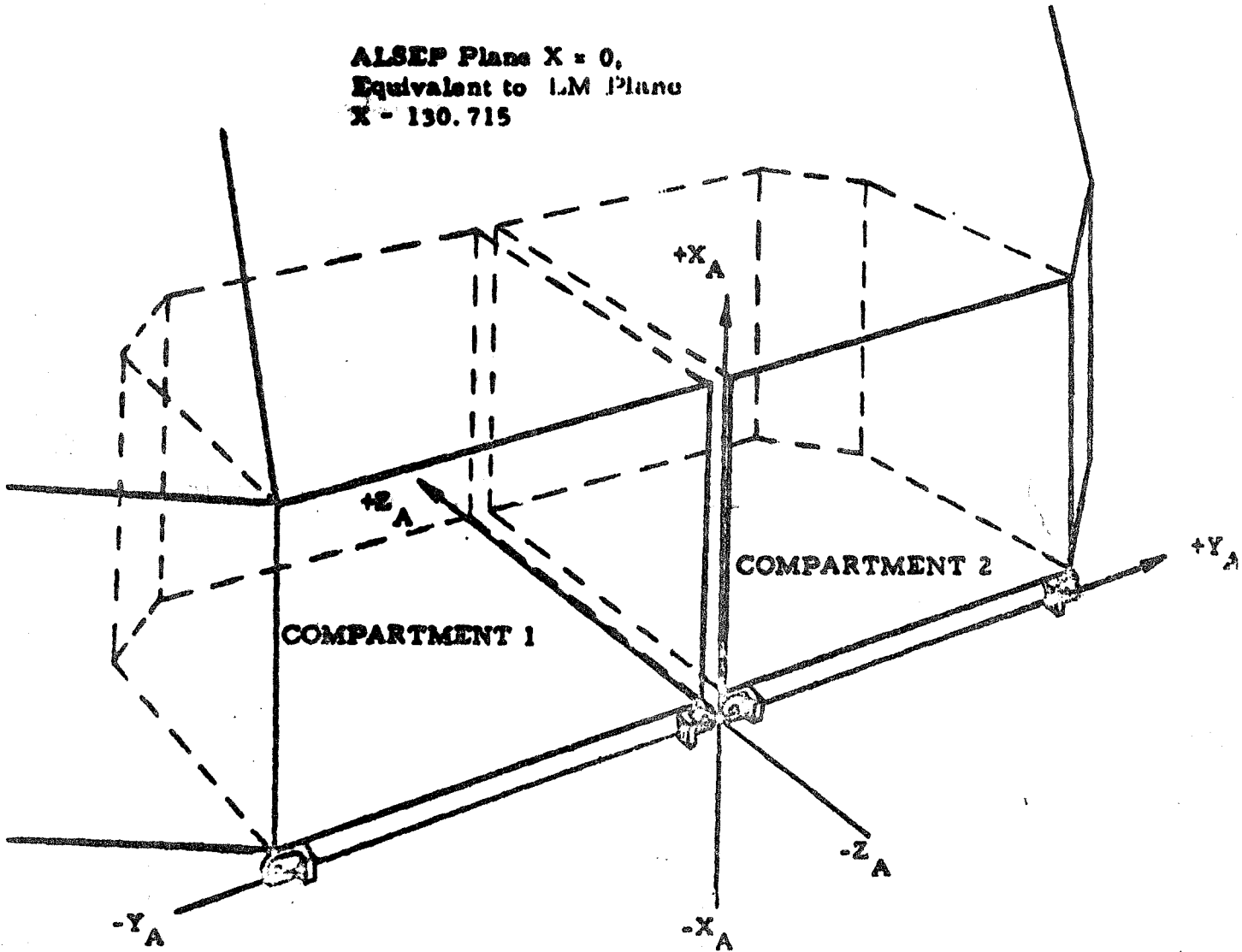


Figure 1 ALSEP Axis Definition



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C. G. Locations and Dimensions Typical Both Compartments

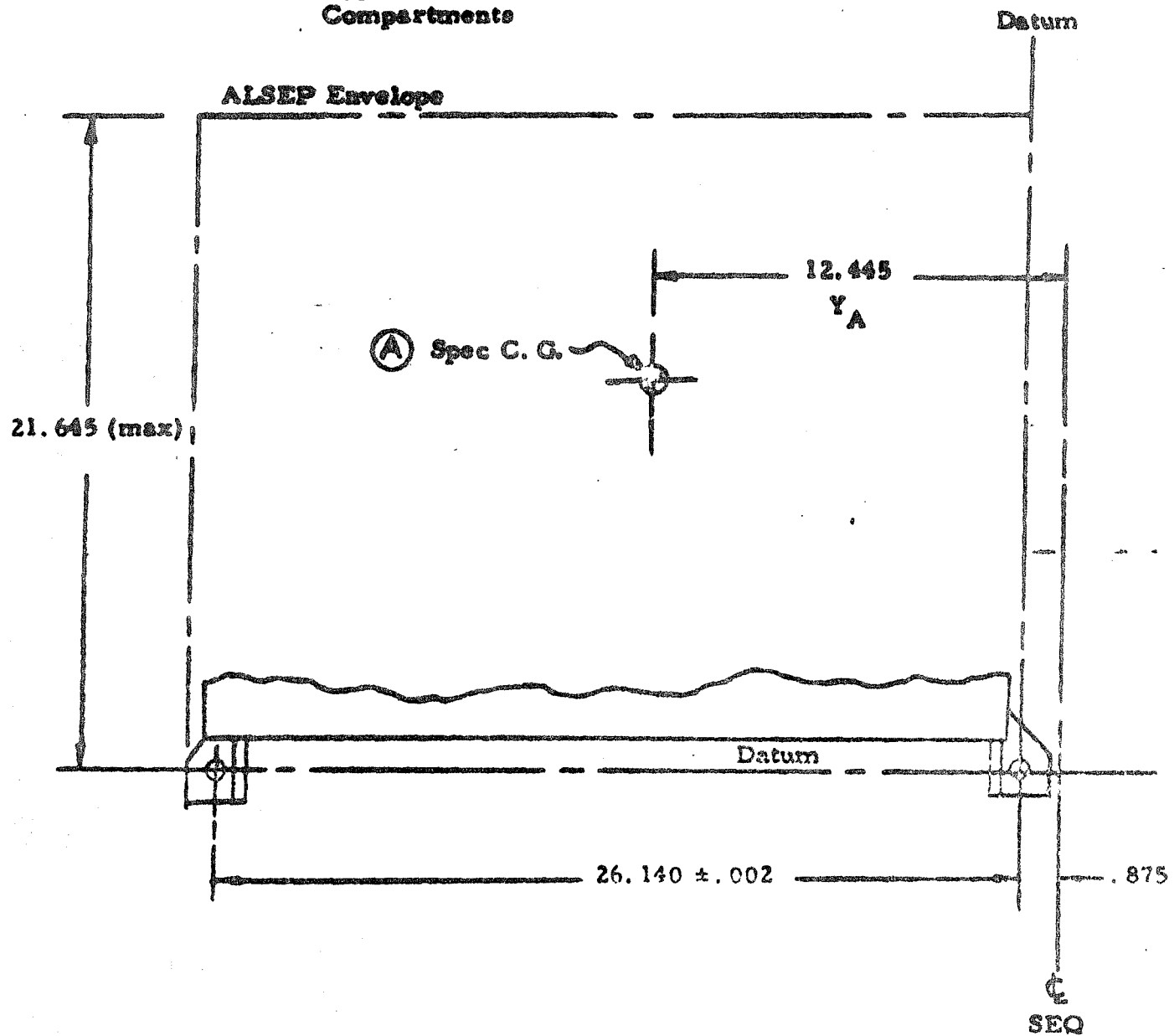


Figure 2 C. G. Spec Location in ALSEP Coordinates



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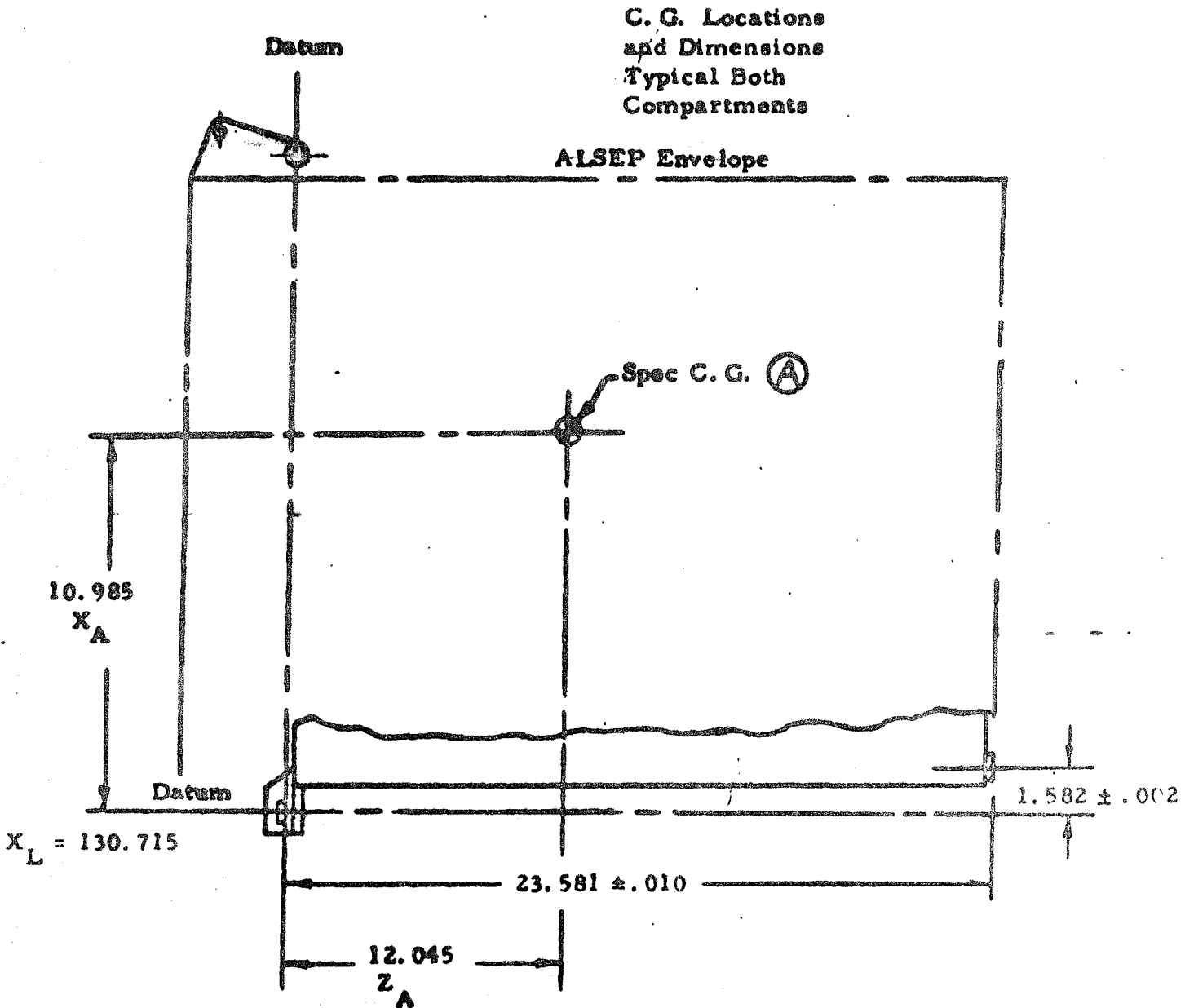


Figure 3 C. G. Spec Location in ALSEP Coordinates



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X - Axis (YAW)
Y - Axis (PITCH)
Z - Axis (ROLL)

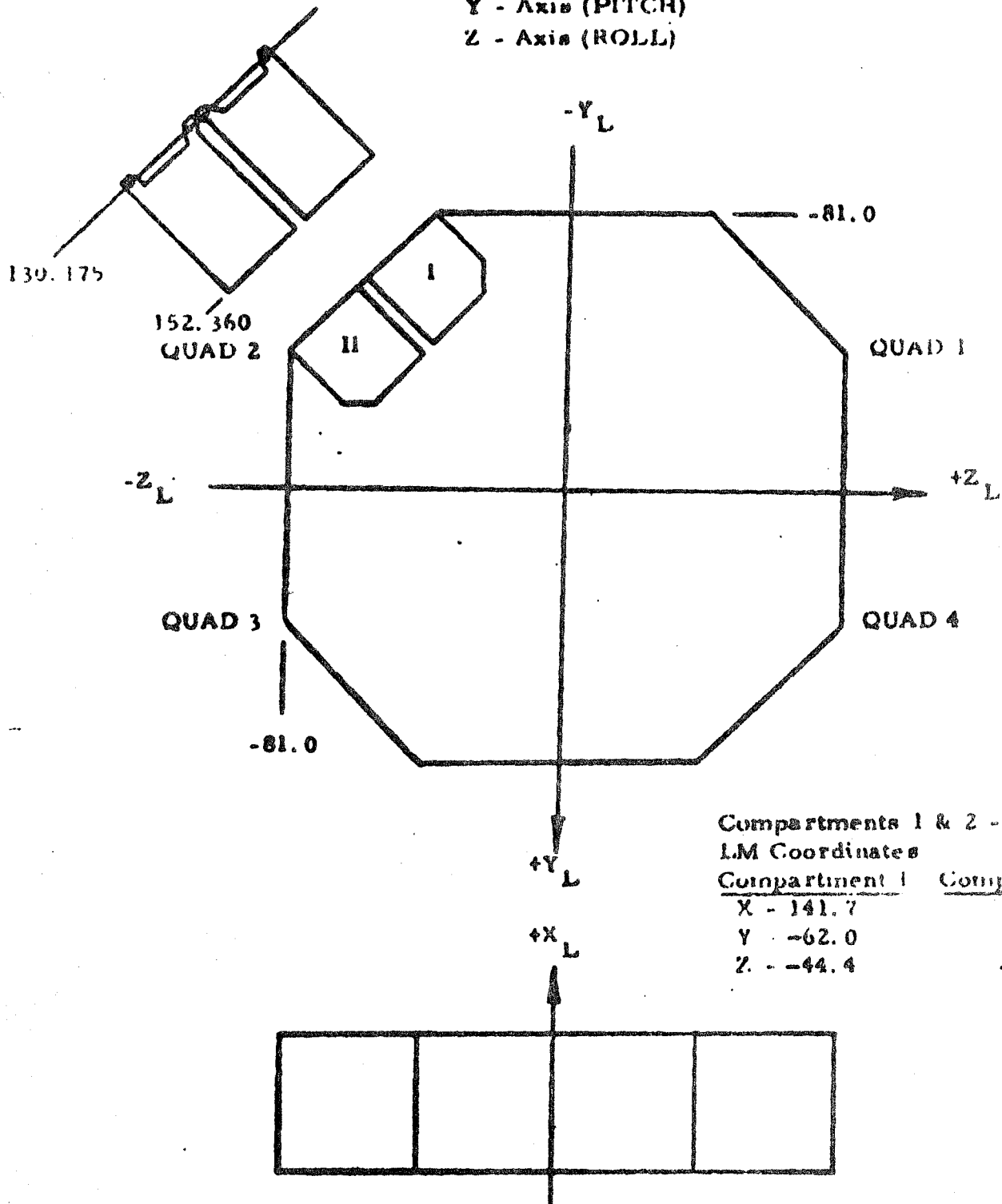


Figure 4 LM Axis Definition



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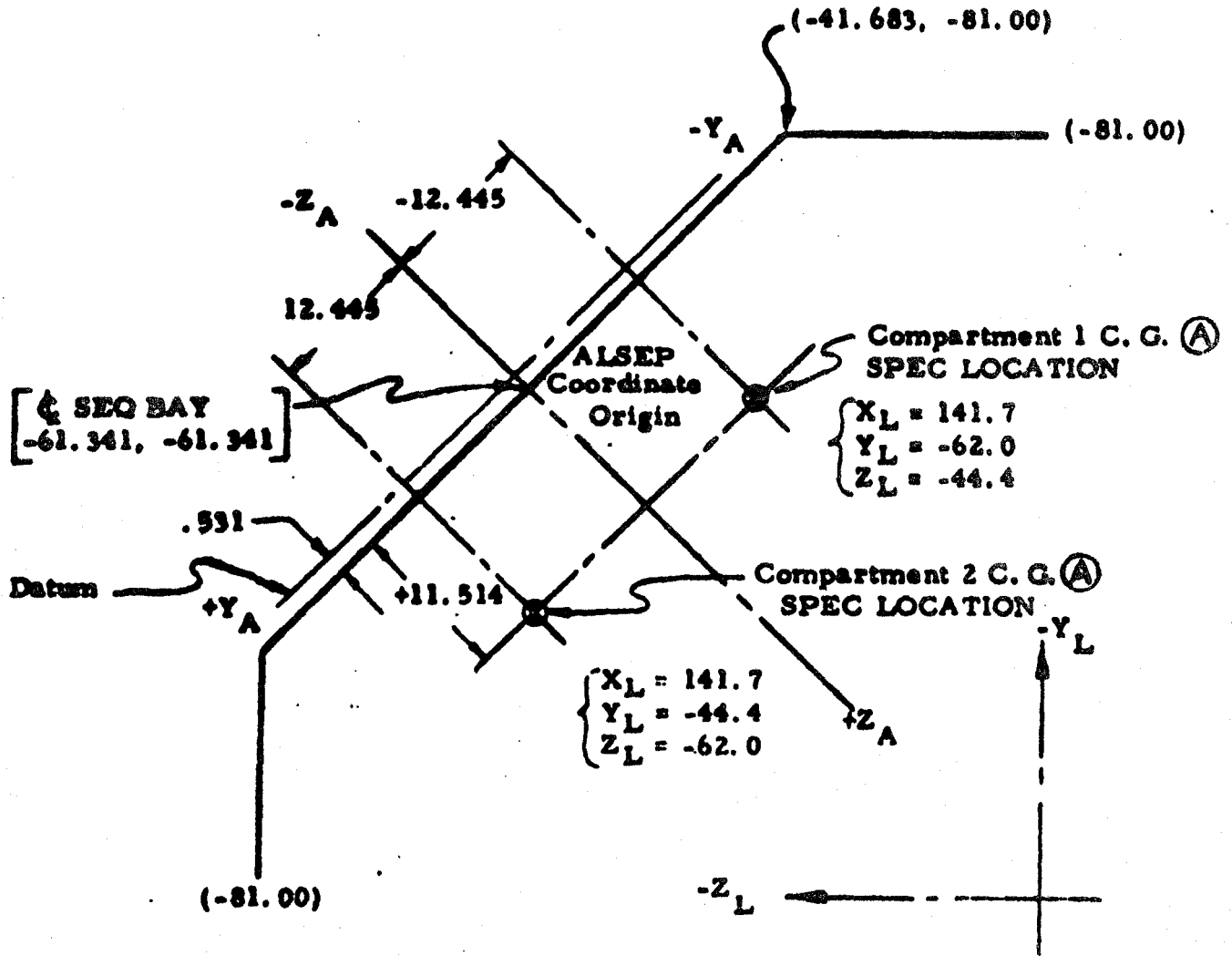


Figure 5 ALSEP Y & Z C. G. Dimensions on $X_L = 141.70$ Plane ($X_A = 10.985$) (MD-22810 COORDINATES)