



**Aerospace
Systems Division**

CPLEE Parts Application Analysis

NO.	REV. NO.
ATM 798	
PAGE <u>1</u>	OF <u>8</u>
DATE 17 October 19	

The purpose of this ATM report is to document a final Parts Application Analysis (PAA) for the flight model design of the Charged Particle Lunar Environment Experiment (CPLEE) Subsystem.

It has been established by the results of the analysis that all electronic, electrical and electromechanical parts employed in CPLEE have been designed to operate within the functional and environmental stress level limits prescribed for hi-rel application by Bendix document ATM 241B, Acceptable Parts List for ALSEP.

Part and assembly level failure rate data provided by this PAA study also serve as the basis for:

CPLEE Flight Model Reliability Predictions, and

Criticality Ranking Factors Used in the CPLEE
Flight Model Failure Modes, Effects and
Criticality Analyses (FMECA)

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1.0 Introduction

This report presents the results of the parts application analysis for the flight model CPLEE Experiment. This analysis represents an updating of previous parts application data prepared for prototype CPLEE hardware.

This analysis included the following:

- (1) Determination of part operational stress levels.
- (2) Determination of part operational temperatures.
- (3) Determination of part operational duty cycles.
- (4) Establishment of part operational failure rates on the basis of part type and information gained from items (1) thru (3) above.

2.0 References

1. BxA Specification AL-260000, Rev. A, Charged Particle Lunar Environment Experiment Specification (Incorporates SCN-1)
2. BxA Specification IC-314107, Rev. B, Interface Control Specification for Charged Particle Lunar Environment Experiment Subsystem for ALSEP (Incorporates SCN 1 thru 7)
3. BxA Reliability Engineering Manual, Revision A

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4. CPLEE Engineering Drawings as listed:
 - a. BxRL Drawing No. 2166263, Rev. C - Logic Module Assembly
 - b. 2165365, Rev. G - Switchable Power Supply
 - c. 2165385, Rev. B - Low Voltage Power Supply
 - d. 2165390, Rev. G - Channeltron Power Supply No. 1
 - e. 2165395, Rev. G - Channeltron Power Supply No. 2
 - f. 2165355, Rev. D - Amplifier Module Assembly
 - g. 2167370, Rev. A - Vertical Analyzer
 - h. 2166260, Rev. E - 60° Analyzer
 - i. 2165405, Rev. C - Ancillary Module Assembly
 - j. 2166577, Rev. H - Electronic Package
 - k. 2165701, Rev. C - CPLEE Experiment
5. BxRL letter CA-25515, CPLEE Part Application Data (prototype design)
6. ATM-605, Failure Rate Data for ALSEP
7. MIL-HDBK-217A, Reliability Stress & Failure Rate Data For Electronic Equipment
8. ASD-R-05-64-1, Information for Reliability Predication (General Electric)
9. HAMLIN Life Test Data on DRVT-1 Dry Reed Switches as submitted to Bendix Aerospace Systems Division on 15 September 1968.
10. ATM-241, Acceptable Parts List for ALSEP Rev. B



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3.0 CPLEE Configuration

The drawings listed in Reference 4 represent flight configuration for the purpose of this analysis. Later revisions have been mechanical in nature and do not affect the analysis.

4.0 Method of Analysis

4.1 Part operational stress levels

A complete electrical stress analysis was performed on the CPLEE electronics. The results of this analysis was verified by ECAP (reference 5), in which an IBM 360 computer was utilized to determine electronic part operational DC and AC stress levels at 25°C.

4.2 Part operational temperature

Component operational temperatures were extracted from BRLD Part Application Data (reference 5).

4.3 Part operational Duty Cycles

Duty cycles were determined from the CPLEE Specifications (references 1 & 2) and may be summarized as follows:

TABLE 4-1 CPLEE Subassembly Operational Data Cycles

A. Logic Module Assembly

B101 - 50%

Remainder of Assembly - 100%

B. Switchable Power Supply

Switching Circuit - 50.0%

-3500V, -3500V Power Supplies - 12.5% (Includes associated secondary circuits)

350V, 35V Power Supplies - 25.0% (Includes associated secondary circuits)

Remainder of Assembly - 100.0%



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- C. Low Voltage Power Supply
 - Total - 50%
- D. Channeltron Power Supply No. 1
 - Total - 100%
- E. Channeltron Power Supply No. 2
 - Total - 100%
- F. Amplifier Module Assembly
 - Amplifier Submodules (A510-A521) - 50%
 - Remainder of Assembly - 100%
- G. Vertical Analyzer Assembly
 - Total - 50%
- H. 60° Analyzer Assembly
 - Total - 50%
- I. Ancillary Module Assembly
 - Temperature Control Circuit - Less than 1%
 - Dust Cover Removal Circuit - Less than 1%
 - Temperature Monitor Circuit - 100%
- J. Electronic Package (miscellaneous parts)
 - Heaters - 50%
 - Thermostats - 100%
- K. Structural/Mechanical Section
 - Dust Cover Assembly - 7.8%
 - Remainder of Section - 100%



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4.4 Part Operation Failure Rates

Failure rates were assigned utilizing the procedures and data contained in ATM 605 (reference 6) for resistors, capacitors, and semiconductors. Failure rates for other parts were assigned utilizing the data contained in references 7 thru 9.

5.0 Results

Tabulated PAA results are contained in Appendices A thru K of this ATM and may be summarized as follows:

ASSEMBLY FAILURE RATES

<u>Unit</u>	<u>Total Failure Rate</u>	<u>Appendix</u>
Logic Module Assembly	1.02431%/1000 hrs.	A
Switchable Power Supply	0.53119%/1000 hrs.	B
Low Voltage Power Supply	0.06332%/1000 hrs.	C
Channeltron Power Supply No. 1	0.15041%/1000 hrs.	D
Channeltron Power Supply No. 2	0.07366%/1000 hrs.	E
Amplifier Module Assembly	0.23561%/1000 hrs.	F
Vertical Analyzer Assembly	0.29706%/1000 hrs.	G
60° Analyzer Assembly	0.29706%/1000 hrs.	H
Ancillary Module Assembly	0.14912%/1000 hrs.	I
Electronic Package (misc. parts)	0.19500%/1000 hrs.	J
Mechanical Assembly *	1.10000%/1000 hrs.	K

*NOTE: For reliability prediction, an "α" factor of 0.10 applies reducing this total failure rate to 0.11000 as compared with the other data so tabulated.



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HIGHEST ELECTRICAL STRESS LEVELS

<u>Unit</u>	<u>Part(s)</u>	<u>Stress Levels</u>	<u>Appendix</u>
Logic Module Assembly	R102 RT1&RT2	0.27 1.00**	A
Switchable Power Supply	C201	0.64	B
Low Voltage Power Supply	C309, C315-6, R307	0.64 0.39	C
Channeltron Power Supply #1	C1-C10 (A401)	0.64	D
Channeltron Power Supply #2	C1-C10 (A403)	0.64	E
Amplifier Module Assembly	C511	0.50	F
Vertical Analyzer	C601 Heater	0.75 0.86**	G
60° Analyzer	C601 Heater	0.75 0.86**	H
Ancillary Module	C706 RT207	0.58 1.00**	I
Electronic Package (misc. parts)	All parts	1.00**	J
Structural/Mechanical Section	Not applicable	---	K

** These parts are designed to operate at the 100% stress level.

6.0 Conclusions

This PAA reflects that the derated parts stress levels of this experiment are good from the reliability standpoint, and that all parts are within the required operational stress levels of ATM 241 (reference 10).



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APPENDIX A
PARTS APPLICATION ANALYSIS DATA
FOR
LOGIC MODULE ASSEMBLY

PARTS APPLICATION ANALYSIS

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RESISTORSPROJECT: ALSEPASSEMBLY: CPLEE ExperimentSUB ASSEMBLY: Logic Module AssemblyDATE: 7 October 1968SCHEMATIC NO: 2166263, Rev. C

(Resistors)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (ALL OR NONE) CONSTRUCTION	MANUFACTURER	RESISTANCE VALUE (OHMS)	TOLERANCE (%)	POWER RATING (WATTS)	MAXIMUM OPERATING POWER (WATTS)	POWER RATIO OPERATING/RATED	MAXIMUM DUTY CYCLE	BULK AIR TEMPERATURE °C	CIRCUIT FUNCTION OR APPLICATION	BASIC FAILURE RATE (S/1000 HRS) - AT SOURCE (SEE BELOW)	FOR USE OF RELIABILITY DEPT	SPECIAL ENVIRONMENTS (Describe)	FAILURE RATE MULTIPLIER	FINAL FAILURE RATE (S/1000 HRS)	TOTAL FAILURE COUNT PER TYPE	TOTAL FAILURE RATE (S/1000 HRS)
R101	RNR55C	—	20K	5	0.1000	0.001	0.01	1.0	40	Register Readout(B106)	0.0151	A	Lunar	1.0	0.0151	1	0.015
R102	"	"	332	"	"	0.0270	0.27	"		"	0.0161	"	"	"	0.0161	1	0.016
R103-R114	"	"	3K	"	"	0.0030	0.03	"	40	Readout Sequencer (B109)	0.0151	"	"	"	0.0151	12	0.180
R116	"	"	20K	"	0.1000	0.001	0.01	"	"	Filter Network(B113)	0.0151	"	"	"	0.0151	1	0.015
—	RC07, Type BB	Allen Bradley	5.1K	"	0.1250	0.001	0.01	"	"	Register Readout(B106)	0.0021	"	"	"	0.0021	1	0.002
R118	RNR 55C	—	3K	"	0.1000	0.0030	0.03	"	"	Filter Network(B113)	0.0151	"	"	"	0.0151	1	0.015
R119	RC07, Type BB	Allen Bradley	5.1K	"	0.1250	0.0050	0.04	"	"	"	0.0021	"	"	"	0.0021	1	0.002
R120	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	1	"
R121	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	1	"
R1	RC07, Type BB	Allen Bradley	5.1K	5	0.1250	0.0020	0.02	1.0	40	Demand Programmer (B107)	0.0021	A	Lunar	1.0	0.0021	1	0.002
R2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	1	"
R1	RNR 55C	—	14K	5	0.1000	0.0020	0.02	1.0	40	Test Oscillator (B108)	0.0151	A	Lunar	1.0	0.0151	1	0.015
R2	"	"	10K	"	"	"	"	"	"	"	"	"	"	"	"	1	"
R3	"	"	47	"	"	0.0010	0.01	"	"	"	"	"	"	"	"	1	"
R4	RC07, Type CB	Allen Bradley	1.5K	"	0.2500	0.002	"	"	"	"	0.0021	"	"	"	0.0021	1	0.002
19						20						21					
FAILURE RATE SOURCES (FOR COLUMN #14)																	
A ATM 605												CALCULATED MTBF 330,000 HRS					
C												TOTAL FAILURE RATE 0.300 S/1000 HRS					
D																	

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PARTS APPLICATION ANALYSIS

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CAPACITORS

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PROJECT: ALSEP
ASSEMBLY: CPLEE ExperimentSUBASSEMBLY: Logic Module AssemblyDATE: 7 October 1968
SCHEMATIC NO: 2166263, Rev. C

(Capacitors)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (MIL OR MFR) AND CONSTRUCTION	MANUFACTURER	CAPACITANCE VALUE and	TOLERANCE %	MANUFACTURER'S RATED VOLTAGE	DC	OPERATING	VOLTAGE RATIO	MAXIMUM DUTY CYCLE	BULK AIR TEMPERATURE (°C)	CIRCUIT FUNCTION OR APPLICATION	BASE FAILURE RATE (S/1000 HRS) AT 25°C	SPECIAL ENVIRONMENT (DE FBIS)	FAILURE RATE MULTIPLIER	FINAL FAILURE RATE	TOTAL CAPACITOR COUNT PER TYPE	TOTAL FAILURE RATE (S/1000 HRS)	
						PEAK AC	VOLTAGE	OPERATING/ RATED										
C101	CKR06C	Aerovox	0.033	10	100	3	—	0.03	1.0	40	Readout Sequencer (B109)	.0004	A	Lunar	1.0	0.0004	2	0.0008
C102											Logic Module Assembly	"	"	"	"	1	0.0004	
C103	CKR05C	"	0.001	"	200	6	"	0.03	"	"	Demand Programmer(B107)	"	"	"	"	1	"	
C104	"	"	"	"	"	2	"	0.01	"	"	Resistor Readout (B106)	"	"	"	"	1	"	
C105	"	"	"	"	"	3	"	0.03	"	"	Sequencer Cmd. Dcdr. (B110)	"	"	"	"	1	"	
C106	CKR06C	"	0.002	"	100	3	"	"	"	"	(B107) Demand Programmer	"	"	"	"	1	"	
C107	CKR05C	"	0.001	"	200	2	"	0.01	"	"	Sequence Cmd. Dcdr. (B110)	"	"	"	"	1	"	
C108	CKR06C	"	0.002	"	100	3	"	0.03	"	"	"	"	"	"	"	1	"	
C109	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	1	"	
C110	"	"	0.033	"	"	"	"	"	"	"	Readout Sequencer(B109)	"	"	"	"	4	0.0016	
C113											Filter Network (B113)	.0032	"	"	"	0.0032	1	0.0032
C114	CSR13B	Kemet	6.8	"	6	"	"	0.50	"	"	"	.0004	"	"	"	0.0004	1	0.0004
C115	CKR06C	Aerovox	0.022	"	100	"	"	0.03	"	"	"	.0005	"	"	"	0.0005	1	0.0005
C117	CSR13G	Kemet	1.0	"	50	"	"	0.06	"	"	"	"	"	"	"	1	"	
C118	"	"	0.068	"	"	"	"	"	"	"	"	"	"	"	"	1	"	
C119	"	"	1.0	"	"	"	"	"	"	"	"	"	"	"	"	1	"	
C120	CSR13B	"	180	"	6	"	"	0.50	"	"	Logic Module Assembly	.0032	"	"	"	0.0032	1	0.0032
C121	CKR06C	Aerovox	0.033	"	100	"	"	0.03	"	"	"	.0004	"	"	"	0.0004	1	0.0004
C1, C2	"	"	0.039	"	"	"	"	"	"	"	Programmer (B111)	"	"	"	"	2	0.0008	
C1, C2	CKR05C	"	150pf	"	200	4	"	0.02	"	"	Test Oscillator (B108)	"	"	"	"	2	"	
C3	CKR06C	"	2200pf	"	"	"	"	"	"	"	"	"	"	"	"	1	0.0004	
20						21						22						
FAILURE RATE SOURCES (FOR COLUMN #14)						CALCULATED MTBF 6,290,000 HRS						TOTAL FAILURE RATE 0.0159 S/1000 HRS						
A ATM605 B _____																		
C _____ D _____																		

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DATE: 7 October 1968

SCHEMATIC NO: 2166263, Rev. C

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E R	MAX. TEMP °C		AVG PWR DISSIPATION (mw)						POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY																																																																																																																																																																																																											
			A M B I E N T T _A	J U N C T I O N T _J	C A S E H O T S P O T T _C	RATED AT				ACTUAL RATED 25°C (Amb.or case)	ACTUAL RATED T _A or T _C	V _{CBO} R A T E D V	V _{CB} A C T U A L V	V _{CEO} R A T E D V	V _{CE} A C T U A L V	R A T E D V	A C T U A L V	R A T E D V			A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V

(SEMICONDUCTORS) - All Flatpacks

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(Semiconductors)

[illegible]

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(SEMICONDUCTORS) - All Flatpacks.

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PROJECT: ALSEP

ASSEMBLY: CPLEE Experiment

SUB ASSEMBLY: Logic Module Assembly

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(Semiconductors)

[illegible]

9549A

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(SEMICONDUCTORS) - All Flatpacks.

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SCHEMATIC NO: 2166263, Rev. C

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MANUFACTURER	MAX. TEMP °C		AVG PWR DISSIPATION (mw)					POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY						
			AMBI- ENT T _A	JUN- CTI- ON T _J	CASE HOT SPOT T _C	RATED AT					ACTUAL RATED 25°C (Amb.or case)	ACTUAL RATED T _A or T _C	V _{CEO} R A T E D V	V _{CB} A C T U A L V	V _{CE0} R A T E D V	V _{CE} A C T U A L V	R A T E D V			A C T U A L V	RATE (%/1000 HRS)	S O U R C E (See below)	F A U L T I R A T E (%/1000 HRS)	F A I L U R E R A T E (%/1000 HRS)	T O T A L F A I L U R E R A T E (%/1000 HRS)	
						AMBI- ENT T _A	CASE T _C	JUN- CTI- ON T _J	ACTUAL T _A	ACTUAL T _C																ACTUAL T _J
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
-	SNR 511	Texas Instr	40	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	B104	Lunar	0.0012	A	1.00012	5	0.0060	
-	SNR 512	"	"	"	"	2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	2	0.0024	
-	SNR 5101	"	"	"	"	3	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	5	0.0060	
-	2N 3051	"	"	"	"	350	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	5	0.0060	
																					Subtotal				0.0204/ Module	

28 FAILURE RATE SOURCE (See Column 23)

A ATM 605 C _____

B _____ D _____

29 NOTE: It is assumed the transient and peak power does not exceed the safe limit.

30 TOTAL FAILURE RATE 0.0408 %/1000 HRS.

(Based on 2 modules in assembly.)

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PARTS APPLICATION ANALYSIS

Page 7 of 15

(SEMICONDUCTORS) - All Flatpacks.

ATM 798, Appendix A

PROJECT: ALSEP
ASSEMBLY: CPLER ExperimentSUB ASSEMBLY: Logic Module AssemblyDATE: 7 October 1968
SCHEMATIC NO: 2166263, Rev. C

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E R	MAX. TEMP °C		AVG PWR DISSIPATION (mw)						POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION OF APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY											
			A M B I E N T T _A	J U N C T I O N T _J	A C T U A L H O T S P O T T _C	RATED AT				A C T U A L R A T E D 25°C (Amb. or case)	A C T U A L R A T E D T _A or T _C	V C B O R A T E D	V C B A C T U A L	V C E O R A T E D	V C E A C T U A L	V R A T E D	V A C T U A L	R A T E D			A C T U A L	R A T E D	F A I L U R E R A T E (%/1000 HRS) (See below)	F A I L U R E R A T E (%/1000 HRS)	F A I L U R E R A T E (%/1000 HRS)	F A I L U R E R A T E (%/1000 HRS)	F A I L U R E R A T E (%/1000 HRS)	T O T A L F A I L U R E R A T E (%/1000 HRS)				
						25°C																							A M B I E N T T _A	A C T U A L T _C	A M B I E N T T _A	A C T U A L T _C
						A M B I E N T T _A	C A S E T _C	A M B I E N T T _A	A C T U A L T _C																							
-	SNR 1731	Texas Inst.	40	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	B105	Lunar	0.0012	1.0	0.002	2	0.0024							
-	SNR 1732	"	"	"	"	-	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	1	0.0012							
-	SNR 1734	"	"	"	"	8	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	6	0.0072							
28 FAILURE RATE SOURCE (See Column 23) A <u>ATM 605</u> C _____ B _____ D _____											29 NOTE: It is assumed the transient and peak power does not exceed the safe limit.											30 TOTAL FAILURE RATE <u>0.0108</u> %/1000 HRS.										

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PARTS APPLICATION ANALYSIS

Page 10 of 15

(SEMICONDUCTORS) - All Flatpacks.

ATM 798, Appendix A

PROJECT: ALSEP

ASSEMBLY: CPLEE Experiment

SUB ASSEMBLY: Logic Module Assembly

DATE: 7 October 1968

SCHEMATIC NO: 2166263, Rev. C

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E R	MAX. TEMP °C			AVG PWR DISSIPATION (mw)						POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY						
			A M B I E N T T _A	J U N C T I O N T _J	A C T U A L H O T S P O T T _C	RATED AT						A C T U A L R A T E D 25°C (Amb. or case)	A C T U A L R A T E D T _A or T _C	V C B O V	V C B V	V C E O V	V C E V	R A T E D V	A C T U A L V			R A T E D %	F A I L U R E R A T E (%/1000 HRS)	F A I L U R E R A T E (%/1000 HRS)	T O T A L F A I L U R E R A T E (%/1000 HRS)			
						25°C		A M B I E N T T _A	A C T U A L T _C	A C T U A L T _C	A C T U A L T _C															A C T U A L T _C		
						A M B I E N T T _A	C A S E T _C																					
A1	2N 3052	Texas Instr.	40	-	-	250	-	-	-	-	-	-	-	-	-	-	-	-	-	B108	Lunar	0.0012	A	1.0	0.0012	1	0.0012	
A2	SNR 1731	"	"	"	"	2.5	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	1	"	
A3	2N 3052	"	"	"	"	250	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	1	"	
28 FAILURE RATE SOURCE (See Column 23) A ATM 605 C _____ B _____ D _____						29 NOTE: It is assumed the transient and peak power does not exceed the safe limit.										30 TOTAL FAILURE RATE 0.0036 %/1000 HRS.												

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(SEMICONDUCTORS) - All Flatpacks

ATM 798, Appendix A

PROJECT: ALSEP

ASSEMBLY: CPLEE Experiment

SUB ASSEMBLY: Logic Module Assembly

DATE: 7 October 1968

SCHEMATIC NO:2166263, Rev. C

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E R	MAX. TEMP °C		AVG PWR DISSIPATION (mw)				POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY							
			A M B I E N T T _A	A C T U A L R A T E D T _J	J U N C T I O N H O T S P O T T _C	A C T U A L C A S E T _C	RATED AT				A C T U A L R A T E D 25°C (Amb.or case)	A C T U A L R A T E D T _A or T _C	V _{CB0} R A T E D V	V _{CB} A C T U A L V	V _{CE0} R A T E D V	V _{CE} A C T U A L V			R A T E D V	A C T U A L V	R A T E (%/1000 HRS) (See below)	S O U R C E F A I L U R E R A T E (%/1000 HRS)	M U L T I P L I C A T I O N F A C T O R	T O T A L F A I L U R E R A T E (%/1000 HRS)		
							25°C		A M B I E N T T _A	C A S E T _C															A C T U A L T _C	
							A M B I E N T T _A	C A S E T _C																		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
-	SNR 511	Teas Instr.	40	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	B109	Lunar	0.0012	A	1.0	0.0012	1	0.0012
-	SNR 514	"	"	"	"	2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	6	0.0072	
-	SNR 516	"	"	"	"	5	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	3	0.0036	
-	SNR 1730	"	"	"	"	15	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	1	0.0012	
-	SNR 1731	"	"	"	"	2.5	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	1	0.0012	
-	SNR 5101	"	"	"	"	3	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	7	0.0084	

28FAILURE RATE SOURCE (See Column 23)
AATM 605C
B
D

29NOTE: It is assumed the transient and peak power does not exceed the safe limit.

30TOTAL FAILURE RATE0.0228%/1000 HRS.

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PARTS APPLICATION ANALYSIS

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ATM 798, Appendix A

(SEMICONDUCTORS) - All Flatpacks

PROJECT: ALSEP
ASSEMBLY: CPLLE ExperimentSUB ASSEMBLY: Logic Module AssemblyDATE: 7 October 1968SCHEMATIC NO: 2166263, Rev. C

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E R	MAX. TEMP °C		AVG PWR DISSIPATION (mW)						POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY						
			A M B I E N T T _A	J U N C T I O N T _J	C A S E H O T S P O T T _C	RATED AT				A C T U A L R A T E D 25°C (Amb. or case)	A C T U A L R A T E D T _A or T _C	V _{CB0} R A T E D V	V _{CB} A C T U A L V	V _{CE0} R A T E D V	V _{CE} A C T U A L V	R A T E D V	A C T U A L V	R A T E (%/1000 HRS)			F A I L U R E R A T E (%/1000 HRS)	F A I L U R E R A T E (%/1000 HRS)	F A I L U R E R A T E (%/1000 HRS)	F A I L U R E R A T E (%/1000 HRS)	T O T A L F A I L U R E R A T E (%/1000 HRS)		
						25°C		A M B I E N T T _A	C A S E T _C																	A C T U A L T _A	A C T U A L T _C
						A M B I E N T T _A	C A S E T _C																				
-	SNR 513	Texas Instr	40	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	B110	Lunar	0.0012	A	1.0	0.0012	3	0.0036		
-	SNR 514	"	"	"	"	2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	1	0.0012			
-	SNR 515	"	"	"	"	3	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	1	0.0012			
-	SNR 516	"	"	"	"	5	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	2	0.0024			
-	2N3048	"	"	"	"	1.4w	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	3	0.0036			

28 FAILURE RATE SOURCE (See Column 23)
A ATM 605 C _____
B _____ D _____

29 NOTE: It is assumed the transient and peak power does not exceed the safe limit.

30 TOTAL FAILURE RATE 0.0120 %/1000 HRS.

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(SEMICONDUCTORS) - All Flatpacks

ATM 798, Appendix A

SCHEMATIC NO: 2166263, Rev. C

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MANUFACTURER	MAX. TEMP °C					AVG PWR DISSIPATION (mw)					POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY						
			A M B I E N T T _A	ACTUAL R A T E D T _J	JUNCTION HOT SPOT T _C	CASE T _C	RATED AT				ACTUAL RATED 25°C (Amb. or case)	ACTUAL RATED T _A or T _C	V _{CBO}	V _{CB}	V _{CEO}	V _{CE}	R A T E D V	A C T U A L V											
							25°C		A M B I E N T T _A	A C T U A L T _C			C A S E T _C	A C T U A L															
							A M B I E N T T	C A S E T																					
-	SNR 511	Texas Instr.	40	-	-	3	-	-	-	-	-	-	-	-	-	-	B111	Lunar	0002	A	1.0	0.002	4	0.0048					
-	SNR 513	"	"	"	"	2.5	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	5	0.0060					
-	SNR 514	"	"	"	"	2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	1	0.0012					

29 FAILURE RATE SOURCE (See Column 23)
 A ATM 605 C _____
 B _____ D _____

NOTE: It is assumed the transient and peak power does not exceed the safe limit.

30 TOTAL FAILURE RATE 0.0120 %/1000 HRS.

(MISC. PARTS)

ATM 798, Appendix A

DATE: 7 October 1968
SCHEMATIC NO: 2166263, Rev. C

CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (CEC, MIL OR MPR) and CONSTRUCTION	M A N U F A C T U R E R	TEMPERATURE RANGE		ELECTRICAL STRESS		PERCENT DUTY CYCLE	MAJOR CHARACTERISTICS and APPLICATION	FOR RELIABILITY USE ONLY				
			MAX	MIN	RATED (mw)	USE (mw)			BASIC FAILURE RATE (%/1000 HOURS) at °C	S O U R C E (SEE #15)	PART SPECIAL ENVIRONMENT (DEFINE)	FAIL- URE RATE MULTI- PLIER	TOTAL FAILURE RATE (%/1000 HOURS)
RT1	Sensistor, Type TG	Texas Instruments	-	-	125	1.25	100%	Test Oscillator Submodule (B108)	0.06	C	Lunar	1.0	0.06
RT2	"	"	"	"	"	"	"	"	"	"	"	"	"
15 FAILURE RATE SOURCES (FOR COLUMN 11) A. <u>ATM 605</u> B. <u>MIL-HDBK-217A</u> C. <u>ASD-R-05-64-1(G, E)</u> D. <u>MIL Std 217 Chart XXIV</u>								16 CALCULATED MTBF <u>8,300 000</u> HOURS	17 TOTAL FAILURE RATE <u>0.012</u> /1000 HOURS				



**Aerospace
Systems Division**

CPLEE Parts Application Analysis

NO.	REV. NO.
ATM-798	
PAGE _____	OF _____
DATE 10/10/68	

APPENDIX B
PARTS APPLICATION ANALYSIS DATA
FOR
SWITCHABLE POWER SUPPLY

PARTS APPLICATION ANALYSIS

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RESISTORS

ATM-798, Appendix B

PROJECT: ALSEPDATE: 4 October 1968ASSEMBLY: CPLER ExperimentSUB ASSEMBLY: Switchable Power SupplySCHEMATIC NO: 2165365, Rev. G

(Resistors)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
CIRCUIT SYMBOL NUMBER	TYPE DESCRIPTION (ALL OR PARTS) CONSTRUCTION	MANUFACTURER	RESISTANCE VALUE (OHMS)	TOLERANCE (%)	POWER RATING (WATTS)	MAXIMUM OPERATING POWER (WATTS)	POWER RATIO OPERATING/ RATED	MAXIMUM DUTY CYCLE	BULK AIR TEMPERATURE °C	CIRCUIT FUNCTION OR APPLICATION	BASIC FAILURE RATE (%/1000 HRS) - A	FAILURE RATE (%/1000 HRS) - B (SEE BELOW)	SPECIAL ENVIRONMENTS (DEFINE)	FAILURE RATE MULTIPLIER	FINAL FAILURE RATE (%/1000 HRS)	TOTAL RESISTOR COUNT PER TYPE	TOTAL FAILURE RATE (%/1000 HRS)
R201	RC07, Type CB	Allen Bradley	1.8K	5	0.25	2.5 mw	0.01	0.50	40	Switching Circuit	.002	A	Lunar	1.0	.002	1	0.002
R202	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R203	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R204	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R205	"	"	"	"	"	30 mw	0.12	"	"	"	"	"	"	"	"	"	"
R206	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R207	"	"	27K	"	"	25 mw	0.10	1.00	"	"	"	"	"	"	"	"	"
R208	"	"	"	"	"	2.5 mw	0.01	.125	"	+3500 v	"	"	"	"	"	"	"
R209	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R210	"	"	160K 300K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R211	"	"	2.2K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R212	"	"	100K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R213	"	"	220K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R214	"	"	27K	"	"	"	"	"	"	-3600 v	"	"	"	"	"	"	"
R215	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R216	"	"	160K 300K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R217	"	"	2.2K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R218	"	"	100K	"	"	"	"	"	"	"	"	"	"	"	"	"	"

19 FAILURE RATE SOURCES (FOR COLUMN #14)

A ATM 605 B _____

C _____ D _____

20 CALCULATED MTBF _____ HRS

See Page 2

21 TOTAL FAILURE RATE _____ %/1000 HRS

See Page 2

PARTS APPLICATION ANALYSIS

Page 2 of 14

RESISTORS

ATM-798, Appendix B

PROJECT: ALSEP
ASSEMBLY: CPLER ExperimentSUB ASSEMBLY: Switchable Power SupplyDATE: 4 October 1968
SCHEMATIC NO: 2165365, Rev. G

(Resistors)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (MIL OR MFR) CONSTRUCTION	MANUFACTURER	RESISTANCE VALUE (OHMS)	TOLERANCE (%)	POWER RATING (WATTS)	MAXIMUM OPERATING POWER (WATTS)	POWER RATIO OPERATING/RAI- EATED	MAXIMUM DUTY CYCLE	BULK AIR TEMPERATURE °C	CIRCUIT FUNCTION OR APPLICATION	BASIC FAILURE RATE (%/1000 HRS) - A - (SEE BELOW)	SPECIAL ENVIRONMENTS (DEFINE)	FAILURE RATE MULTIPLIER	FINAL FAILURE RATE (%/1000 HRS)	TOTAL RESISTOR COUNT PER TYPE	TOTAL FAILURE RATE (%/1000 HRS)	
R219	RC07, Type CB	Allen Bradley	220K	5	250	2.5 mw	0.01	125	40	-3500 v Circuit	.002	A	Lunar	1.0	.002	1	0.002
R220	"	"	27K	"	"	"	"	0.25	"	350 v	"	"	"	"	"	"	"
R221	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R222	"	"	300K 620K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R223	"	"	4.7K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R224	"	"	100K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R225	"	"	220K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R226	"	"	27K	"	"	"	"	"	"	35 v	"	"	"	"	"	"	"
R227	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R228	"	"	300K 620K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R229	"	"	2.7K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R230	"	"	100K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R231	"	"	220K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R232	"	"	47K	"	"	"	"	1.00	"	Housekeeping	"	"	"	"	"	"	"
R233	RC07, Type BB	"	20M	"	125	1.2 mw	"	0.50	"	Secondary	"	"	"	"	5	0.010	"
R234	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
19						20						21					
FAILURE RATE SOURCES (FOR COLUMN #14)						CALCULATED MTBF <u>1,190,000</u> HRS						TOTAL FAILURE RATE <u>0.084</u> %/1000 HRS					
A <u>ATM 605</u> B _____																	
C _____ D _____																	

RESISTORS

ATM-798, Appendix B

SCHEMATIC NO: 2165365, Rev. G

(Resistors)

[illegible]

PARTS APPLICATION ANALYSIS

Page 4 of 14

CAPACITORS

ATM-798, Appendix B

PROJECT: ALSEP

DATE: 4 October 1968

ASSEMBLY: CPLEE Experiment

SUBASSEMBLY: Switchable Power Supply

SCHEMATIC NO: 2165365, Rev. G

(Capacitors)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19											
CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (MIL or MFR) CONSTRUCTION	MANUFACTURER	CAPACITANCE VALUE and	TOLERANCE %	MANUFACTURER'S RATED VOLTAGE	DC	OPERATING	VOLTAGE RATIO	MAXIMUM DUTY CYCLE	BULK AIR TEMPERATURE (°C)	CIRCUIT FUNCTION OR APPLICATION	BASIC FAILURE RATE (1/1000 HRS)	FAILURE RATE (1/1000 HRS)	SPECIAL ENVIRONMENT (DEFINE)	FAILURE RATE MULTIPLIER	FINAL FAILURE RATE	TOTAL CAPACITOR COUNT PER TYPE	TOTAL FAILURE RATE (1/1000 HRS)											
						PEAK AC	VOLTAGE	OPERATING RATED																					
C201	CSR13	Kemet	18	10	50	32	-	0.64	1.00	40	Switching Circuit	.004	A	Lunar	1.0	.004	1	0.004											
C202	"	"	"	"	"	5.4	"	0.27	0.50	"	"	.001	"	"	"	.001	"	0.001											
C203	"	"	"	"	"	"	"	0.27	"	"	"	"	"	"	"	"	"	"											
C204	"	"	"	"	"	4	"	0.08	.125	"	+3500 v	.0005	"	"	"	.0005	"	0.0005											
C205	CKR06	Aerovox	.047	"	100	1	"	0.07	"	"	"	.0004	"	"	"	.0004	"	0.0004											
C206	"	"	.01	"	"	7	"	0.07	"	"	"	"	"	"	"	"	"	"											
C207	CSR13	Kemet	1	"	50	3.5	"	0.07	"	"	-3500 v	.005	"	"	"	.005	"	0.005											
C208	CKR06	Aerovox	.047	"	100	1	"	0.01	"	"	"	.0004	"	"	"	.0004	"	0.0004											
C209	"	"	.01	"	"	7	"	0.07	"	"	"	"	"	"	"	"	"	"											
C210	CSR13	Kemet	.1	"	75	7.5	"	0.10	0.25	"	350 v	.005	"	"	"	.005	"	0.005											
C211	CKR06	Aerovox	.047	"	100	2	"	0.02	"	"	"	.0004	"	"	"	.0004	"	0.0004											
C212	"	"	.0022	"	200	6	"	0.03	"	"	"	"	"	"	"	"	"	"											
C213	CSR13	Kemet	.1	"	75	3.75	"	0.05	"	"	35 v	.005	"	"	"	.005	"	0.005											
C214	CKR06	Aerovox	.047	"	100	1	"	0.01	"	"	"	.0004	"	"	"	.0004	"	0.0004											
C215	CKR05	"	.001	"	"	8	"	0.08	1.00	"	"	"	"	"	"	"	"	"											
C216	CSR13	Kemet	2.7	"	15	5	"	0.33	0.50	"	Housekeeping	.001	"	"	"	.001	"	0.001											
C217	"	"	1	"	50	3.5	"	0.07	.125	"	+3500 v	.005	"	"	"	.005	"	0.005											
C218	"	"	1	"	"	"	"	"	"	"	-3500 v	"	"	"	"	"	"	"											
C219	Ceramic, TCDN 220	Aerovox	56 pf	"	500	10	"	0.02	"	"	Secondary	.0004	"	"	"	.0004	"	0.0004											
20										21										22									
FAILURE RATE SOURCES (FOR COLUMN #14)										CALCULATED MTBF _____ HRS										TOTAL FAILURE RATE _____ 1/1000 HRS									
A _____ ATM 605 _____ B _____																													
C _____ D _____																													

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PARTS APPLICATION ANALYSIS

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CAPACITORS

ATM-798, Appendix B

PROJECT: ALSEP

DATE: 4 October 1968

ASSEMBLY: CPLEE Experiment

SUBASSEMBLY: Switchable Power Supply

SCHEMATIC NO: 2165365, Rev. G

(Capacitors)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
CIRCUIT SYMBOL NUMBER	TYPE DESCRIPTION (MFG. OR MFR.) CONSTRUCTION	MANUFACTURER	CAPACITANCE VALUE MFD	TOLERANCE %	MANUFACTURER'S RATED VOLTAGE	OPERATING VOLTAGE DC PEAK AC	VOLTAGE RATIO	OPERATING RATIO	MAXIMUM DUTY CYCLE	BULK AIR TEMPERATURE (°C)	CIRCUIT FUNCTION OR APPLICATION	BASIC FAILURE RATE (S/1000 HRS) - 21 -	USE BELOW	SPECIAL ENVIRONMENT (08 TIME)	FAILURE RATE MULTIPLIER	FINAL FAILURE RATE	TOTAL CAPACITOR COUNT PER TYPE	TOTAL FAILURE RATE (S/1000 HRS)
C220	Ceramic, TCDN 220	Aerovox	56 pf	10	500	90	-	0.18	0.25	40	Secondary Circuit	.0004	A	Lunar	1.0	0.0004	1	0.0004
C221	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
C222	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
C223	"	"	"	"	"	10	"	0.02	"	"	"	"	"	"	"	"	"	"
C224	"	"	"	"	"	90	"	0.18	"	"	"	"	"	"	"	"	"	"
C225	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
C226	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
C1	Ceramic, HVD-6	Aerovox	56 pf	10	6KV	420	3KV	0.07	0.50	40	Submodule A201	.0004	A	Lunar	1.0	0.0004	1	0.0004
C2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
C1	Ceramic, HVD-6	Aerovox	50 pf	10	6KV	420	3KV	0.07	0.50	40	Submodule A202	.0004	A	Lunar	1.0	0.0004	1	0.004
C2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
C1	Ceramic, HVD-4	Aerovox	25 pf	10	6KV	540	3KV	0.09	0.50	40	Submodule A203	.0004	A	Lunar	1.0	0.0004	1	0.0004
C2	"	"	"	"	"	1020	"	0.17	"	"	"	"	"	"	"	"	"	"
C3	"	"	"	"	"	540	"	0.09	1.00	"	"	"	"	"	"	"	"	"
20						21						22						
FAILURE RATE SOURCES (FOR COLUMN #14)						CALCULATED MTBF 2,400,000 HRS						TOTAL FAILURE RATE 0.0417 S/1000 HRS						
A ATM 605 B																		
C D																		

BS-321A

(SEMICONDUCTORS)

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ATM-798, Appendix B

PROJECT: ALSEP
ASSEMBLY: CPLER Experiment

SUB ASSEMBLY: Switchable Power Supply

DATE: 4 October 1968

SCHEMATIC NO: 2165365, Rev. G

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MANUFACTURER	MAX. TEMP °C		AVG PWR DISSIPATION (mw)					POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY						
			AMBI- ENT T _A	JUN- CTI- ON T _J	HOT SPOT T _C	RATED AT				ACTUAL RATED 25°C (Amb.or case)	ACTUAL RATED T _A or T _C	V _{CEO} R- A- T- E- D V	V _{CB} A- C- T- U- A- L V	V _{CE0} R- A- T- E- D V	V _{CE} A- C- T- U- A- L V	R A- T- E- D V	A- C- T- U- A- L V			RATE (%/1000 HRS)	S- O- U- R- C- E (See below)	F- A- U- L- T- I- R- A- T- E- R	F- U- N- C- T- I- O- N R- A- T- E (%/1000 HRS)	T- O- T- A- L P- E- R T- Y- P- E	TOTAL FAILURE RATE (%/1000 HRS)	
						25°C																				
						AMBI- ENT T _A	JUN- CTI- ON T _J	HOT SPOT T _C	A- C- T- U- A- L T _A																	A- C- T- U- A- L T _C
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Q201	2N760A, NPN	Raytheon	40	200	-	500	1.8w	-	-	5	0.01	-	60	5	60	2	-	-	Switching Circuit	Lunar	.001	A	1.0	.001	1	.001
Q202	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	2	"	"	"	"	"	"	"	"	"	"
Q203	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	2	"	"	-3500V Circuit	"	"	"	"	"	"	"
Q204	2N3799, PNP	Moto- rola	"	"	"	360	1.2w	"	"	3.6	"	"	"	"	"	2	"	"	"	"	.006	"	"	.006	"	.006
Q205	2N2484, NPN	Fair- child	"	"	"	360	1.2w	"	"	2.9	0.08	"	"	"	"	2	"	"	"	"	.001	"	"	.001	"	.001
Q206	2N30574, NPN	"	"	"	"	400	5.0w	"	"	4	0.01	"	140	7	80	23	"	"	"	"	"	"	"	"	"	
Q207	2N760A, NPN	Raytheon	"	"	"	500	1.8w	"	"	5	"	"	60	5	60	2	"	"	+3500V Circuit	"	"	"	"	"	"	
Q208	2N3799A, PNP	Moto- rola	"	"	"	360	1.2w	"	"	3.6	"	"	"	"	"	2	"	"	"	"	.006	"	"	.006	"	.006
Q209	2N2484, NPN	Fair- child	"	"	"	360	1.2w	"	"	29	0.08	"	"	"	"	2	"	"	"	"	.001	"	"	.001	"	.001

28

FAILURE RATE SOURCE (See Column 23)
A ATM 605 C _____
B _____ D _____

29

NOTE: It is assumed the transient and peak power does not exceed the safe limit.

30

TOTAL FAILURE RATE _____ %/1000 HRS.

PARTS APPLICATION ANALYSIS

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(SEMICONDUCTORS)

ATM-798, Appendix B

PROJECT: ALSEP
ASSEMBLY: CPLEE Experiment

SUB ASSEMBLY: Switchable Power Supply

DATE: 4 October 1968
SCHEMATIC NO: 2165365, Rev. G

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E R	MAX. TEMP °C		AVG PWR DISSIPATION (mw)						POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY																																																																																																																																																																																																	
			A M B I E N T T _A	A C T U A L R A T E D T _J	J U N C T I O N H O T S P O T T _C	RATED AT		A M B I E N T T _A	A C T U A L R A T E D T _C	A M B I E N T T _A	A C T U A L R A T E D T _C	A C T U A L R A T E D T _A or T _C	V _{CB0}	V _{CB}	V _{CE0}	V _{CE}	R A T E D V	A C T U A L V			R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A

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PARTS APPLICATION ANALYSIS

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(SEMICONDUCTORS)

ATM-798, Appendix B

PROJECT: ALSEP
ASSEMBLY: CPLER ExperimentSUB ASSEMBLY: Switchable Power SupplyDATE: 4 October 1968SCHEMATIC NO: 2165365, Rev. G

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E R	MAX. TEMP °C			AVG PWR DISSIPATION (mw)					POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY								
			A M B I E N T T _A	A C T U A L R A T E D T _J	J U N C T I O N H O T S P O T T _C	A C T U A L C A S E T _C	RATED AT				A C T U A L R A T E D 25°C (Amb. or case)	A C T U A L R A T E D T _A or T _C	V C B O R A T E D V	V C B A C T U A L V	V C B O R A T E D V	V C E A C T U A L V	R A T E D V	A C T U A L V			R A T E D %	S O U R C E R A T E (%/1000 HRS) (See below)	F A I L U R E R A T E (%/1000 HRS)	M I N I M U M R A T E (%/1000 HRS)	T O T A L F A I L U R E R A T E (%/1000 HRS)				
							25°C																			A C T U A L R A T E D T _A	A C T U A L R A T E D T _C	A C T U A L R A T E D T _C	A C T U A L R A T E D T _C
							A M B I E N T T _A	A C T U A L R A T E D T _J	J U N C T I O N H O T S P O T T _C	A C T U A L C A S E T _C																			
CR 201	Reference MC7103	Micro S/C	40	200	-	250	-	-	-	2.5	0.01	-	-	-	-	-	1KV	10V	House-keeping Circuit	Lunar	0.001	A	1.0	0.001	1	0.001			
CR 202	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"				
CR 203	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"				
CR 204	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"				
CR 205	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	Switching Circuit	"	"	"	"	"	"	"			
CR 206	"	"	"	"	"	"	"	"	"	80	0.32	"	"	"	"	"	"	"	"	"	"	"	"	"	"				
CR 207	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"				
CR 208	"	"	"	"	"	"	"	"	"	2.5	0.01	"	"	"	"	"	"	"	Secondary Circuit	"	"	"	"	"	"	"			
CR 209	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"				

28 FAILURE RATE SOURCE (See Column 23)

A ATM 605 C _____

B _____ D _____

29 NOTE: It is assumed the transient and peak power does not exceed the safe limit.

30 TOTAL FAILURE RATE _____ %/1000 HRS.

PC40A

BS-321A

PARTS APPLICATION ANALYSIS

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(SEMICONDUCTORS)

ATM-798, Appendix B

PROJECT: ALSEP
ASSEMBLY: CPLEE ExperimentSUB ASSEMBLY: Switchable Power SupplyDATE: 4 October 1968
SCHEMATIC NO: 2165365, Rev. G

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E R	MAX. TEMP °C			AVG PWR DISSIPATION (mw)					POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY						
			A M B I E N T T _A	A C T U A L R A T E D T _J	J U N C T I O N H O T S P O T T _C	RATED AT					A C T U A L R A T E D 25°C (Amb. or case)	A C T U A L R A T E D T _A or T _C	V _{CB0} R A T E D V	V _{CB} A C T U A L V	V _{CE0} R A T E D V	V _{CE} A C T U A L V	R A T E D V	A C T U A L V			R A T E (%/1000 HRS)	S O U R C E (See below)	F A I L U R E R A T E (%/1000 HRS)	M E A N T I M E T O F R E P A I R (HRS)	T O T A L F A I L U R E R A T E (%/1000 HRS)		
						25°C	A M B I E N T T _A	A C T U A L R A T E D T _J	A C T U A L R A T E D T _C	A C T U A L R A T E D T _A or T _C																	
CR 210	Reference MC7103	Milias S/C	40	200	-	250	-	-	-	2.5	0.01	-	-	-	-	1KV	10V	Secondary Circuit	Lunar	001	A	1.0	0.001	1	0.001		
CR 211	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
CR 212	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
CR 213	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
CR 214	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
CR 215	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		

28
FAILURE RATE SOURCE (See Column 23)
A ATM 605 C _____
B _____ D _____

30
NOTE: It is assumed the transient and peak power does not exceed the safe limit.

30
TOTAL FAILURE RATE 0.015 %/1000 HRS.

9249A

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PARTS APPLICATION ANALYSIS

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(SEMICONDUCTORS)

ATM-798, Appendix B

PROJECT: ALSEP
ASSEMBLY: CPLER ExperimentSUB ASSEMBLY: Switchable Power SupplyDATE: 4 October 1968
SCHEMATIC NO: 2165365, Rev. G

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E R	MAX. TEMP °C			AVG PWR DISSIPATION (mw)				POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY												
			A M B I E N T T _A	R A T E D T _J	A C T U A L T _C	RATED AT			A C T U A L T _C	A C T U A L RATED 25°C (Amb. or case)	A C T U A L RATED T _A or T _C	V C B O R A T E D V	V C B A C T U A L V	V C E O R A T E D V	V C E A C T U A L V	R A T E D V	A C T U A L V			R A T E (%/1000 HRS)	S O U R C E R A T E (%/1000 HRS) (See below)	F A I L U R E R A T E (%/1000 HRS)	F A I L U R E R A T E (%/1000 HRS)	T O T A L F A I L U R E R A T E (%/1000 HRS)								
						A M B I E N T T _A	C A S E T _C	A C T U A L T _C																	A C T U A L RATED 25°C (Amb. or case)	A C T U A L RATED T _A or T _C	V C B O R A T E D V	V C B A C T U A L V	V C E O R A T E D V	V C E A C T U A L V	R A T E D V	A C T U A L V
CR1	Reference MC7101	Micro S/C	40	200	-	250	-	-	-	7.5	.03	-	-	-	-	6KV	3.5 KV	A201 Sub- Module	Lunar	.001	A	1.0	.001	1	0.001							
CR2	"	"	"	"	"	"	"	"	"	2.5	.01	"	"	"	"	"	"	"	"	"	"	"	"	"								
CR3	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"								
CR1	Reference MC7101	Micro S/C	40	200	-	250	-	-	-	7.5	.03	-	-	-	-	6KV	3.5 KV	A202 Sub- Module	Lunar	.001	A	1.0	.001	1	0.001							
CR2	"	"	"	"	"	"	"	"	"	2.5	.01	"	"	"	"	"	"	"	"	"	"	"	"	"								
CR3	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"								

28 FAILURE RATE SOURCE (See Column 23)

A ATM 605 C _____

B _____ D _____

29 NOTE: It is assumed the transient and peak power does not exceed the safe limit.

30 TOTAL FAILURE RATE 0.006 %/1000 HRS.

9549A

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ATM-798, Appendix B

SUB ASSEMBLY: Switchable Power Supply

DATE: 4 October 1968
SCHEMATIC NO: 2165365 Rev. G

(Inductors & Transformers)

[illegible]

PARTS APPLICATION ANALYSIS

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(RELAYS)

ATM-798, Appendix B

PROJECT: ALSEPDATE: 4 October 1968ASSEMBLY: CPL EE ExperimentSUB ASSEMBLY: Switchable Power SupplySCHEMATIC NO: 2165365, Rev. G

(Relays)

CIRCUIT REFER- ENCE DESIG- NATION	TYPE DESIGNATION (CEC, MIL OR MFR) AND CONSTRUCTION	MANUFACTURER	CONTACT LOAD							NUMBER OF POLES	RELAY COIL						MISCELLA- NEOUS REMARKS	B F A I L U R E R A T E (%/1000 HRS)	S O F T M O D I F I E R	F R M O D I F I E R	TOTAL FAILURE RATE (%/1000 HOURS)	
			RATED		ACTUAL				TYPE OF L O A D		POWER		VOLTAGE		RATE OF OPERA- TIONS PER HOUR OR SECOND	REQ'D LIFE PER OPERA- TIONS						
			V O L T A G E V	C U R R E N T A	VOLTAGE		CURRENT				T O T A L	A C T I V E	M A X R A T E D	A C T U A L								M A X M I N I M U M
					STEADY STATE	PEAK	STEADY STATE	SURGE														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
K1	Reed Relay (DRVT-1)	Hamlin	5KV	10ma	-	3KV	0.1 ma	-	Resis- tance	1	1	-	-	-	-	275/ hr.	2,409 000	Xo = 2,116,000 cycles.	0.058	D	1.0	0.058
K2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	0.058	
24	DEVICE AVERAGE AMBIENT TEMPERATURE °C 40	FAILURE RATE SOURCES (FOR COLUMN NO. 21) A <u>ATM 605</u> B <u>MIL-HDBK-217A</u> C <u>ASD-R-05-6A-1(G.E.)</u> Vendor Data								CALCULATED MTBF <u>862,000</u> HOURS						TOTAL FAILURE RATE <u>0.116</u> %/1000 HRS						
25									26							27						

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PARTS APPLICATION ANALYSIS

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(CONNECTORS)

ATM-798, Appendix B

PROJECT: ALSEP

ASSEMBLY: CPLEE Experiment

SUB ASSEMBLY: Switchable Power Supply

DATE: 4 October 1968

SCHEMATIC NO: 2165365, Rev. G

(Connectors)

CIRCUIT, REF. DESIG- NATION	TYPE DESIGNATION (CEC, MIL OR MFR) AND CONSTRUCTION	MANU- FACTUR- ER	PINS											AMBI- ENT TEMP °C	INSERT MATL	GUIDE	NO. OF IN- SER- TIONS DURING LIFE	MISCELLA- NEOUS REMARKS	BASIC F A I L U R E RATE (%/1000 Hours) (See 24)	S O U R C E OF F.R.	F.R. MODI- FIER	TOTAL FAILURE RATE (%/1000 Hours)
			NUMBER			CURRENT		VOLTAGE														
			TOTAL	ACTIVE	RATED	ACTUAL		BETWEEN PINS			ACROSS THE CONTACT											
						MAX.	MIN.	RATED	ACTUAL	TRAN- SIENT	STEADY STATE	SURGE										
-	Terminals 2031A-4	USECO	1	1	-	-	-	-	-	-	-	-	-	40	Brass	Spring	1	Used on A201, A202	.001	B	4	0.004
-	Terminals 2031B-4	"	1	1	-	-	-	-	-	-	-	-	"	"	"	1	3 used in A203	.001	B	17	0.017	
-	Terminals 3231-2	Cambion	1	1	-	-	-	-	-	-	-	-	"	"	"	1	10 used in Assembly	.001	B	10	0.010	
23	REQUIRED LIFE HOURS	24	FAILURE RATE SOURCES (FOR COLUMN 20) A ATM 605 B MIL-HDBK-2174 C D										25	3,200,000 CALCULATED MTBF HOURS				26	TOTAL FAILURE RATE 0.03%/1000 HOURS			

DHD P283

(BS-321A)

PARTS APPLICATION ANALYSIS

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ATM-798, Appendix B

(MISC. PARTS)

PROJECT: ALSEPDATE: 4 October 1968ASSEMBLY: CPLEE ExperimentSUB ASSEMBLY: Switchable Power SupplySCHEMATIC NO: 2165365, Rev. G

(Misc. Parts)

CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (CEC, MIL OR MFR) and CONSTRUCTION	M A N U F A C T U R E R	TEMPERATURE RANGE		ELECTRICAL STRESS		PERCENT DUTY CYCLE	MAJOR CHARACTERISTICS and APPLICATION	FOR RELIABILITY USE ONLY				
			MAX	MIN	RATED	USE			BASIC FAILURE RATE (%/1000 HOURS) at °C	S O U R C E (SEE #15)	PART SPECIAL ENVIRONMENT (DEFINE)	FAIL- URE RATE MULTI- PLIER	TOTAL FAILURE RATE (%/1000 HOURS)
-	High voltage cable Assembly, 2171389	BxRL	-	-	-	-	25%	High Voltage Line	0.0475	C	Lunar	1.0	0.0475
15 FAILURE RATE SOURCES (FOR COLUMN 11) A. <u>ATM 605</u> B. <u>MIL-HDBK-217A</u> C. <u>ASD-R-05-64-1 (GE)</u> D. <u>MIL Std 217 Chart XXIV</u>								16 CALCULATED MTBF <u>2,100,000</u> HOURS	17 TOTAL FAILURE RATE <u>0.0475</u> %/1000 HOURS				

DD Form 9258

BS-321A



**Aerospace
Systems Division**

CPLEE Parts Application Analysis

NO.	REV. NO.
ATM-798	
PAGE _____	OF _____
DATE 10/10/68	

APPENDIX C
PARTS APPLICATION ANALYSIS DATA
FOR
LOW VOLTAGE POWER SUPPLY

PARTS APPLICATION ANALYSIS

Page 1 of 8

CAPACITORS

ATM-798, Appendix C

PROJECT: ALSEPASSEMBLY: CPLEE ExperimentSUBASSEMBLY: Low Voltage Power SupplyDATE: 27 September 1968SCHEMATIC NO: 2165385, Rev. E

(Capacitors)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (MFR. OR MFR.) CONSTRUCTION	MANUFACTURER	CAPACITANCE VALUE and	TOLERANCE %	MANUFACTURER'S RATED VOLTAGE	DC OPERATING VOLTAGE	AC OPERATING VOLTAGE	VOLTAGE RATIO, OPERATING/ RATED	MAXIMUM DUTY CYCLE	BULK AIR TEMPERATURE (°C)	CIRCUIT FUNCTION OR APPLICATION	BASIC FAILURE RATE (3,000 HRS) -- A --	USE BELOW -- B --	SPECIAL ENVIRONMENT (DEFINE)	FAILURE RATE MULTIPLIER	FINAL FAILURE RATE	TOTAL CAPACITOR COUNT PER TYPE	TOTAL FAILURE RATE (3,000 HRS)
C301	CSR13	Kemet	1.0	20	50	291	—	0.57	0.50	40°	Regulator Circuit	0.0051	A	Lunar	1.0	0.005	1	0.005
C302	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
C303	"	"	18.0	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
C304	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
C305	CKR06	Aerovox	0.01	"	100	"	"	"	"	"	Oscillator	0.001	"	"	"	0.001	"	0.001
C306	CSR13	Kemet	180.0	"	6	3	"	0.50	"	"	+3V	0.003	"	"	"	0.003	"	0.003
C307	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
C308	"	"	39.0	"	10	6	"	0.60	"	"	-16V	0.006	"	"	"	0.006	"	0.006
C309	"	"	1.0	"	50	32	"	0.64	"	"	"	0.009	"	"	"	0.009	"	0.009
C310	"	"	3.9	"	"	"	"	"	"	"	+32V	"	"	"	"	"	"	"
C311	"	"	18.0	"	"	27	"	0.54	"	"	+27V	0.001	"	"	"	0.001	"	0.001
C312	CKR06	Aerovox	0.1	"	"	3	"	0.06	"	"	+3V	0.004	"	"	"	0.004	"	0.004
C313	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
C314	"	"	"	"	"	6	"	0.12	"	"	+6V	"	"	"	"	"	"	"
C315	"	"	"	"	"	32	"	0.64	"	"	-16V	0.001	"	"	"	0.001	"	0.001
C316	"	"	"	"	"	"	"	"	"	"	+32V	"	"	"	"	"	"	"
C317	"	"	"	"	"	27	"	0.54	"	"	+27V	"	"	"	"	"	"	"
C318	CSR13	Kemet	6.8	"	6	3	"	0.50	"	"	-3V	0.003	"	"	"	0.003	"	0.003
20												21		22				
FAILURE RATE SOURCES (FOR COLUMN #14) A <u>ATM-605</u> B _____ C _____ D _____												CALCULATED MTBF <u>1,690,000</u> HRS		TOTAL FAILURE RATE <u>0.0592</u> x 1000 HRS				

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RESISTORS

ATM-798, Appendix C

DATE: 27 September 1968
SCHEMATIC NO: 2165385, Rev. E

[illegible]

(SEMICONDUCTORS)

ATM-798, Appendix C

SCHEMATIC NO: 2165385, Rev. E

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E R	MAX. TEMP °C		AVG PWR DISSIPATION (mw)						POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY						
			A M B I E N T T _A	J U N C T I O N T _J	C A S E T _C	RATED AT						A C T U A L RATED 25°C (Amb. or case)	A C T U A L RATED T _A or T _C	V _{CB0}	V _{CB}	V _{CE0}	V _{CE}	R A T E D			A C T U A L	R A T E D	F M T O T A L F A I L U R E R A T E (%/1000 HRS) (See below)	F M T O T A L F A I L U R E R A T E (%/1000 HRS)	C O U N T P E R T Y P E	T O T A L F A I L U R E R A T E (%/1000 HRS)	
						25°C		A M B I E N T T _A	C A S E T _C	A C T U A L T _A	A C T U A L T _C																
						A M B I E N T T _A	C A S E T _C																				
Q301	Transistor, Silicon, NPN(2N2891)	Fairchild	—	200	—	0.8	5.0	—	2.8	0.03	0.01	—	100	0.3	80	0.1	—	—	Regulator Circuit	Lunar	0.001	1.0	0.001	1	0.001		
Q302	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"			
Q303	"	"	"	"	"	"	"	"	"	"	"	"	0.5	"	"	"	"	Oscillator Circuit	"	"	"	"	"	"			
Q304	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"			
Q305	"	"	"	"	"	"	"	"	"	0.14	0.05	"	2.9	"	"	"	"	+3V Circuit	"	"	"	"	"	"			
Q306	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"			

28 FAILURE RATE SOURCE (See Column 23)

A ATM-605 C _____

B _____ D _____

29 NOTE: It is assumed the transient and peak power does not exceed the safe limit.

30 TOTAL FAILURE RATE 0.006 %/1000 HRS.

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BS-321A

(SEMICONDUCTORS)

ATM,-798, Appendix C

SCHEMATIC NO: 2165385, Rev. E

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E R	MAX. TEMP °C		AVG PWR DISSIPATION (mw)						POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY						
			A M B I E N T T _A	J U N C T I O N T _J	C A S E H O T S P O T T _C	RATED AT					A C T U A L R A T E D 25°C (Amb. or case)	A C T U A L R A T E D T _A or T _C	V _{CEO} R A T E D V	V _{CB} A C T U A L V	V _{CE0} R A T E D V	V _{CE} A C T U A L V	R A T E D V	A C T U A L V			R A T E (%/1000 HRS)	F A I L U R E R A T E (%/1000 HRS)	F A I L U R E R A T E (%/1000 HRS)	T O T A L F A I L U R E R A T E (%/1000 HRS)			
						25°C		A C T U A L T _A	A M B I E N T T _C	C A S E T _C															A C T U A L		
						A M B I E N T	C A S E																				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
CR 301	Diode, Silicon Reference, MC7102	Mic-ro-S.C.	40	200	—	250	—	—	—	2.5	0.01	—	—	—	—	—	50	29	Regu-lator Circuit	Lunar	0.001	A	1.0001	1	0.001		
CR 302	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
CR 303	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
CR 304	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
CR 305	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
CR 306	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
CR 307	Diode, Zener TC30A50A	Soli-tron	"	"	"	5W	"	"	"	50	"	"	"	"	"	"	30	—	"	"	0.004	"	"	0.004	0.004		
CR 308	Diode, Silicon Reference, MC7102	Mic-ro-S.C.	"	"	"	250	"	"	"	2.5	"	"	"	"	"	"	50	29	Oscil-lator Circuit	"	0.001	"	"	0.001	0.001		
CR 309	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
22 FAILURE RATE SOURCE (See Column 23) A <u>ATM-605</u> C _____ B _____ D _____											29 NOTE: It is assumed the transient and peak power does not exceed the safe limit.											30 TOTAL FAILURE RATE See page 6 %/1000 HRS.					

PARTS APPLICATION ANALYSIS

Page 5 of 8

(SEMICONDUCTORS)

ATM-798, Appendix C

PROJECT: ALSEP
ASSEMBLY: CPLEE Experiment

SUB ASSEMBLY: Low Voltage Power Supply

DATE: 27 September 1968

SCHEMATIC NO: 2165385, Rev. E

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E R	MAX. TEMP °C			AVG PWR DISSIPATION (mw)				POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY							
			A M B I E N T T _A	R A T E D T _J	J U N C T I O N T _J	A C T U A L H O T S P O T T _C	RATED AT				A C T U A L R A T E D 25°C (Amb.or case)	A C T U A L R A T E D T _A or T _C	V C B O R A T E D	V C B A C T U A L	V C E O R A T E D	V C E A C T U A L	V R A T E D			V R A T E D	R A T E D (%/1000 HRS)	S O U R C E R P L A T I E R (See below)	F A I L U R E R A T E (%/1000 HRS)	F A I L U R E R A T E (%/1000 HRS)	T O T A L F A I L U R E R A T E (%/1000 HRS)		
							25°C		A M B I E N T T _A	A C T U A L T _C																A C T U A L T _C	A C T U A L T _C
							A M B I E N T T _A	C A S E T _C																			
CR 310	Diode, Silicon Reference, MC7102	Mic- ro- S.C.	—	—	—	250	—	—	—	7.5	0.03	—	—	—	—	—	50	29	Regu- lator Circuit	Lunar	0.001	A	1.0001	1	0.001		
CR 311	"	"	"	"	"	"	"	"	"	2.5	0.01	"	"	"	"	"	6	+6V Circuit	"	"	"	"	"	"			
CR 312	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	-16V Circuit	"	"	"	"	"	"			
CR 313	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	+6V Circuit	"	"	"	"	"	"			
CR 314	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	32	+32V Circuit	"	"	"	"	"	"			
CR 316	"	"	"	"	"	"	"	"	"	7.5	0.03	"	"	"	"	"	27	+27V Circuit	"	"	"	"	"	"			
CR 317	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"			
CR 318	"	"	"	"	"	"	"	"	"	2.5	0.01	"	"	"	"	"	3	-3V Circuit	"	"	"	"	"	"			
CR 319	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"			

28 FAILURE RATE SOURCE (See Column 23)

A ATM-605 C _____

B _____ D _____

29 NOTE: It is assumed the transient and peak power does not exceed the safe limit.

30 TOTAL FAILURE RATE See page 6 %/1000 HRS.

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BS-321A

(SEMICONDUCTORS)

ATM-798, Appendix C

ASSEMBLY: CPLLEE Experiment

DATE: 27 September 1968

SCHEMATIC NO: 2165385, Rev. E

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MANUFACTURER	MAX. TEMP °C		AVG PWR DISSIPATION (mw)						POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY								
			AMBI- ENT T _A	ACTUAL RAT- ION T _J	JUNCTION TEMP T _C	CASE TEMP T _C	RATED AT				ACTUAL RATED 25°C (Amb.or case)	ACTUAL RATED T _A or T _C	V _{CBO} RATED V	V _{CB} ACTU- AL V	V _{CEO} RATED V	V _{CE} ACTU- AL V	RATED V	ACTU- AL V			RATE (%/1000 HRS)	SOUR- CE (See below)	FAC- TUAL RAT- ION T _J	FAC- TUAL TEMP T _C	FAC- TUAL RATED T _A or T _C	PER TYPE	TOTAL FAILURE RATE (%/1000 HRS)		
							25°C		AMBI- ENT T _A	CASE TEMP T _C																		ACTUAL RATED T _A	ACTUAL RATED T _C
							AMBI- ENT T _A	CASE TEMP T _C																					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27			
CR 320	Diode, Zener UZ806	Uni- trode	40	175	—	5W	—	—	—	50	0.01	—	—	—	—	—	6.8	—	-3V Circuit	Lunar	0.004	A	1.0004	1	0.004				
CR 321	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	-3V Circuit	"	"	"	"	"	"	"			
CR 322	Diode, Zener UZ833	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	33	"	-6V Circuit	"	"	"	"	"	"	"			
CR 323	Diode, Zener UZ808	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	8.2	"	-27V Circuit	"	"	"	"	"	"	"			
																				</									

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BS-321A

(INDUCTORS & TRANSFORMERS)

ATM-798, Appendix C

DATE: 27 September 1968
SCHEMATIC NO: 2165385, Rev. E

1 CIRCUIT SYMBOL NUMBER	2 TYPE DESIGNATION (MIL or ANS) CONSTRUCTION	3 MANUFACTURER	CONSTRUCTION					8 VA RATING	9 INDUCTANCE AT RATED CUR	10 SPECIFIED FREQ	11 MISCELLANEOUS	TEMPERATURE (°C)								PRIMARY CURRENT		SECONDARY			HIPOT READING		25 BASIC FAILURE RATE (1/1000 HRS) - 27° C - (SEE BELOW)	26 TOTAL FAILURE RATE (1/1000 HRS)	27
			4 TYPE OF CASE (SEE BELOW)	5 WIRE SIZE, PRIMARY	6 WIRE SIZE, SECONDARY	7 INSULATION CLASS	12 IMBIBENT HOT SPOT (SURFACE)					13 RISE (AIR METHOD)	14 RISE EST. ACTUAL	15 RISE OPERATING	16 TEMP MAX	17 ACTUAL	18 RATED	19 PRIMARY VOLTAGE	20 NO. WINDINGS	21 WINDING NO.	22 VOLTAGE	23 WINDINGS	24 VOLTS						
L301	MIL-T-27	BxRL	C	—	27	C	5.8	400	—	—	40	—	15	15	55	100	201	39	23	—	29	—	—	0.017	B	0.017			
T301	"	"	"	38/30	32	"	17.3	"	"	"	"	"	"	"	"	"	"	"	54	+3V	5.4	"	"	"	"	"			
"	"	"	"	"	32	"	-	-	-	-	-	-	-	-	-	-	-	-	71	+6V	7.1	"	"	—	—	—			
"	"	"	"	"	38	"	"	"	"	"	"	"	"	"	"	"	"	"	320	+32V	32.0	"	"	"	"	"			
"	"	"	"	"	36	"	"	"	"	"	"	"	"	"	"	"	"	"	275	-16V	27.5	"	"	"	"	"			
"	"	"	"	"	33	"	"	"	"	"	"	"	"	"	"	"	"	"	41	-3V	4.1	"	"	"	"	"			

28 TYPE OF CASE

A. HER. SEAL
B. VAC. IMP.
C. ENCAP.
D. OPEN

29 FAILURE RATE SOURCES (FOR COLUMN #26)

A. ATM-605 B. MIL-HDBK-217A

C. _____ D. _____

30 CALCULATED MTBF 2,940,000 HRS

31 TOTAL FAILURE RATE 0.034 1/1000 HRS

PARTS APPLICATION ANALYSIS

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(CONNECTORS)

ATM-798, Appendix C

PROJECT: ALSEPDATE: 27 September 1968ASSEMBLY: CPLER ExperimentSUB ASSEMBLY: Low Voltage Power SupplySCHEMATIC NO: 2165385, Rev. E

(Connectors)

CIRCUIT, REF. DESIG- NATION	TYPE DESIGNATION (CEC, MIL OR MFR) AND CONSTRUCTION	M A N U F A C T U R E R	PINS											AMBI- ENT TEMP °C	INSERT MATL	GUIDE	NO. OF IN- SER- TIONS DURING LIFE	MISCELLA- NEOUS REMARKS	BASIC F A I L U R E R A T E (%/1000 Hours) (See 24)	S O U R C E O F F A I L U R E	F.R. M O D I F I E R	TOTAL FAILURE RATE (%/1000 Hours)
			NUMBER			CURRENT		VOLTAGE														
			TOTAL	ACTIVE	RATED	ACTUAL		BETWEEN PINS			ACROSS THE CONTACT											
						MAX.	MIN.	RATED	ACTUAL	TRAN- SIENT	STEADY STATE	SURGE										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
—	Jack-Non Std. Pt.	Cambion	1	1	—	—	—	—	—	—	—	—	40	Brass		1	Stress level less than 0.1	0.001	B	1.0	0.001	
(NOTE: THERE ARE 31 OF THESE CORRECTIONS IN THE SUPPLY.)																						
23 REQUIRED LIFE HOURS			24 FAILURE RATE SOURCES (FOR COLUMN 20) A <u>ATM-605</u> B <u> </u> C <u> </u> D <u> </u>										25 CALCULATED MTBF <u>3,230,000</u> HOURS					26 TOTAL FAILURE RATE <u>0.031%</u> / 1000 HOURS				

DND 9263

(BS-321A)



**Aerospace
Systems Division**

CPLEE Parts Application Analysis

NO.

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APPENDIX D

PARTS APPLICATION ANALYSIS DATA
FOR
CHANNELTRON POWER SUPPLY NO. 1

PARTS APPLICATION ANALYSIS

Page 1 of 7RESISTORS

ATM-798, Appendix D

PROJECT: ALSEP
ASSEMBLY: CPLEE ExperimentSUB ASSEMBLY: Channeltron Power Supply No. 1DATE: 1 October 1968
SCHEMATIC NO: 2165390, Rev. G

(Resistors)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (MIL or MFR) CONSTRUCTION	MANUFACTURER	RESISTANCE VALUE (OHMS)	TOLERANCE (%)	POWER RATING (WATTS)	MAXIMUM OPERATING POWER (WATTS)	POWER RATIO OPERATING/ RATED	MAXIMUM DUTY CYCLE	BULK AIR TEMPERATURE °C	CIRCUIT FUNCTION OR APPLICATION	BASIC FAILURE RATE (%/1000 HRS) AT SOURCE (SEE BELOW)	FOR USE OF RELIABILITY DEPT	SPECIAL ENVIRONMENTS (DEFINITE)	FAILURE RATE MULTIPLIER	FINAL FAILURE RATE (%/1000 HRS)	TOTAL RESISTOR COUNT PER TYPE	TOTAL FAILURE RATE (%/1000 HRS)
R401	RNR57	Mepco	18-35K	5	0.125	7.50	0.06	1.00	40	Input Circuit	0.015	A	Lunar	1.0	0.015	1	0.015
R402	"	"	154K	"	"	2.50	0.02	"	"	Transient Suppressor (A406)	"	"	"	"	"	"	"
R403	RC07	Allen Bradley	100K	"	0.250	1.25	0.01	"	"	Input Circuit	0.002	"	"	"	0.002	"	0.002
R404	"	"	4.7K	"	"	"	"	1.00	"	Switching Circuit	"	"	"	"	"	"	"
R405	"	"	10K	"	"	2.50	0.02	"	"	"	"	"	"	"	"	"	"
R406	"	"	220-360K	"	"	1.25	0.01	"	"	"	"	"	"	"	"	"	"
R407	"	"	1.6K	"	"	2.50	0.02	"	"	"	"	"	"	"	"	"	"
R408	"	"	1.2K	"	"	1.25	0.01	1.00	"	Oscillator	"	"	"	"	"	"	"
R409	"	"	1.6K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R410	"	"	1.2K	"	"	3.75	0.03	"	"	+3V	"	"	"	"	"	"	"
R415	"	"	5.6K	"	"	1.25	0.02	"	"	Housekeeping	"	"	"	"	"	"	"
R416	"	"	75K	"	"	11.25	0.09	"	"	Switching	"	"	"	"	"	"	"
R417	"	"	0-150K	"	"	1.25	0.01	"	"	Input	"	"	"	"	"	"	"
R1	Comp., Type BB	Allen Bradley	1.0M	5	0.125	1.25	0.01	1.00	40	Filter Assembly (A402)	0.002	A	Lunar	1.0	0.002	1	0.002
R2	"	"	10K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R3	"	"	1.0M	"	"	"	"	"	"	"	"	"	"	"	"	"	"
19					20					21							
FAILURE RATE SOURCES (FOR COLUMN #14)										CALCULATED MTBF 1,720,000 HRS				TOTAL FAILURE RATE 0.058 %/1000 HRS			
A ATM-605 B _____																	
C _____ D _____																	

CAPACITORS

ATM-798, Appendix D

ASSEMBLY: CPLEE Experiment

SUBASSEMBLY: Channeltron Power Supply No. 1

SCHEMATIC NO: 2165390, Rev. G.

(Capacitors)

[illegible]

(SEMICONDUCTORS)

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ATM-798, Appendix D

PROJECT: ALSEP

ASSEMBLY: CPLER Experiment

SUB ASSEMBLY: Channeltron Power Supply No. 1 SCHEMATIC NO: 2165390, Rev. G

DATE: 1 October 1968

1 SCHEMATIC NO: 2165390, Rev. G

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E R	MAX. TEMP °C		AVG PWR DISSIPATION (mw)						POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY														
			A M B I E N T T _A	J U N C T I O N T _J	A C T U A L H O T S P O T T _C	RATED AT				A C T U A L A m b. o r c a s e	A C T U A L R A T E D T _A or T _C	V C B O R A T E D V	V C B A C T U A L V	V C E O R A T E D V	V C E A C T U A L V	R A T E D V	A C T U A L V	R A T E (%/1000 HRS)			S O U R C E (See below)	F A C T U A L R A T E (%/1000 HRS)	F A C T U A L P E R T Y P E	T O T A L F A I L U R E (%/1000 HRS)											
						25°C		A M B I E N T T _A	C A S E T _C																A C T U A L T _A	C A S E T _C									
						A M B I E N T T _A	C A S E T _C																												
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27									
Q401	2N2484, NPN	Fairchild	25	200	—	360	—	25	—	3.6	0.01	—	60	3.0	60	0.7	—	—	Input Circuit	Lunar	0.001	A	1.0001	1	0.001										
Q402	2N3799, PNP	Motrola	"	"	"	1.2W	"	"	"	12	"	"	"	0.1	"	0.2	"	"	"	"	0.006	"	"	0.006	"	0.006									
Q403	2N760A, NPN	Raytheon	"	"	"	500	"	"	"	5	"	"	"	"	"	1.0	"	"	Switch- ing Circuit	"	0.001	"	"	0.001	"	0.001									
Q404	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"										
Q405	2N3057A, NPN	Fairchild	"	"	"	400	"	"	"	72	0.18	"	140	25	80	1.7	"	"	Oscil- lator Circuit	"	"	"	"	"	"										
22 FAILURE RATE SOURCE (See Column 23)												29												30											
A ATM-605 C												NOTE: It is assumed the transient and peak power does not exceed the safe limit.												TOTAL FAILURE RATE 0.010 %/1000 HRS.											
B D																																			

(SEMICONDUCTORS)

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ATM-798, Appendix D

PROJECT: ALSEP
ASSEMBLY: CPLEE Experiment

SUB ASSEMBLY: Channeltron Supply Power No. 1 SCHEMATIC NO: 2165390, Rev. C

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E R	MAX. TEMP °C			AVG PWR DISSIPATION (mw)					POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION OR APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY						
			A M B I E N T T _A	J U N C T I O N T _J	C A S E H O T S P O T T _C	RATED AT					A C T U A L R A T E D 25°C (Amb.or case)	A C T U A L R A T E D T _A or T _C	V _{CB0} R A T E D V	V _{CB} A C T U A L V	V _{CEO} R A T E D V	V _{CE} A C T U A L V	R A T E D V	A C T U A L V			R A T E (%/1000 HRS) (See below)	F A I L U R E R A T E (%/1000 HRS)	F A I L U R E P E R T Y P E (%/1000 HRS)	C O U N T T O T A L F A I L U R E R A T E (%/1000 HRS)			
						25°C		A M B I E N T T _A	C A S E T _C	A C T U A L T _A															A C T U A L T _C		
						A M B I E N T T _A	C A S E T _C																				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
CR 401	Reference MC7103	Mic- ro- S.C.	25	—	—	250	—	25	200	2.5	0.01	—	—	—	—	—	1000	29	Input Circuit	Lunar	0.013	A	1.0	0.013	1	0.013	
CR 402	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	Switch- ing Circuit	"	"	"	"	"	"	"	
CR 403	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 404	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	House- keeping Circuit	"	"	"	"	"	"	"	
CR 405	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR1 CR10	Reference MC7103	Mic- ro- S.C.	25	—	—	250	—	25	200	75	0.03	—	—	—	—	—	1000	29	Voltage Multi- plier	Lunar	0.013	A	1.0	0.013	10	0.013	

28

FAILURE RATE SOURCE (See Column 23)
A ATM-605 C _____
B _____ D _____

29

NOTE: It is assumed the transient and peak power does not exceed the safe limit.

30

TOTAL FAILURE RATE 0.078 %/1000 HRS.

(INDUCTORS & TRANSFORMERS)

ATM-798, Appendix D

SUB ASSEMBLY: Channeltron Power Supply No. 1 **SCHEMATIC NO:** 2165390, Rev. G

DATE: 1 October 1968
1 SCHEMATIC NO: 2165390, Rev. G

(Inductors & Transformers)

[illegible]

PARTS APPLICATION ANALYSIS

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(RELAYS)

ATM-798, Appendix D

PROJECT: ALSEPDATE: 1 October 1968ASSEMBLY: CPLLE ExperimentSUB ASSEMBLY: Channeltron Power Supply No.1SCHEMATIC NO: 2165390, Rev. G

(Relays)

CIRCUIT REFER- ENCE DESIG- NATION	TYPE DESIGNATION (CEC, MIL OR MFR) AND CONSTRUCTION	MANUFACTURER	CONTACT LOAD						NUMBER OF POLES	RELAY COIL						MISCELLA- NEOUS REMARKS	B F A I L U R E R A T E (%/1000 HRS)	O F F M O D I F I E R	TOTAL FAILURE RATE (%/1000 HOURS)			
			RATED		ACTUAL					TYPE OF L O A D	POWER		VOLTAGE		RATE OF OPERA- TIONS PER HOUR OR SECOND					REQ'D LIFE OPERA- TIONS		
			V O L T A G E V	C U R R E N T A	VOLTAGE		CURRENT				M A X P O W E R W	A C T U A L	M A X V O L T A G E V	M I N V O L T A G E V								
					STEADY STATE	PEAK	STEADY STATE	SURGE														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
K401	Trans-Case Relay (SPDT) 421-36	Teledyne	28	1.0	0.1	—	0.005	—	Resis- tive	1	1	100	26	9.4	5	—	2	—	0.005	B	1.0	0.005
24	DEVICE AVERAGE AMBIENT TEMPERATURE °C	FAILURE RATE SOURCES (FOR COLUMN NO. 21) A <u>ATM-605</u> B <u>MIL-HDBK-217A</u> C _____ D _____								CALCULATED MTBF <u>20,000,000</u> HOURS						TOTAL FAILURE RATE <u>0.005</u> %/1000 HRS						
25										26						27						

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PARTS APPLICATION ANALYSIS

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ATM-798, Appendix D

(CONNECTORS)

PROJECT: ALSEP
ASSEMBLY: CPLLE ExperimentSUB ASSEMBLY: Channeltron Power Supply No. 1DATE: 1 October 1968
SCHEMATIC NO: 2165390, Rev. G

(Connectors)

CIRCUIT, REF. DESIG- NATION	TYPE DESIGNATION (CEC, MIL OR MFR) AND CONSTRUCTION	M A N U F A C T U R E R	PINS											AMBI- ENT TEMP °C	INSERT MATL	GUIDE	NO. OF INSE- RTIONS DURING LIFE	MISCELLA- NEOUS REMARKS	BASIC F A I L U R E R A T E (%/1000 Hours) (See 24)	S O U R C E O F F. R. (See 24)	M O D I F I E R	TOTAL FAILURE RATE (%/1000 Hours)
			NUMBER		CURRENT		VOLTAGE															
			TOTAL	ACTIVE	RATED	ACTUAL		BETWEEN PINS			ACROSS THE CONTACT											
						MAX.	MIN.	RATED	ACTUAL	TRAN- SIENT	STEADY STATE	SURGE										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
E401- E409	Connector, Plug 3231-1	Cambion	1	1	—	—	—	—	—	—	—	—	40	Brass	Spr- ing	1		0. 001	C	1.0	0.009	
E410	Terminal, Insulated 2031A-4	USECO	1	1	"	"	"	"	"	"	"	"	"	"	—	"		—	"	"	0.00005	
E423	"	"	"	"	"	"	"	"	"	"	"	"	"	"	—	"		"	"	"	"	

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APPENDIX E

PARTS APPLICATION ANALYSIS DATA
FOR
CHANNELTRON POWER SUPPLY NO. 2

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ATM-798, Appendix E

ATM-798, Appendix E

DATE: 2 October 1968

SUB ASSEMBLY: Channeltron Power Supply No2

SCHEMATIC NO: 2165395, Rev. G

(Resistors)

[illegible]

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ATM-798, Appendix E

DATE: 2 October 1968

SUBASSEMBLY: Channeltron Power Supply No. 2

SCHEMATIC NO: 2165395, Rev. G

[illegible]

(SEMICONDUCTORS)

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ATM-798, Appendix E

PROJECT: ALSEP
ASSEMBLY: CPLEE Experiment

DATE: 1 October 1968
SUB ASSEMBLY: Channeltron Power Supply No.2 SCHEMATIC NO: 2165395, Rev. G

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E R	MAX. TEMP °C		AVG PWR DISSIPATION (mw)						POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION OR APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY						
			A M B I E N T T _A	J U N C T I O N T _J	C A S E H O T S P O T T _C	RATED AT						A C T U A L R A T E D 25°C (Amb.or case)	A C T U A L R A T E D T _A or T _C	V C B O R A T E D V	V C B A C T U A L V	V C E O R A T E D V	V C E A C T U A L V	R A T E D V			A C T U A L V	R A T E (%/1000 HRS)	S O U R C E (See below)	F A U L T I R A T E (%/1000 HRS)	F A I L U R E R A T E (%/1000 HRS)	T O T A L F A I L U R E R A T E (%/1000 HRS)	
						25°C		A M B I E N T T _A	C A S E T _C	A C T U A L T _A	A C T U A L T _C																
						A M B I E N T T _A	C A S E T _C																				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
Q406	2N3057A, NPN	Fair- Child	40	200	—	400	2.8W	25	100	32	0.18	—	140		7.0		—	—	Oscil- lator Circuit	Lunar	0.001	A	1.0	001	1	0.0010	
CR1- CR10	Reference MC7103	Mic- ro- S. C.	40	200	—	250	—	25	—	7.5	0.03	—	—	—	—	—	50	39	Voltage Multi- plexer (A403)	Luna	0.0012	A	1.0	0012	10	0.0120	
A3, A7	2N3048	Texas Instr	40	200	—	350	—	25	—	21	0.06	—	—	—	—	—	—	—	Buffer & Inverter (A405)	Lunar	0.0012	A	1.0	0012	2	0.0024	
A4, A6	SNR513B	"	"	"	"	10	"	"	"	0.1	0.01	"	"	"	"	"	"	"	"	"	"	"	"	"	2	0.0024	
A5	SNR516B	"	"	"	"	10	"	"	"	2.9	0.29	"	"	"	"	"	"	"	"	"	"	"	"	"	1	0.0012	

28

FAILURE RATE SOURCE (See Column 23)

A ATM-605 C _____

B _____ D _____

29

NOTE: It is assumed the transient and peak power does not exceed the safe limit.

30

TOTAL FAILURE RATE 0.0190 %/1000 HRS.

(INDUCTORS & TRANSFORMERS)

ATM-798, Appendix E

SUB ASSEMBLY: Channeltron Power Supply No.2 SCHEMATIC NO: 2165395, Rev. G

DATE: 1 October 1968

2 SCHEMATIC NO: 2165395, Rev. G

(Inductors & Transformers)

[illegible]

PARTS APPLICATION ANALYSIS

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(CONNECTORS)

ATM-798, Appendix E

PROJECT: ALSEPASSEMBLY: CPLER ExperimentSUB ASSEMBLY: Channeltron Power Supply No. 2DATE: 1 October 1968SCHEMATIC NO: 2165395, Rev. G

(Connectors)

CIRCUIT, REF. DESIG- NATION	TYPE DESIGNATION (CEC, MIL OR MFR) AND CONSTRUCTION	M A N U F A C T U R E R	PINS											AMBI- ENT TEMP °C	INSERT MATL	GUIDE	NO. OF INSE- RTIONS DURING LIFE	MISCELLA- NEOUS REMARKS	BASIC F A I L U R E R A T E % /1000 Hours (See 24)	S O U R C E OF F.R. (See 24)	F.R. M O D I F I E R	TOTAL FAILURE RATE (%/1000 Hours)
			NUMBER		CURRENT		VOLTAGE															
			TOTAL	ACTIVE	RATED	ACTUAL		BETWEEN PINS			ACROSS THE CONTACT											
						MAX.	MIN.	RATED	ACTUAL	TRAN- SIENT	STEADY STATE	SURGE										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
E411- E420	Plug, Jack 3231-3	Cambion	1	1	—	—	—	—	—	—	—	—	—	40	Brass	Spr-	1	—	0.001	B	1.0	0.010
(NOTE: TOTAL FAILURE RATE BASED ON ALL 10 CONNECTORS.)																						
23 REQUIRED LIFE HOURS	24 FAILURE RATE SOURCES (FOR COLUMN 20) A <u>ATM-605</u> B <u>MIL-HDBK-217A</u> C _____ D _____											25 CALCULATED MTBF <u>10,000</u> HOURS				26 TOTAL FAILURE RATE <u>0.010</u> %/1000 HOURS						

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(BS-321A)



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CPLEE Parts Application Analysis

NO. REV. NO.

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APPENDIX F

PARTS APPLICATION ANALYSIS DATA
FOR
AMPLIFIER MODULE ASSEMBLY

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ATM-798, Appendix F

DATE: 2 October 1968

SUB ASSEMBLY: Amplifier Module Assembly

SCHEMATIC NO: 2165355, Rev. D

1 CIRCUIT SYMBOL NUMBER	2 TYPE DESIGNATION (MIL-STD-883C) CONSTRUCTION	3 MANUFACTURER	4 RESISTANCE VALUE (OHMS)	5 TOLERANCE (%)	6 POWER RATING (WATTS)	7 MAXIMUM OPERATING POWER (WATTS)	8 POWER RATIO OPERATING/ RATED	9 MAXIMUM DUTY CYCLE	10 BULK IR TEMPERATURE °C	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATE (S/1000 HRS) - AT SOURCE (SEE BELOW)	13 SPECIAL ENVIRONMENTS (DESTIN)	14 FAILURE RATE MULTIPLIER	15 FINAL FAILURE RATE (S/1000 HRS)	16 TOTAL RESISTOR COUNT PER TYPE	17 TOTAL FAILURE RATE (S/1000 HRS)
R501	RC07	Allen Bradley	200	5	0.25	2.5 mw	0.01	0.50	40	Amplifier Submodules	0.0021 A	Lunar	1.0	0.002	12	0.024
R502	"	"	36K	"	"	"	"	"	"	"	"	"	"	"	"	"
R503	"	"	3.3K	"	"	"	"	"	"	"	"	"	"	"	"	"
R504	"	"	10K	"	"	7.5 mw	0.03	"	"	"	"	"	"	"	"	"
R505	"	"	13K	"	"	9 mw	0.06	"	"	"	"	"	"	"	"	"
R506	"	"	3.3K	"	"	0.275	0.11	"	"	"	"	"	"	"	"	"
R510	RC07	Allen Bradley	2.7	5	0.25	2.5 mw	0.01	1.00	40	Amplifier Assembly	0.0021 A	Lunar	1.0	0.002	1	0.002
R511	"	"	8.2	"	"	"	"	"	"	"	"	"	"	"	"	"
R512	RC07	Allen Bradley	15	5	0.25	2.5 mw	0.01	1.00	40	Filter Network(A522)	0.0021 A	Lunar	1.0	0.002	1	0.002
R513	"	"	100	"	"	"	"	"	"	"	"	"	"	"	"	"

19

FAILURE RATE SOURCES (FOR COLUMN #14)

A ATM-605 B _____

C _____ D _____

20

CALCULATED MTBF 660,000 HRS

21

TOTAL FAILURE RATE 0.152 %/1000 HRS

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SUBASSEMBLY: Amplifier Module Assembly

DATE: 2 October 1968
SCHEMATIC NO: 2165355 Rev. D

[illegible]

(SEMICONDUCTORS)

ATM-798, Appendix F

SUB ASSEMBLY: Amplifier Module Assembly

DATE: 2 October 1968
SCHEMATIC NO: 2165355, Rev. D

(Semiconductors)

[illegible]

PARTS APPLICATION ANALYSIS

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(CONNECTORS)

ATM-798, Appendix F

PROJECT: ALSEP
ASSEMBLY: CPLLE ExperimentSUB ASSEMBLY: Amplifier Module AssemblyDATE: 2 October 1968
SCHEMATIC NO: 2165355, Rev. D

(Connectors)

CIRCUIT, REF. DESIGNATION	TYPE DESIGNATION (CEC, MIL OR MFR) AND CONSTRUCTION	M A N U F A C T U R E R	PINS										AMBI- ENT TEMP °C	INSERT MATL	GUIDE	NO. OF INSE- RTIONS DURING LIFE	MISCELLA- NEOUS REMARKS	BASIC F A I L U R E R A T E % /1000 Hours (See 24)	S O U R C E OF F.R. (See 24)	F.R. M O D I F I E R	TOTAL FAILURE RATE (%/1000 Hours)
			NUMBER		CURRENT		VOLTAGE														
			TOTAL	ACTIVE	RATED	ACTUAL		BETWEEN PINS		ACROSS THE CONTACT											
						MAX.	MIN.	RATED	ACTUAL	TRAN- SIENT	STEADY STATE	SURGE									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
—	Terminals	Cambion	1	1	—	—	—	—	—	—	—	—	40	Brass	Spr- ing	1	—	0. 001	B	1.0	0.031
(TOTAL FAILURE RATE REFLECTS THE 31 TERMINALS USED IN THIS ASSEMBLY)																					
23	24		25										26								
REQUIRED LIFE HOURS	FAILURE RATE SOURCES (FOR COLUMN 20) A <u>ATM-605</u> B <u>MIL-HDBK-217A</u> C _____ D _____		CALCULATED MTBF <u>2,220,000</u> HOURS										TOTAL FAILURE RATE <u>0.031</u> %/1000 HOURS								

DHD 9263

(BS-321A



**Aerospace
Systems Division**

CPLEE Parts Application Analysis

NO.	REV. NO.
ATM-798	
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APPENDIX G
PARTS APPLICATION ANALYSIS DATA
FOR
VERTICAL ANALYZER

Page 1 of 4

RESISTORS

DATE: 2 October 1968

SUB ASSEMBLY: Vertical Analyzer (NO. 1-A)

SCHEMATIC NO: 2167370, Rev. A

[illegible]

Page 2 of 4

ATM-798, Appendix G

DATE: 2 October 1968

SUBASSEMBLY: Vertical Analyzer (NO. 1-A)

SCHEMATIC NO: 2167370, Rev. A

(Capacitors)

[illegible]

BS-321A

(SEMICONDUCTORS)

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ATM-798, Appendix G

PROJECT: ALSEP
ASSEMBLY: CPLEE Experiment

SUB ASSEMBLY: Vertical Analyzer (NO. 1-A)

DATE: 2 October 1968

SCHEMATIC NO: 2167370, Rev. A

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E R	MAX. TEMP °C		AVG PWR DISSIPATION (mw)						POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Defline)	FOR RELIABILITY USE ONLY						
			A M B I E N T T _A	J U N C T I O N T _J	C A S E A C T U A L H O T S P O T T _C	RATED AT					A C T U A L R A T E D 25°C (Amb.or case)	A C T U A L R A T E D T _A or T _C	V _{CB0}	V _{CB}	V _{CE0}	V _{CE}	R A T E D	A C T U A L									
						25°C		A M B I E N T T _A	C A S E A C T U A L	A C T U A L T _C			A C T U A L	V	V	V	V	V			V						
						A M B I E N T T _A	C A S E T _C																				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
O601	FK2484, NPN	Texas Inst.	25	200	—	175	-	-	-	21	0.12	—	-	-	-	-	—	—	Preamplifier Assembly	Lunar	0.001	A	1.0001	6	0.006		
CR 601	Reference MC7100	Mic- ro- S.C.	25	200	—	125	—	—	—	1.25	0.01	—	—	—	—	—	1000	2g	Preamplifier Assembly	Lunar	0.001	A	1.0001	6	0.006		
CR 602	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
								</																			

PARTS APPLICATION ANALYSIS

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(MISC. PARTS)

ATM-798, Appendix G

PROJECT: ALSEPDATE: 2 October 1968ASSEMBLY: CPLEE ExperimentSUB ASSEMBLY: Vertical Analyzer (NO. 1-A)SCHEMATIC NO: 2167370, Rev. A

(Misc. Parts)

CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (CEC, MIL OR MFR) and CONSTRUCTION	M A N U F A C T U R E R	TEMPERATURE RANGE		ELECTRICAL STRESS		PERCENT DUTY CYCLE	MAJOR CHARACTERISTICS and APPLICATION	FOR RELIABILITY USE ONLY				
			MAX	MIN	RATED	USE			BASIC FAILURE RATE (%/1000 HOURS) at °C (SEE #15)	S O U R C E (SEE #15)	PART SPECIAL ENVIRONMENT (DEFINE)	FAIL- URE RATE MULTI- PLIER	TOTAL FAILURE RATE (%/1000 HOURS)
—	Channeltron	BxRL	—	—	—	—	0.50	Preamp. Assemblies (6)	0.016	C	Lunar	1.0	0.096
"	Collector Rod 2166256	"	"	"	"	"	"	Analyzer Assembly	0.036	"	"	"	0.036
"	Collector Rod 2166257	"	"	"	"	"	"	" "	"	"	"	"	"
"	Deflection Holder 2120176	"	"	"	"	"	"	" "	"	"	"	"	0.105
"	Ultra-Violet Trap 2165631	"	"	"	"	"	0.50 for 120 hrs.	" "	0.105	"	"	"	"
15 FAILURE RATE SOURCES (FOR COLUMN 11) A. <u>ATM-605</u> B. <u>MIL-HDBK-217A</u> C. <u>ASD-R-05-64-1</u> D. <u>MIL Std 217 Chart XXIV</u>								16 CALCULATED MTBF <u>324,000</u> HOURS	17 TOTAL FAILURE RATE <u>0.309</u> %/1000 HOURS				

ORD Form 9258

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**Aerospace
Systems Division**

CPLEE Parts Application Analysis

NO.

ATM-798

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APPENDIX H
PARTS APPLICATION ANALYSIS DATA
FOR
60° ANALYZER

Page 1 of 4

ATM-798, Appendix H

DATE: 2 October 1968

SUB ASSEMBLY: 60° Analyzer Assembly(No. 2-B) SCHEMATIC NO: 2166260, Rev. E

3) SCHEMATIC NO: 2166260, Rev. E

[illegible]

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ATM-798, Appendix H

SUBASSEMBLY: 60° Analyzer Assembly(No.2-B)

DATE: 2 October 1968
SCHEMATIC NO: 2166260, Rev. E

[illegible]

PARTS APPLICATION ANALYSIS

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(MISC. PARTS)

ATM-798, Appendix H

PROJECT: ALSEPASSEMBLY: CPLEE ExperimentSUB ASSEMBLY: 60° Analyzer Assembly(No. 2-B)DATE: 2 October 1968SCHEMATIC NO: 2166260, Rev. E

(Misc. Parts)

CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (CEC, MIL OR MFR) and CONSTRUCTION	M A N U F A C T U R E R	TEMPERATURE RANGE		ELECTRICAL STRESS		PERCENT DUTY CYCLE	MAJOR CHARACTERISTICS and APPLICATION	FOR RELIABILITY USE ONLY				
			MAX	MIN	RATED	USE			BASIC FAILURE RATE (%/1000 HOURS) at °C (SEE #15)	S O U R C E (SEE #15)	PART SPECIAL ENVIRONMENT (DEFINE)	FAIL- URE RATE MULTI- PLIER	TOTAL FAILURE RATE (%/1000 HOURS)
—	Channeltron	BxRL	—	—	—	—	0.50	Preamplifier Assemblies (6)	0.016	C	Lunar	1.0	0.096
"	Collector Rod 2166256	"	"	"	"	"	"	Analyzer Assembly	0.036	"	"	"	0.036
"	Collector Rod 2166257	"	"	"	"	"	"	" "	"	"	"	"	"
"	Deflection Holder 2170176	"	"	"	"	"	"	" "	"	"	"	"	"
"	Ultra-Violet Trap 2165631	"	"	"	"	"	0.50 for 120 hrs	" "	0.105	"	"	"	0.105

15 FAILURE RATE SOURCES (FOR COLUMN 11)

A. ATM-605 B. MIL-HDBK-217A

C. ASD-R-05-64-1(G E) D. MIL Std 217 Chart XXIV

16 CALCULATED MTBF 324,000 HOURS

17 TOTAL FAILURE RATE 0.309 %/1000 HOURS



CPLEE Parts Application Analysis

NO. REV. NO.

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APPENDIX I
PARTS APPLICATION ANALYSIS DATA
FOR
ANCILLARY MODULE ASSEMBLY

PARTS APPLICATION ANALYSIS

Page 1 of 9

RESISTORS

ATM-798, Appendix I

PROJECT: ALSEP

DATE: 30 September 1968

ASSEMBLY: CPLEE Experiment

SUB ASSEMBLY: Ancillary Module Assembly

SCHEMATIC NO: 2165405, Rev. C

(Resistors)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (MIL or MFR) CONSTRUCTION	MANUFACTURER	RESISTANCE VALUE (OHMS)	TOLERANCE (%)	POWER RATING (WATTS)	MAXIMUM OPERATING POWER (WATTS)	POWER RATIO OPERATING/ RATED	MAXIMUM DUTY CYCLE	BULK AIR TEMPERATURE °C	CIRCUIT FUNCTION OR APPLICATION	BASIC FAILURE RATE (x 1000 HRS) - A - °C	FOR USE OF RELIABILITY DEPT. (SEE BELOW)	SPECIAL ENVIRONMENTS (DEFINING)	FAILURE RATE MULTIPLIER	FINAL FAILURE RATE (x 1000 HRS)	TOTAL FAILURE COUNT PER TYPE	TOTAL FAILURE RATE (x 1000 HRS)
R701	RNR55C	—	402K	1.0	0.1	1	0.01	0.01	40	Temperature Control	0.015	A	Lunar	1.0	0.015	1	0.015
R702	"	"	2.80K	"	"	3	0.03	"	"	"	"	"	"	"	"	"	"
R703	"	"	2.10K	"	"	"	0.01	"	"	"	"	"	"	"	"	"	"
R704	"	"	402K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R705	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R706	"	"	2.80K	"	"	3	0.03	"	"	"	"	"	"	"	"	"	"
R707	"	"	2.10K	"	"	1	0.01	"	"	"	"	"	"	"	"	"	"
R708	"	"	402K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R712	"	"	75K	"	"	9	0.09	"	"	"	"	"	"	"	"	"	"
R713	"	"	10K	"	"	1	0.01	"	"	"	"	"	"	"	"	"	"
R721	"	"	22.1K	"	"	"	"	"	"	Dust Cover Removal	"	"	"	"	"	"	"
R722	"	"	10K	"	"	3	0.03	"	"	"	"	"	"	"	"	"	"
R723	"	"	49.9K	"	"	2	0.02	"	"	"	"	"	"	"	"	"	"
R724	RWR69G	"	4.0	"	2.5	50	"	"	"	"	0.001	"	"	"	0.001	"	0.001
R731	RNR55C	"	10K	"	0.1	41	0.41	1.00	"	Temperature Monitor	0.015	"	"	"	0.015	"	0.015
R732	"	"	2.80K	"	"	1	0.01	"	"	"	"	"	"	"	"	"	"
R733	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R734	"	"	10K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
19						20						21					
FAILURE RATE SOURCES (FOR COLUMN #14)						CALCULATED MTBF _____ HRS						TOTAL FAILURE RATE _____ %/1000 HRS					
A ATM-605 _____ B _____																	
C _____ D _____																	

RESISTORS

ATM-798, Appendix I

SUB ASSEMBLY: Ancillary Module Assembly

DATE: 30 September 1968
SCHEMATIC NO: 2165405, Rev. C

(Resistors)

[illegible]

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ATM-798, Appendix I

SUBASSEMBLY: Ancillary Module Assembly

DATE: 30 September 1968
SCHEMATIC NO: 2165405, Rev. C

(Capacitors)

[illegible]

(SEMICONDUCTORS)

ATM-798, Appendix I

ASSEMBLY: CPLEE Experiment

SUB ASSEMBLY: Ancillary Module Assembly

SCHEMATIC NO: 2165405, Rev. C

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E R	MAX. TEMP °C		AVG PWR DISSIPATION (mw)						POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY																																																																																																																																																																																																						
			A M B I E N T T _A	J U N C T I O N T _J	C A S E T _C	H O T S P O T T _C	RATED AT				A C T U A L R A T E D 25°C (Amb. or case)	A C T U A L R A T E D T _A or T _C	V C B O	V C B	V C E O	V C E	R A T E D V	A C T U A L V			R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T E D V	A C T U A L V	R A T

PARTS APPLICATION ANALYSIS

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(SEMICONDUCTORS)

ATM-798, Appendix I

PROJECT: ALSEP
ASSEMBLY: CPLER ExperimentSUB ASSEMBLY: Ancillary Module AssemblyDATE: 30 September 1968
SCHEMATIC NO: 2165405, Rev. C

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MANU- FACTURER	MAX. TEMP °C		AVG PWR DISSIPATION (mw)						POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY							
			A M B I E N T T _A	J U N C T I O N HOT SPOT T _J	C A S E T _C	RATED AT				ACTUAL RATED 25°C Ambor case	ACTUAL RATED T _A or T _C	V _{CEO} R A T E D V	V _{CB} A C T U A L V	V _{CEO} R A T E D V	V _{CE} A C T U A L V	R A T E D V	A C T U A L V	R A T E D V			A C T U A L V	RATE (%/1000 HRS)	S O U R C E R E P L A C E (See below)	F A I L U R E R A T E (%/1000 HRS)	F A I L U R E R A T E (%/1000 HRS)	T O T A L F A I L U R E R A T E (%/1000 HRS)		
						25°C		A M B I E N T T _A	C A S E T _C																		A C T U A L T _A	C A S E T _C
						A M B I E N T T _A	C A S E T _C																					
Q724	2N3420, NPN	Texas Instr	40	200	—	800	10W	25°	100	34	0.45	—	85	—	60	—	—	—	—	—	Dust Cover Removal	Lunar	0.006	A	1.0	0.006	1	0.006
CR 701	Reference, MC7102	Mic- ro- S.C.	40	200	—	250	—	—	—	2.5	0.01	—	—	—	—	—	50	39	Temp. Control	Lunar	0.001	A	1.0	0.001	1	0.001		
CR 702	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 703	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 704	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 705	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 706	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 707	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	

28 FAILURE RATE SOURCE (See Column 23)

A ATM-605 C _____

B _____ D _____

29 NOTE: It is assumed the transient and peak power does not exceed the safe limit.

30 TOTAL FAILURE RATE _____ %/1000 HRS.

PC40A

BS-321A

PARTS APPLICATION ANALYSIS

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(SEMICONDUCTORS)

ATM-798, Appendix I

PROJECT: ALSEP
ASSEMBLY: CPLEE ExperimentSUB ASSEMBLY: Ancillary Module AssemblyDATE: 30 September 1968
SCHEMATIC NO: 2165405, Rev. C

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MANUFACTURER	MAX. TEMP °C			AVG PWR DISSIPATION (mw)				POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION OF APPLI- CATION	PART SPECIAL ENVIRON- MENT (Define)	FOR RELIABILITY USE ONLY						
			AMBI- ENT TA	JUN- CTION TEMP TJ	ACTU- AL HOT SPOT TC	RATED AT			ACTUAL RATED 25°C Amb.or case	ACTUAL RATED TA or TC	VCBO RATED V	VCB ACTU- AL V	VCEO RATED V	VCE ACTU- AL V	RA TATED V	AC TUAL V	RATE (%/1000 HRS)			SO- URCE (See below)	FAC- TUAL RPLI- TIES	FAC- TUAL RATE (%/1000 HRS)	FAC- TUAL PER TYPE	TOTAL FAILURE RATE (%/1000 HRS)		
						25°C	AMBI- ENT TA	ACTU- AL TC																	ACTU- AL TA or TC	
CR 708	Reference, MC7102	Mic- ro- S.C.	40	200	-	250				2.5	0.01					50	29	Temp. Control	Luna	0.	0.	1.0	0.001	1	0.001	
CR 709	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 710	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 721	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	Dust Cover Removal	"	"	"	"	"	"	"	
CR 722	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 731	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 731	Zener, 1N4611A	Fair- Child	"	"	"	500	"	"	"	5.00	"	"	"	"	"	"	6.6	6.6	Temp. Control	"	"	"	"	"	"	"

22 FAILURE RATE SOURCE (See Column 23)

A ATM-605 C _____

B _____ D _____

23 NOTE: It is assumed the transient and peak power does not exceed the safe limit.

24 TOTAL FAILURE RATE 0.039 %/1000 HRS.

P045A

BS-321A

PARTS APPLICATION ANALYSIS

Page 7 of 9(RELAYS)

ATM-798, Appendix I

PROJECT: ALSEPDATE: 30 September 1968ASSEMBLY: CPL EE ExperimentSUB ASSEMBLY: Ancillary Module AssemblySCHEMATIC NO: 21065405, Rev. C

(Relays)

CIRCUIT REFER- ENCE DESIG- NATION	TYPE DESIGNATION (CEC, MIL OR MPR) AND CONSTRUCTION	MANUFACTURER	CONTACT LOAD							TYPE OF LOAD	NUMBER OF POLES		RELAY COIL				RATE OF OPER- ATIONS PER HOUR OR SECOND	REQD LIFE OPER- ATIONS	MISCELLA- NEOUS REMARKS	B F A S I C U C R E R A T E (%/1000 HRS)	S O F F T W A R E R A T E (%/1000 HRS)	F R E Q U E N C Y R A T E (%/1000 HRS)	M O D I F I C A T I O N R A T E (%/1000 HRS)	TOTAL FAILURE RATE (%/1000 HOURS)							
			RATED		ACTUAL		V O L T A G E V	C U R R E N T A	S T E A D Y S T A T E V		P E A K V	S T E A D Y S T A T E A	S U R G E A	T O T A L	A C T I V E	M A X P O W E R W									A C T U A L V	M A X P O W E R W	M I N P O W E R W				
			V O L T A G E V	C U R R E N T A	S T E A D Y S T A T E V	P E A K V																						S T E A D Y S T A T E A	S U R G E A		
K701	Magnetic Latching, DPDT	Teledyne		0.5	29	29	0.13		Resis- tive	2	2	100	27	10.6	24		24	Temp. Control	0.005	B	1.0	0.005									
K702	"	"		"	"	"	0.06	"	"	"	"	"	"	"	"	"	"	"	"	"	"										
24	DEVICE AVERAGE AMBIENT TEMPERATURE °C	FAILURE RATE SOURCES (FOR COLUMN NO. 21) A <u>ATM-605</u> B _____ C _____ D _____										CALCULATED MTBF <u>10,000,000</u> HOURS										TOTAL FAILURE RATE <u>0.010</u> %/1000 HRS									
25												26										27									

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(CONNECTORS)

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PROJECT: ALSEP
ASSEMBLY: CPLEE ExperimentSUB ASSEMBLY: Ancillary Module AssemblyDATE: 30 September 1968
SCHEMATIC NO: 21065405, Rev. C

(Connectors)

CIRCUIT, REF. DESIG- NATION	TYPE DESIGNATION (CEC, MIL OR MFR) AND CONSTRUCTION	MANU- FACTURER	PINS											AMBI- ENT TEMP °C	INSERT MATL	GUIDE	NO. OF INSER- TIONS DURING LIFE	MISCELLA- NEOUS REMARKS	BASIC F A I L U R E R A T E % /1000 Hours (See 24)	S O U R C E OF F.R. (See 24)	M O D I F I E R	TOTAL FAILURE RATE (%/1000 Hours)	
			NUMBER			CURRENT		VOLTAGE					ACROSS THE CONTACT										
			TOTAL	ACTIVE	RATED	ACTUAL		BETWEEN PINS	RATED	ACTUAL	TRAN- SIENT	STEADY STATE											SURGE
						MAX.	MIN.																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
—	Terminals, 3231-1	Cambion	1	1	—	—	—	—	—	—	—	—	40	Brass	Spr-ing	1	Lunar	.0004	B	.0004			
(THERE ARE 22 OF THESE IN THE ASSEMBLY)																							
23	24		25										26										
REQUIRED LIFE HOURS	FAILURE RATE SOURCES (FOR COLUMN 20) A <u>ATM-605</u> B <u>MIL-HDBK-217A</u>										CALCULATED MTBF _____ HOURS		TOTAL FAILURE RATE <u>0.0088</u> <u>20</u> / 1000 HOURS										
C _____	D _____																						

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CPLEE Parts Application Analysis

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DATE 10/10/68	

APPENDIX J

PARTS APPLICATION ANALYSIS DATA
FOR
ELECTRONIC PACKAGE (MISCELLANEOUS PARTS)

PARTS APPLICATION ANALYSIS

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ATM-798, Appendix J

(MISC. PARTS)

PROJECT: ALSEP
ASSEMBLY: CPLER ExperimentSUB ASSEMBLY: Electronic Package
(Miscellaneous Parts)DATE: 8 October 1968
SCHEMATIC NO: 2166597, Rev. H.

(Misc. Parts)

CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (CEC, MIL OR MFR) and CONSTRUCTION	M A N U F A C T U R E R	TEMPERATURE RANGE		ELECTRICAL STRESS		PERCENT DUTY CYCLE	MAJOR CHARACTERISTICS and APPLICATION	FOR RELIABILITY USE ONLY				
			MAX	MIN	RATED	USE			BASIC FAILURE RATE (%/1000 HOURS) at °C	S O U R C E (SEE #15)	PART SPECIAL ENVIRONMENT (DEFINE)	FAIL- URE RATE MULTI- PLIER	TOTAL FAILURE RATE (%/1000 HOURS)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
—	Electrofilm Heater (2106258)	BxRL	—	—	—	—	50%	Double Compartment Assem- bly (2167060)	0.07	C	Lunar	0.5	0.035
"	"	"	"	"	"	"	"	"	"	"	"	"	"
"	Electrofilm Heater (2160259)	"	"	"	"	"	"	Single Compartment Assem- bly (2167050)	"	"	"	"	"
"	Thermostat & Bracket (2169814)	"	"	"	"	"	"	Double Compartment Assem- bly (2167060)	0.03	"	"	1.0	0.030
"	Dual Thermostat & Bracket (2169837)	"	"	"	"	"	"	"	0.06	"	"	"	0.060
15	FAILURE RATE SOURCES (FOR COLUMN 11) A. <u>ATM-605</u> B. <u>MIL-HDBK-217A</u> C. <u>ASD-R-05-64-1(G.E.)</u> D. <u>MIL Std 217 Chart XXIV</u>							16	CALCULATED MTBF <u>5,130.000</u> HOURS		17	TOTAL FAILURE RATE <u>0.195</u> %/1000 HOURS	

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**Aerospace
Systems Division**

CPLEE Parts Application Analysis

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APPENDIX K

PARTS APPLICATION ANALYSIS DATA
FOR
STRUCTURAL/MECHANICAL SECTION

PARTS APPLICATION ANALYSIS

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(MISC. PARTS)

PROJECT: ALSEPDATE: 10 October 1968ASSEMBLY: CPL EE ExperimentSUB ASSEMBLY: Structural/ Mechanical SectionSCHEMATIC NO: 2165701, Rev. C

(Misc. Parts)

CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (CEC, MIL OR MFR) and CONSTRUCTION	M A N U F A C T U R E R	TEMPERATURE RANGE		ELECTRICAL STRESS		PERCENT DUTY CYCLE	MAJOR CHARACTERISTICS and APPLICATION	FOR RELIABILITY USE ONLY				
			MAX	MIN	RATED	USE			BASIC FAILURE RATE (%/1000 HOURS) at °C (SEE #15)	S O U R C E (SEE #16)	PART SPECIAL ENVIRONMENT (DEFINE)	FAIL- URE RATE MULTI- PLIER	TOTAL FAILURE RATE (%/1000 HOURS)
1	Mechanical Structure (2165707)	BxRL	-	-	-	-	100%	Housing and Assembly of Experiment	.1100	C	Lunar	1.0	0.1100
	Dust Cover Assy. (2167322)	"	"	"	"	"	7.8%	Maximum Usage on Moon is 120 hours	.1100	"	"	.078	0.0860
	Leveling/orienta- tion Support Function (2166021, 2165605)	"	"	"	"	"	100%	Leveling & Orientation of Experiment.	.8565	"	"	1.0	0.8565
	Cable Assembly (2331505)	"	"	"	"	"	100%	Power junction from central Station to experiments.	.0475	"	"	1.0	0.0475
15	FAILURE RATE SOURCES (FOR COLUMN 11) A. <u>ATM 605</u> B. <u>MIL-HDBK-217A</u> C. <u>ASD-R-05-6A-1(G.E.)</u> D. <u>MIL Std 217 Chart XXIV</u>							16	CALCULATED MTBF <u>91,000</u> HOURS		17	TOTAL FAILURE RATE <u>1.109</u> /1000 HOURS	

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