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BIF003W/2-237196-83

24 March 1983
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Unit 10

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LORRI II

LORRI II SYSTEM CRITICAL DESIGN REVIEW

CONTRACT [redacted]

24 MARCH 1983

CLASSIFIED BY: BYE-1
REVIEW ON 24 MAR 2003

WARNING - THIS DOCUMENT SHALL NOT BE USED AS A SOURCE FOR DERIVATIVE CLASSIFICATION

HANDLE VIA SYSTEMS CONTROL SYSTEMS ONLY

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AGENDA

24 March 1983

[redacted] 25X1

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2.0 SUMMARY OF ACTION ITEMS

3.0 STATEMENT OF REQUIREMENT CHANGES

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- 4.2 Command and Control
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HANDLE VIA BYEMAN CONTROL SYSTEM

AGENDA (CONT)

24 MARCH 1983

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4.5 Physical Properties
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INTRODUCTION

ACTION ITEM SUMMARY

SOURCE	ACTION ITEMS	OPEN	CLOSED
PDR	9		9
PAYLOAD CDR	17	5	12
CDRs	14	1	13

CDR 7	PROVIDE STRESS ANALYSIS ON LB ANTENNA BASED ON RESULTS OF THERMAL ANALYSIS
L-1	DETERMINE C MOS SUSCEPTABILITY TO RADIATION AND LATCHUP FAILURES
L-9	RELATE TM SIGNAL LIST OF CDR, PG 67, TO PRESENT LIST OF RUBY TEMPERATURE SENSORS
L-12	RESOLVE IMPACT OF 32-FOOT COAX CABLE LENGTH ON TRANSMITTER INPUT MISMATCH PER CDR, PG 69
L-15	PROVIDE LEAD TIME REQUIRED FOR S/C TO PREPARE EQUIPMENT FOR TEMPEST TEST
L-16	RESOLVE SIGNAL BANDWIDTH REQUIREMENTS OF RUBY SUBASSEMBLY RELATIVE TO PERFORMANCE IN THE PRESENCE OF Bi ϕ MODULATION AT A MINIMUM 6-μsec MODULATION RATE

GSS: VHF PAYLOAD THRESHOLD LEVELS
PROPOSED: +3.3 dBm FOR MAINBEAMS

-7.7 dBm
-11 dBm } FOR SIDELOBES

TEST PLAN: FAST PUMPDOWN OF VHF ANTENNA REQUIRED

SINE VIBRATION OF VHF ELECTRONICS AND DCU II REQD

CCB: PSDA – REDUNDANT POWER CONTROL RELAYS ADDED

DCU II – REDUNDANT POWER CONTROL RELAYS ADDED

ANTENNA – POINTING ANGLE CHANGED TO 30 DEGREES FWD

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SYSTEM OVERVIEW

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COMMAND AND CONTROL

HANDLE VIA STEMAD CONTROL SYSTEMS ONLY

COMMAND	FUNCTION	LOCATION	DECODER
NSPC-1	NORMAL IF AMP/HOT LOADS ON	P/L	A
NSPC-2 (P/L BU-2)	TR-1 RECORD	PSDA	A
NSPC-3 (P/L BU-3)	STOP ANTENNA - PRIMARY STOP ANTENNA - BACKUP SELECT SYNC TO MOTOR DRIVE NO. 1	PSDA DCU-II - CMD #10 - PSDA	A
NSPC-4 (P/L BU-4)	ANTENNA UP	PSDA	B
NSPC-5 (P/L BU-5)	ANTENNA DOWN	PSDA	A

COMMAND	FUNCTION	LOCATION	DECODER
NSPC-6	PRIMARY DATA SOURCE & PRIMARY BASEBAND	P/L	A
(P/L BU-6)	SELECT MOTOR DRIVE NO.1	PSDA	
	SELECT TR-1 @ 4:1	PSDA	
	SELECT TR-2 @ 2:1	PSDA	
	STOP RECORD	PSDA	
	ENABLE NORMAL P/L FUSE	PSDA	
	SELECT DCU-II CH. 1 @ 512 KBPS	DCU-II	
	SELECT DCU-II CH. 2 @ 256 KBPS	DCU-II	
	SELECT DCU-II TO P/L NORMAL B/B	DCU-II	
	SELECT DIU NO. 1 TRACK 1	DIU NO. 1	
	SELECT DIU NO. 1 @ 512 KBPS	DIU NO. 1	
	SELECT DIU NO. 2 TRACK 1	DIU NO. 2	
	SELECT DIU NO. 2 @ 256 KBPS	DIU NO. 2	
NSPC-7	BACKUP DATA SOURCE & BACKUP BASEBAND	PL	A
(P/L BU-7)	SELECT MOTOR DRIVE NO. 2	PSDA	
	SELECT TR-1 @ 2:1	PSDA	
	SELECT TR-2 @ 4:1	PSDA	
	STOP RECORD	PSDA	
	ENABLE P/L FUSE BYPASS	PSDA	
	SELECT DCU-II CH. 1 @ 256 KBPS	DCU-II	

COMMAND	FUNCTION	LOCATION	DECODER
NSPC-7	SELECT DCU-II CH. 2 @ 512 KBPS	DCU-II	
(P/L BU-7	SELECT DCU-II TO P/L BACKUP B/B	DCU-II	
(Continued)	SELECT DIU NO. 1 TRACK 2	DIU NO. 1	
	SELECT DIU NO. 1 @ 256 KBPS	DIU NO. 1	
	SELECT DIU NO. 2 TRACK 2	DIU NO. 2	
	SELECT DIU NO. 2 @ 512 KBPS	DIU NO. 2	
NSPC-8	REDUNDANT IF AMP/HOT LOADS ON	P/L	B
PSPC-1	HIGH GAIN ANTENNA PIN PULLERS (PYRO)	+Y PALLET	
PSPC-2	HIGH GAIN ANTENNA PIN PULLERS (PYRO)	+Y PALLET	
PSPC-3	SELECT P/L FUSE AS ENABLED	PSDA	A
	SELECT COAX SWITCH NORMAL POSITION	COAX SWITCH	
	SELECT DCU-II PRIMARY POWER	DCU-II CMD #9	
	SELECT ENCRYPTION		
PSPC-4	SELECT COAX SWITCH TRANSFER POSITION	COAX SWITCH	A

COMMAND	FUNCTION	LOCATION	DECODER
PSPC-5	SELECT P/L VSPC NOMINAL MULTIPLEXER	P/L	A
(P/L BU-8)	HOT LOADS OFF & DISABLE CONVERTERS A & B	P/L	
	TR-1 RECORD STOP & PLAYBACK STOP	PSDA	
	TR-2 RECORD STOP & PLAYBACK STOP	PSDA	
(ALL OFF)	DIU NO. 1 POWER OFF	DIU NO. 1	
	DIU NO. 2 POWER OFF	DIU NO. 2	
	DIU-II CH. 1 & CH. 2 DISCONNECTED	DCU-II	
	KG NO. 1 DISABLED	DCU-II CMD #3	
	KG NO. 2 DISABLED	DCU-II	
PSPC-6 (P/L BU-1)	TR-2 RECORD	PSDA	B
PSPC-7	SELECT ENCRYPTION BYPASS	DCU-II CMD #4	A
PSPC-8	SELECT DCU-II REDUNDANT POWER	DCU-II CMD #5	B
PSPC-9	SPARE		A
PSPC-10	SELECT P/L VSPC BACKUP MULTIPLEXER	P/L	B

COMMAND	FUNCTION	LOCATION		DECODER
RTC-1	P/L BASEBAND * ON	P/L		A
	TR-1 READOUT	PSDA		
	DIU NO. 1 POWER ON	DCU-II		
	DCU-II CH. 1 CONNECTED	DCU-II	CMD #7	
	KG NO. 1 ENABLED	DCU-II		
RTC-2	P/L BASEBAND * ON	P/L		B
	TR-2 READOUT	PSDA		
	DIU NO. 2 POWER ON	DCU-II		
	DCU-II CH. 2 CONNECTED	DCU-II	CMD #8	
	KG NO. 2 ENABLED	DCU-II		
RTC-3	ALL OFF - SAME AS PSPC-5			A
TRANSPOND	DCU-II CH. ** CONNECTED	DCU-II	CMD #6	
	KG NO. ** ENABLED	DCU-II		

VSPC RELAY COMMANDS

RELAY COMMAND	FUNCTION	DESTINATION
00 0000	PEARL ON LOW POWER	VIDEO PROCESSOR
10 0000	PEARL LOW TO HIGH POWER	VIDEO PROCESSOR
10 0001	DIRECT TRANSPOND	PRIME
10 0010	RUBY POWER ON	RUBY
10 0101	RUBY SELECT PRIMARY CONV	RUBY
10 0110	RUBY SELECT REDUNDANT	RUBY
10 1001	RUBY CLOSE ONE FUSE BYPASS	RUBY
10 1010	RUBY SELECT NORMAL RF/IF	RUBY
10 1101	RUBY SELECT RED RF/IF	RUBY
10 1110	[redacted] POWER ON	[redacted]
11 0001	PSPC 6 BACK-UP	PRIME
11 0010	NSPC 2 BACK-UP	PRIME
11 0100	NSPC 3 BACK-UP	PRIME
11 0110	NSPC 4 BACK-UP	PRIME
11 1001	NSPC 5 BACK-UP	PRIME
11 1110	NSPC 6 BACK-UP	PRIME
11 1101	NSPC 7 BACK-UP	PRIME
11 1010	OFF PILOT BACK-UP	PRIME

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(01) EXECUTE	00 DATA	
1000	0000	SYNT TUNE 4 LSB
1001	XX00	SYNT TUNE 2 MSB
1001	1XXX	SELECT REDUNDANT SYNTH
1010	00XX	ATTENUATION SETTING
1010	XX00	THRESHOLD SELECT
1011	X000	TSG COMMANDS
1100	1XXX	NOTCH BYPASS
1100	X1XX	SHORT PULSE ENABLE
1100	XX1X	REDUNDANT SIGNAL PROCESSING ENABLE
1101	00XX	PULSE PRIORITY SEL
1110	XXXX	RESERVE FOR [redacted]
1111	XXXX	8 BITS

25X1

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SUMMARY OF COMMAND LIMITATIONS

	COMMANDS AFFECTED	ACTION: ALARM	ACTION: SHALL DO
1. NORMAL BAND CHANGES (EXCEPT PULSE ONLY) MUST BE PRECEDED AND FOLLOWED BY A TSG MODE 3. BAND CHANGE FROM PULSE-ONLY TO NORMAL MUST BE FOLLOWED BY A TSG MODE 3.	VSPC 9-24		T(1)
2. TSG MODES 1 AND 3 ARE USED ONLY DURING DATA COLLECTION AND ANALYSIS.	VSPC 39 & 40	T(1)	
3. A TSG MODE 3 MUST PRECEDE A TSG MODE 1 AT THE END OF A TASKING SEQUENCE.	VSPC 39 & 40	T(1)	
4. MINIMUM DATA COLLECTION DURATION IS 6 SECONDS.	VSPC NSPC 2 PSPC 6, 5		T(1)
5. MINIMUM ANTENNA DRIVE INTERVAL IS 0.6 SECOND.	NSPC 3,4,5		T(1)
6. NSPC 6 AN 7 USED TO STOP TAPE RECORDER MUST AGREE WITH PREVIOUSLY SELECTED DATA SYSTEM.	NSPC 6,7		T(1)

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		COMMANDS AFFECTED	ACTION ALARM	ACTION SHALL DO
7.	SWITCHING BETWEEN PRIMARY & REDUNDANT DATA SYSTEMS OR UFs MUST BE ACCOMPLISHED WITH PAYLOAD POWER OFF.	PSPC 5 NSPC 6,7,1,8		T(1)
	AN OFF COMMAND MUST FOLLOW THE APPLICATION OF HV +Y POWER.	PSPC 5		T(1)
9.	AN OFF COMMAND SHOULD PRECEDE THE INTERRUPTION OF HV POWER.	PSPC 5		T(1)
10.	AN OFF COMMAND SHALL BE EXECUTED 2 TO 30 SECONDS AFTER RTS FADE.	PSPC 5	T(1)	
11.	THE ANTENNA MUST BE STOPPED WITHIN 190 SECONDS AFTER IT HAS BEEN STARTED.	NSPC 4,5,3		T(1)
12.	THE FUSE BYPASS MODE, PSPC 3 FOLLOWING A NSPC 7, MUST ONLY BE USED BY PROGRAM DIRECTION AND THEN ONLY AFTER A FAILURE IN THE PAYLOAD.	NSPC 7	T(1)	

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		COMMANDS AFFECTED	ACTION ALARM	ACTION SHALL DO
13.	THE PAYLOAD RECEIVER REQUIRES 6 SECONDS TO SWITCH BANDS AND 30 SECONDS TO WARM UP BEFORE TASKING OR CALIBRATION.	VSPC 9-24		T(1)
14.	PAYLOAD HOT LOADS REQUIRE 120 SECONDS TO WARM UP.	NSPC 1,3		T(1)
15.	600 MSEC MINIMUM MUST ELAPSE BETWEEN THE FIRST TWO VSPCs FOLLOWING AN OFF COMMAND. THE FIRST VSPC FUNCTION SHOULD ONLY TURN ON PAYLOAD POWER IN THE LOW POWER MODE.	VSPC (RELAY)		T(1)
16.	PAYLOAD POWER SHOULD BE APPLIED BEFORE THE ANTENNA IS MOVED, EXCEPT WHEN DRIVING TO EITHER LIMIT.	NSPC 4,5 PSPC 6 VSPC 39,40	T(1)	
17.	A TSG MODE 1 REQUIRES 37 SECONDS TO COMPLETE.	VSPC 40		T(1)
18.	A TSG MODE 3 REQUIRES 12 SECONDS TO COMPLETE.	VSPC 39		T(1)

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HANDLE VIA BYEMAN CONTROL SYSTEM

		COMMANDS AFFECTED	ACTION: ALARM	ACTION: SHALL DO
19.	AN NSPC 2 OR PSPC 6 MUST PRECEDE A TSG CALIBRATION BY 2 SECONDS	NSPC 2 PSPC 6 VSPC 39,40		T(1)
20.	THE HIGH-GAIN ANTENNA MUST BE STOWED FOR HV MANEUVERS GREATER THAN 50° OUT OF PLANE.	NSPC 3 & 4		T(1)
21.	TASKING IN THE EXCLUSION BAND SHALL BE FLAGGED.		TS	
22.	COMMANDS SHALL BE SEPARATED BY ONE SECOND MINIMUM.		T(1)	
23.	THERE MUST BE AT LEAST ONE PSPC 5 PER REV.	PSPC 5	T(1)	
24.	THE ANTENNA SHOULD NOT BE MOVED DURING THE LAST 23 SECONDS OF A TSG MODE 1 SEQUENCE AT THE BEGINNING OF A TASKING SEQUENCE.	NSPC 3, 4, 5		TS
25.	COMMAND SEQUENCES MUST NOT BE CHANGED IF A COMMAND IS SLIPPED DUE TO AN INTERFERENCE.			T(1)

		COMMANDS AFFECTED	ACTION: ALARM	ACTION: SHALL DO
26.	FLAG SUCCESSIVE IDENTICAL COMMANDS THAT ARE NOT REDUNDANT.	VSPC XXX		TS
27.	CRITICAL DATA SHOULD NOT BE RECORDED DURING THE LAST 15 SECONDS BEFOR READ-IN E.O.T.	NSPC 2 PSPC 6		TS
28.	TAPE RECORDERS SHOULD BE EMPTY WHEN THEY ARE TRANSFERRED.	NSPC 6 & 7		TS
29.	AN PSPC 5 MUST BEL DELAYED TWO SECONDS FOLLOWING THE FINAL TSC MODE 1 OPERATIONS.	PSPC 5		T(1)
30.	NORMAL BAND CHANGES REQUIRE A MINIMUM OF 55 SECONDS TO COMPLETE. PULSE-ONLY TO NORMAL BAND CHANGE REQUIRES 43 SECONDS TO COMPLETE	VSPC 9-24		TS
31.	THE ANTENNA SHALL NOT BE MOVED WITHIN 38 SECONDS OF TIME OF BORESIGHT INTERCEPT DURING DF TASKING.	NSPC 4,5		TS

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		COMMANDS AFFECTED	ACTION: ALARM	ACTION: SHALL DO
32.	THE ANTENNA SHALL NOT BE MOVED DURING TSG MODES 2 AND 3 OPERATIONS.	NSPC 4, 5 VSPCs 40 & 41		TS
33.	VHF PAYLOAD CONVERTER POWER SHALL NOT BE SWITCHED WHN POWER IS APPLIED.	VSPC (RELAY		T(1)
34.	-Y PALLET POWER SHALL BE REMOVED WHEN THE DCU II POWER CONVERTERS ARE SWITCHED FROM PRIMARY & REDUNDANT AND VISA VERSA.	HVC B.		T(1)
35.	ENCRYPTION BYPASS SHALL NOT BE GIVEN WITHOUT WRITTEN PROGRAM AUTHORIZATION.	PSPC 7	TS	
36.	-Y PALLET POWER SHALL BE APPLIED DURING THE TIME THAT THE SV IS IN THE TRACKING STATION CODE.	HVC A		T(1)
37.	THE LB TSG REQUIRES 16.2 SEC TO COMPLETE IN THE LONG MODE AND _____ SHORT MODE.		TS	

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		COMMANDS AFFECTED	ACTION: ALARM	ACTION: SHALL DO
38.	A LB SHORT MODE TSG IS REQUIRED AT THE BEGINNING AND END OF A LB TASKING PERIOD AND WHEN THE BAND IS CHANGED		TS	
39.	A VSPC 35 MUST PRECEDE VSPC 39 A VSPC 36 MUST PRECEDE VSPCs 40 AND 41		TS	
40.	VSPCs MUST BE SENT IN PAIRS			TS
41.	THE FIRST TWO VSPCs SENT WHEN PAYLOAD POWER IS OFF MUST BE SEPARATED BY A MINIMUM OF 600 MS.	VSPC (RELAY)		
42.	PAYLOAD POWER MUST BE APPLIED BEFORE TTL VSPCs CAN BE LOADED IN THE PAYLOAD MULTIPLEXERS.	VSPC (RELAY)		TS
43.	WITH THE EXCEPTION OF (41) ABOVE COMMANDS THAT MAKE UP A VSPC, COMMAND PAIR SHOULD BE SEPARATED BY 200 MS AND MOVED AS A COMMAND PAIR IN THE EVENT OF A INTERFERENCE.			

NOTES:

TS = TASK SCHEDULE RESPONSIBILITY
T(1) = S/W RESPONSIBILITY

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RF
LINK
ANALYSIS

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RF LINK CALCULATIONS

SHEET 1 OF 4

FREQUENCY: 2217.5 MHz

MODULATION: PCM -FM/FM

DATA RATE: 128 KBPS BIØ-M xpond, narrowband or 256 KBPS BIØ-M R/O narrowband or 512 KRPS BIØ-M R/O and 256 KBPS BIØ-M R/O on 1.7 MHz SCO wideband.

RECEIVED SIGNAL POWER with:		60 Ft. Dish	46 Ft. Dish	14 Ft. Dish
1. Spacecraft XMTR Power (4W)	dBm	+36.0	+36.0	+36.0
2. Spacecraft RF Line Losses	dB	-2.0	-2.0	-2.0
3. Spacecraft Antenna Gain (min.)	dBi	-3.0	-3.0	-3.0
4. Effective Radiated Power	dBm	+31.0	+31.0	+31.0
5. Space Attenuation (750 n.m.)	dB	-162.6	-162.6	-162.6
6. Polarization Loss	dB	-0.5	-0.5	-0.5
7. Atmospheric Loss	dB	-0.5	-0.5	-0.5
8a. Ground Antenna Gain - 60 Ft Dish	dB	+48.2	------	------
8b. Ground Antenna Gain - 46 Ft Dish	dB	------	+47.3	------
8c. Ground Antenna Gain - 14 Ft Dish	dB	------	------	+33.5
9. Signal Power at RCVR Input	dBm	-84.4	-85.1	-99.1
REQUIRED SIGNAL POWER:				
10. Noise Density (k)	dBm/Hz	-198.6	-198.6	-198.6
11a. Noise Temperature (T=450°K)	dB/°K	26.5	------	------
11b. Noise Temperature (T=170°K)	dB/°K	------	22.3	------
11c. Noise Temperature (T=376°K)	dB/°K	------	------	25.8
12a. RCVR IF Bandwidth (B=5MHz)	dB.Hz	67.0	67.0	------
12b. RCVR IF Bandwidth (B=1.5 MHz)	dB.Hz	------	------	61.8
13. Noise Power (NP)	dBm	-105.1	-109.3	-111.0
14. Required CNR (FM Threshold)	dB	12.0	12.0	12.0
15 Total Required Signal Power	dBm	-93.1	-97.3	-99.0

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HANDLE VIA BYEMAN CONTROL SYSTEM

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GROUND ANTENNA: 60 Ft. Dish

SYSTEM MARGIN for:		128 KBPS BIØ-M	512 KBPS BIØ-M and 256 KBPS BIØ-M on 1.7 MHz SCO	
			512 KBPS	256 KBPS
16. Noise Power (NP) (Line 13)	dBm	-105.1	-105.1	-105.1
17. Total Received Signal Power (Line 9)	dBm	-84.4	-84.4	-84.4
18. Actual Carrier-to-Noise Ratio (CNR)	dB	+20.7	+20.7	+20.7
19. FM Improvement	dB	+18.5	+13.0	+10.3
20. Data-to-Noise Ratio (DNR)	dB	+39.2	+33.7	+31.0
21. Required SNR (BER=1x10^{-5})	dB	-13.4	-13.4	-13.4
22. Required Increase in SNL for KG-46	dB	-1.5	-1.5	-1.5
23. System Margin	dB	+24.3	+18.8	+16.1
CARRIER-TO-NOISE MARGIN:				
24. Carrier-to-Noise Ratio (Line 18)	dB	+20.7	+20.7	+20.7
25. Required CNR (FM Threshold)	dB	12.0	12.0	+12.0
26. CNR Margin	dB	+8.7	+8.7	+8.7

GROUND ANTENNA: 46 Ft. Dish

		128 KBPS BIØ-M	512 KBPS BIØ-M AND 256 KBPS BIØ-M on 1.7 MHz SCO	
SYSTEM MARGIN for:			512 KBPS	256 KBPS
16. Noise Power (NP) (Line 13)	dBm	-109.3	-109.3	-109.3
17. Total Received Signal Power (Line 9)	dBm	-85.1	-85.1	-85.1
18. Actual Carrier-to-Noise Ratio (CNR)	dB	+24.2	+24.2	+24.2
19. FM Improvement	dB	+18.5	+13.0	+10.3
20. Data-to-Noise Ratio (DNR)	dB	-42.7	+37.2	+34.5
21. Required SNR (BER=1x10^{-5})	dB	-13.4	-13.4	-13.4
22. Required Increase in SNR for KG-46	dB	-1.5	-1.5	-1.5
23. System Margin	dB	+27.8	+22.8	+19.6
CARRIER-TO-NOISE MARGIN:				
24. Carrier-to-Noise Ratio (Line 18)	dB	+24.2	+24.2	+24.2
25. Required CNR (FM Threshold)	dB	12.0	12.0	12.0
26. CNR Margin	dB	+12.2	+12.2	+12.2

GROUND ANTENNA: 14 Ft. Dish

SYSTEM MARGIN for:		256 kbps BIO-M
16. Noise Power (NP) (Line 13)	dBm	-111.0
17. Total Received Signal Power (Line 9)	dBm	-99.1
18. Actual Carrier-to-Noise Ratio (CNR)	dB	+11.9
19. FM Improvement	dB	+11.0
20. Data-to-Noise Ratio (DNR)	dB	+22.9
21. Required SNR (BER=1x10^{-5})	dB	-13.4
22. Required Increase in SNL for KG-46	dB	-1.5
23. System Margin	dB	+8.0
CARRIER-TO-NOISE MARGIN:		
24. Carrier-to-Noise Ratio (Line 18)	dB	+11.9
25. Required CNR (FM Threshold)	dB	+12.0
26. CNR Margin	dB	-0.1

LORRI I 1.7-MHz SCO DATA PROBLEM

- PROBLEM
  - POOR QUALITY 256-kbps BIϕ-M DATA FROM 1.7-MHz SCO
- ANALYSIS
  - REVIEW OF STATION TAPES 1161C, 2009G AND 3918P SHOW ASYMMETRY OF 1.7-MHz SCO. UPPER SIDEBANDS ARE 6 - 8 dB DOWN FROM LOWER SIDEBANDS
- SOLUTION
  - LIMIT AMPLITUDE DIFFERENCE BETWEEN UPPER AND LOWER SIDEBANDS. TEST DATA AND ANALYSIS SHOW DIFFERENCE SHOULD BE LESS THAN 3 dB

CONTRIBUTOR	ATTENUATION (dB)
PAYLOAD	<1.0
TRANSMISSION LINE	<0.2
TRANSMITTER	<1.5
TOTAL	~~<2.7~~

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RF LINK ANALYSIS MARGIN SUMMARY

MODE	GROUND ANTENNA SIZE					
	60 FT		46 FT		14 FT	
	CNR	SNR	CNR	SNR	CNR	SNR
TRANSPOND 128-kbps DATA AT BASEBAND	+8.7 dB	+24.3 dB (NOTE 1)	+12.2 dB	+27.8 dB (NOTE 1)	N/A	N/A
T/R READOUT OF 512-kbps DATA AT BASEBAND SIMULTANEOUS WITH T/R READOUT OF 256-kbps DATA ON A 1.7-MHz SCO	+8.7 dB	+18.8 dB/BB +16.1 dB/SCO (NOTE 2)	+12.2 dB	+22.8 dB/BB +19.6 dB/SCO (NOTE 2)	N/A	N/A
T/R READOUT OF 256-kbps DATA AT BASEBAND	N/A	N/A	N/A	N/A	-0.1 dB	+8.0 dB (NOTE 1)

NOTES:

1. FOR TRANSMITTER DEVIATION OF ±0.35 MHz
2. FOR TRANSMITTER DEVIATION OF ±0.6 MHz BY BASEBAND SIGNAL AND ±1.5 MHz BY 1.7-MHz SCO. ALSO FOR 1.7-MHz FSK SCO DEVIATION OF ±243 kHz.

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DATA ENCRYPTION

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- BASIC SYSTEM REQUIREMENT

ENCRYPT ALL DIGITAL PCM PAYLOAD DATA AS LONG AS POSSIBLE. IN THE EVENT OF FAILURE OF THE TWO KG-46 UNITS OR FAILURE OF THE CODE CONVERTERS THE CAPABILITY TO BYPASS THE ENCRYPTORS AND CODE CONVERTERS SHALL BE PROVIDED

- IMPLEMENTATION OF THE BASIC REQUIREMENT

- ALL PAYLOAD PCM DATA SHALL BE ENCRYPTED BY MEANS OF TWO KG-46 UNITS.

- PCM PAYLOAD DATA SHALL BE RECORDED, REPRODUCED, AND SIGNAL CONDITIONED IN PLAIN TEXT. ONLY THE SIGNAL CONDITIONED PLAIN TEXT DATA SHALL BE CODE CONVERTED FOR ENCRYPTION AND CODE CONVERTED AGAIN FOR TRANSMISSION IN CYPHER TEXT TO A DESIGNATED RTS.

- IN CASE OF A KG-46 MALFUNCTION ONLY SINGLE TAPE RECORDER READOUTS AND DATA TRANSMISSIONS IN CYPHER TEXT WILL BE POSSIBLE AND PERMISSIBLE.

- IN CASE BOTH KG-46 UNITS BECOME INOPERATIVE, THE CAPABILITY TO BYPASS THE PCM DATA, ORIGINALLY APPLIED TO EITHER KG-46 UNIT, SHALL BE PROVIDED.

- IMPLEMENTATION OF THE BASIC REQUIREMENT (CONTINUED)

  - SIMULTANEOUS DATA TRANSMISSIONS OF PLAIN TEXT AND CYPHER TEXT SHALL BE PREVENTED BY APPROPRIATE COMMAND OPERATIONS.

- TEMPEST CONTROL PLAN

  - THE TEMPEST CONTROL PLAN ESTABLISHES CERTAIN PROCEDURES, APPROACHES AND POLICIES TO BE FOLLOWED IN THE DESIGN AND PRODUCTION OF CERTAIN PORTIONS OF THE PAYLOAD, DATA HANDLING EQUIPMENT, SYSTEM TEST EQUIPMENT, [redacted] 25X1

- TEMPEST TESTING

IT IS PLANNED TO SUBMIT THE PALLET TO A COMPREHENSIVE TEMPEST TEST IN ACCORDANCE WITH A TEMPEST TEST PLAN. THE TYPES OF TESTS TO BE PERFORMED ARE HIJACK TESTS AND NONSTOP TESTS. IN ADDITION, HIJACK TESTS, POWER LINE CONDUCTED AND BLACKLINE CONDUCTED TESTS WILL BE PERFORMED ON THE DCU AND CLOCK JITTER, POWER LINE CONDUCTED AND BLACK LINE CONDUCTED TESTS WILL BE PERFORMED ON THE PAYLOAD.

- TEMPEST TEST PLAN

THE SYSTEM LEVEL TEMPEST TEST PLAN, TO BE PUBLISHED, SHALL DEFINE THE TEST OBJECTIVE, THE TEST PROVISIONS AND THE TEST REQUIREMENTS.

- TEMPEST TEST OBJECTIVE

DEMONSTRATE THAT ANY COMPROMISING EMANATIONS ARE REDUCED TO A LEVEL WHERE UNAUTHORIZED INTERESTED OBSERVERS ARE UNABLE TO EXTRACT EXTRANEOUS ENERGY RELATED TO THE CLASSIFIED PAYLOAD DATA BEING PROCESSED.

- TEMPEST TEST RESULTS

UPON COMPLETION OF THE SYSTEM LEVEL TEMPEST TESTS, A REPORT WILL BE ISSUED BY THE CSE SUMMARIZING THE TEST RESULTS AND IDENTIFYING ANY POTENTIAL PROBLEM AREAS.

SOLUTIONS TO ALLEVIATE ANY POTENTIAL PROBLEM AREAS DISCOVERED DURING THESE TESTS SHALL BE NEGOTIATED AS REQUIRED.

989
LORR II

TAPE RECORDER
AND
DIU MODIFICATIONS

TAPE RECORDER AND DIU MODIFICATIONS

TAPE RECORDER - HARDWARE

- CLEAN, RELUBRICATE AND PERFORM BEARING SIGNATURE ANALYSIS ON ALL BEARINGS
- STAKE MODULES TO THE MOTHERBOARDS
- INSTALL HEAT SINK BRACKETS (2)
- INSTALL IN TYPE 38 ENCLOSURES (USE TYPE 38 THIRD LEG SUPPORT)

TAPE RECORDER - TEST

- ADD DIGITAL BIT ERROR RATE TEST
- DELETE PERFORMANCE TEST ASSOCIATED WITH ANALOG OPERATION ONLY
- REDUCED REQUIRED BANDWIDTH TO: 10 kHz to 600 kHz

DIU

- INCORPORATES MODIFICATION TO PREVENT LOCKUP

989
LORRI II

INSTRUMENTATION

LORRI II INSTRUMENTATION LIST

- DISCRETE'S 1 SPS
  - TOTAL OF 40 AVAILABLE
  - 31 USED
  - 9 SPARES
- ANALOGS 1 SPS
  - TOTAL OF 16 AVAILABLE
  - 16 USED
- ANALOGS 1/6 SPS
  - TOTAL OF 64 AVAILABLE
  - 53 USED
  - 11 SPARES

L-I	SV MEAS NO	DESCRIPTION	SPS	DISCRETE STATE 0	1
	X751	DIU NO. 1 TRACK SELECT	1	TRK2	TRK1
	X752	DIU NO. 1 BTC DISA/ENA	1	ENA	DISA
	X753	DIU NO. 1 256 KB DATA SEL	1	DISA	ENA
	X754	DIU NO. 1 512 KB DATA SEL	1	DISA	ENA
	X755	DIU NO. 2 TRACK SELECT	1	TRK2	TRK1
	X756	DIU NO. 2 BTC DISA/ENA	1	ENA	DISA
	X757	DIU NO. 2 256 KB DATA SEL	1	DISA	ENA
	X758	DIU NO. 2 512 KB DATA SEL	1	DISA	ENA
	X759	SPARE	1	—	—
	X760	DCU-II CONFIG. NO.3/NO.1 OR NO.2	1	NO.1/2	NO.3
	X761	DCU-II CONFIG. NO.2/NO.1 OR NO.3	1	NO.1/3	NO.2
	X762	SPARE	1	—	—
	X763	DCU-II DELAY NO.1 INPUT LOW/HIGH	1	HIGH	LOW
	X764	DELAY SIGNAL NO.1 HIGH/LOW	1	LOW	HIGH

L-I	SV MEAS NO	DESCRIPTION		SPS	DISCRETE STATE 0	1
	X765	DCU-II DELAY NO.2 INPUT	LOW/HIGH	1	HIGH	LOW
	X766	DELAY SIGNAL NO.2	HIGH/LOW	1	LOW	HIGH
	X767	DCU-II CONFIG NO.1/NO.2 OR NO.3		1	NO.2/3	NO.1
	X768	KG'S BYPASS/NORMAL		1	NORMAL	BYPASS
	X769	DCU-II COMMAND RELAY POSITION B/A		1	A	B
	X770	DCU-II CH 1 ON/OFF		1	OFF	ON
	X771	DCU-II CH 2 ON/OFF		1	OFF	ON
	X772	DCU-II PWR SUPPLY A ON/OFF		1	OFF	ON
	X773	DCU-II PWR SUPPLY B ON/OFF		1	OFF	ON
	X774	SPARE		1	-	-
X	X775	R.F. SWITCH POS. NORMAL/XFERED		1	XFERED	NORMAL
X	X776	PAYLOAD FUSES NORMAL/BYPASS		1	BYPASS	NORMAL
	X777	SPARE		1	-	-
X	X778	HIGH GAIN ANT 1ST MOTION LIMIT SW		1	1ST MOTION	STOWED

L-I	SV MEAS NO	DESCRIPTION	SPS	DISCRETE STATE 0	1
X	X779	TAPE REC 1 & 2 2:1/4:1 SELECT	1	T/R1 2:1 T/R2 4:1	T/R1 4:1 T/R2 2:1
X	X780	HIGH GAIN ANT MTR UP/DOWN (BACKUP)	1	DOWN	UP
	X781	SPARE	1	-	-
	X782	SPARE	1	-	-
X	X783	HIGH GAIN ANT MTR UP/DOWN (PRIMARY)	1	DOWN	UP
	X784	SPARE	1	-	-
	X785	SPARE	1	-	-
	X786	SPARE	1	-	-
X	X787	TAPE RECORDER NO. 1 R/I E.O.T.	1	NO	R/I E.O.T.
X	X788	TAPE RECORDER NO. 1 R/O E.O.T.	1	NO	R/O E.O.T.
X	X789	TAPE RECORDER NO. 2 R/I E.O.T.	1	NO	R/I E.O.T.
X	X790	TAPE RECORDER NO. 2 R/O E.O.T.	1	NO	R/O E.O.T.

L-I	SV MEAS NO	DESCRIPTION	SPS	MEASUREMENT RANGE
	X609	DIU NO. 1 TEMPERATURE (EXT,TS-5)	1	-30 - 160 DEG F
	X610	KG-46 NO. 1 TEMPERATURE (EXT,TS-6)	1	-30 - 160 DEG F
	X611	LOW BAND ELECT BOX TEMP (EXT,TS-7)	1	-30 - 160 DEG F
	X612	LOW BAND ANTENNA TEMP (EXT,TS-8)	1	-50 - 150 DEG F
X	X613	TAPE RECORDER NO. 1 TEMP (EXT,TS-1)	1	-30 - 160 DEG F
X	X614	TAPE RECORDER NO. 2 TEMP (EXT,TS-2)	1	-30 - 160 DEG F
X	X615	HIGH GAIN ANT MTR TEMP (EXT,TS-4)	1	-30 - 160 DEG F
X	X616	VIDEO PROCESSOR TEMP (EXT,TS-3)	1	-30 - 160 DEG F

NOTES:
- ALL TEMPERATURE SENSORS ARE LS41072-002 EXCEPT X612 WHICH IS A 1616310-33.
- X609 THRU X616 ARE POWERED AND CONDITIONED BY THE HOST. THE SENSORS ARE SUPPOIED BY THE LORRI II CONTRACTOR.
- X822 AND X823 ARE ALSO LS41072-002 SENSORS.

L-I	SV MEAS NO	DESCRIPTION	SPS	MEASUREMENT RANGE
X	X701	PAYLOAD A BUS VOLTS	1	0 - 33.0V
X	X702	CURRENT SENSOR (MAG AMP)	1	0 - 5.0 A
X	X703	HIGH GAIN ANTENNA POSITION (COARSE)	1	0 - 180 DEG

L-I	SV MEAS NO	DESCRIPTION	SPS	MEASUREMENT RANGE
X	X704	HIGH GAIN ANTENNA POSITION (FINE)	1	0 - 25 DEG
X	X705	HIGH GAIN ANT POSITION EXCITATION	1	4.94V - 5.06V
	X706	LOWBAND ELECT BUS A	1	0-33.0 V
	X707	LOWBAND ELECT BUS B	1	0-33.0 V
X	X708	PAYLOAD B BUS VOLTS	1	0 - 33.0 V

L-1	SV MEAS NO	DESCRIPTION	SPS	MEASUREMENT RANGE
	X801	LOWBAND ELECT TEMP 1	1/6	TBD
	X802	LOWBAND ELECT TEMP 2	1/6	TBD
	X803	LOWBAND ELECT TEMP 3	1/6	TBD
	X804	LOWBAND ELECT TEMP 4	1/6	TBD
	X805	LOWBAND ELECT TEMP 5	1/6	TBD
	X806	LOWBAND ELECT TEMP 6	1/6	TBD
	X807	LOWBAND ELECT TEMP 7	1/6	TBD
	X808	LOWBAND ELECT TEMP 8	1/6	TBD
	X809	LOWBAND ELECT TEMP 9	1/6	TBD
	X810	LOWBAND ELECT +5.0 VDC MON	1/6	TBD
	X811	LOWBAND ELECT -5.0 VDC MON	1/6	TBD
	X812	LOWBAND ELECT +15.0 VDC MON	1/6	TBD
	X813	LOWBAND ELECT -15.0 VDC MON	1/6	TBD
	X814	LOWBAND ELECT +28.0 VDC MON	1/6	TBD
	X815	LOW BAND ANTENNA POSITION	1/6	0 - 100 DEG

L-I	SV MEAS NO	DESCRIPTION	SPS	MEASUREMENT RANGE
	X816	DCU-II POWER SUPPLY NO. 1 VOLTAGE	1/6	TBD
	X817	DCU-II POWER SUPPLY NO. 2 VOLTAGE	1/6	TBD
X	X818	TAPE RECORDER NO. 1 MOTOR MONITOR	1/6	0 - 4.50 V
	X819	TAPE RECORDER NO. 2 MOTOR MONITOR	1/6	0 - 4.50 V
	X820	KG-46 NO. 1 5.0 V MON	1/6	4.40 - 5.06 V
	X821	KG-46 NO. 2 5.0 V MON	1/6	4.40 - 5.06 V
	X822	DCU-II TEMP (PRIMARY) (INT,TS-9)	1/6	-30 - 165 DEG F
	X823	DCU-II TEMP (REDUNDANT)(INT,TS-10)	1/6	-30 - 165 DEG F
	X824	DIU NO. 1 5.0 V PWR MON	1/6	0 - 5.06 V
	X825	DIU NO. 2 5.0 V PWR MON	1/6	0 - 5.06 V
	X826	SPARE	1/6	
	X827	SPARE	1/6	
	X828	SPARE	1/6	
	X829	SPARE	1/6	

L-1	SV MEAS NO	DESCRIPTION	SPS	MEASUREMENT RANGE
	X830	SPARE	1/6	
	X831	SPARE	1/6	
	X832	SPARE	1/6	
X	X833	PAYLOAD - 5.0 VDC MON	1/6	-4.80 TO -5.50.V
X	X834	DATA STREAM CHECK B	1/6	0 - 5.06 V
X	X835	MWFE TEMPERATURE 1 (L/O)	1/6	-10 - 170 DEG F
X	X836	MWFE TEMPERATURE 2 (IF AMP)	1/6	-10 - 170 DEG F
X	X837	MWFE TEMPERATURE 3 (REDUN IF)	1/6	-20 - 170 DEG F
X	X838	MWFE TEMPERATURE 4 (TSG)	1/6	-20 - 170 DEG F
X	X839	MWFE HOT LOAD'S TEMPERATURE	1/6	-15 - 228 DEG F
X	X840	MWFE AMBIENT LOAD TEMPERATURE	1/6	-15 - 228 DEG F
X	X841	V.P. TEMPERATURE 1 (DC/DC A)	1/6	-20 - 170 DEG F
X	X842	V.P. TEMPERATURE 2 (DC/DC B)	1/6	-20 - 170 DEG F
X	X843	V.P. TEMPERATURE 3 (PULSE AMP)	1/6	-10 - 170 DEG F

L-I	SV MEAS NO	DESCRIPTION	SPS	MEASUREMENT RANGE
X	X844	V.F. TEMPERATURE 4 (FBR)	1/6	-20 - 170 DEG F
X	X845	F & F TEMPERATURE 1 (BASEPLATE A)	1/6	-20 - 170 DEG F
X	X846	F & F TEMPERATURE 2 (BASEPLATE B)	1/6	-20 - 170 DEG F
X	X847	FBR END CHANNEL A1	1/6	0 - 5.06 V
X	X848	FBR END CHANNEL B1	1/6	0 - 5.06 V
X	X849	FBR END CHANNEL A2	1/6	0 - 5.06 V
X	X850	FBR END CHANNEL B2	1/6	0 - 5.06 V
X	X851	PULSE WIDTH	1/6	0 - 5.06 V
X	X852	PULSE AMPLITUDE	1/6	0 - 5.06 V
X	X853	ACTIVE CHANNEL/WBT	1/6	0 - 5.06 V
X	X854	CMD CK/FRONT END CH SEL/DICKE MODE	1/6	0 - 5.06 V

L-I	SV MEAS NO	DESCRIPTION	SPS	MEASUREMENT RANGE
X	X855	V.P. TEMPERATURE 5 (BASEPLATE)	1/6	-20 - 170 DEG F
X	X856	DATA STREAM CHECK A	1/6	0 - 5.06 V
	X857	SPARE	1/6	
	X858	SPARE	1/6	
	X859	SPARE	1/6	
	X860	SPARE	1/6	
X	X861	PAYLOAD +15.0 VDC MON	1/6	+14.50 TO +15.50V
X	X862	PAYLOAD -15.0 VDC MON	1/6	-14.50 TO +15.50V
X	X863	PAYLOAD +10.0 VDC MON	1/6	+9.70 TO +10.40V
X	X864	PAYLOAD +5.0 VDC MON	1/6	+4.80 TO +5.20V

TEMPERATURE SENSORS

L-I	TS NO.	MEAS ID	LOCATION	TYPE	RANGE	REMARKS
X	1	X613	TAPE RCDR NO.1	LS41072-002	-30 TO 160 DEG F	EXT
X	2	X614	TAPE RCDR NO.2	LS41072-002	-30 TO 160 DEG F	EXT
X	3	X616	VIDEO PROCESSOR	LS41072-002	-30 TO 160 DEG F	EXT
X	4	X615	HIGH GAIN ANT MOTOR	LS41072-002	-30 TO 160 DEG F	EXT
	5	X609	DIU-1	LS41072-002	-30 TO 160 DEG F	EXT
	6	X610	KG46-1	LS41072-002	-30 TO 160 DEG F	EXT
	7	X611	LOW BAND ELECT BOX	LS41072-002	-30 TO 160 DEG F	EXT
	8	X612	LOW BAND ANTENNA	1S16310-33	-50 TO 200 DEG F	EXT
	9	X822	DCU-II (PRI)	LS41072-002	-30 TO 160 DEG F	INT
	10	X823	DCU-II (R/U)	LS41072-002	-30 TO 160 DEG F	INT

NOTE: ALL SENSORS EXCEPT X822 AND X823 ARE POWERED AND CONDITIONED BY THE HOST

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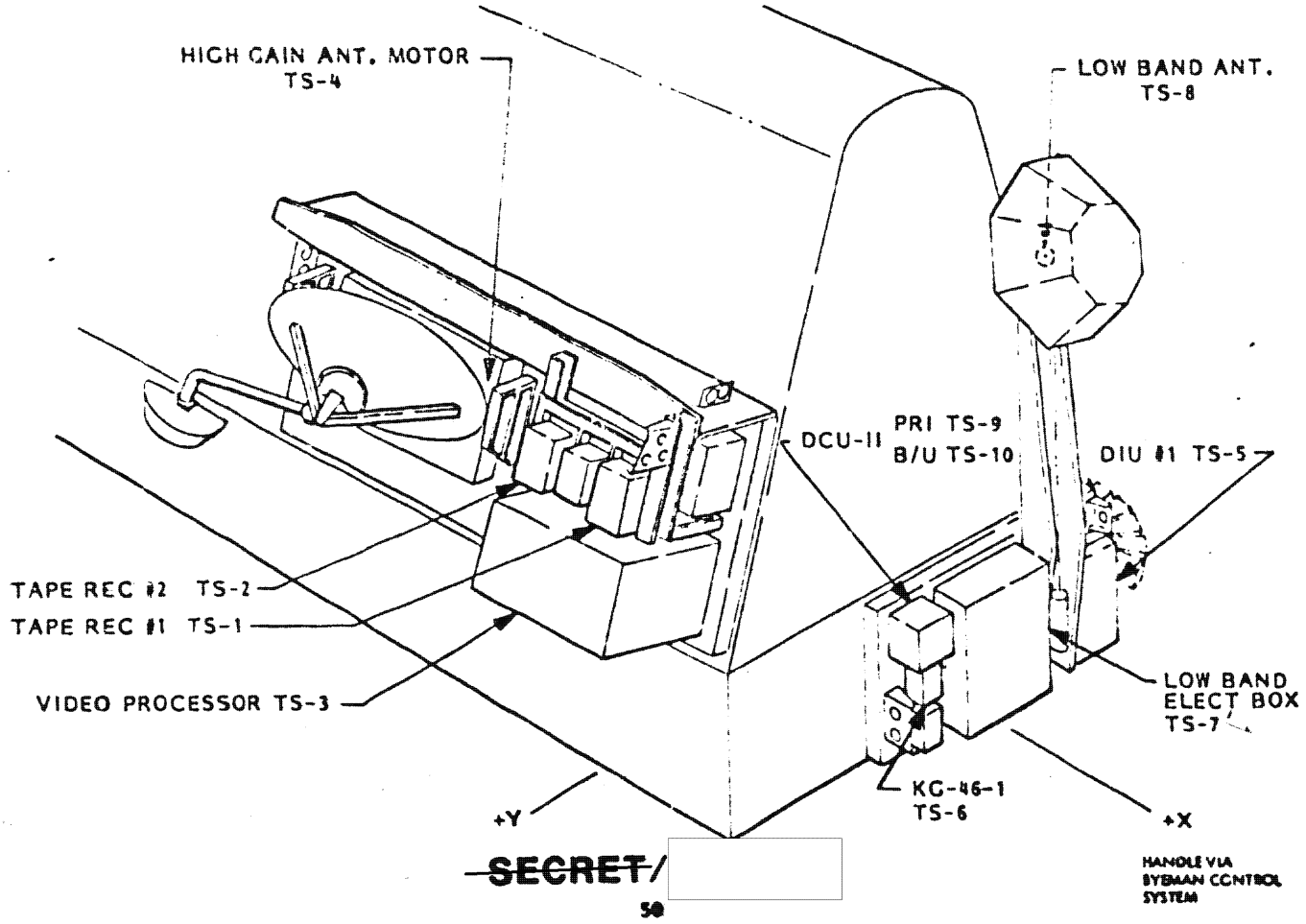
LORRI II

EQUIPMENT CONFIGURATION AND TEMPERATURE SENSOR LOCATION



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989
LORRI II

PSDA

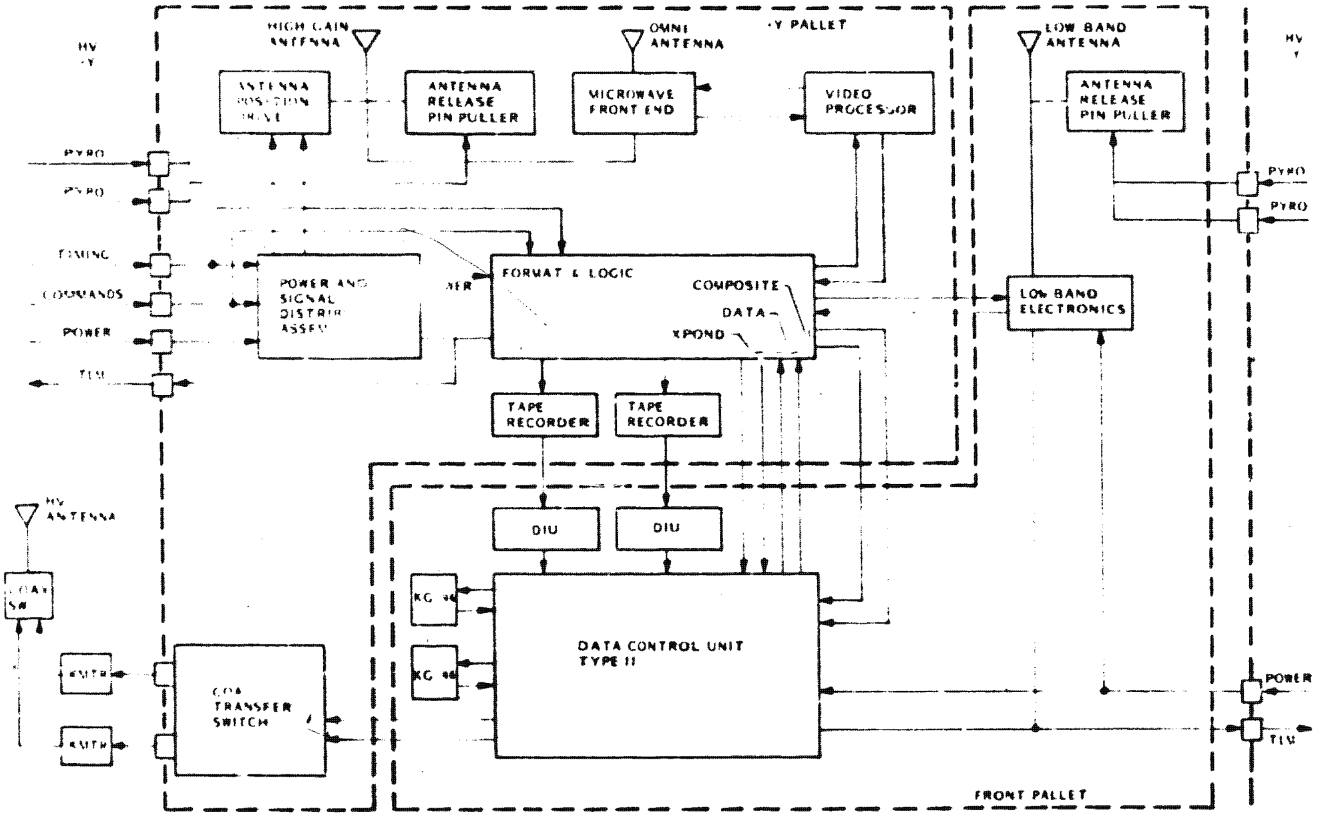
P&DA MODIFICATIONS FROM L-I

- REPLACED COMPONENTS THAT DID NOT MEET RELIABILITY DERATING CRITERIA: 2 CAPACITORS
  2 DIODES

- ADDED CAPABILITY FOR BACK-UP COMMANDS FROM P/L VSPC COMMANDS.

- ADDED CAPABILITY FOR REDUNDANT ANTENNA MOTOR OFF CONTROL RELAY.

PSDA LAYOUT



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25X1

HANDLE VIA BYEMAN CONTROL SYSTEM

989
LORRI II

GROUNDING

- BOTH PALLETS CONFORM TO THE HV SINGLE POINT GROUND SYSTEM

- DC ISOLATION OF 1 MEGOHM MINIMUM BETWEEN EACH OF THE FOLLOWING CIRCUITS

  - UNREGULATED POWER AND RETURNS (COMMON TO DISCRETE AND ANALOG 1 SPS TELEMETRY)
  - PYRO POWER I AND RETURN
  - PYRO POWER II AND RETURNS
  - COMMAND LINES AND RETURNS
  - TIMING SIGNALS AND RETURNS
  - SEQUENTIAL ANALOG (1/6 SPS) TELEMETRY AND RETURNS (COMMON TO STRUCTURE)

- ELECTRICAL PACKAGES BONDED TO THE PALLETS IN ACCORDANCE WITH ELECTRICAL BONDING SPECIFICATION 2P14917A.

  - NON-CONDUCTIVE FINISHES REMOVED AND BONDING SURFACES CLEANED IMMEDIATELY PRIOR TO BONDING.
  - MAGNESIUM ENCLOSURES USE A GROUNDING STRAP ATTACHED TO THE STUD ON THE ENCLOSURE (FORMAT, MWFE AND LOW BAND ELECTRONICS).

- PALLET STRUCTURES ARE CONNECTED TO THE HV STRUCTURE BY GROUNDING STRAPS ATTACHED TO THE STUDS ON THE PALLETS.

989
LORRI II

+Y PALLET
MODS

989 LORAN II

+Y PALLET MODIFICATION FROM L-I

- FORMAT AND LOGIC - ADDED CIRCUITRY
  - ADDED EXTERNAL CONNECTORS
  - INCREASED WEIGHT AND POWER
- MODIFIED MOUNTING TRAY - TO INCREASE ROOM FOR TAPE RECORDERS
- ADDED BRACKETRY - FOR ELECTRICAL INTERFACE TO FRONT PALLET
- ADDED THERMAL CONTROL REQUIREMENTS FOR NEW BRACKETRY
- MODIFIED PSDA (POWER AND SIGNAL DISTRIBUTION ASSEMBLY)
- MODIFIED TAPE RECORDERS
- MODIFIED DIU's (DIGITAL INTERFACE UNITS)
- MODIFIED ELECTRICAL HARNESS AND COAX CABLES TO ACCOMODATE ADDITION OF FRONT PALLET
- HIGH GAIN AND OMNI ANTENNA POLARIZER DIELECTRIC HAS CHANGED FROM 1 MIL TO 2 MIL.

WEIGHT SUMMARY

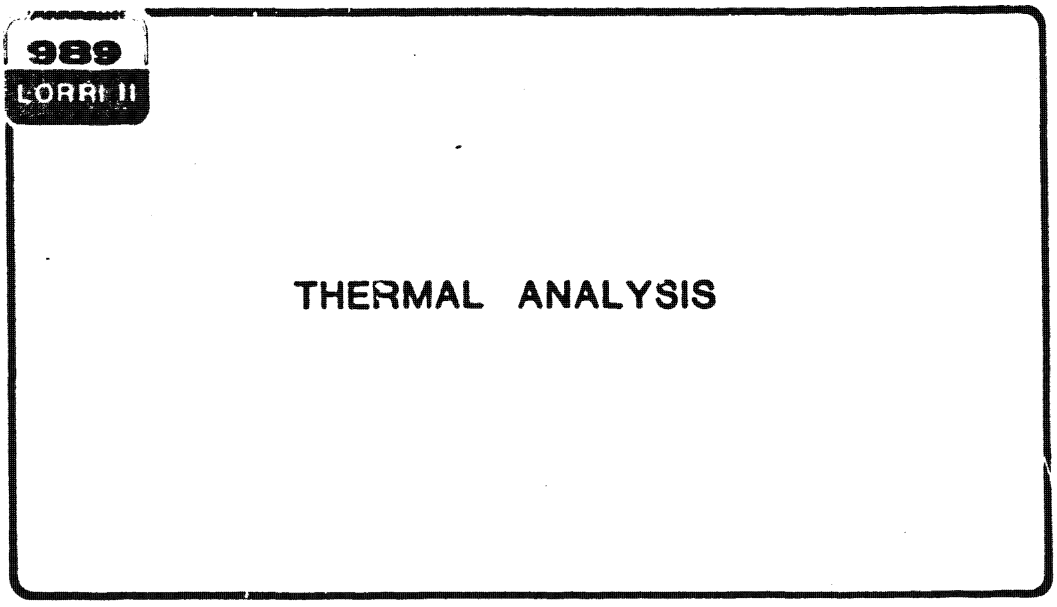
	WEIGHT (LBS)	
+Y PALLET	311.2	
CONTINGENCY - 1%	3.5	(9.3)
FRONT PALLET	139.3	
CONTINGENCY - 4%	6.0	(14.4)
+Y/FRONT HARNESS	8.0	
CONTINGENCY - 25%	2.0	(4.0)
FRONT/-Y HARNESS	4.0	
CONTINGENCY - 25 %		
	475	(492.2)

( ) = PREDICTED BASED ON CONTINGENCY ALLOCATION PLAN

989
LORRAINE

MASS PROPERTIES

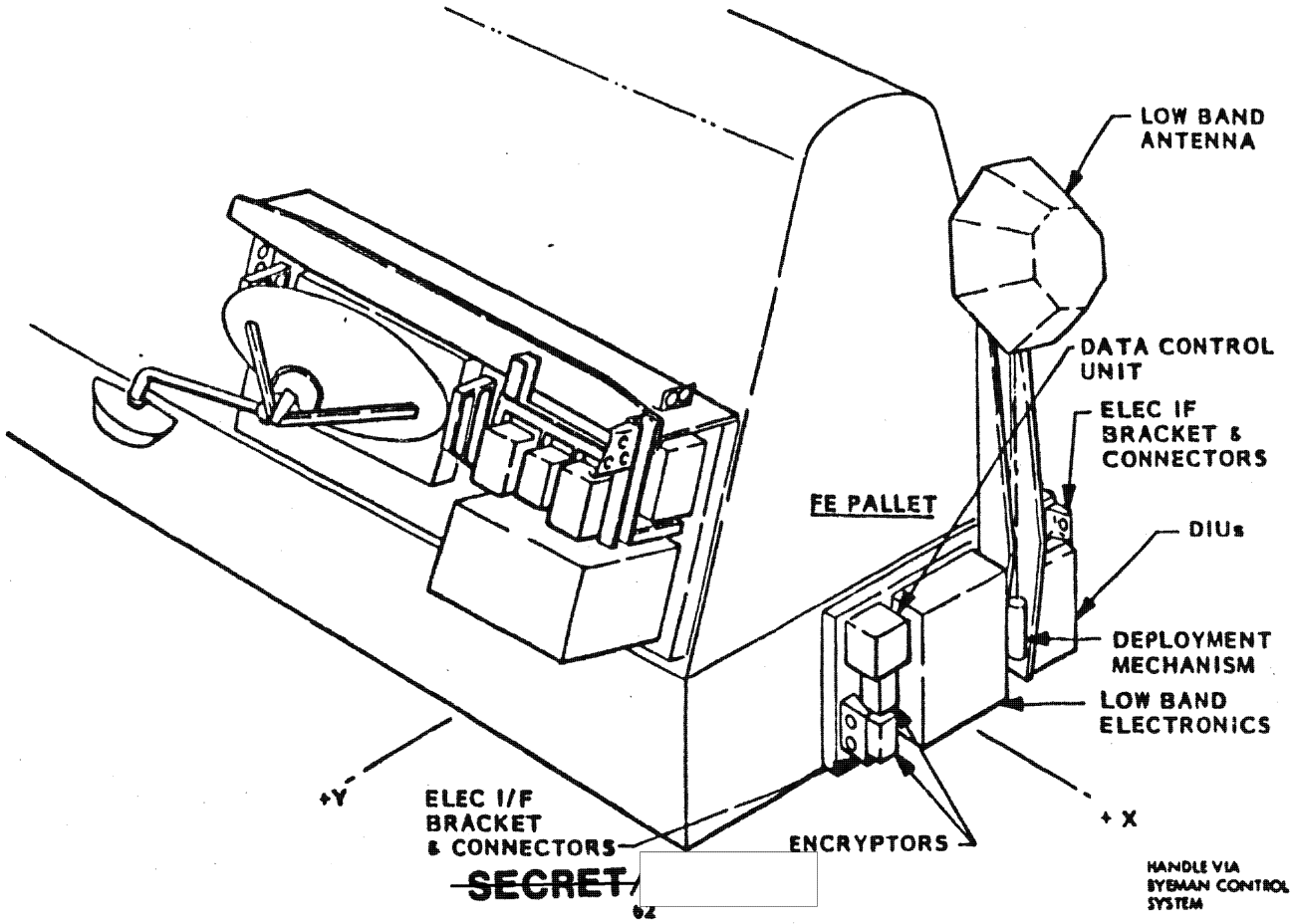
	WEIGHT (lb)	CENTER OF GRAVITY (in.)			MOMENT OF INERTIA (slug ft^2)			PRODUCT OF INERTIA (lb-in.^{2})		
	W	X	Y	Z	I_X	I_Y	I_Z	I_{XY}	I_{XZ}	I_{YZ}
SATPAC STOWED +Y PALLET	311.2 ±3.5	1667.1 ±2.0	35.8 ±2.0	-14.9 ±2.0	6.4 ±5%	27.8 ±5%	24.6 ±5%	-1.58 ±5%	-0.67 ±5%	0.90 ±5%
FWD PALLET	139.3 ±6.0	1634.2 ±2.0	-10.7 ±2.0	5.6 ±2.0	5.8 ±10%	3.3 ±10%	3.2 ±10%	0.01 ±10%	0.39 ±10%	0.95 ±10%
WIRE HARNESS +Y TO FWD	8.0 ±2.0	1650.0 ±2.0	20.0 ±2.0	-5.0 ±2.0						
WIRE HARNESS FWD TO -Y	4.0 ±1.0	1682.0 ±2.0	35.0 ±2.0	-5.0 ±2.0						
TOTAL	462.5 ±12.5									
SATPAC DEPLOYED +Y PALLET	311.2 ±3.5	1667.1 ±2.0	36.1 ±2.0	-13.5 ±2.0	8.8 ±5%	29.9 ±5%	24.8 ±5%	-1.22 ±5%	1.13 ±15%	1.14 ±5%
FWD PALLET	139.3 ±6.0	1631.7 ±2.0	-10.7 ±2.0	9.8 ±2.0	4.3 ±10%	4.7 ±10%	6.2 ±10%	1.03 ±10%	-1.74 ±10%	-0.80 ±10%
WIRE HARNESS +Y TO FWD	8.0 ±2.0	1650.0 ±2.0	20.0 ±2.0	-5.0 ±2.0						
WIRE HARNESS FWD TO -Y	4.0 ±1.0	1682.0 ±2.0	35.0 ±2.0	-5.0 ±2.0						
TOTAL	462.5 ±12.5									



THERMAL ANALYSIS

- REQUIREMENT
  - PROVIDE TEMPERATURE CONTROL FOR ALL LORRI-II COMPONENTS DURING ALL PHASES OF SYSTEM LIFE TIME (LAUNCH, ASCENT, ORBITAL OPERATION)

- CONSTRAINTS
  - COMPONENT TEMPERATURE LIMITS
  - BETA RANGE: -8 TO +30°
  - ALTITUDE: 91 TO 148 nm
  - TASKING: 250 RIMPD (READ-IN MINUTES PER DAY)
  - DESIGN LIFETIME: 9 MONTHS
  - HV HEAT EXCHANGE: 10 watts MAX EACH PALLET
  - UNIQUE SURFACE HEATING: PER ICD



FRONT PALLET – THERMAL ENVIRONMENTS

- ASCENT
  - SHROUD-ON — ICD TEMP CURVE MAX TEMP ~550°F, SHROUD INTERIOR ϵ = 0.15 MAX 291 sec EARLIEST SHROUD SEPARATION
  - SHROUD-OFF
    - SOLAR
    - ALBEDO
    - EARTHSHINE

    } HEAT RATE PROGRAM
    - AERODYNAMIC — ICD HEAT RATE CURVES, DURATION 291 TO 490 sec
- ORBITAL
  - SOLAR
  - ALBEDO
  - EARTHSHINE

  } HEAT RATE PROGRAM
  - FREE MOLECULAR — ICD HEAT RATE CURVES
  - UNIQUE HEAT PULSE — ICD: 0.8 sec HEAT PULSE, 1.1 BTU/ft^2-sec PEAK HEAT RATE, 0.7 BTU/ft^2 MAX TOTAL HEAT

FRONT PALLET, THERMAL ANALYSIS

- MULTI-NODE THERMAL MATH MODEL DEVELOPED
- INCIDENT HEAT RATES DETERMINED FOR BETA OF -8° and +30°
- INTERNAL HEAT GENERATION BASED ON TASKING MODEL
- ANALYSIS PERFORMED TO:
  - ESTABLISH THERMAL CONTROL DESIGN
  - PREDICT TEMPERATURES

FE PALLET **BOXES**

TEMPERATURES, °F

	LB ELEC		DCU-II		KG 46-1		KG 46-2		DIU-1		DIU-2	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
MINIMUM TEMPERATURE β = +30° NO TASKING	36	38	36	37	34	37	37	37	36	38	40	42
MAXIMUM TEMPERATURE β = -8°	73	80	84	88	73	78	79	81	75	79	78	71
ATP TEMPERATURES	-10	120	-30	160	-30	160	-30	160	-30	165	-30	165
MAXIMUM TEMPERATURE β = -8° 20-MIN TASKING*	73	81	87	92	74	78	80	82	77	82	80	83

*STARTING FROM ORBIT AVERAGE TEMPERATURE DISTRIBUTION

FE PALLET

LOW BAND ANTENNA

NORMAL OPERATING TEMPERATURE RANGE, °F

BETA ANGLE	HYBRIDS	TOP ASSEMBLY	BASE ASSEMBLY	ELEMENT SUPPORT	DEPLOYMENT MECHANISM
-8°	-62 TO +191	-2 TO +185	-65 TO +228	-68 TO +193	120 TO 123
+30°	-71 TO +156	-18 TO +108	-81 TO +83	-83 TO +83	30 TO 93
ATP TEMPERATURE	-73 TO +200				-40 TO +150

ASCENT TEMPERATURE, °F

-8°	228	331	256	384	73

LOW BAND ANTENNA
TEMPERATURE DISTRIBUTION, °F

FE PALLET

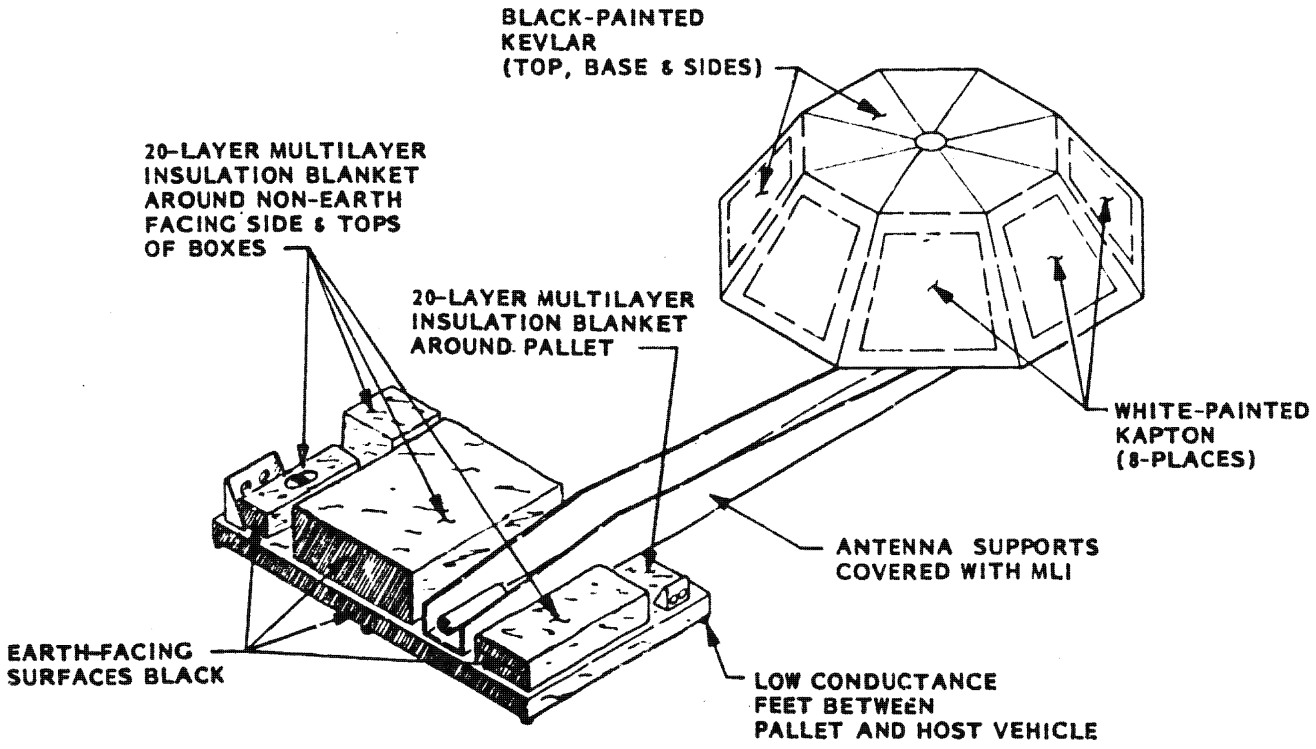
-8° BETA

	UPPER HALF ELEMENT SUPPORT		LOWER HALF ELEMENT SUPPORT		TOP HC ASSEMBLY		BASE HC ASSEMBLY		Al TUBE	Mg PLATE
	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH		
AVG	30	112	21	105	77	100	70	86	95	71
MIN	-57	-34	-68	-48	-2	6	-72	-59	50	-62
MAX	94	193	97	190	149	193	182	228	105	191

+30° BETA

AVG	-18	49	-20	44	46	49	47	59	62	49
MIN	-68	36	-83	38	1	53	-81	-70	28	-71
MAX	28	83	48	80	92	108	150	188	72	156

FRONT PALLET THERMAL CONTROL DESIGN



25X1

989
LORRI II

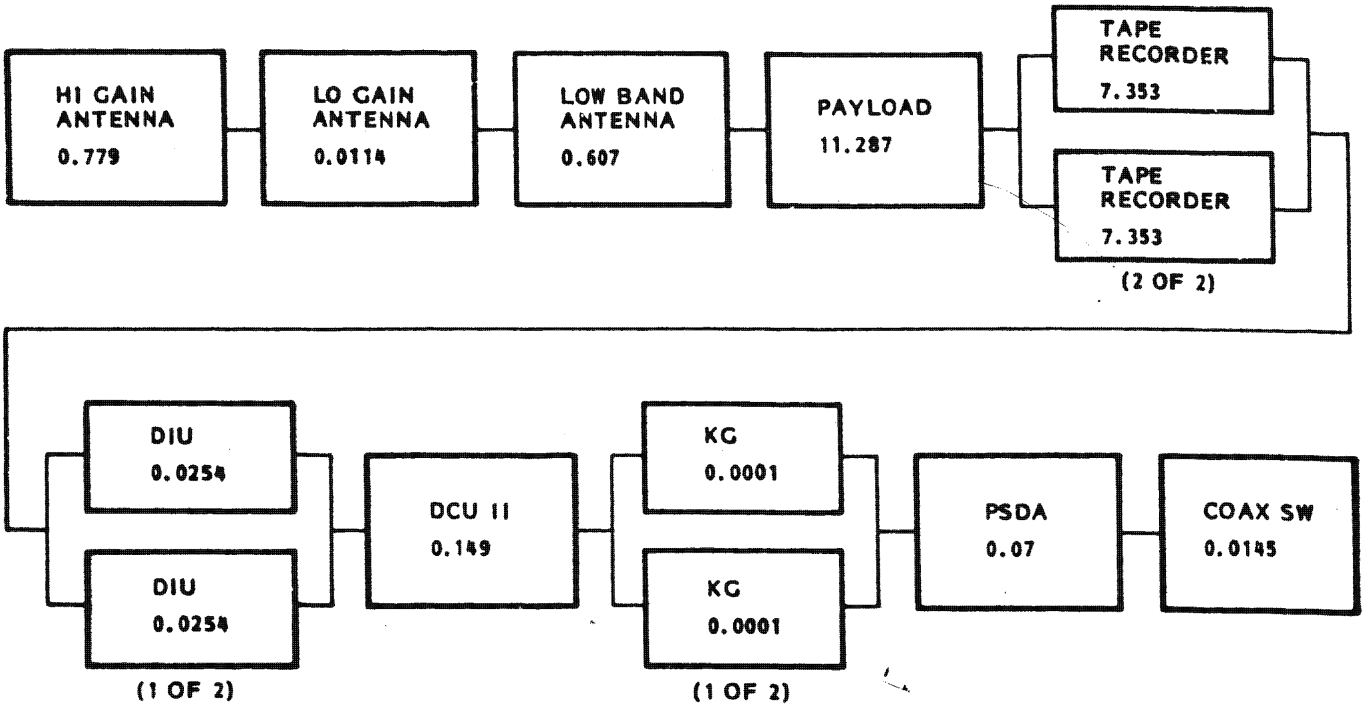
RELIABILITY

25X1

- LORRI II REQUIREMENTS
  - 9 MONTHS AT 250 RIMPD DUTY CYCLE
- SYSTEM ANALYSIS RESULTS
  - PROBABILITY OF SUCCESS: 0.87 AT 9 MONTHS
  - MMD = 19.6 MO (WITH TAPE RECORDER WEAROUT TRUNCATION)
- ANTENNA DEPLOYMENT (ONE SHOT) PROBABILITY OF SUCCESS
  - HIGH GAIN = 0.9999
  - LOW BAND = 0.9998

25X1

RELIABILITY MODEL



NOTE:

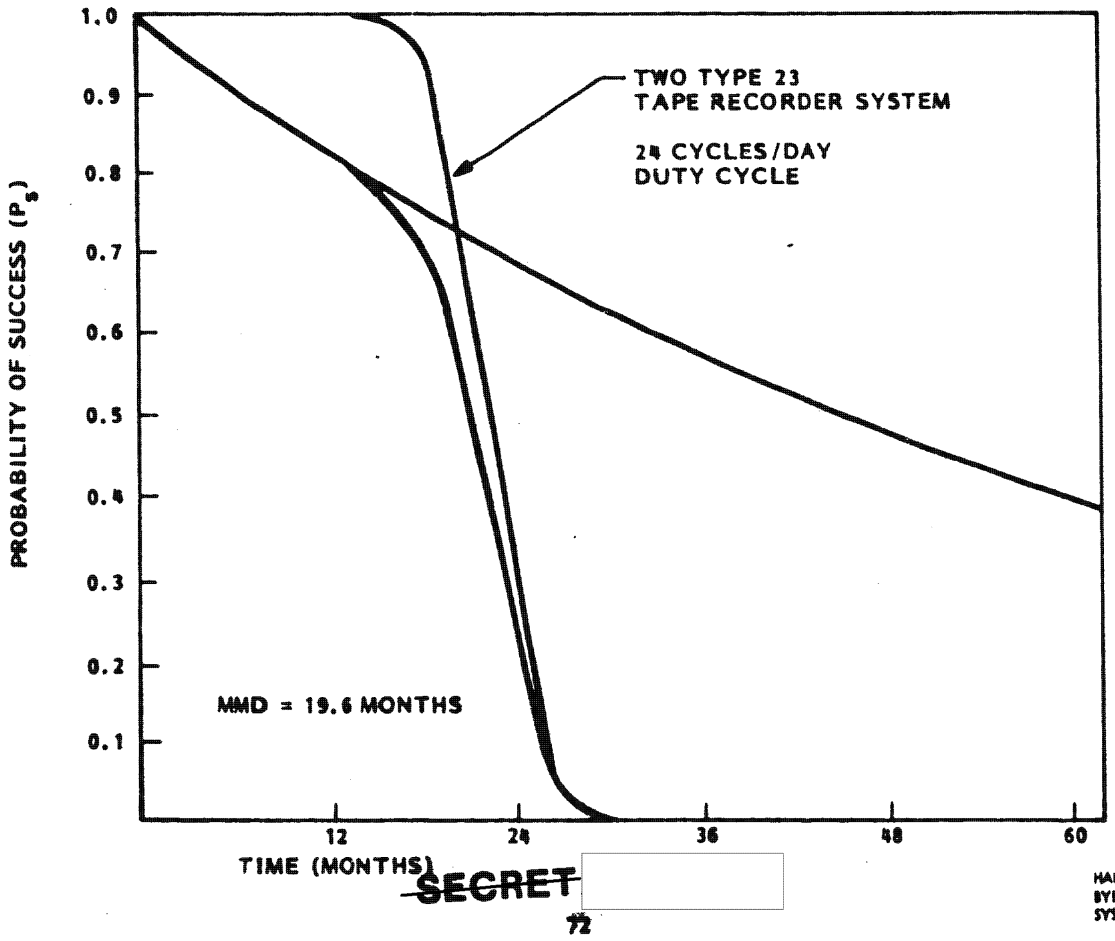
EFFECTIVE FAILURE RATE (λe) INDICATED WITHIN ELEMENT BLOCKS ARE 10^{-6}.

25X1

HANDLE VIA BYEMAN CONTROL SYSTEM

25X1

PROBABILITY OF SUCCESS/MMD (20% DUTY CYCLE)



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ANTENNAS

VHF ANTENNA

- 27 "DIAMETER BASE X 14" HEIGHT; 10 1/2 DIAMETER AT TOP
- MOUNTED ON FRONT END +X PALLET
- RIGHT HAND AND LEFT HAND CIRCULAR POLARIZATION
- RF BEAMS PEAK 30° FORWARD OF NADIR
- 130 MHz to 180 MHz
- GAIN 77° OFF BORESIGHT NOMINALLY -10 dB
- GAIN ON BORESIGHT

989
FLORRI D

EHF OMNI

- 18"X3" HALF BICONIC
- MOUNTED ON +Y PALLET
- RIGHT HAND CIRCULAR POLARIZATION
- SERVICE AREA 7°X160°
- RF BEAM FIELD
- 26 GHz TO 42 GHz
- GAIN: 6.1 dB TO 7.4 dB (SPEC)

EHF HIGH GAIN ANTENNA

- 38.5 X 9.8 REFLECTOR
- MOUNTED ON +Y PALLET
- RIGHT HAND CIRCULAR POLARIZATION
- SERVICE AREA 0.6° X 3.0°
- 3° BEAM CAN BE POSITIONED
- 26 GHz TO 42 GHz
- GAIN 34.9 dB TO 37.3 (MEASURED)

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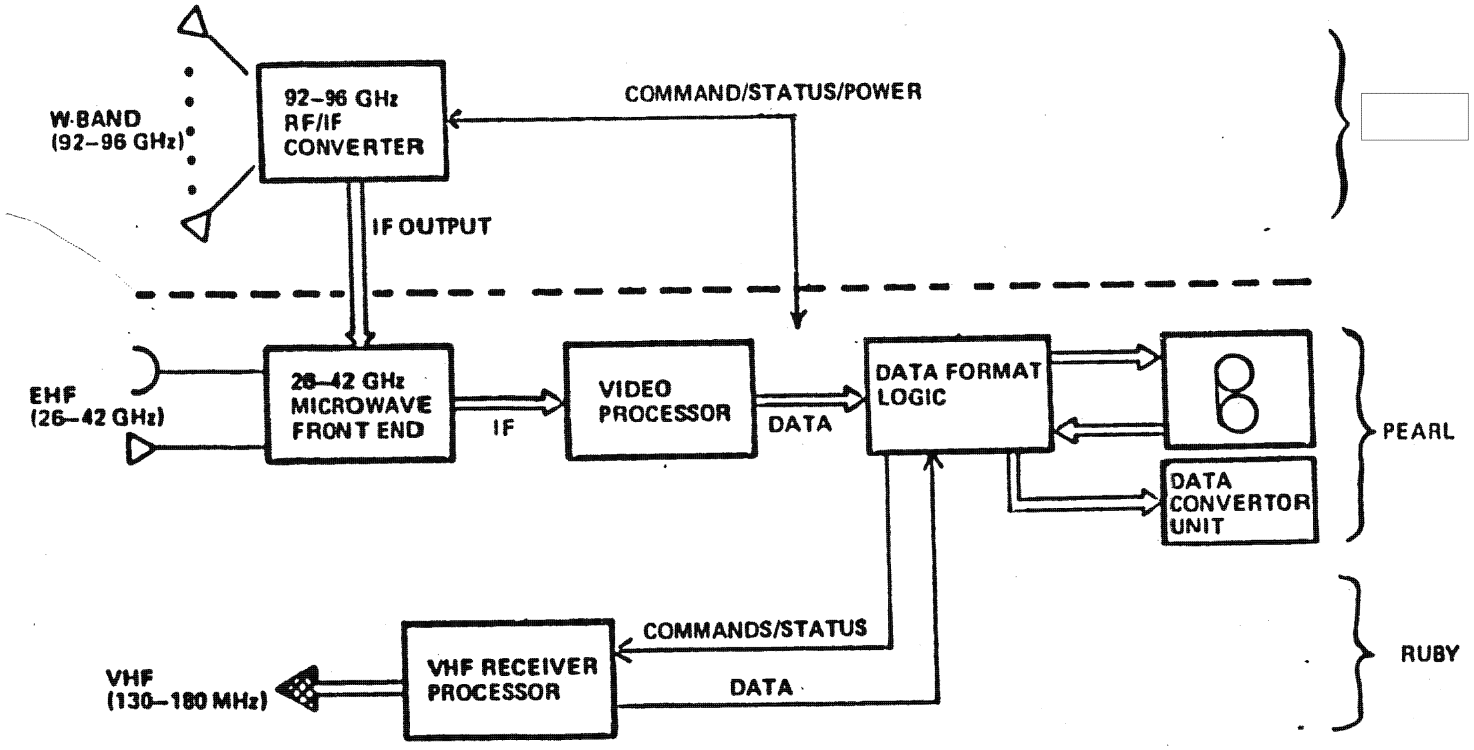
LORRI II

PAYLOAD PERFORMANCE



SYSTEM CHARACTERISTICS

	EHF	VHF
FREQUENCY RANGE	26–42 GHz	130–180 MHz
INSTANTANEOUS BANDWIDTH	4 GHz	5 MHz
RECEIVER TYPE	FILTERBANK RADIOMETER AND PULSE RECEIVER	DUAL CHANNEL PULSE POLARMETER
MEASUREMENTS	PULSE FREQUENCY AMPLITUDE PULSEWIDTH TOA CW FREQUENCY AMPLITUDE TOA	PULSE FREQUENCY AMPLITUDE PULSEWIDTH PHASE DIFFERENCE TOA
SPECIAL CHARACTERISTICS	HIGH CW SENSITIVITY; 20 NANO-SECOND PULSE CAPABILITY	INTRA PULSE SAMPLING
DATA OUTPUT	128 Kbps SERIAL	INTERLEAVED INTO EHF DATA

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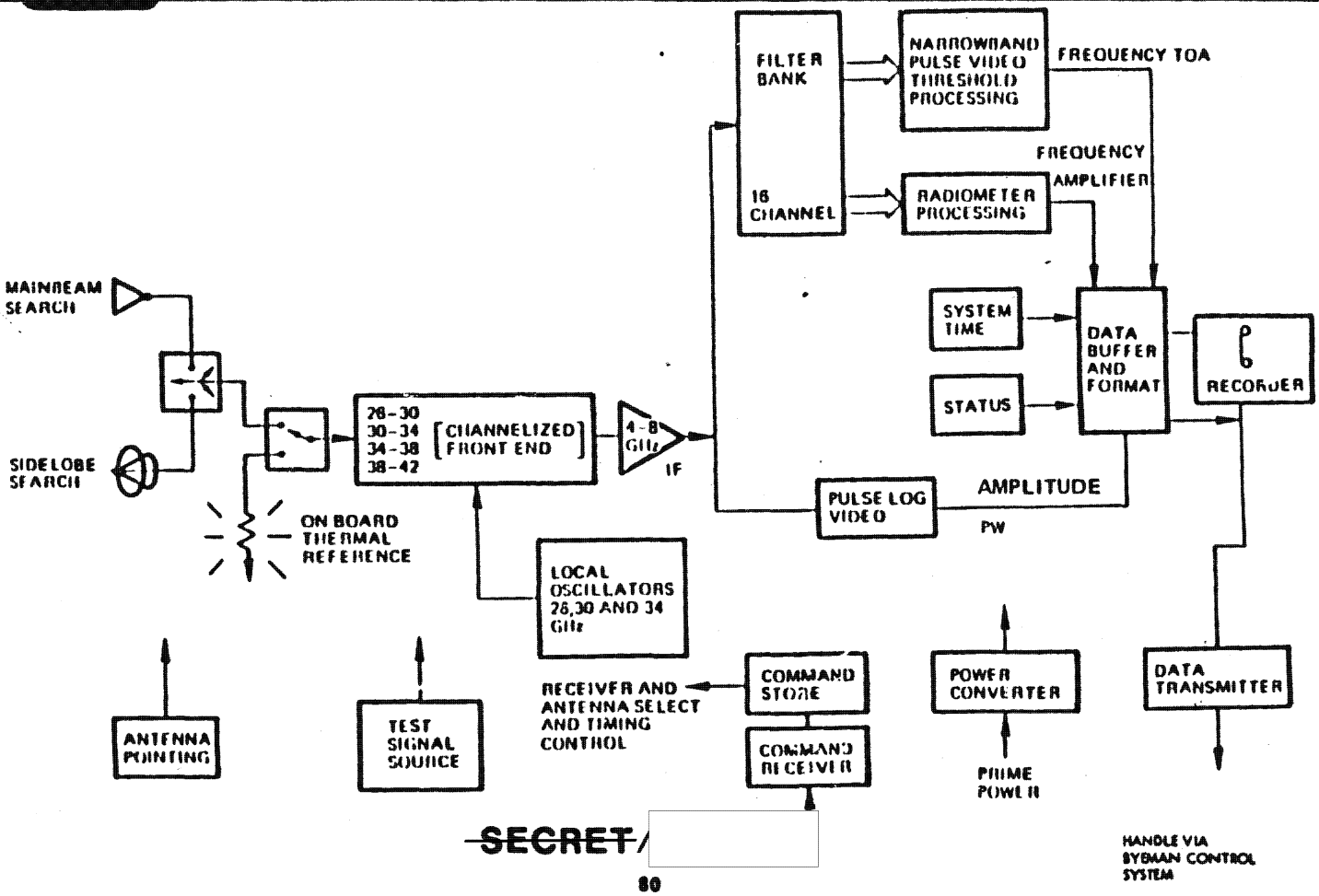
EHF BLOCK DIAGRAM



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EHF PARAMETER MEASUREMENTS

		RANGE	RESOLUTION	ACCURACY
PULSE SIGNALS	FREQUENCY	26 - 42 GHz	250 MHz	±150 MHz
	AMPLITUDE	25 dB	1 dB	±5 dB
	PULSEWIDTH	21.4 - 386 ns 0.36 - 9.63 µs	21.4 ns 0.214 µs	±4[illegible].8 ns ±0.1µs ±10%
	TOA	Signal Duration	1 µs	±1µs PLUS ±1µs/SEC
	TIME OF MEASUREMENT	HV Time	200 ms	±25 ms
CW SIGNAL	FREQUENCY (FILTER BANK)	26 - 42 GHz	250 MHz	±150 MHz
	AMPLITUDE	30 dB	1 dB	±5 dB
	TIME OF MEASUREMENT (FILTER BANK)	HV Time	200 ms	25 ms

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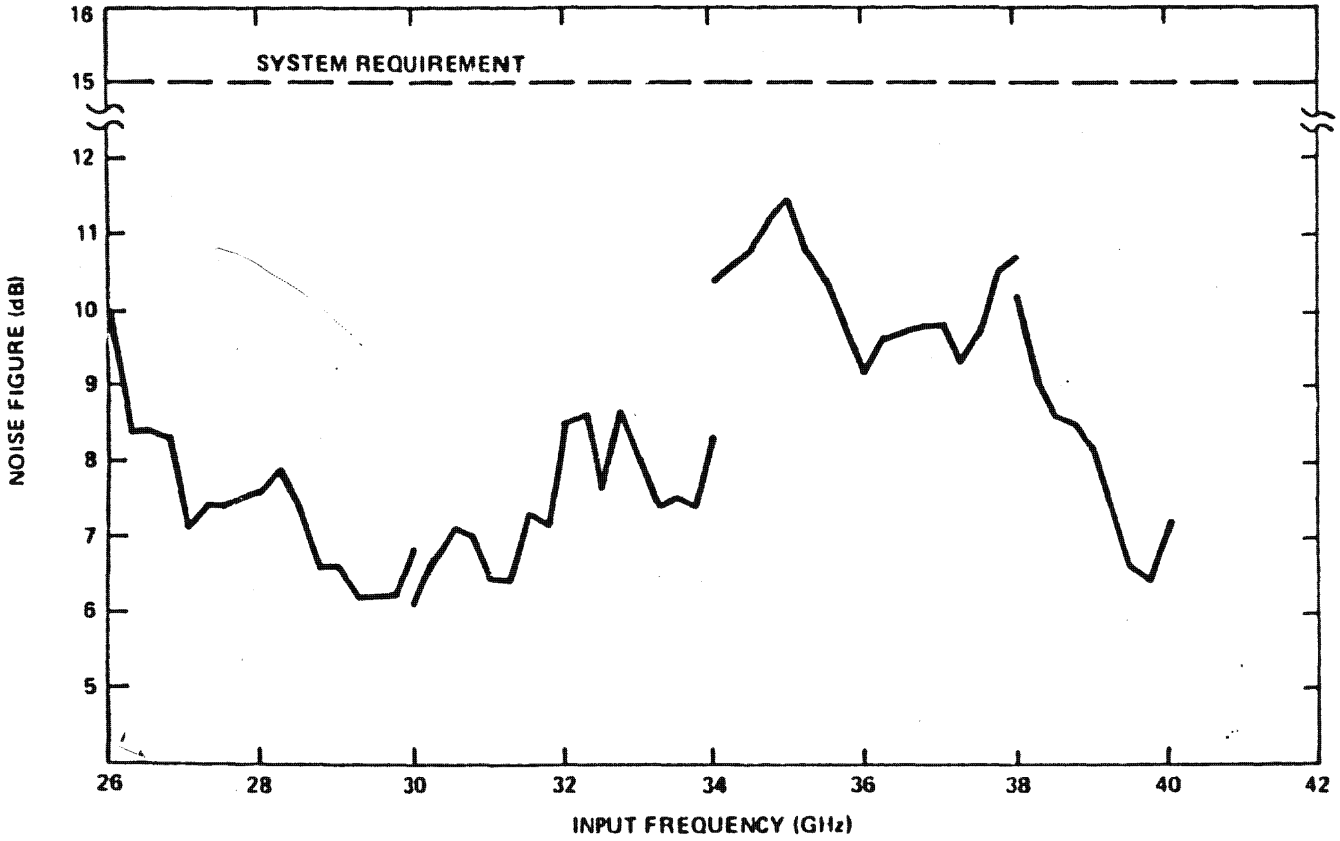
EHF RF-IF CONVERTER SUBASSEMBLY NOISE FIGURE
ROOM TEMPERATURE



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EHF RECEIVER SYSTEM SENSITIVITY

FILTER BANK	SENSITIVITY @ 50% Pd/FAR-1/second
PULSE THRESHOLD (PW = 50 NSEC)	- 69 dBm
RADIOMETER (100 MSEC INTEGRATION TIME) @ 17 dB SNR	- 100 dBm

LOG VIDEO RECEIVER	
PULSE AMPLITUDE THRESHOLD (PW = 50 NSEC)	- 64 dBm
PULSE WIDTH THRESHOLD (PW = 50 NSEC)	- 60 dBm

SYSTEM SENSITIVITY IS PREDICATED ON A SYSTEM NOISE FIGURE OF 15 dB AT THE RF-IF CONVERTER ASSEMBLY.

SENSITIVITY IMPROVEMENT WITH PW

PW (nsec)	25	50	100	1000	8000
ΔdB	-1	0	+1	+3	+4

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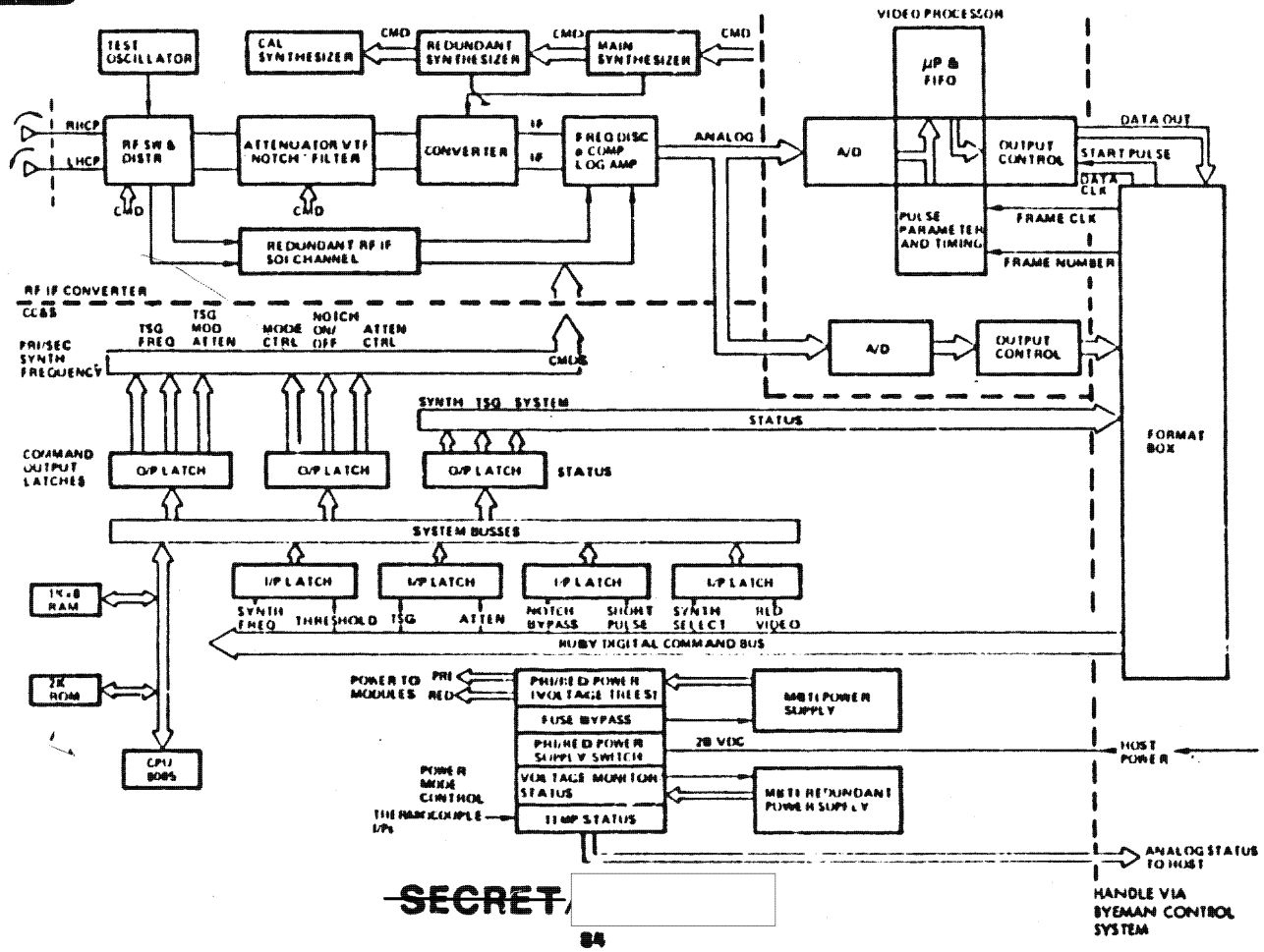
VHF FUNCTIONAL BLOCK



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VHF SIGNAL MEASUREMENTS

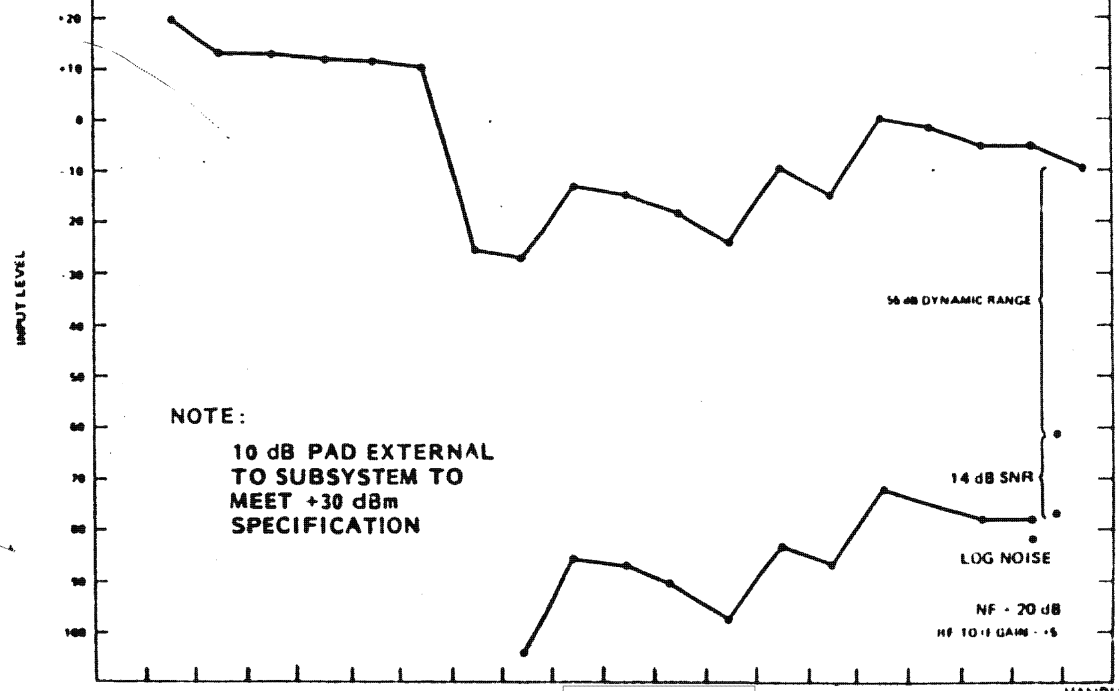
PARAMETER	RANGE	RESOLUTION	ACCURACY* (95%)
FREQUENCY	130 - 180 MHz	100 KHz MAX	±200 KHz
AMPLITUDE (RHCP AND LHCP)	53 dB**	0.5 dB MAX	±1.4 dB
POLARIZATION PHASE	360°	7.5° MAX	±15°
PULSEWIDTH	50 - 2500 us 5 - 2500 us	1 us 1 us	±1% OR 1 us ±1% OR 1 us
TIME OF ARRIVAL	200 ms	1 us	±1us

*ASSUMES CALIBRATION
**60-dB DIGITALIZATION RANGE WITH COMMANDABLE THRESHOLDS

VHF - MAIN CHANNEL PARAMETERS

NF, dB								4.14		3				3		3				
GAIN dB	0	83	-8	87	-0.5	85	-0.5	28.34	2	+15	2	4	8	+15	5	+15	18	37		4
I_3 dBm				+41	+41		+41	+29	+25	+17	+25		+21	+17		+24				
$C_{1\,dB}$ dBm	+25*				+25*			+22.6	-8	+5		0.5	+7	+5		+12				
LEVEL	+20	+19.7	+11.7	+11	+10.5	+10	+9.5	25.5	27.5	12.5	14.5	18.5	24.5	9.5	14.5	+0.5	1.3	5	5	5 to 9
	IN	20 dB CPLR	FIXED ATT	SP 31SW	SP 21SW	NOTCH FILT	SP 21SW	PROG ATT	WTF	AMP	VTF	FIXED ATT	MIXER	AMP	FIXED ATT	AMP	BPF	QUAD HYB	LOG	TEMP ADS

LOG OUT



*(0.1 dB)

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VHF PROTOTYPE
AMPLITUDE MATCH MAIN CHANNEL (CENTRAL 5 MHz)

ASSEMBLY	ERROR BUDGET (dB) @ 95%
• INPUT MODULE	±0.2
• NOTCH FILTER	±0.1
• PROGRAM ATTENUATOR	±0.2
• VTF	±0.2
• CONVERTER	±0.2
• IF FILTER	±0.3
• LOG AMPLIFIER	±1
RSS ERROR	1.12 dB
PAYLOAD SPECIFICATION	1.4 dB

NOTE: UNCALIBRATED

25X1

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LORRI II

VHF PROTOTYPE
PHASE MATCH MAIN CHANNEL (CENTRAL 5 MHz)

ASSEMBLY	ERROR BUDGET (°) @ 95%
• INPUT MODULE	±1
• NOTCH FILTER	±1
• PROGRAM ATTENUATOR	±1
• VTF	±2
• CONVERTER	±2
• IF FILTER	±3
• LIMITER	±8
• PHASE DETECTOR	±10
RSS VALUE	13.6°
PAYLOAD SPECIFICATION	15°

NOTE: UNCALIBRATED

25X1

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MAXIMUM LIMITER PHASE ERROR OVER 70 dB DYNAMIC RANGE VS FREQUENCY

	FREQUENCY - MHz						
	57	58	59	60	61	62	63
+22°C							
LIM A	3.0°	2.4°	2.1°	2.1°	2.6°	2.8°	3.3°
LIM B	4.9°	4.1°	3.5°	2.7°	2.6°	3.2°	1.8°
-10°C							
LIM A	2.7°	3.8°	4.4°	4.9°	5.6°	6.4°	7.1°
LIM B	1.9°	1.8°	2.1°	2.5°	3.2°	3.9°	4.5°
+62°C							
LIM A	3.7°	3.3°	2.9°	2.2°	2.0°	2.2°	2.4°
LIM B	6.7°	6.0°	5.5°	5.0°	4.5°	4.0°	3.6°

PROJECTED ERROR BUDGET, ±8°

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SYSTEM PERFORMANCE ANALYSIS

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EHF SYSTEM ANALYSIS

	GSS 95%			MEASURED OR CALCULATED PERFORMANCE (95%)		
	26 GHz	34 GHz	42 GHz	26.5 GHz	34 GHz	40 GHz
Hi Gain Antenna (Ga)[2]	28.3 dBi	30.4 dBi	32.4 dBi	30.6 dBi	32.5 dBi	33.0 dBi
OMNI Antenna (Ga)[3]	4.7 dBi	5.5 dBi	6.2 dBi	9.0 dBi	9.7 dBi	10.3 dBi
Recv Sensitivity (Pulse)		-69 dBm		-74 dBm	-72 dBm	-75 dBm
Recv Sensitivity (CW)		-100 dBm		-105 dBm	-103 dBm	-106 dBm
System Sensitivity (dBm)[1]						
Pulse, Hi Gain	- 97.3	- 99.4	-101.4	-104.6	-104.5	-108.0
Pulse, OMNI	- 73.7	- 74.5	- 75.2	- 83.0	- 81.7	- 85.3
CW, High Gain	-128.3	-130.4	-132.4	-135.6	-135.5	-139.0
CW, OMNI	-104.7	-105.5	-106.2	-114.0	-112.7	-116.3
Dynamic Range		30 dB			> 35 dB	
Frequency Measurement		±150 MHz			±150 MHz	
Pulsewidth (PW < 390 nsec)		±43 nsec			±41.8 nsec	
PRI	10-1000 nsec for PRIs of 300-20000 PPS			TOA	±1 usec	
Amplitude		±5 dB			±5 dB	

NOTES: (1) System sensitivity based on Pd = 0.5 and FAR = 1/second.

(2) Matched gain over service area minus 4.3 dB VSWR and polarization loss.

(3) Peak matched gain minus 4.3 dB VSWR and polarization loss.

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HANDLE VIA BYEMAN CONTROL SYSTEM

	GSS (95%)	MEASURED OR CALCULATED PERFORMANCE (95%)
Frequency Range	130-180 MHz	130-180 MHz
Antenna Net Gain[2]	- 6 dBi	-4.7 dBi
Receiver Sensitivity	-53 dBm	-61 dBm @ SNR = 14 dB
System Sensitivity[1]	-47 dBm	-56.3 dBm
Dynamic Range	53 dB Instantaneous	55 dB above SNR = 14 dB
	+30 dB Commandable	+30 dB Commandable
Frequency Measurement	±0.2 MHz	±0.2 MHz
Pulse Width	±1% or 1 usec	±1 usec or 1%
PRI	±1.5 usec > 100 usec	TOA ±1 usec
ERP[3]	±2 dB 152-165 MHz	±1.52 dB
	±3 dB 130-148/165-180	-
TILT ANGLE[3]	±10°	±9.8°

NOTES: (1) System sensitivity is based on a 50% Pd and a FAR of 1/second
(2) Matched gain less 3 dB polarization loss.
(3) Post calibration

VHF CALIBRATION CRITERIA

Antenna	95% Gain Measurement Error	1.4 dB	
	95% Tilt Angle Error*		6.7°
Payload	95% Gain Measurement Error	1.0 dB	
	95% Tilt Angle Error*		7.2°
95% Confidence Level Error		1.7 dB	9.8°
ERP @ 95%	Linear Polarization	1.40 dB	
	Elliptic Polarization	1.52 dB	
	Circular Polarization	1.52 dB	

* Tilt Angle = $\frac{\Delta\Theta}{2}$

25X1

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TEST

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AGE REQUIREMENTS

- SIMULATE HOST VEHICLE
  - PROVIDE TO PALLET
    - POWER
    - COMMANDS
    - TIMING
- RECEIVE FROM PALLET
  - ANALOG
  - DISCRETE TELEMETRY
  - PCM
- PROVIDE SPECIAL TEST EQUIPMENT

MAJOR COMPONENTS

- LANDLINE SUPPORT CONSOLE
  - COMMANDS AND TELEMETRY SUBSYSTEM
  - POWER SUBSYSTEM
  - SPECIAL FUNCTIONS SUBSYSTEM
- BASEBAND SEPARATION CONSOLE
  - SEPARATE COMPOSITE SIGNAL
  - DEMODULATE 1.7 MHz SUBCARRIER
  - DECYPHER
- MAGNETIC TAPE RECORDER
- ANALOG RECORDER
- PAYLOAD PROVIDED AGE
  - PAYLOAD CONSOLE
  - SIGNAL INSERTION CONSOLE
  - BACKGROUND BRIGHTNESS CONSOLE

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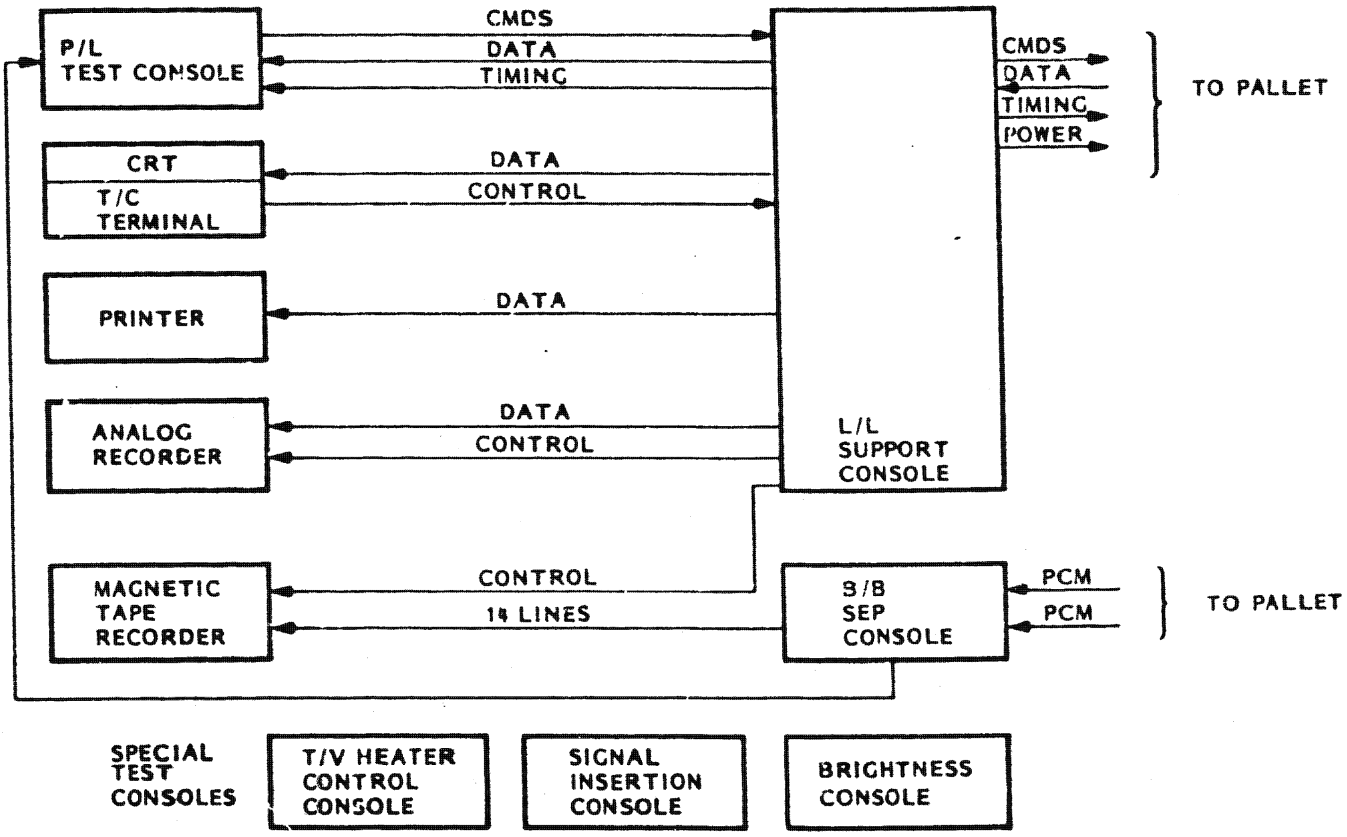
PALLET II TEST SET



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HANDLE VIA BYEMAN CONTROL SYSTEM

- COMMAND AND TELEMETRY SUBSYSTEM
  - DEC 11/23 COMPUTER
  - ANALOGIC ANDS 5400 DATA SYSTEM
  - AMP PATCH PANEL
- POWER SUBSYSTEM
  - HP POWER SUPPLY (6269)
  - AGE POWER
- SPECIAL FUNCTIONS SUBSYSTEM
  - MONITOR SELECT PANEL
  - MANUAL FUNCTIONS PANEL
  - DATUM SYSTEM TIME GENERATOR
  - INTERCOM SYSTEM

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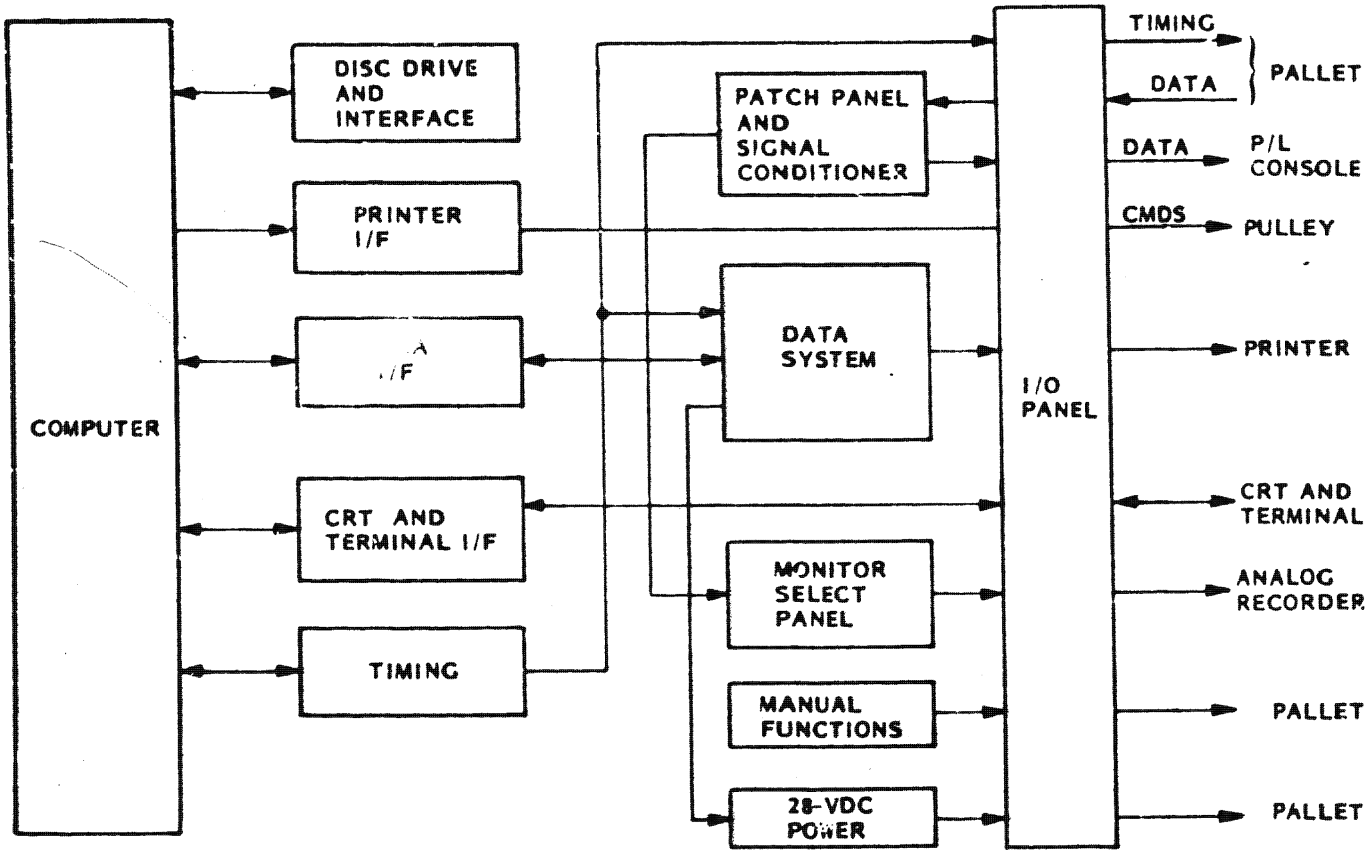
L/L SUPPORT CONSOLE

SHEET 1 OF 2



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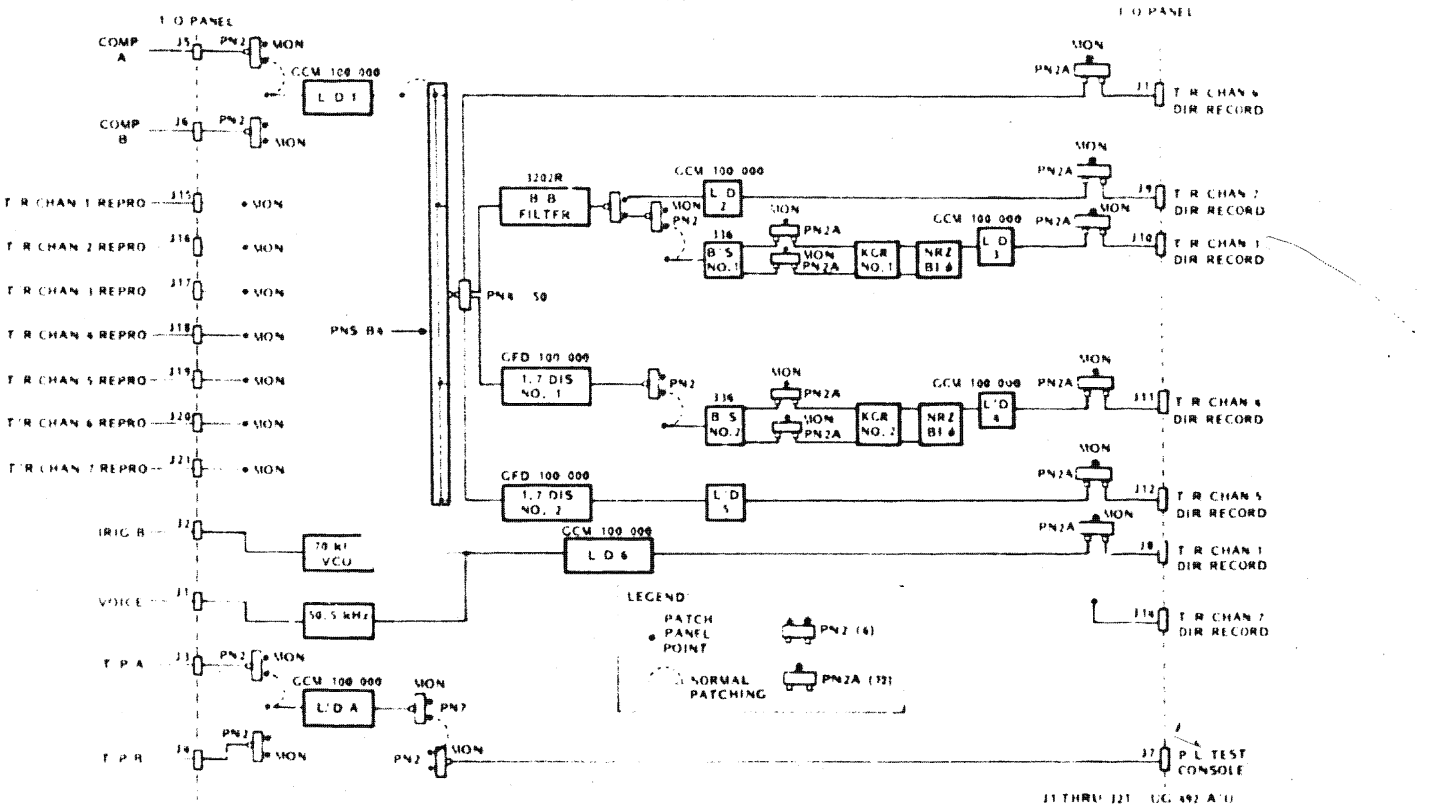
LORRI II

2P25510 B/B SEPARATION CONSOLE

I/O PANEL



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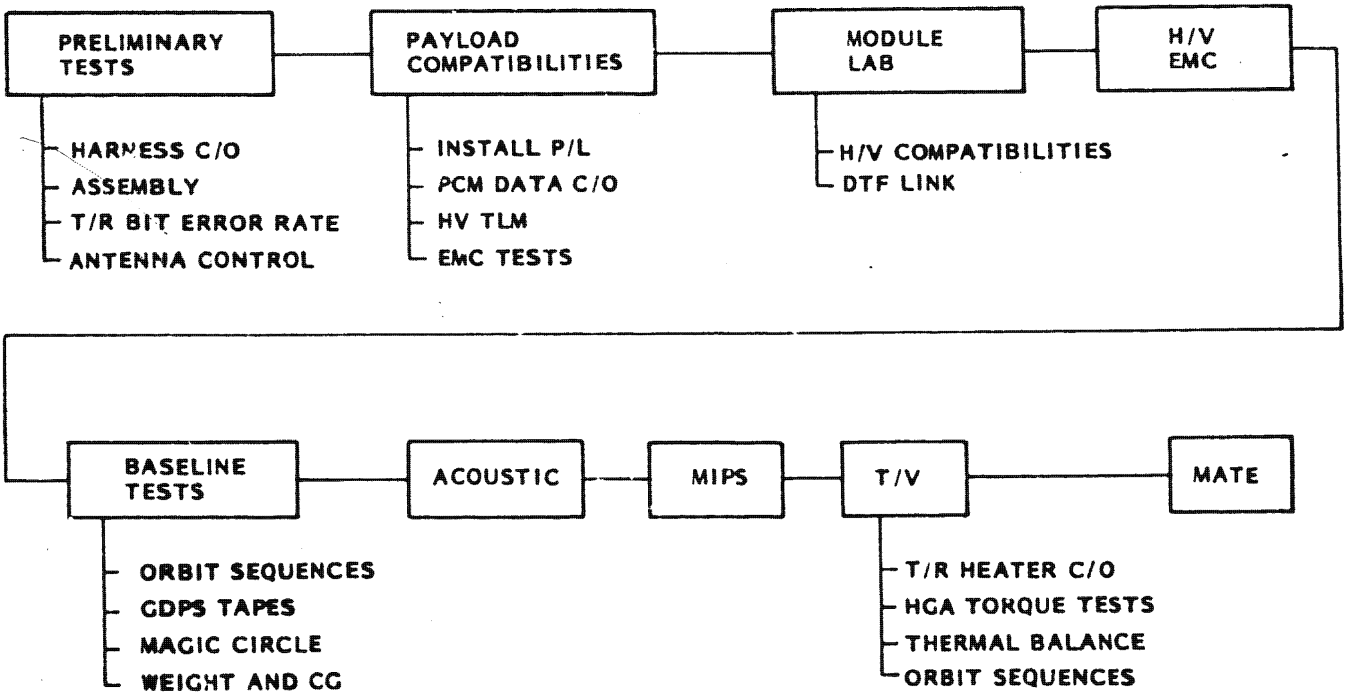
TEST FLOW



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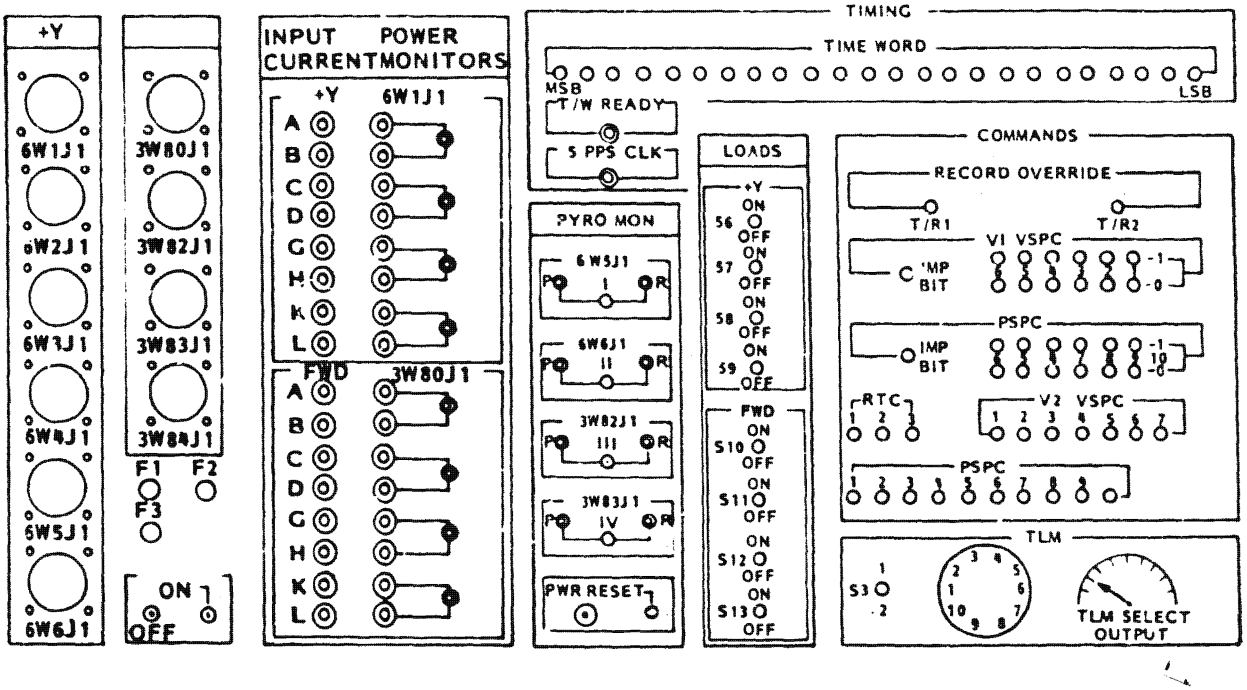

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HANDLE VIA BYEMAN CONTROL SYSTEM

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GROUND SEGMENT SUPPPORT

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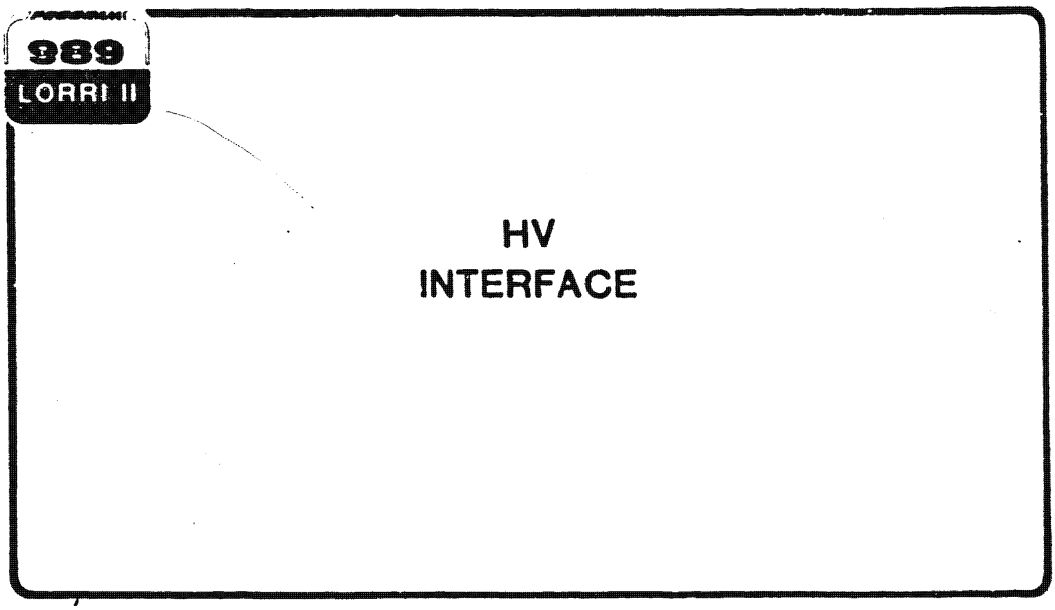

L-II TO HV COMMAND REQUIREMENTS

- L-I PLUS
- PROVISIONS FOR 3 PAYLOADS
- PROVISIONS FOR NOTCH FILTER
- SHIPPED TO STC ELECTRONICALLY
  - CARD BACKUP
- COMPOUND TIME FIELD CAPABILITY
  - VEHICLE TIME
  - SYSTEM TIME
  - STATION EVENTS BIASED
  - LATITUDE CROSSINGS BIASED
  - ORBITAL EVENTS BIASED

HV GENERATED L-II SPROTI

- L-I SPROTI
- STATION EVENTS
  - SEPARATE TABLE
  - FORWARD SPAN

MISSION PLANNING OPERATIONS

- STATION EVENTS READ INTO L-II MP DATA BASE
- MP FLAGS ACTIVE STATIONS
- SCHEDULER RUN
- ACTIVE STATIONS DISPLAYED ON L-II TASKING DISPLAY

ADVANTAGES

- AUTOMATES STATION EVENTS INFO
- EVENTS AND SCHEDULE FROM SAME EPHEMERIS

HV ACTIONS

- DEFINE DBS TARGETS USING CIRCLES
- PROVIDE CIRCLE DEFINITIONS TO L-II

L-II MP SOFTWARE ACTIONS

- CALCULATE DBS INTERCEPTS
- DBS INHIBIT = INTERCEPT TIME + DATA BASE DEFINED BIAS
- TARGETS WITH DBS FLAG SET NOT TASKED DURING DBS INHIBIT ZONE
- DISPLAY DBS INHIBIT ZONES ON MP DISPLAY
- ALLOW MANUAL OVERRIDE DURING DBS INHIBIT ZONES

- GENERATED BY HOST ON 3800
- 7-TRACK
- PROVIDED TO L-II DAILY
- TAPE CONTENTS

1. UNCLASSIFIED COMMAND NUMBER
2. COMMAND DESCRIPTOR
3. REVOLUTION NUMBER (XXXXX.X)
4. SYSTEM TIME (XXXXX.X)
5. 22 BIT VEHICLE TIME (XXXXXX.X)
6. LONGITUDE AND LATITUDE (±XXX.X, ± XX.X)
7. DATE (DDMMMYY)