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Exhibit E, Para. 5.2	Line Item 13.0	LEM	NAS 9-1100	1/14/63

TYPE II

Primary Code 713

REPORT

NO. LED-490-17

DATE: 1 February 1965

LEM MASS PROPERTY REPORT (U)

CODE 26512

R Aeder

PREPARED BY:
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REVISIONS

DATE	REV. BY	REVISIONS & ADDED PAGES	REMARKS

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INTRODUCTION

This report is the LEM Mass Properties Status as of January 22, 1965 for the Lunar Landed Vehicle. The total weight at Separation is 29789 pounds, which is 657 pounds lighter than that previously reported in LED-490-16, dated 1 January 1965.

A summary of changes since the last report is as follows:

A.	Ascent Stage inert * weight	-59
B.	Ascent Stage propellant increase	-51
C.	Descent Stage inert * weight	-176
D.	Descent Stage propellant increase	-371
	Total LEM weight change at Separation	-657

A more detailed breakdown of the changes since the last report is included on page 33.

The weight estimate for resizing the LEM vehicle in accordance with reference 4 is updated based on clarification of previously obscure areas. Estimates for Landing Gear and Reaction Control Subsystems, included herein, were omitted in the previous report.

The weight reporting mission shown on page 5 is the Design Reference Mission with a daylight landing described in ref. 2. The water quantity will be updated in a subsequent report when the water study to meet the weight reporting mission is completed. It should be noted that the Reaction Control Subsystem, page 27, indicates the expenditure of Parking Orbit Contingency fuel, although this nine hour period is not included in the weight reporting mission (or DRM).

The quantity of PLSS recharges, LiOH cartridges, water and oxygen, were reduced from 6 to 4 in accordance with ref. 3. Implementation of the third PLSS battery and its provisions are not included in this report, but will be incorporated when GFE listing is updated to include it. The PLSS LiOH cartridge recharges do not appear in the Government Furnished Equipment, pages 42 and 43, but are currently considered common usage items.

* Inert weight includes all non-propulsion expendables.

The weight reduction, obtained through the use of supercritical helium in lieu of ambient helium for pressurization of propulsion propellant tanks, is in this report. The ambient helium tanks, used as a base in obtaining the weight saving, reflect the LEM resizing and the reduced safety factor changes.

The preliminary Mass Property History and the Weight Mission History By Stages of the Design Weight LEM are included in this report for information purposes only. The Control Weight LEM Mass Property History is intentionally omitted from this report since this area is presently unresolved. The tables of Government Furnished Equipment and Pending Changes are also included herein.

The assumed ΔV Budget of 14094 fps. remains unchanged since the last report. The distribution of this budget is Ascent ΔV = 6664 fps. and Descent ΔV = 7430 fps.

Table 1

LEM MASS PROPERTY HISTORY - CURRENT WEIGHT

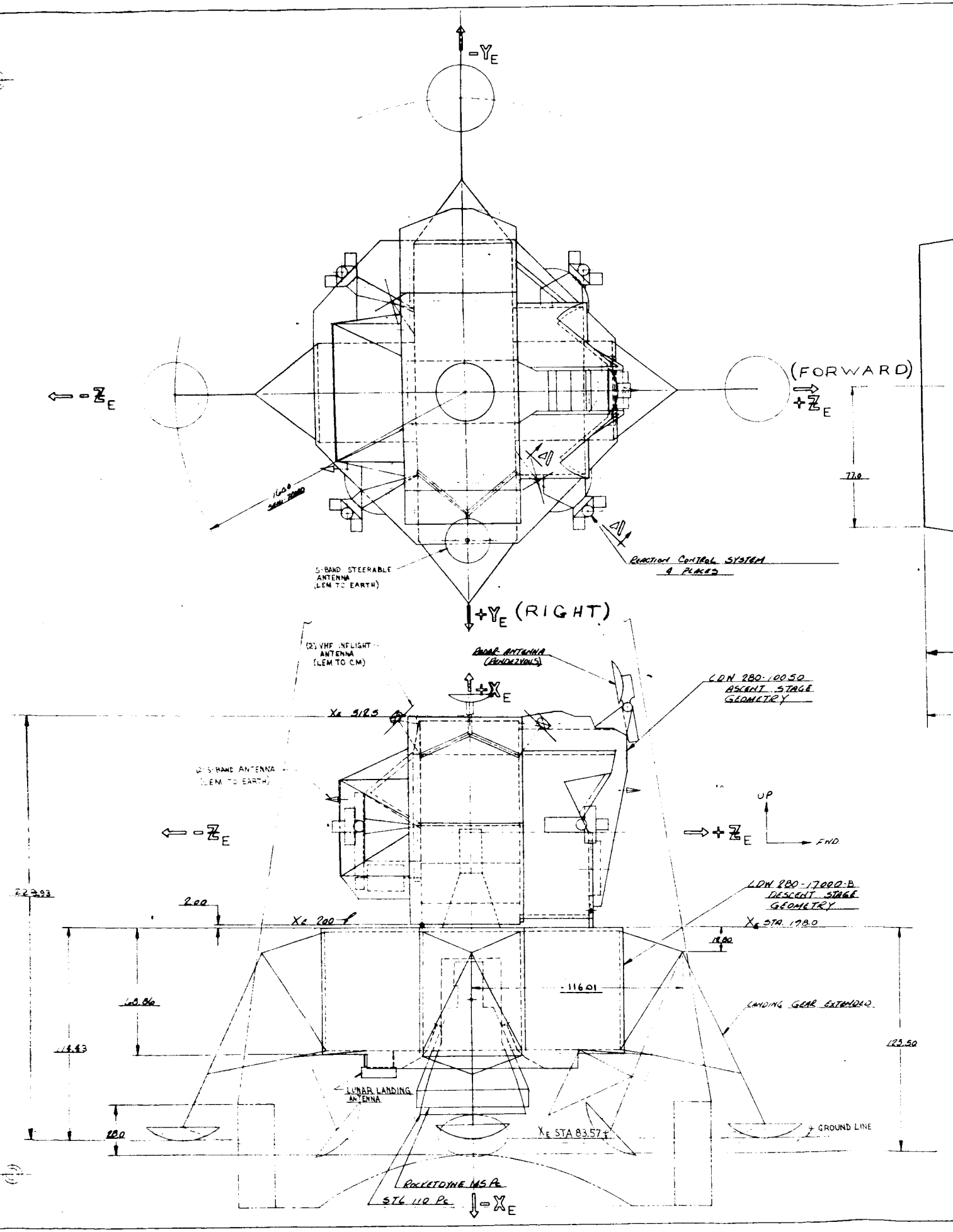
MISSION PHASE	WEIGHT EARTH POUNDS	CENTER OF GRAVITY			MOMENTS OF INERTIA			PRODUCTS OF INERTIA		
		STATION INCHES	DISTANCE FROM THRUST AXIS		SLUG FT^2			SLUG FT^2		
		X	Y	Z	I_{xx}	I_{yy}	I_{zz}	I_{yz}	I_{xz}	I_{xy}
Translunar Injection	29245	182.7	0.6	-1.9	19966	22345	22455	-61	197	-3
LEM/CSM Separation	29789	184.4	0.6	-0.8	21269	23745	23669	-25	550	78
End Insertion to Hohman - Descent	29428	184.3	0.6	-0.8	21042	23491	23433	-22	549	79
Begin Hover	15525	206.6	0.9	-1.4	11890	14192	16144	13	626	36
Lunar Touchdown	13764	215.7	1.0	-1.5	10756	11263	13459	15	667	9
Lunar Launch (Lift-off)	9815	241.8	0.6	0.8	5982	3032	5300	-1	202	66
End Insertion to Hohman - Ascent	4995	254.4	1.2	1.8	2647	2403	1500	0	180	46
Burnout (Docked)	4817	253.9	1.3	2.0	2563	2382	1419	7	181	47
Completion of Crew Transfer	4159	253.9	0.5	-3.7	2224	2062	1278	-3	205	39

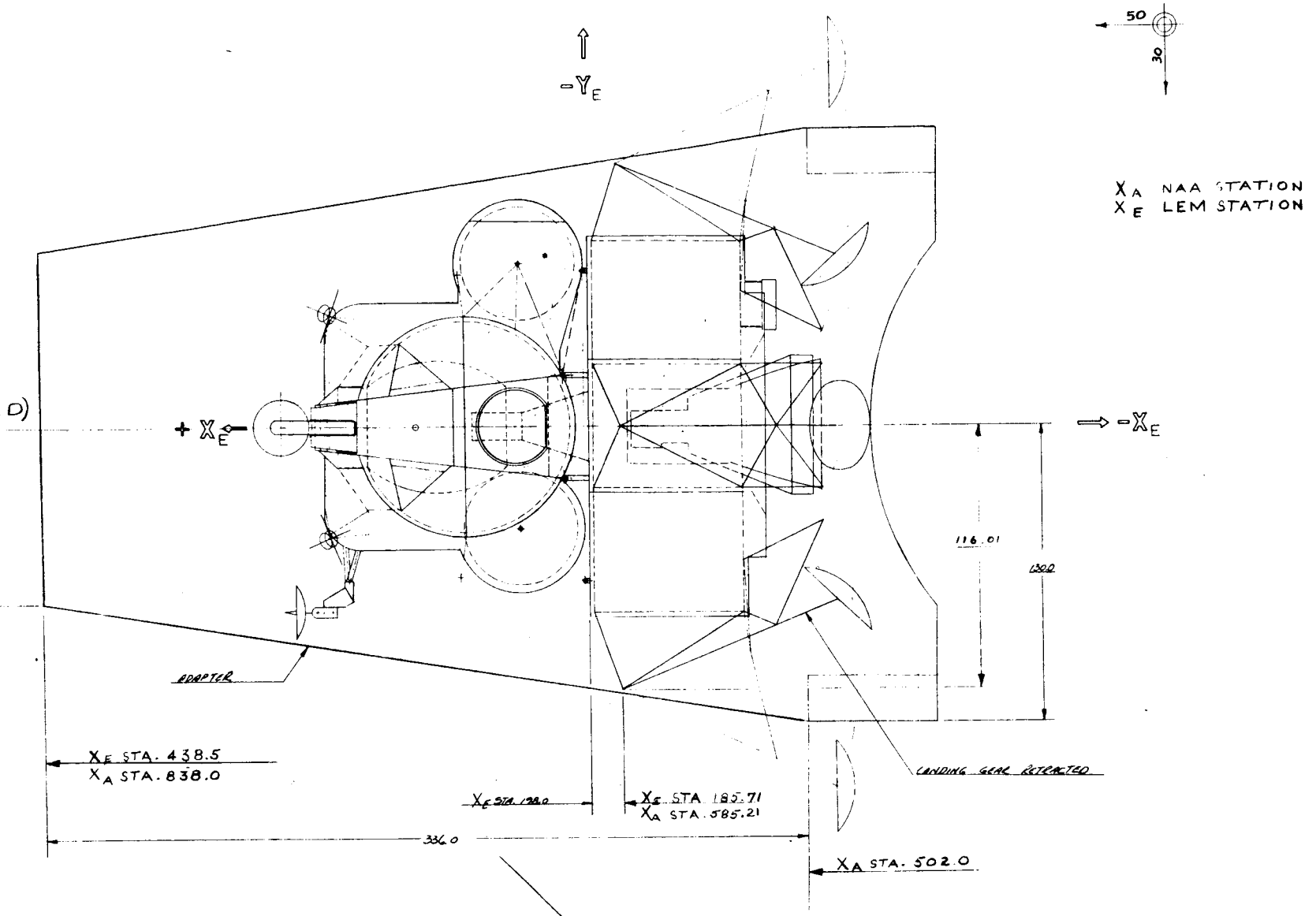
Table

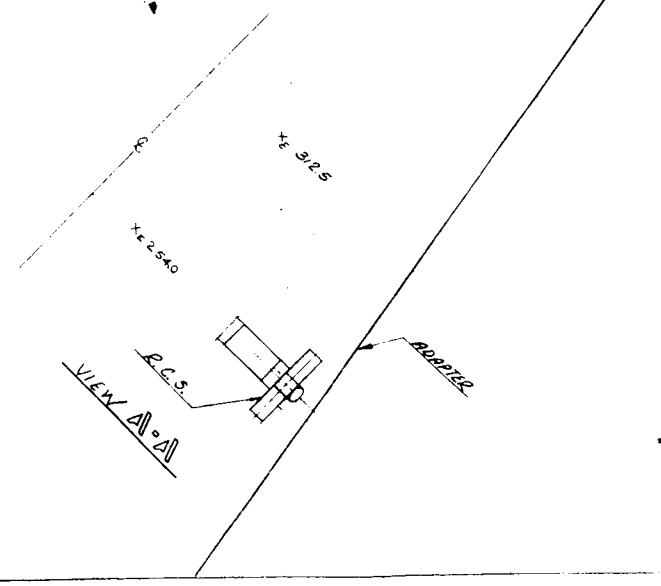
LEM MASS PROPERTY HISTORY - DESIGN WEIGHT - PRELIMINARY

MISSION EVENT	WEIGHT (EARTH LBS)	CENTER OF GRAVITY STA. (In.) X	CENTER OF GRAVITY Dist from Thrust Axis Y	CENTER OF GRAVITY Dist from Thrust Axis Z	MOMENT OF INERTIA (SLUG-FT^2) I_{xx}	MOMENT OF INERTIA (SLUG-FT^2) I_{yy}	MOMENT OF INERTIA (SLUG-FT^2) I_{zz}
TRANSLUNAR INJECTION	32000	187	0	-1	21400	23350	23450
LEM/CSM SEPARATION	32500	188	0	0	22500	24600	24500
END INSERTION TO HOHMANN -DESCENT	32113	188	0	0	22300	24300	24250
BEGIN HOVER	16947	210	0	0	12350	14500	16500
LUNAR TOUCHDOWN - MINIMUM	14650	218	0	0	10850	11250	13500
LUNAR TOUCHDOWN - NOMINAL	15021	218	0	0	11100	11500	13800
LUNAR TOUCHDOWN - MAXIMUM	16200	213	0	0	12000	12800	15150
LUNAR LAUNCH	10820	244	0	0	6500	3300	5650
END INSERTION TO HOHMANN	5516	254	0	0	2900	2700	1650
BURNOUT (DOCKED)	5322	254	0	0	2800	2650	1500
COMPLETION OF CREW TRANSFER	4695	254	-1	-5	2500	2400	1400

SYM	REVISION	BY	CHK	DATE
A	REDESIGNED & REDRAWN			
B	REVISED TO SHOW NEW ANTENNA LOCATIONS AND NEW AFT EQUIP. BAY LOCATION			
C	REVISED TO SHOW NEW AFT EQUIP BAY LOCATION AND FRONT RCS THRUSTER CLUSTERS & REAR S-BAND LOCATION. REVISED DESCENT STAGE REVISED - LANDING GEAR, ENGINE LOCATION			







X_A NAA STATION
X_E LEM STATION

LED-490-17
1 February 1965
Page 4

Figure 1
[illegible]

THIS DRAWING IS REPRESENTATIVE FOR PURPOSES OF REFERENCE AXIS ORIENTATION AND SIGN CONVENTION.

FOR ENGRG INFO ONLY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCE UNLESS SPECIFIED FRACTIONS - DECIMALS - ANGLES	DRAWN BY EVR CASE	GRUMMAN AIRCRAFT ENGRG CORP BETHPAGE, L.I., N.Y.	
	LAYOUT BY DEC. 7, 1965	GENERAL ARRANGEMENT LEM	
ORIG DWG AUTH		CONTRACT NO NAS 9-100	
CLASS II ENGRG CHANGE		CODE IDENT NO	DWG NO
CLASS I ENGRG CHANGE		26512	R LDW280-10000 C
GRUMMAN REQ INFO		SCALE 1:80	SHEET 1 OF 1

LDW 280 10000 C

LDW280-10000 C

SUPERSEDES LDW 280-10000 'B' CHANGE

Table 3
SUMMARY OF LEM WEIGHT REPORTING MISSION

MISSION PHASE	ELAPSED TIME FROM EARTH LAUNCH		REPORTING MISSION (Day Landing) For Loading Expendables			
Description	Hours	Minutes	Hours	Minutes		
Prelaunch (Launch Vehicle Fueling)	-10	0	10		Pre-Separation Period	Dormant Period
Launch	0	0		12		
Earth Parking Orbit		12	2	49		
Translunar Injection	3	1		5		
Translunar Coast- Prior to Transposition	3	6		15		
-During Transposition	3	21		30		
-Subsequent to Transposition	3	51	60	24		
Lunar Orbit- Insertion	64	15		6		
-Coast Prior to Separation	64	21	1	26		
-Checkout	65	47	2	17		
LEM Separation and Insertion to Descent Transfer Orbit	68	4		20	Descent*	Active Period
Coast in Descent Transfer Orbit	68	24		58		
Powered Descent (& Hover)	69	22		10		
Lunar Staytime	69	32	34	45		
Powered Ascent	104	17		7	Ascent**	
Parking Orbit Contingency ***	104	24				
Coasting Ascent Transfer				47		
Rendezvous	105	11		8		
Docking	105	19		15		
Crew Transfer	105	34		10		
	105	44				
Dormant LEM Time			75	47		
Active LEM Time			39	57		
Post-Separation LEM Time			(37)	(40)		
Total LEM Period			115	44		

* Descent Period - 1 Hour 28 Minutes
**Ascent Period - 1 Hour 27 Minutes
***The Design Reference Mission (DRM) does not appear to have any Parking Orbit Contg..

Table 4

LEM WEIGHT BY STAGES AT EARTH
LAUNCH AND LUNAR ORBIT SEPARATION

		ASCENT TOTAL	DESCENT TOTAL	TOTAL
1.0	Structure	1101.3	1208.3	2309.6
2.0	Stabilization and Control	67.0	14.2	81.2
3.0	Navigation and Guidance	276.9	28.0	304.9
4.0	Crew Provisions*	123.3	20.5	143.8
5.0	Environmental Control	317.2	229.9	547.1
6.0	Landing	--	560.0	560.0
7.0	Instrumentation	190.5	175.0	365.5
8.0	Electrical Power Supply	968.2	390.9	1359.1
9.0	Propulsion Inert	565.5	1352.0	1917.5
10.0	Reaction Control Inert	(502.0)	--	(502.0)
	-Without Useable Propellant	350.1	--	350.1
	-Attitude Propellant	151.9	--	151.9
11.0	Communications	120.3	14.1	134.4
12.0	Controls and Displays	228.9	--	228.9
	Inert Totals	4461.1	3992.9	8454.0
	ΔV Propellant	(4884.8)	(15905.9)	(20790.7)
	-Main Propulsion	4550.5	15905.9	20456.4
	-Reaction Control	334.3	--	334.3
	Totals - Earth Launch	9345.9	19898.8	29244.7
4.0	Crew Provisions	+576.7	--	+576.7
5.0	Environmental Control	-1.0	-61.2	-62.2
7.0	Instrumentation	+80.0	--	+ 80.0
8.0	Electrical Power Supply	-5.6	-40.3	-45.9
10.0	RCS - Attitude Propellant	-4.1	--	-4.1
	Totals - Separation	9991.9	19797.3	29789.2

* Without crew, suits, PLSS, radiation dosimeters, etc. (576.7 pounds).

Table 5

LEM CURRENT WEIGHT MISSION HISTORY BY STAGES

MISSION PHASE AND CONSUMABLE DESCRIPTION	ASCENT STAGE		DESCENT STAGE		TOTAL WEIGHT (LBS)
	DRY WEIGHT (LBS)	ΔV-PROPELL. WEIGHT (LBS)	DRY WEIGHT (LBS)	ΔV-PROPELL. WEIGHT (LBS)	
EARTH LAUNCH AND TRANSLUNAR INJECTION	4461.1	4884.8	3992.9	15905.9	29244.7
Crew and Equipment	+576.7				
Water, Oxygen & Hydrogen	- 5.6		-40.3		
RCS - Checkout Propellant	- 4.1				
ECS - Umbilical Hardware	- 1.0				
Scientific Equipment	+ 80.0				
SEPARATION	5107.1	4884.8	3891.4	15905.9	29789.2
Water, Oxygen & Hydrogen			- 17.7		
Descent ΔV Propellant					
-Main				-15905.9	
-RCS		- 28.3			
RCS - Attitude	- 73.7				
LUNAR TOUCHDOWN	5033.4	4856.5	3873.7		13763.6
Scientific Samples & Equip.			-170.0		
Jettisoned on Lurain	- 70.8		-3717.1		
RCS - Checkout Propellant	- 4.1				
LUNAR LIFT - OFF	4958.5	4856.5			9815.0
Water, Oxygen & Hydrogen	- 92.9				
Ascent ΔV Propellant					
-Main		-4550.5			
-RCS		-306.0			
RCS-Attitude Propellant	- 49.0				
BURNOUT (DOCKING)	4816.6				4816.6

Table 6

LEM DESIGN WEIGHT MISSION HISTORY BY STAGES

MISSION PHASE AND CONSUMABLE DESCRIPTION	ASCENT STAGE		DESCENT STAGE		TOTAL WEIGHT (LBS.)
	DRY WEIGHT (LBS.)	ΔV-PROPELL. WEIGHT (LBS.)	DRY WEIGHT (LBS.)	ΔV-PROPELL WEIGHT (LBS.)	
EARTH LAUNCH AND TRANSLUNAR INJECTION	5072.7	5385.0	4186.8	17355.5	32000.0
Crew and Equipment Water, Oxygen & Hydrogen RCS - Checkout Propellant ECS - Umbilical Hardware Scientific Equipment	+541.0		-41.0		
SEPARATION	5613.7	5385.0	4145.8	-17355.5	32500.0
Landing Flare Water, Oxygen & Hydrogen Descent ΔV Propellant -Main -RCS RCS - Attitude	-73.7	-30.9	-5.0 -17.7	-17355.5	
LUNAR TOUCHDOWN	5540.0	5354.1	4123.1		15017.2
Scientific Samples & Equip Jettisoned on Lurain RCS - Checkout Propellant	-70.0 -4.1		-170.0 -3953.1		
LUNAR LIFT-OFF	5465.9	5354.1			10820.0
Water, Oxygen & Hydrogen Ascent ΔV Propellant -Main -RCS RCS-Attitude Propellant	-96.6 -49.0	-5016.4 - 337.7			
BURNOUT (DOCKING)	5320.3				

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LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
1.0	Structure	2309.6	1101.3		1208.3		2309.6		2309.6
2.0	Stabilization and Control	84.3	67.0		14.2		81.2		81.2
3.0	Navigation and Guidance	304.9	276.9		28.0		304.9		304.9
4.0	Crew Provisions	(734.5)	(644.9)		(75.6)		(720.5)	(-576.7)	(143.8)
	-Inert	702.5	644.9		57.6		702.5	-576.7	125.8
	-Expendables	32.0	0		18.0		18.0	0	18.0
5.0	Environmental Control	(484.9)	(244.4)	(61.6)	(167.3)	(11.6)	(484.9)	(62.2)	(547.1)
	-Inert	268.4	244.4	0	24.0	0	268.4		268.4
	-Expendables	216.5	0	61.6	143.3	11.6	216.5	62.2	278.7
6.0	Landing Gear	410.0			560.0		560.0		560.0
7.0	Instrumentation	445.5	270.5		175.0		445.5	- 80.0	365.5
8.0	Electrical Power	(1263.2)	(929.5)	(31.3)	(346.3)	(6.1)	(1313.2)	(45.9)	(1359.1)
	-Inert	1083.9	929.5	0	221.2	0	1150.7	0	1150.7
	-Expendables	179.3	0	31.3	125.1	6.1	162.5	45.9	208.4
9.0	Propulsion	(23222.8)	(565.5)	(4550.5)	(1352.0)	(15905.9)	(22373.9)		(22373.9)
	-Inert	2358.9	565.5	0	1352.0	0	1917.5		1917.5
	-Expendables - ΔV Propellant	20863.9	0	4550.5	0	15905.9	20456.4		20456.4
10.0	Reaction Control	(833.5)	(371.1)	(355.0)	(4.1)	(102.0)	(832.2)	(4.1)	(836.3)
	-Inert	353.3	350.1	0		0	350.1		350.1
	-Expendables - Att. Prop.	141.6	21.0	49.0	4.1	73.7	147.8	4.1	151.9
	- ΔV Propellant	338.6		306.0		28.3	334.3		334.3

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LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
11.0	Communications	129.6	116.6		17.8		134.4		134.4
12.0	Controls and Displays Total	223.3	228.9				228.9		228.9
	-Inert	8674.2	4795.6	0	3658.1	0	8453.7	-656.7	7797.0
	-Expend. - W/O ΔV Prop.	569.4	21.0	141.9	290.5	91.4	544.8	112.2	657.0
	- ΔV Prop. Only	21202.5	0	4856.5	0	15934.2			20790.7
	Total	30446.1	4816.6	4998.4	3948.6	16025.6	29789.2	-544.5	29244.7
	Burnout Weight	4872.5	4816.6 lbs.						
	Lift-off Weight	9933.0		9815.0 lbs.					
	Touchdown Weight	14068.3			13763.6 lbs.				
	Separation Weight	30446.1					29789.2 lbs.		
	Earth Launch Weight	29905.0							29244.7 lbs

[redacted]

LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
1.0	Structure	2309.6	1101.3		1208.3		2309.6		2309.6
1.1	Front Face	(177.7)	(177.7)				(177.7)		(177.7)
1.1.1	Skin	48.9	48.9				48.9		48.9
1.1.2	Shielding	18.6	18.6				18.6		18.6
1.1.4	Beams	34.9	34.9				34.9		34.9
1.1.7	Frames	12.6	12.6				12.6		12.6
1.1.8	Trusses & Supports	8.0	8.0				8.0		8.0
1.1.10	Windows (2)	20.0	20.0				20.0		20.0
1.1.11	Hatches (1)	25.0	25.0				25.0		25.0
1.1.12	Joints, Splices & Fasteners	9.7	9.7				9.7		9.7
1.2	Cabin	(192.0)	(192.0)				(192.0)		(192.0)
1.2.1	Skin	34.3	34.3				34.3		34.3
1.2.2	Shielding	18.1	18.1				18.1		18.1
1.2.4	Beams	11.0	11.0				11.0		11.0
1.2.5	Longerons	18.2	18.2				18.2		18.2
1.2.6	Stiffeners	22.5	22.5				22.5		22.5
1.2.7	Frames	17.6	17.6				17.6		17.6
1.2.8	Trusses & Supports	39.4	39.4				39.4		39.4
1.2.9	Decks	8.0	8.0				8.0		8.0
1.2.10	Windows	3.6	3.6				3.6		3.6
1.2.12	Joints, Splices & Fasteners	19.3	19.3				19.3		19.3
1.3	Mid-Section	(553.6)	(553.6)				(553.6)		(553.6)
1.3.1	Skin	44.0	44.0				44.0		44.0
1.3.2	Shielding	80.9	80.9				80.9		80.9
1.3.3	Bulkheads	94.1	94.1				94.1		94.1
1.3.4	Beams	31.8	31.8				31.8		31.8
1.3.5	Longerons	7.6	7.6				7.6		7.6
1.3.6	Stifferners	27.1	27.1				27.1		27.1

[redacted]

LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
1.3.7	Frames	31.6	31.6				31.6		31.6
1.3.8	Trusses & Supports	85.8	85.8				85.8		85.8
1.3.9	Decks	67.8	67.8				67.8		67.8
1.3.11	Hatches	25.0	25.0				25.0		25.0
1.3.12	Joints,Splices &Fasteners	17.9	17.9				17.9		17.9
1.3.40	Misc.-Resizing Estimate	40.0	40.0				40.0		40.0
1.4	Aft Equipment Bay	(178.0)	(178.0)				(178.0)		(178.0)
1.4.2	Shielding	40.9	40.9				40.9		40.9
1.4.4	Beams	36.8	36.8				36.8		36.8
1.4.7	Frames	14.1	14.1				14.1		14.1
1.4.8	Trusses & Supports	72.6	72.6				72.6		72.6
1.4.9	Decks	7.2	7.2				7.2		7.2
1.4.12	Joints,Splices &Fasteners	6.4	6.4				6.4		6.4
1.11	Forward Section (+Z)	(293.3)			(293.3)		(293.3)		(293.3)
1.11.1	Panel-Closure	31.8			31.8		31.8		31.8
1.11.2	- Left Hand	17.7			17.7		17.7		17.7
1.11.3	- Right Hand	17.7			17.7		17.7		17.7
1.11.6	Deck - Upper	7.4			7.4		7.4		7.4
1.11.7	- Lower	7.4			7.4		7.4		7.4
1.11.8	Equipment Bay - Left	19.2			19.2		19.2		19.2
1.11.9	- Right	21.8			21.8		21.8		21.8
1.11.10	Shielding	37.9			37.9		37.9		37.9
1.11.11	Trusses & Supports	96.8			96.8		96.8		96.8
1.11.12	S-IV-B Attach. Fittings	6.0			6.0		6.0		6.0
1.11.13	Steps & Grips	11.5			11.5		11.5		11.5
1.11.14	Egress Platform	10.0			10.0		10.0		10.0
1.11.19	Protective Coating	8.1			8.1		8.1		8.1

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LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
1.12	Left Mid-Section (-Y)	(152.2)			(152.2)		(152.2)		(152.2)
1.12.1	Panel - Closure	30.5			30.5		30.5		30.5
1.12.4	- Forward	17.3			17.3		17.3		17.3
1.12.5	- Aft	17.0			17.0		17.0		17.0
1.12.6	Deck - Upper	7.4			7.4		7.4		7.4
1.12.7	- Lower	7.4			7.4		7.4		7.4
1.12.10	Shielding	10.0			10.0		10.0		10.0
1.12.11	Trusses & Supports	52.7			52.7		52.7		52.7
1.12.12	S-IV-B Attach. Fittings	6.0			6.0		6.0		6.0
1.12.19	Protective Coating	3.9			3.9		3.9		3.9
1.13	Center Mid-Section	(94.7)			(94.7)		(94.7)		(94.7)
1.13.2	Panel - Left	18.9			18.9		18.9		18.9
1.13.3	- Right	18.9			18.9		18.9		18.9
1.13.4	- Forward	18.5			18.5		18.5		18.5
1.13.5	- Aft	18.0			18.0		18.0		18.0
1.13.11	Trusses & Supports	11.2			11.2		11.2		11.2
1.13.20	Joints, Splices & Fasteners	9.2			9.2		9.2		9.2
1.14	Right Mid-Section (+Y)	(152.0)			(152.0)		(152.0)		(152.0)
1.14.1	Panel - Closure	30.5			30.5		30.5		30.5
1.14.4	- Forward	17.3			17.3		17.3		17.3
1.14.5	- Aft	16.8			16.8		16.8		16.8
1.14.6	Deck - Upper	7.4			7.4		7.4		7.4
1.14.7	- Lower	7.4			7.4		7.4		7.4
1.14.10	Shielding	10.0			10.0		10.0		10.0
1.14.11	Trusses & Supports	52.7			52.7		52.7		52.7
1.14.12	S-IV-B Attach. Fittings	6.0			6.0		6.0		6.0
1.14.19	Protective Coating	3.9			3.9		3.9		3.9

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LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
1.15	Aft Section (-Z)	(248.6)			(248.6)		(248.6)		(248.6)
1.15.1	Panel - Closure	30.6			30.6		30.6		30.6
1.15.2	- Left	16.7			16.7		16.7		16.7
1.15.3	- Right	16.7			16.7		16.7		16.7
1.15.6	Deck - Upper	7.4			7.4		7.4		7.4
1.15.7	- Lower	7.4			7.4		7.4		7.4
1.15.8	Equipment Bay - Left	19.2			19.2		19.2		19.2
1.15.9	- Right	21.8			21.8		21.8		21.8
1.15.10	Shielding	37.9			37.9		37.9		37.9
1.15.11	Trusses & Supports	76.8			76.8		76.8		76.8
1.15.12	S-IV-B Attach. Fittings	6.0			6.0		6.0		6.0
1.15.9	Protective Coating	8.1			8.1		8.1		8.1
1.16	Base Heat Shield	134.5			134.5		134.5		134.5
1.17	Miscellaneous	(133.0)			(133.0)		(133.0)		(133.0)
1.17.11	Trusses & Supports	14.0			14.0		14.0		14.0
1.17.15	Separation System	29.0			29.0		29.0		29.0
1.17.40	Resizing Estimate	90.0			90.0		90.0		90.0

LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
2.0	Stabilization and Control	84.3	67.0		14.2		81.2		81.2
2.2	Att. Translation Control Assy.	27.0	27.0				27.0		27.0
2.3	Rate Gyro Assembly (1)	3.6	1.5				1.5		1.5
2.4	Inflight Monitor Functions	4.0	0				0		0
2.5	Descent Engine Control Syst.	(13.7)			(14.2)		(14.2)		(14.2)
2.5.1	Descent Engine Control Assy.	6.8			7.3		7.3		7.3
2.5.2	Gimbal Drive Actuators (2)	6.9			6.9		6.9		6.9
2.6	Abort Guidance System	(36.0)	(38.5)				(38.5)		(38.5)
2.6.1	Abort Sensor Assembly *	15.0	17.5				17.5		17.5
2.6.2	Abort Electronic Assembly **	21.0	21.0				21.0		21.0

* Includes sensor package and power supply.

** Includes electronics and programmer.

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WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
3.0	Navigation and Guidance	304.9	276.9		28.0		304.9		304.9
3.1	GFE	198.5	198.5				198.5		198.5
3.1.1	IMU								
3.1.2	AOT & Eyepieces								
3.1.3	AGC								
3.1.4	PSA-CDU								
3.1.5	Star, Maintenance Book								
3.1.6	Cabling								
3.1.7	Navigation Base								
3.1.8	Cold Plate								
3.2	Rendezvous Radar	(78.4)	(78.4)				(78.4)		(78.4)
3.2.1	Gimbaled Antenna & Boom	26.2	26.2				26.2		26.2
3.2.2	Electronics	32.1	32.1				32.1		32.1
3.2.3	Transponder	17.6	17.6				17.6		17.6
3.2.4	Transponder Antenna & Wave-guide	2.5	2.5				2.5		2.5
3.3	Landing Radar	(28.0)			(28.0)		(28.0)		(28.0)
3.3.1	2-Position Antenna	18.0			18.0		18.0		18.0
3.3.2	Electronics	10.0			10.0		10.0		10.0

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LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
4.0	Crew Provisions	734.5	644.9		75.6		720.5	-576.7*	143.8
4.1	Crew Accessories	(280.3)	(228.3)		(52.0)		(280.3)	(-224.7)	(55.6)
4.1.1	Pressure Garment Assy. (2)	68.0	68.0				68.0	-68.0	
4.1.2	Portable Life Supt Syst. (2)	122.0	122.0				122.0	-122.0	
4.1.3	Radiation Dosimeter (2)	3.3	3.3				3.3	-3.3	
4.1.4	Liquid Cooled Garment (2)	9.0	9.0				9.0	-9.0	
4.1.5	Bioinstrumentation (2)	2.5	2.5				2.5	-2.5	
4.1.6	Thermal Garment-External (2)	26.8	13.4		13.4		26.8	-13.4	13.4
4.1.8	Meteoroid Protect. Garment (2)	38.6			38.6		38.6		38.6
4.1.9	Suit Repair Kit	1.2	1.2				1.2		1.2
4.1.10	PLSS Calibration Unit	.8	.8				.8		.8
4.1.11	Emergency Oxygen Syst. (2)	6.5	6.5				6.5	-6.5	
4.1.12	PLSS Spare Parts	1.6	1.6				1.6		1.6
4.2	Crew (2)	352.0	352.0				352.0	-352.0	0
4.3	Restraints (2)	35.0	35.0				35.0		35.0
4.4	Lighting **	(15.5)	(10.5)				(10.5)		(10.5)
4.4.1	Landing	5.0				0	0		0
4.4.2	Internal	2.5	2.5				2.5		2.5
4.4.3	External	8.0	8.0				8.0		8.0

* The crew and miscellaneous items considered in this total are considered part of inert weight.

** Panel lighting (4#) is under Controls and Displays.

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LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
4.5	Sustenance & Assoc. Equip.	(36.7)	(4.1)		(23.6)		(27.7)		(27.7)
4.5.1	Water Probe ***	.5	.5				.5		.5
4.5.2	Food, Packaging&Disinfectant	9.2	3.6		5.6		9.2		9.2
4.5.3	Medical Equipment	0	0				0		0
4.5.4	LiOH Cartridge -PLSS (4)	27.0	0		18.0		18.0		18.0
4.6	Waste Management	15.0	15.0				15.0		15.0
	Total Crew Prov. - Inert	702.5	644.9		57.6		702.5	-576.7	125.8
	Total Crew Prov. - Expend.	32.0	0		18.0		18.0	0	18.0

*** Drinking water is under ECS code.

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LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
5.0	Environmental Control	484.9	244.4	61.6	167.3	11.6	484.9	62.2	547.1
5.1	Atmosphere Revitalization Sect.	(80.5)	(80.5)				(80.5)		(80.5)
5.1.1	Suit Circuit Assembly	55.5	55.5				55.5		55.5
5.1.2	Cabin Recirculation Assy.	21.8	21.8				21.8		21.8
5.1.3	CO_2 Sensor	3.2	3.2				3.2		3.2
5.2	Heat Transport Section	(39.0)	(39.0)				(39.0)		(39.0)
5.2.1	Coolant Recirculation Assy.	7.2	7.2				7.2		7.2
5.2.2.1	Controls - Primary Loop	26.4	26.4				26.4		26.4
5.2.2.2	Controls - Redundant Loop	3.0	3.0				3.0		3.0
5.2.3	Heat Exchangers (4)	2.4	2.4				2.4		2.4
5.3	O_2 Supply & Cn. Press. Section	(33.9)	(33.9)				(33.9)		(33.9)
5.3.1	GOX Accumulator	18.8	18.8				18.8		18.8
5.3.2	Controls	15.1	15.1				15.1		15.1
5.3.3	SOX Tank *								
5.4	Water Management Section	(38.2)	(14.7)		(23.5)		(38.2)		(38.2)
5.4.1	Water Tanks (3)	33.2	9.7		23.5		33.2		33.2
5.4.2	Controls	5.0	5.0				5.0		5.0
5.5	Plumbing - GAEC	(21.6)	(21.1)		(.5)		(21.6)	(1.0)	(22.6)
5.5.1	Atmosphere Revit. Section	.1	.1				.1		.1
5.5.2	Heat Transport Section	12.2	12.2				12.2	1.0	13.2
5.5.3	O_2 Supply & Cn. Press. Sect.	3.2	3.2				3.2		3.2
5.5.4	Water Management Sect.	6.1	5.6		.5		6.1		6.1

* Listed under EPS.

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LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
5.6	Cold Plates **	(7.8)	(7.8)				(7.8)		(7.8)
5.6.1	Cold Plates-Primary Loop	7.5	7.5				7.5		7.5
5.6.2	Cold Plates - Redundant Loop	.3	.3				.3		.3
5.7	Coolant	(34.5)	(34.5)				(34.5)		(34.5)
5.7.1	Coolant - Primary Loop	31.2	31.2				31.2		31.2
5.7.2	Coolant - Redundant Loop	3.3	3.3				3.3		3.3
5.8	Consumables	(229.4)	(12.9)	(61.6)	(143.3)	(11.6)	(229.4)	(61.2)	(290.6)
5.8.1	LiOH - ECS (2)	14.9	7.5		7.4		14.9		14.9
5.8.2	GOX	9.3	2.2	7.1			9.3		9.3
5.8.3	SOX *								
5.8.4	Water ***	205.2	3.2	54.5	135.9	11.6	205.2	61.2	266.4
	Total ECS - Inert	268.4	244.4	0	24.0	0	268.4	0	268.4
	Total ECS - Expendables	216.5	0	61.6	143.3	11.6	216.5	62.2	278.7

** Structural Cold Plates are included in Structures.
***Includes Drinking Water.

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LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
6.0	Landing Gear - (4 Gear)	410.0			560.0		560.0		560.0
6.1	Primary Struts	(160.8)			(160.8)		(160.8)		(160.8)
6.1.1	Tubes	122.8			122.8		122.8		122.8
6.1.2	Fittings	24.0			24.0		24.0		24.0
6.1.3	Shocks	14.0			14.0		14.0		14.0
6.2	Secondary Struts	(48.4)			(48.4)		(48.4)		(48.4)
6.2.1	Tubes	12.8			12.8		12.8		12.8
6.2.2	Fittings	11.6			11.6		11.6		11.6
6.2.3	Shocks	24.0			24.0		24.0		24.0
6.3	Extension Mechanism	(74.8)			(74.8)		(74.8)		(74.8)
6.3.1	Downlock	36.8			36.8		36.8		36.8
6.3.2	Uplock	10.0			10.0		10.0		10.0
6.3.3	Deployment *	10.0			10.0		10.0		10.0
6.3.4	Misc. Locking	18.0			18.0		18.0		18.0
6.4	Pads and Fittings	(46.0)			(46.0)		(46.0)		(46.0)
6.4.1	Pads	36.0			36.0		36.0		36.0
6.4.2	Fittings	10.0			10.0		10.0		10.0
6.5	Landing Gear/Structure Truss	(72.0)			(72.0)		(72.0)		(72.0)
6.5.1	Truss Tubes	48.0			48.0		48.0		48.0
6.5.2	Fittings	24.0			24.0		24.0		24.0
6.6	Thermal Paint	8.0			8.0		8.0		8.0
6.7	Miscellaneous - Resizing	-			(150.0)		(150.0)		(150.0)
6.7.1	Structure Δ	-			130.0		130.0		130.0
6.7.2	Footpad Δ	-			20.0		20.0		20.0

* Includes Instrumentation and deploy-ment sensors.

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LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
7.0	Instrumentation	445.5	270.5		175.0		445.5	-80.0	365.5
7.1	Operational	(125.8)	(125.8)				(125.8)		(125.8)
7.1.1	Signal Conditioner	90.0	90.0				90.0		90.0
7.1.2	PCMTE	32.1	32.1				32.1		32.1
7.1.3	Data Storage Equipment	3.7	3.7				3.7		3.7
7.2	In-Flight Status System	(15.0)	(15.0)				(15.0)		(15.0)
7.2.3	Caution and Warning Equip.	15.0	15.0				15.0		15.0
7.3	Scientific Equipment - GFE	(250.0)	(80.0)		(170.0)		(250.0)	(-80.0)	(170.0)
7.3.1	Lunar Bound	250.0			250.0		250.0	-80.0	170.0
7.3.2	Earth Bound	0	80.0		-80.0		0		0
7.4	Sensors *	(54.7)	(49.7)		(5.0)		(54.7)		(54.7)
7.4.1	Structure	.1			.1		.1		.1
7.4.2	Stabilization and Control	2.1	2.1				2.1		2.1
7.4.3	Navigation and Guidance	4.0	4.0				4.0		4.0
7.4.5	Environmental Control Sys.	15.1	14.1		1.0		15.1		15.1
7.4.7	Instrumentation	0					0		0
7.4.8	Electrical Power Syst.	11.0	10.5		.5		11.0		11.0
7.4.9	Propulsion	14.1	10.7		3.4		14.1		14.1
7.4.10	Reaction Control System	7.7	7.7				7.7		7.7
7.4.11	Communications	.6	.6				.6		.6

* The current weight is based on a total of 397 sensors. The weight for 9 of these quantity gaging sensors are under Reaction Control and Electrical Power Supply.

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LEM
WEIGHT STATEMENT

CODE	ITEM		1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
8.0	Electrical Power Supply *		1263.2	929.5	31.3	346.3	6.1	1313.2	45.9	1359.1
8.1	Power Generation Section **		(704.2)	(437.3)	(31.3)	(293.1)	(6.1)	(767.8)	(45.9)	(813.7)
8.1.1	Fuel Cells	(3)	197.4	197.4				197.4		197.4
8.1.2	Oxygen Tanks ***	(2)	40.5	19.5		57.3		76.8		76.8
8.1.3	Hydrogen Tanks ***	(3)	122.2	75.5		98.6		174.1		174.1
8.1.4.1	Oxygen-Ascent		21.1		19.8	1.2		21.0		21.0
8.1.4.2	-Descent		112.2			101.8	3.8	105.6	24.2	129.8
8.1.4.3	-Residual		3.6	.8		3.5		4.3		4.3
8.1.4.4	-Vented -Ascent								--	--
8.1.5.1	Hydrogen-Ascent		13.9		11.5	.6		12.1		12.1
8.1.5.2	-Descent		32.1			21.5	2.3	23.8	16.1	39.9
8.1.5.3	-Residual		7.0	.8		2.4		3.2		3.2
8.1.5.4	-Vented-Ascent								5.6	5.6
8.1.6	Auxiliary Battery System		53.0	53.0				53.0		53.0
8.1.7.1	Plumbing -O_2 Feed		15.8	13.8		2.1		15.9		15.9
8.1.7.2	-H_2 Feed		27.5	18.6		4.1		22.7		22.7
8.1.8	Pyrotechnic Batteries	(2)	7.0	7.0				7.0		7.0
8.1.9	Battery Charger		3.2	3.2				3.2		3.2
8.1.10	Electrical Control Assy.	(3)	47.7	47.7				47.7		47.7
8.2	Power Conversion Section		(31.5)	(31.5)				(31.5)		(31.5)
8.2.1	Inverters	(2)	30.0	30.0				30.0		30.0
8.2.2	Control Unit		1.5	1.5				1.5		1.5
8.3	Distribution Section		(68.0)	(47.4)		(5.0)		(52.4)		(52.4)
8.3.1	Circuit Breaker Panel-Left	(1)	15.0	16.7				16.7		16.7
8.3.2	-Right	(1)	15.0	17.7				17.7		17.7
8.3.3	Relay Boxes	(2)	20.0	7.0		5.0		12.0		12.0
8.3.4	Terminal Box	(1)	10.0	6.0				6.0		6.0
	Distribution Boxes		8.0	0				0		0

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LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
8.4	Electrical Provisions	(459.5)	(413.3)		(48.2)		(461.5)		(461.5)
8.4.2	Stabilization and Control	16.2	18.0		.2		18.2		18.2
8.4.3	Navigation and Guidance	99.5	97.0		2.5		99.5		99.5
8.4.4	Crew System	2.5	2.5				2.5		2.5
8.4.5	Environmental Control	4.8	4.8				4.8		4.8
8.4.7	Instrumentation	198.0	171.0		27.0		198.0		198.0
8.4.8	Electrical Power	86.4	71.4		15.0		86.4		86.4
8.4.9	Propulsion	22.5	19.0		3.5		22.5		22.5
8.4.10	Reaction Control	17.0	17.0				17.0		17.0
8.4.11	Communications	7.9	7.9				7.9		7.9
8.4.12	Controls and Displays	4.7	4.7				4.7		4.7
	Total EPS - Inert	1083.9	929.5	0	221.2	0	1150.7	0	1150.7
	Total EPS - Expendables	179.3	0	31.3	125.1	6.1	162.5	45.9	208.4

* Heat Exchangers and Glycol Plumbing are included under ECS.

** Based on a 121 KWH energy level.

*** Includes Reactant Quantity Gaging.

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LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
9.0	Propulsion System	23222.8	565.5	4550.5	1352.0	15905.9	22373.9		22373.9
9.1	Propellant	(21079.9)	(51.5)	(4550.5)	(169.3)	(15905.9)	(20677.2)		(20677.2)
9.1.1.1	Usable - Ascent	4605.2		4550.5			4550.5		4550.5
9.1.1.2	- Descent	16258.7				15905.9	15905.9		15905.9
9.1.2.1	Trapped- Ascent	50.0	51.5				51.5		51.5
9.1.2.2	- Descent	166.0			169.3		169.3		169.3
9.2	Propellant System	(737.3)	(198.9)		(537.5)		(736.4)		(736.4)
9.2.1	Fuel Tanks - Ascent	92.1	92.1				92.1		92.1
9.2.2	- Descent	238.8			238.8		238.8		238.8
9.2.3	Oxid. Tanks- Ascent	92.1	92.1				92.1		92.1
9.2.4	- Descent	239.0			239.0		239.0		239.0
9.2.5	Plumbing - Ascent	15.0	14.7				14.7		14.7
9.2.6	- Descent	60.3			59.7		59.7		59.7
9.3	Pressurization System	(766.9)	(104.1)		(217.5)		(321.6)		(321.6)
9.3.1	Helium Tanks- Ascent	140.0	45.7				45.7		45.7
9.3.2	- Descent	503.2			102.9		102.9		102.9
9.3.3	Helium - Ascent	14.3	12.3				12.3		12.3
9.3.4	- Descent	52.6			61.4		61.4		61.4
9.3.5	Plumbing - Ascent	24.9	46.1				46.1		46.1
9.3.6	- Descent	31.9			53.2		53.2		53.2

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LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
9.4	Engines	(638.7)	(211.0)		(427.7)		(638.7)		(638.7)
9.4.1	Engine - Ascent	203.0	203.0				203.0		203.0
9.4.2	- Descent	390.0			390.0		390.0		390.0
9.4.3	Shield - Ascent	0	0		0		0		0
	- Descent	0			0		0		0
9.4.4	Gimbal Actuators*	--					--		--
9.4.5	Engine Mount - Ascent	0	0				0		0
	- Descent	16.7			16.7		16.7		16.7
9.4.6	Misc. - Ascent	8.0	8.0				8.0		8.0
	- Descent	21.0			21.0		21.0		21.0
	Total Propulsion - Inert	2358.9	565.5		1352.0	0	1917.5		1917.5
	Total Propulsion - Expendable	20863.9	0	4550.5	0	15905.9	20456.4		20456.4

* Included in Stabilization and Control.

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LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
10.0	Reaction Control System	833.5	371.1	355.0	4.1	102.0	832.2	4.1	836.3
10.1	Propellant	(521.2)	(59.8)	(355.0)	(4.1)	(102.0)	(520.9)	(4.1)	(525.0)
10.1.1	ΔV	340.8		306.0		28.3	334.3		334.3
10.1.2	Attitude Control	93.8		26.3		73.7	100.0		100.0
10.1.3	Parking Orbit Contingency	22.7		22.7			22.7		22.7
10.1.4	Tank Failure Contingency	21.0	21.0				21.0		21.0
10.1.5	Checkout	4.1			4.1		4.1	4.1	8.2
10.1.6	Trapped	38.8	38.8				38.8		38.8
10.2	Propellant System *	(135.8)	(135.8)				(135.8)		(135.8)
10.2.1	Fuel Tanks	20.4	20.4				20.4		20.4
10.2.2	Oxidizer Tanks	24.5	24.5				24.5		24.5
10.2.3	Plumbing								
	-Ascent Tie-In	6.0	6.0				6.0		6.0
	-Fuel and Oxidizer System **	64.9	64.9				64.9		64.9
	-Thruster Isolation Valves	20.0	20.0				20.0		20.0
10.3	Pressurization System	(57.2)	(54.0)				(54.0)		(54.0)
10.3.1	Helium Tanks	21.0	15.9				15.9		15.9
10.3.2	Helium Gas	2.1	2.1				2.1		2.1
10.3.3	Plumbing	34.1	36.0				36.0		36.0

* Capacity of usable propellant is 575.6#.
** Includes Propellant Quantity Gaging (18.3#).

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LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
10.4	Thruster Inst. Assy.	(121.5)	(121.5)				(121.5)		(121.5)
	Thrust Chamber Assy.	91.9	91.9				91.9		91.9
	Cluster Hardware	29.6	29.6				29.6		29.6
	TCA Failure Device *								
	Total RCS - Inert	353.3	350.1	0		0	350.1		350.1
	Total RCS - Expendables	(480.2)	(21.0)	(355.0)	(4.1)	(102.0)	(482.1)	(4.1)	(486.2)
	-Att. Control Prop.	141.6	21.0	49.0	4.1	73.7	147.8	4.1	151.9
	Δ V Propellant	338.6		306.0		28.3	334.3		334.3

* Included under Instrumentation Sensors.

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LEM
WEIGHT STATEMENT

CODE	ITEM		1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
11.0	Communications		129.6	116.6		17.8		134.4		134.4
11.1	VHF LEM/CM		(41.7)	(41.0)		(3.7)		(44.7)		(44.7)
11.1.1	Transceiver ERA*	(1)		15.9				15.9		15.9
11.1.2	Signal Processor ERA	(1)	26.5	11.1				11.1		11.1
11.1.3	Inflight Antenna	(2)	3.3	5.0				5.0		5.0
11.1.4	R. F. Switch		1.1	1.1				1.1		1.1
11.1.5	B. H. Flanges	(3)	.4	.4				.4		.4
11.1.7	R. F. Cables		7.8	7.5		1.1		8.6		8.6
11.1.8	EVA Antenna		2.6			2.6		2.6		2.6
11.2	S-Band LEM/Earth		(77.6)	(66.8)		(12.6)		(79.4)		(79.4)
11.2.1	Transponder ERA		37.5	20.2				20.2		20.2
11.2.2	Power Amplifier ERA **			14.8				14.8		14.8
11.2.3	Antenna Electronics ERA			2.8				2.8		2.8
11.2.4	Inflight Antenna	(2)	2.3	2.3				2.3		2.3
11.2.5	Erectable Antenna		10.0			10.0		10.0		10.0
11.2.6	Steerable Antenna ***		17.0	17.0				17.0		17.0
11.2.7	R.F. Switch		1.0	1.0				1.0		1.0
11.2.8	B.H. Flanges	(4)	.5	.5				.5		.5
11.2.9	R.F. Cables		9.3	8.2		2.6		10.8		10.8
11.3	Television		(10.3)	(8.8)		(1.5)		(10.3)		(10.3)
11.3.1	Camera, Portable - GFE		5.5	5.5				5.5		5.5
11.3.2	Lens - GFE		2.0	2.0				2.0		2.0
11.3.3	Camera Thermal Equip-GFE		.5	.5				.5		.5
11.3.4	Cable		1.5			1.5		1.5		1.5
11.3.5	Tripod		.8	.8				.8		.8

* Includes Multiplexer 3.5#.
** Includes Diplexer 1.0#.
*** Includes Earth Sensor and Drive.

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LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
12.0	Controls and Displays	223.3	228.9				228.9		228.9
12.1	Structure	--							
12.2	Stabilization and Controls	(62.0)	(67.6)				(67.6)		(67.6)
12.2.1	Flight Controls	43.5	49.4				49.4		49.4
12.2.2	Abort Guidance	4.5	4.5				4.5		4.5
12.2.3	Controllers	14.0	13.7				13.7		13.7
12.3	Navigation and Guidance	(43.2)	(43.2)				(43.2)		(43.2)
12.3.1	GFE	41.5	41.5				41.5		41.5
12.3.2	Rendezvous & Landing Radar	1.7	1.7				1.7		1.7
12.4	Crew Provisions	3.3	3.3				3.3		3.3
12.5	Environmental Control	9.0	9.0				9.0		9.0
12.6	Lunar Landing System	--							
12.7	Instrumentation	9.1	9.1				9.1		9.1
12.8	Electrical Power	(23.3)	(23.3)				(23.3)		(23.3)
12.8.1	Cryogenic Storage	5.2	5.2				5.2		5.2
12.8.2	Power Generation	6.1	6.1				6.1		6.1
12.8.3	Power Distribution	6.8	6.8				6.8		6.8
12.8.4	Pyrotechnic Control	5.2	5.2				5.2		5.2

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LEM
WEIGHT STATEMENT

CODE	ITEM	1/1/65 WEIGHT AT SEPARATION	CURRENT WEIGHT STATUS: BURN OUT	CONS'D ON ASCENT	JET. ON LURAIN	CONS'D ON DESCENT	TOTAL SEPARATION	X-LUNAR EXPEND-ABLES	EARTH LAUNCH TOTAL
12.9	Propulsion	(10.0)	(10.0)				(10.0)		(10.0)
12.9.1	Prop. Engine Thrust Control	1.5	1.5				1.5		1.5
12.9.2	Main Propulsion	8.5	8.5				8.5		8.5
12.10	Reaction Control	16.0	16.0				16.0		16.0
12.11	Communications	14.4	14.4				14.4		14.4
12.12	Displays	(33.0)	(33.0)				(33.0)		(33.0)
12.12.1	Instrument Panel and Side consoles	29.0	29.0				29.0		29.0
12.12.2	E.L. Panels and Overlays	4.0	4.0				4.0		4.0

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Table 7

LEM WEIGHT COMPARISON
AT SEPARATION BY STAGES

SUBSYSTEM	ITEM	1/1/65 WEIGHT	CURRENT WEIGHT	WEIGHT
A.	Ascent Stage Weight at Separation	10102.5	9991.9	-110.6
1.0	Structure	1101.3	1101.3	0
2.0	Stabilization and Control	70.6	67.0	-3.6
3.0	Navigation and Guidance	276.9	276.9	0
4.0	Crew Provisions	709.0	700.0	-9.0
5.0	Environmental Control	316.2	316.2	0
6.0	Landing Gear	--	--	
7.0	Instrumentation - Operational	190.5	190.5	0
	- Scientific	80.0	80.0	0
8.0	Electrical Power Supply	941.1	962.6	+21.5
9.0	Propulsion System	(5244.6)	(5116.0)	(-128.6)
	Propulsion Inert	589.4	514.0	-75.4
	Propellant (Includes 51.5# trapped)	4655.2	4602.0	-53.2
10.0	Reaction Control	(833.5)	(832.2)	(-1.3)
	Propulsion Inert	314.5	311.3	-3.2
	Propellant (Includes 38.8# trapped)	519.0	520.9	+1.9
11.0	Communications	115.5	120.3	+4.8
12.0	Controls and Displays	223.3	228.9	+5.6
B.	Descent Stage Weight at Separation	20343.6	19797.3	-546.3
1.0	Structure	1208.3	1208.3	0
2.0	Stabilization and Control	13.7	14.2	+.5
3.0	Navigation and Guidance	28.0	28.0	0
4.0	Crew Provisions	25.5	20.5	-5.0
5.0	Environmental Control	168.7	168.7	0
6.0	Landing Gear	410.0	560.0	+150.0
7.0	Instrumentation - Operational	5.0	5.0	0
	- Scientific	170.0	170.0	0
8.0	Electrical Power Supply	322.1	350.6	+28.5
9.0	Propulsion System	(17978.2)	(17257.9)	(-720.3)
	Propulsion Inert	1553.5	1182.7	-370.8
	Propellant (Includes 169.3# trapped)	16424.7	16075.2	-349.5
11.0	Communications (Portable)	14.1	14.1	0
	Total Separation Weight (A & B)	30446.1	29789.2	-656.9

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DISCUSSION OF WEIGHT CHANGES BY RESPONSIBILITY AND PHASES SINCE LAST REPORT - AT SEPARATION

	Inert*Wt. Chgs. By Mission Phases		Effective Weight By Responsibility	
	Ascent	Descent	GAEC	NASA
Resizing Weight Changes				
This category was listed in the previous report (ref. 11) and is continued to include those items which were not sufficiently defined for purposes of weight estimating. The preliminary weight estimates of these items are as follows:				
6.0 Landing Gear		(+150.0)		(+323.1)
-Structure		+130.0		+280.0
-Foot Pad		+ 20.0		+ 43.1
10.0 Reaction Control - Attitude Propellant		+ 6.2		+ 10.1
Revised weight estimate of the Propulsion Pressurization section which was quoted in previous report. The revisions include a 1# increase in descent helium with the associated increase in descent tank weight, an increase in ascent tank weight due to correction of design helium quantity, and the higher maximum environment temperature increased the resized weight increment of the ascent tank. The change is as follows:				
9.0 Propulsion	(+ 16.6)	(+ 12.8)		(+ 98.4)
-Helium Tank	+ 16.6	+ 11.8		+ 96.2
-Helium		+ 1.0		+ 2.2
CCA #97 Change				
The Primary Navigation and Guidance Subsystem and the Stabilization and Control Subsystem were altered in accordance with NASA directive, ref. 8. This change effects the GFE equipment in the Navigation and Guidance Subsystem to the extent that the AGC will be used in lieu of a LGC designed particularly for the LEM. The weight change is not included since the AGC is below the NASA/GAEC control weight. Estimated effects of this change on other subsystems are as follows:				
2.0 Stabilization and Control	(- 1.5)	(+ .5)		(- 5.3)
-Delete (1) Rate Gyro	- 1.5			- 6.4
-Changes to DECA		+ .5		+ 1.1

* Inert weight excludes ΔV propellant.

DISCUSSION OF WEIGHT CHANGES BY RESPONSIBILITY AND PHASES SINCE LAST REPORT - AT SEPARATION - Cont.

	Inert*Wt. Chgs. By Mission Phases		Effective Weight By Responsibility	
	Ascent	Descent	GAEC	NASA
CCA #97 Change - Cont.				
8.0 Electrical Power Supply				
-Changes to Wiring	+ 1.8	+ .2		+ 8.1
12.0 Controls and Displays	(+ 5.6)			(+ 23.9)
-Change to Translation Control Assembly	- .3			- 1.3
-Changes to Control Panel	+ 3.7			+ 15.8
-Change to GASTA	+ 2.2			+ 9.4
CCA #95 Change				
The Communication Subsystem was changed in accordance with NASA directive, ref. 7 . Which required separate ERA packaging for several communication functions. The estimated effects of this change on the subsystem is as follows:				
11.0 Communications	(+ 3.1)			(+ 13.2)
-Delete VHF Transceiver function from signal processor ERA	- 15.4			- 65.7
-Add VHF Transceiver ERA	+ 15.9			+ 67.8
-Delete S-Band Pwr Amplif. and Antenna Electr. Funct. from transponder ERA	- 17.3			- 73.8
-Add S-Band Power Amplifier ERA (with Diplexer)	+ 14.8			+ 63.2
-Add S-Band Antenna Electronics ERA	+ 2.8			+ 11.9
-Add VHF wiring	+ .8			+ 3.4
-Add S-Band wiring	+ 1.5			+ 6.4
Weight Reduction Change - Ambient Helium Safety Factor Reduction				
The safety factor for gaseous helium tanks is reduced from 2.0 to 1.5 as approved by NASA, ref. 9. Estimated weight changes for this change are as follows:				
9.0 Propulsion - Helium Tanks	- 38.0	-128.4	-438.7	
10.0 Reaction Control - Helium Tanks	- 5.1		- 21.8	

* Inert weight excludes ΔV propellant.

DISCUSSION OF WEIGHT CHANGES BY RESPONSIBILITY
AND PHASES SINCE LAST REPORT - AT SEPARATION - Cont.

	Inert*Wt. Chgs. By Mission Phases		Effective Weight By Responsibility	
	Ascent	Descent	GAEC	NASA
Change in Ambient Helium Bottle Sizing Criteria				
Tests presently indicate that the Rocketdyne engine requires helium injection into the oxidizer feed side of the engine only, although the required total quantity of injected helium remains fixed. The present method of providing this helium is by means of a tap upstream of the Quad check valves. This method eliminates the pressure decay technique which had been used to cancel the descent engine helium requirements from tank sizing. The penalty associated with providing the descent engine helium is as follows:				
9.0 Propulsion		(+ 84.8)	(+182.6)	
-Helium Tank		+ 76.8	+165.4	
-Helium		+ 8.0	+17.2	
EPS Supercritical Bottle Weights				
The Design requirements used by Airesearch for tank sizing and weight estimates shown in their CDR report (ref. 15) resulted in an unacceptable Bottle weight. This area has been discussed and some requirements changed, since the CDR, in an attempt to reduce the Airesearch predicted Bottle weight. Although the values listed below are not finalized with the Vendor, they are considered more representative of the bottle weights than the values in the previous report. These values are based on the November AiResearch Progress Report with the December calculated reactant and tankage weights, which were received in January. A breakdown of the changes is as follows:				
8.0 Electrical Power Supply	(+ 39.3)	(+ 30.8)	(+230.4)	
-Oxygen Tanks	+ 10.4	+ 25.9	+100.2	
-Hydrogen Tanks	+ 34.5	+ 17.4	+184.7	
-Oxygen - Ascent	- 1.3	+ 1.2	- 2.9	
- Descent (+ .2# during Translunar)		- 4.8	- 10.3	
- Residual	- .3	+ 1.0	+ .9	
- Vented	-	-		

* Inert weight excludes ΔV propellant.

DISCUSSION OF WEIGHT CHANGES BY RESPONSIBILITY AND PHASES SINCE LAST REPORT - AT SEPARATION - Cont.

	Inert*Wt. Chgs. By Mission Phases		Effective Weight By Responsibility	
	Ascent	Descent	GAEC	NASA
EPS Supercritical Bottle Weights -Cont.				
8.0 Electrical Power Supply - Cont.				
-Hydrogen - Ascent	- 2.4	+ .6	- 8.9	
- Descent (+4.4# during Translunar)		- 8.3	- 17.9	
- Residual	- 3.4	- .4	- 15.4	
- Vented (+5.6# during Translunar)				
EPS/PDS - Incorporation of the Non-Redundant Bus Config.				
The electrical distribution section weights reflect configuration (4) units noted in ref. 13. This concept was approved by NASA per ref. 10 ; however the battery weight will not be changed at this time. Wiring changes are not included in this report but will be included in a subsequent report, when the wiring weight has been determined from current schematics. A breakdown of the change is as follows:				
8.0 Electrical Power	(- 20.6)	(+ 5.0)	(- 77.2)	
-Circuit Breaker Panel - Left	+ 1.7		+ 7.2	
- Right	+ 2.7		+ 11.5	
-Relay Boxes	- 13.0	+ 5.0	- 44.7	
-Terminal Box (Formerly Junction Boxes)	- 4.0		- 17.1	
-Distribution Boxes	- 8.0		- 34.1	
Change in PLSS Recharge Requirements				
The quantity of LEM provided recharges for the Portable Life Support System units is reduced from 6 to 4 (LiOH cartridges, oxygen refills, and water refills) per ref. 3 . A breakdown of the change is as follows:				
4.0 Crew Provisions				
-LiOH Cartridges	- 9.0			- 38.4
5.0 Environmental Control				
-Water (-13.6# during Translunar)				
8.0 Electrical Power Supply				
-Oxygen		- 1.8		- 3.9

* Inert weight excludes ΔV propellant.

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DISCUSSION OF WEIGHT CHANGES BY RESPONSIBILITY AND PHASES SINCE LAST REPORT - AT SEPARATION - Cont.

	Inert*Wt. Chgs. By Mission Phases		Effective Weight By Responsibility	
	Ascent	Descent	GAEC	NASA
Change in Reporting Mission				
The NASA directive, ref. 2, to report on other then an Earthshine Mission permits the deletion of the landing flares. Other changes (e.g. water quantity) will be made in subsequent reports, when the necessary studies are completed. The flare change is:				
4.0 Crew Provisions - Landing Lighting		- 5.0		- 10.8
CCA #82 Change - Incorporation of Supercritical Helium In Lieu Of Ambient Helium				
The supercritical helium pressurization system is considered the method of pressurizing the LEM propulsion system rather than the ambient helium pressurization system as approved by NASA, ref. 6 . Structure and instrumentation changes are still being reviewed and will be incorporated in a subsequent report. Estimated propulsion changes are as follows:				
9.0 Propulsion	(- 52.5)	(-336.7)	(-948.9)	
-Trapped Propellant	+ 1.5	+ 3.3	+ 13.8	
-Propellant Plumbing	- .3	- .6	- 2.6	
-Helium Tanks	- 72.9	-360.5	-1087.6	
-Helium	- 2.0	- .2	- 8.9	
-Pressurization Plumbing	+ 21.2	+ 21.3	+136.4	
Miscellaneous Electronic Changes				
The Abort Sensor Assembly specification weight was negotiated at 17.5#. The Rate Gyros are currently reported to weight 1.5# each including their pig-tail connectors. The Inflight Monitor Function weight allotment can be deleted since this capability presently exists in other components. The VHF inflight antenna specification weight is 2.5# each. The effects of these miscellaneous changes are as follows:				
2.0 Stabilization and Control	(- 2.1)		(- 9.0)	
-Rate Gyro Assemblies	- .6		- 2.6	

*Inert weight excludes ΔV propellant.

DISCUSSION OF WEIGHT CHANGES BY RESPONSIBILITY AND PHASES SINCE LAST REPORT - AT SEPARATION - Cont.

	Inert*Wt. Chgs. By Mission Phases		Effective Weight By Responsibility	
	Ascent	Descent	GAEC	NASA
Miscellaneous Electronic Changes - Cont.				
2.0 Stabilization and Control - Cont.				
-Inflight Monitor Functions	- 4.0		- 17.1	
-Abort Sensor Assembly	+ 2.5		+ 10.7	
11.0 Communications - VHF Inflight Antennas	+ 1.7		+ 7.2	
Miscellaneous EPS Plumbing Changes				
The reactant feed plumbing weights are in accordance with current plumbing schematics. Some of the reactant plumbing in the immediate vicinity is provided by the reactant tank vendor and is included in the reactant tanks' weights rather than current reactant feed plumbing weights. A breakdown of the change is as follows:				
8.0 Electrical Power Supply	(+ 1.0)	(- 5.7)	(- 8.0)	
-Plumbing - Oxygen Feed	+ 3.4	- 3.3	+ 7.4	
- Hydrogen Feed	- 2.4	- 2.4	- 15.4	
Miscellaneous RCS Plumbing Changes				
The helium test port at each propellant tank is changed to a propellant fill/vent disconnect because the test ports are not compatible with propellant vapors. Current design indicates that each parallel leg of a quad check valve has a test port between the two series poppets for system checkout; thus two test ports in lieu of one are required for each of the four quad check valves. NAA specification weights for common usage fill/vent disconnects, pressure regulators, pressure relief valves and helium filters reflect an increase of .1# over the weight previously estimated for these items. These result in the following plumbing weight change.				
10.0 Reaction Control				
-Pressurization System	+ 1.9		+ 8.1	
Total Inert Weight Changes	- 59.6	-185.5		
Total Effective Weight Changes By Responsibility			-1075.3	+418.4
Total Normal Effective and Reported Weight Changes =		-656.9		

* Inert Weight excludes ΔV propellant.

[redacted]

PENDING CHANGES

Items listed below are those changes considered most imminent and/or that need NASA approval before incorporation. Some of these changes may be NASA approved but the weight data was not sufficient for complete incorporation.

		Estimated Weight Increment		
		Ascent (Inert*)	Descent (Inert*)	Separation (Effective)
1.	Delete the Redundant Pressurization Feed System from the Reaction Control Sub-System- Proposed Weight Reduction.	-11.1		-47.4
2.	Stage PLSS and Extravehicular Garments- This weight reduction item was partially incorporated with the abandonment of two meteoroid protection garments and one external thermal garment on the lunar surface.	-97.0	+177.0	-32.6
3.	Reduce the LEM Hover time by one minute - Proposed Weight Reduction is in terms of equivalent inert weight at touchdown.		-530.0	-1141.6
4.	Incorporate the estimated structure and instrumentation changes resulting from the use of supercritical helium in lieu of ambient - Weight Reduction item.	--	- 6.0	-12.9
5.	Incorporate heat shielding required to protect the RCS thruster supports.	+20.0		+85.3
6.	Increase the docking drogue weight based on NAA estimate.	+ 8.0		+34.1
7.	Incorporate the expendable changes resulting from the use of the Design Reference Mission with a daylight landing.	--	--	
8.	Incorporate the increase in trapped propellant resulting from resizing the vehicle.	--	--	

* Inert weight excludes ΔV Propellant.

PENDING CHANGES - Cont.

	Estimated Weight Increment		
	Ascent (Inert*)	Descent (Inert*)	Separation (Effective)
9. Add the extra PLSS battery (Approx. 4#) to enable more efficient use of oxygen for lunar excursions. Any increase over the present reported four excursions will also increase the quantity and weight of water, oxygen and LiOH cartridges. Addition of PLSS battery to GFE list will add battery to the reported vehicle.	--	--	
10. Incorporate wiring changes based on current schematics when study is complete.	--	--	
11. Reduce the quantity and tankage of descent supercritical helium to meet the requirements of the STL engine rather than the injection requirements of the Rocketdyne engine.		-23.7	-51.0

* Inert weight excludes Δ V Propellant.

GOVERNMENT FURNISHED EQUIPMENT

This report incorporates Government Furnished Equipment Design Weights per reference 5. Table is a listing of these GFE items and their weights.

It should be noted that the MIT equipment control weight of 250 pounds has been distributed between Navigation and Guidance (198.5#) and Controls and Displays (41.5#). This is an assumed breakdown used for mass property purposes.

Table 8

GOVERNMENT FURNISHED EQUIPMENT - DESIGN WEIGHT

Code	Item	Qty.	Control Weight	Remarks
3.0	Navigation and Guidance		198.5	
3.1	MIT Equipment (Partial)		198.5	See Controls and Displays below for the remainder of this equipment. This is an assumed distribution of the weight pending receipt of a MSC distribution.
	-IMU			
	-AGC			
	-AGC/PSA Interconnection Assy.			
	-PSA			
	-PSA Cover			
	-CDU's			
	-Telescope and Eyepiece			
	-Navigation Base and Mounts			
	-Book of Procedures			
4.0	Crew Provisions		642.0	
	Crew Accessories - CSM Stored at Earth Launch			
4.1.1	Pressure Garment Assembly	2	68.0	
	-Torso Garment W/Integral Boots			
	-Waste Management System			
	-Helmet (Incl. Visor & EVSTC)			
	-Gloves (pair)			
4.1.2	Portable Life Support System - Charged	2	(122.0)	
	-Dry PLSS		76.4	
	-LiOH Cartridge		9.0	
	-Water		16.2	
	-Oxygen		2.2	
	-Battery		8.2	
	-PLSS mounted EVSTC and Antenna		10.0	
4.1.3	Radiation Dosimeters		(3.3)	
	-Personal Whole Body	2	2.0	
	-Passive	1	.3	
	-Survey Meter (Less Charger & Battery)	1	1.0	
4.1.4	Liquid Cooled Garment (Charged)	2	9.0	
4.1.5	Bioinstrumentation	1	2.5	
4.1.11	Emergency Oxygen System	2	6.5	
4.2	Crew - CSM Stored at Earth Launch	2	352.0	
	Crew Accessories - LEM Stored at Earth Launch			
4.1.6	Thermal Garment - External	2	26.8	
4.1.8	Meteoroid Protection Garment (Incl. visor)	2	38.6	
4.1.9	Suit Repair Kit	1	1.2	
4.1.10	PLSS Calibration Unit	1	.8	
4.1.12	PLSS Spare Parts	1	1.6	
4.5.1	Water Probe		.5	This is an assumed portion of the weight pending receipt of a MSC distribution.
4.5.2	Food, Packaging and Disinfectant		9.2	
4.5.3	Medical Equipment		(Negligible)	
	-Medications			
	-Clinical Instruments			

Table 8

GOVERNMENT FURNISHED EQUIPMENT - DESIGN WEIGHT - Cont.

Code	Item	Qty.	Control Weight	Remarks
7.0	Instrumentation		250.0	
7.3	Scientific Equipment		(250.0)	Includes sample containers.
	Ascent Stage		80.0	
	Descent Stage		170.0	
11.0	Communications		8.8	
11.3	Television		(8.8)	
11.3.1	Camera		5.5	
11.3.2	Lens		2.0	
11.3.3	Thermal Equipment		.5	
11.3.5	Tripod		.8	
12.0	Controls and Displays		41.5	
12.3.1	MIT Equipment (Partial)		41.5	See Navigation and Guidance above for the remainder of this equipment.
	-Eye Register for Reticule			
	-Two Digit Readout for Reticule			
	-LGC Displays and Controls			
	Total GFE Control Weight		1140.8	

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1. MSC letter PL2-13-64-571, dated 26 October 1964, "Contract NAS 9-1100, Transmittal of the Apollo Lunar Landing Design Reference Mission Trajectory."

2. MSC letter PP6-13-64-646, dated 20 November 1964, "Contract NAS 9-1100, LEM Weight Report."

3. MSC letter PL2-12-77/13-64-704, dated 14 December 1964, "Contract NAS 9-1100, Resolution of M-5 Mockup Review Chits 1-16 and 1-20."

4. MSC letter BG54 64-406, dated 16 December 1964, "Contract Change Authorization No. 98 Addition of LEM Design Weights to Exhibit A."

5. MSC letter PS5/L1670-13-64-709, dated 14 December 1964, "Contract NAS 9-1100, Design Reference Weights for LEM GFE."

6. MSC letter BG 54 64-322, dated 16 October 1964, "Contract NAS 9-1100, Contract Change Authorization No. 82 Supercritical Helium Pressurization."

7. MSC letter BG 54 64-375, dated 20 November 1964, "Contract No. NAS 9-1100, Contract Change Authorization No. 95 Communications Subsystem Packaging."

8. MSC letter BG 54 64-392, dated 4 December 1964, "Contract NAS 9-1100, Contract Change Authorization No. 97, LEM Guidance and Control Configuration."

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10. MSC TWX EE4-8-64-802. Contract NAS 9-1100. Clarification of EPS Buss Arrangement and Load Distribution Configuration Approval.

11. LED-490-16, dated 1 January 1965, "LEM Mass Property Report (U)."

12. LED-490-100, dated 30 April 1964, "Allocation of Propellants and ΔV to Meet the ΔV Budget."

13. LMO-390-330, dated 9 November 1964, "Power Distribution Buss Design."

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15. LMO-500-37, Revision F, dated 9 January 1965, "LEM ΔV Budget."

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18. LTM-340-10003, dated 13 March 1964, Inboard Profile.

19. LDW-280-10050, Revision C, dated 7 July 1964, "Geometry Ascent Stage -2 Tank" Drawing.

LIST OF REFERENCES - Cont.

20. LDW-280-17000, Revision B, dated 28 August 1964, "General Arrangement Descent Stage" Drawing.

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