



**Aerospace
Systems Division**

Reliability Failure Mode, Effects,
and Criticality Analysis

Addendum 1; HFE

ATM501

B-1

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DATE 8/6/71

This addendum is an update to 501 B for HFE, Array A-2, D, E. Contained in this addendum is the discussion of the changes and the updated FMECA Work Sheets as follows.

<u>Page</u>	<u>line:</u>	<u>Was:</u>	<u>Is:</u>
3.7.73	3&4	2N4042H	2N4044
3.7.76	9&13	Film	G202A
3.7.76	6	R49 Film, etc.	Delete.
3.7.25	3	CR1 FD300-2	Delete

Replace the above sheet in ATM501 RevB with the enclosed sheets of Attachment "1".

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Approved by: *S. J. Ellison*
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There are three (3) CDRs covering three changes which have been made to the circuits since ATM 501B was released. ATM 501B contains the FMECA for the Heat Flow Experiment (HFE).

- I. CRD 60623: This CRD covers the addition of ferite beads to the emitters of the 2N2222 drive transistors on the Pulse Power Supply/ Constant Current Supply located on board P 104. This device was added to increase stability of the pulse power supply but it was subsequently proved that this change while adding stability was not needed in the final flight configuration. No FMECA work sheet addition is needed for the beads.

- II. CRD 60439: This CRD changed the configuration of the P-44 terminal board and effected a changed in the number of the same to P-74, (see Figure 1 for change). This circuit change deleted one diode which was a redundant inhibit to a low voltage condition on the survival power supply. The change was to assure adequate thermal control of off equatorial HFE. Other changes were slight adjustment in the linearizing resistors. The reliability is effected upward by the deletion of one diode. The effect is not significant on the over-all reliability.

- III. CRD 60438: This CRD effects the data amplifier and allows substitution of part for non-available items and to improve component mounting methods to avoid unit damage. See Figure 2. The effect on reliability is upward since the new design deletes one resistor. Q7 was also changed from a 2N4042 to 2N 4044; this not effecting the reliability either up or down. The effect is not significant on the over-all reliability.

These changes in no way effect the single point failure summary.



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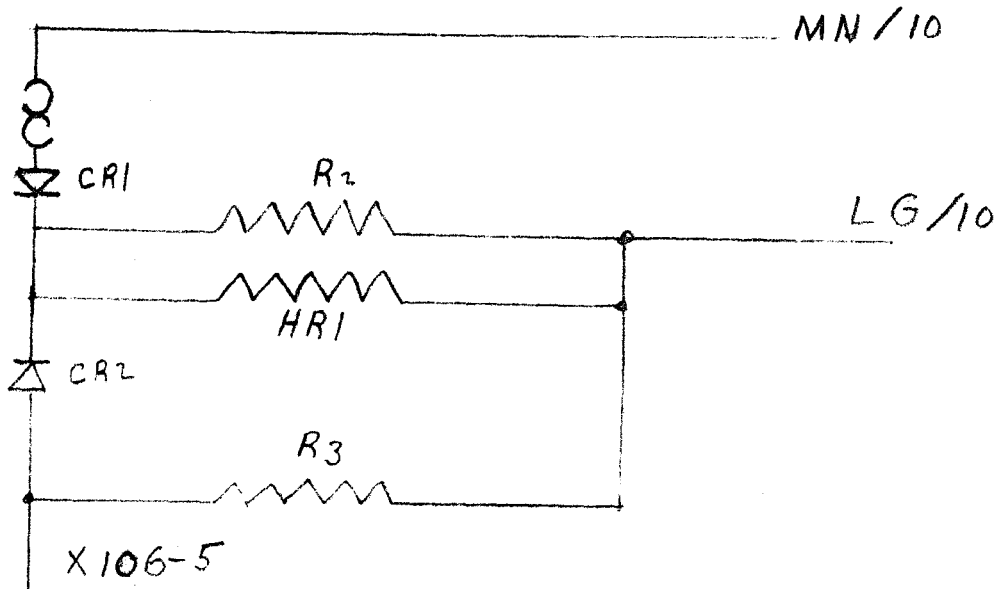
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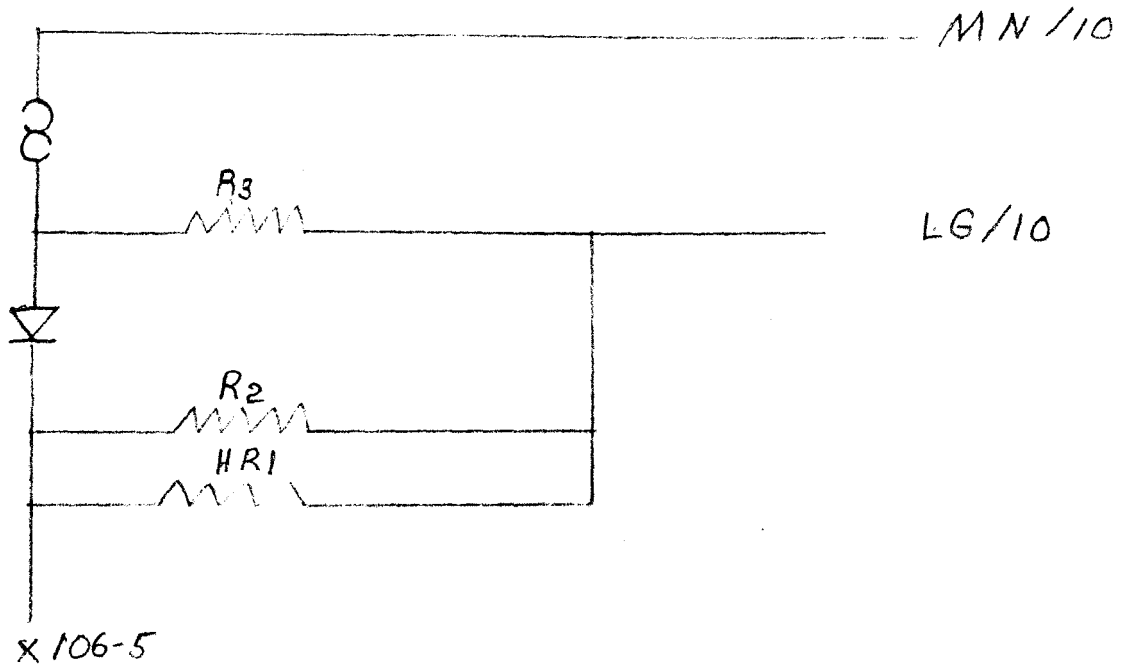
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FIGURE 1

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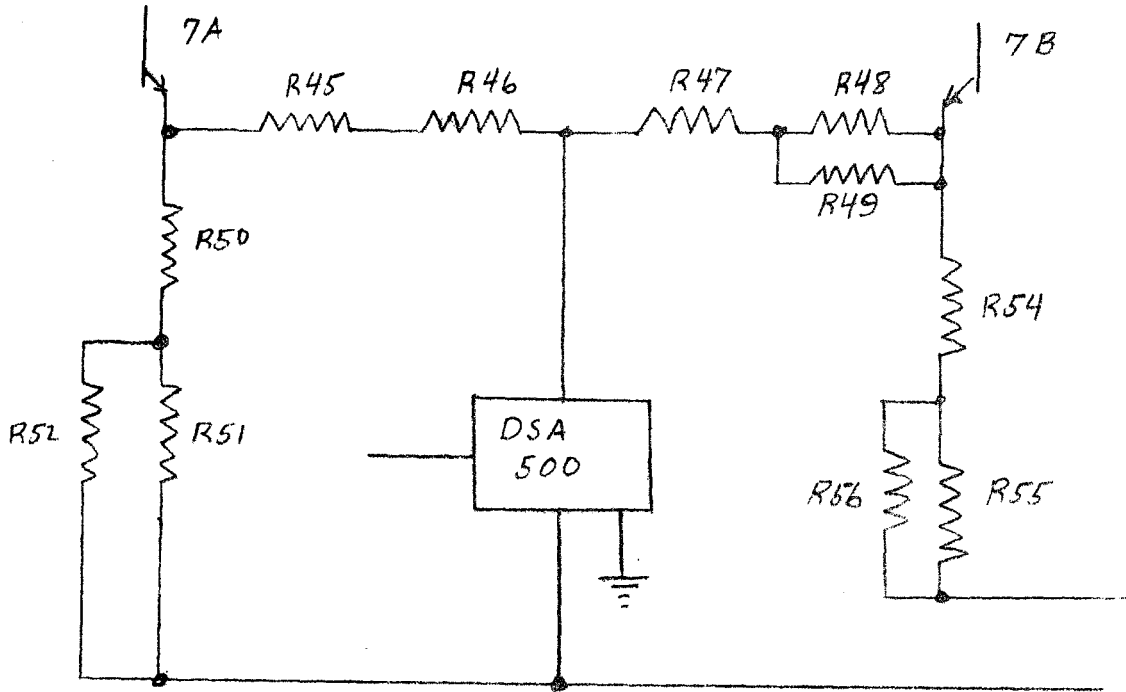
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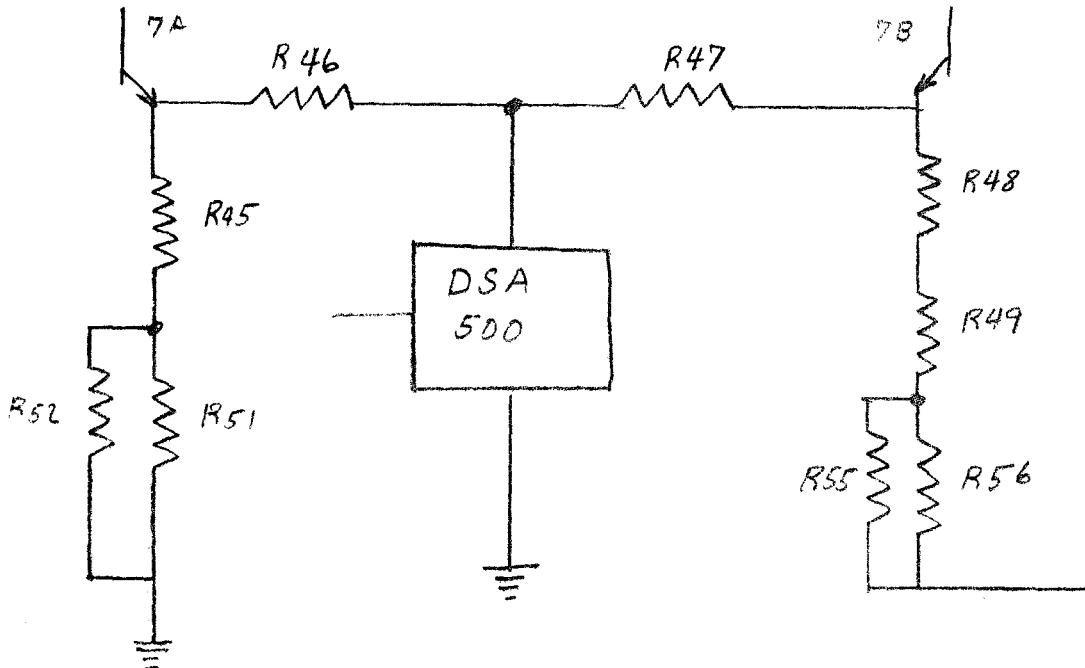
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FIGURE 2

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ATTACHMENT I

The attached FMECA Work Sheets should be replaced in ATM 501 REV B.

Addendum 1

NO. ATM-601 REV. NO. B-1
PAGE 97-26 OF 97-104 PAGES

FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET

ASSY FAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHASE(S)	ASSY DWG OR SK REFERENCE	ORIGINATOR	DATE INITIAL REVISION	SUBSYSTEM NAME	ASSEMBLY NAME	
LOSS OF DATA	0.9994	GUYTON IND OSD	T-	138075117	RLR12	6/10/67	HEAT FLOW ELECTRONICS	OUTPUT SHIFT REGISTER	
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMENT OF THE ASSUMED FAILURE	FAILURE MODE	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY = 10 ⁶ (Q)	DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE	PROBABILITY CRITICALITY PRODUCT (P) = (E) * (Q) = 10 ⁵	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
HR1 G107109 SURVIVAL MTR	SHORTS AND OPENS	FAILS SHORT 010	LOSS OF TDRU OR LOSS OF SURVIVAL MTR	1.00	0.00010	REDUNDANT MTR	0.000010	12	
		FAILS OPEN 090	LOSS OF SURVIVAL MTR	1.00	0.00010		0.000090	6	
LR1 DIODE FD300-2	SHORTS AND OPENS	FAILS SHORT 030	TDRU ON SURVIVAL MTR LINE	0.10	0.00100	REDUNDANT DIODE OR ELIMINATE	0.0000048	8	
		OPEN 010	LOSS OF SURVIVAL MTR	1.00	0.00100		0.000100	5	
		DRIFT 060	NEGLECTIBLE	0.01	0.00100		0.0000060	13	
LR2 DIODE FD300-2	SHORTS AND OPENS	FAILS SHORT 030	5 DIODES FOR TDRU TO THE SURVIVAL MTR IN NORMAL MODE NEGLECTIBLE	0.01	0.00100	REDUNDANT DIODE	0.0000050	2	
		OPEN 010			0.00100		0.000010	10	
		DRIFT 060			0.01	0.00100		0.0000060	13

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Addendum 1

NO. **ATM-501** REV. NO. **13-1**
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FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET

FAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHASE(S)	ASSY DWG OR SK REFERENCE	ORIGINATOR	DATE INITIAL REVISION	SUBSYSTEM NAME	ASSEMBLY NAME	
LOSS OF DATA	0.9997	GULTON INC OSD	T-	138075117	R LER	6/16/67	HEAT FLOW ELECTRONICS	DATA AMP.	
COMPONENT UNIT, CHART OR DRAWING REFERENCE	STATEMENT OF THE ASSUMED FAILURE	FAILURE MODE	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY = 10 ⁵ (Q)	DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE	PROBABILITY CRITICALITY PRODUCT (a) = (E) x (Q) = 10 ⁵	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
A19 OP-AMP MA-709Z	FIXED OUT PUT LEVEL	FIXED OUTPUT LOW GAIN	LOSS OF DATA ERRON DATA	1.00 0.80	0.0012 0.0012	REDUNDANT AMP	0.001080 0.000096	5 29	
A20 OP-AMP MA-709-2	↓	↓	LOSS OF DATA ERRON DATA	1.00 0.80	0.0012 0.0012	↓	0.001080 0.000096	5 29	
Q7A 2N4044	OPEN AND SHORTS	C-E SHORT OPEN DRIFT	LOSS OF DATA LOSS OF DATA ERRON DATA	1.00 1.00 0.50	0.0103 0.0103 0.0013	REDUNDANT TRANS	0.0000780 0.0000780 0.0001130	8 16 24	
Q7B 2N4044		C-E SHORT OPEN DRIFT	LOSS OF DATA LOSS OF DATA ERRON DATA	1.00 1.00 0.50	0.0103 0.0103 0.0013		0.0000780 0.0000780 0.0001130	8 16 24	
Q8 2N2907A-2		C-E SHORT OPEN DRIFT	ERRON DATA LOSS OF DATA "	0.80 0.80 0.10	0.0053 0.0053 0.0053		0.0001584 0.0001584 0.0000860	3 10 32	
Q9 2N2907A-2		C-E SHORT OPEN DRIFT	ERRON DATA LOSS OF DATA "	0.80 0.80 0.10	0.0053 0.0053 0.0053		0.0001584 0.0001584 0.0000860	3 10 32	
Q10 2N2608-1		D-S OPEN G-D SHORT OPEN G-S SHORT OPEN	ERRON DATA LOSS OF DATA " " "	0.50 0.50 0.50 0.50 0.50	0.0014 0.0014 0.0014 0.0014 0.0014		0.0000700 0.0000700 0.0000700 0.0000700 0.0000700	30 17 28 17 28	
Q11 2N2608-2		D-S OPEN G-D SHORT OPEN G-S SHORT OPEN	ERRON DATA LOSS OF DATA " " "	0.50 0.50 0.50 0.50 0.50	0.0014 0.0014 0.0014 0.0014 0.0014		0.0000700 0.0000700 0.0000700 0.0000700 0.0000700	30 17 28 17 28	
Q12 2N2222 ML 2		C-E SHORT OPEN DRIFT	LOSS OF DATA " ERRON DATA	1.00 1.00 0.50	0.0015 0.0015 0.0015		0.0000900 0.0000900 0.0001500	7 15 22	

Addendum 1

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FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET

FAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHASE(S)	ASSY DWG OR SK REFERENCE	ORIGINATOR	DATE INITIAL REVISION	SUBSYSTEM NAME	ASSEMBLY NAME	
Loss of Data	0.9997	GULTON INC D30	T	138675117	R LEE	11/16/67	HEAT FLOW ELECTRONICS	DATA AMP	
Part Description	STATEMENT OF THE ASSUMED FAILURE	FAILURE MODE	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY $\times 10^5$ (Q)	DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE	PROBABILITY CRITICALITY PRODUCT $(Q) \times (E) \times (Q) \times 10^5$	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
R44 Film	OPENS AND DRIFT	OPEN 0.85 DRIFT 0.15	LOSS OF DATA POSS. ERROR	1.00 0.20	0.00016 0.00016	RESONANT R.F.T.	0.000136 0.00048	23 43	
R45 Film		OPEN 0.85 DRIFT 0.15	ERROR IN DATA UNUSABLE	0.50 0.20	0.00016 0.00016		0.00068 0.00048	31 43	
R46 W.W.		OPEN 0.85 DRIFT 0.15	ERROR IN DATA POSS ERROR	0.50 0.20	0.00050 0.00050		0.00340 0.0015	13 38	
R47 W.W.		OPEN 0.85 DRIFT 0.15	ERROR IN DATA POSS ERROR	0.50 0.20	0.00050 0.00050		0.00340 0.0015	13 38	
R48 Film		OPEN 0.85 DRIFT 0.15	ERROR IN DATA POSS ERROR	0.50 0.20	0.00016 0.00016		0.00068 0.00048	31 43	
R49	-----	OPEN 0.85 DRIFT 0.15	ERROR IN DATA POSS ERROR	0.50 0.20	0.00016 0.00016		0.00068 0.00048	31 43	
R50 W.W.		OPEN 0.85 DRIFT 0.15	ERROR IN DATA POSS ERROR	1.00 0.20	0.00050 0.00050		0.00425 0.0015	11 38	
R51 Film		OPEN 0.85 DRIFT 0.15	ERROR IN DATA POSS ERROR	0.50 0.20	0.00016 0.00016		0.00068 0.00048	31 43	
R52 G202A		OPEN 0.85 DRIFT 0.15	ERROR IN DATA POSS ERROR	0.50 0.20	0.00016 0.00016		0.00068 0.00048	31 43	
R53 Film		OPEN 0.85 DRIFT 0.15	INTD IN A17 " " "	0.50 0.20	0.00016 0.00016		0.00068 0.00048	31 43	
R54 W.W.		OPEN 0.85 DRIFT 0.15	ERROR IN DATA POSS ERROR	1.00 0.20	0.00050 0.00050		0.00425 0.0015	11 38	
R55 Film		OPEN 0.85 DRIFT 0.15	ERROR IN DATA POSS ERROR	0.50 0.20	0.00016 0.00016		0.00068 0.00048	31 43	
R56 G202A		OPEN 0.85 DRIFT 0.15	ERROR IN DATA POSS ERROR	0.50 0.20	0.00016 0.00016		0.00068 0.00048	31 43	
R57 Film		OPEN 0.85 DRIFT 0.15	LOSS OF DATA POSS ERROR	1.00 0.20	0.00016 0.00016		0.00136 0.00048	23 43	

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