

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE
 NUMBER:05-2B-22200M -X

SUBSYSTEM NAME: COMM & TRACK: UHF SPACE COMMUNICATION

REVISION: 0 11/14/95

PART DATA

PART NAME	PART NUMBER
VENDOR NAME	VENDOR NUMBER
LRU : SSOR (GFE)	SED16102580

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
 SPACE-TO-SPACE ORBITER RADIO (SSOR), (GFE)

REFERENCE DESIGNATORS: 83V74A164

QUANTITY OF LIKE ITEMS: 1
 ONE

FUNCTION:

- (1) PROVIDES RF DUPLEX VOICE COMM BETWEEN ORBITER AND BETWEEN EMU'S.
- (2) RECEIVES BIOMED AND TELEMETRY FROM EMU.
- (3) PROVIDES RF DUPLEX VOICE COMM BETWEEN ORBITER AND STATION.
- (4) PROVIDES RF COMMAND TO SPACE STATION AND TELEMETRY FROM SPACE STATION.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

NUMBER: 05-2B-22200M-01

REVISION#: 0 10/03/96

SUBSYSTEM NAME: COMM & TRACK: UHF SPACE COMMUNICATION

LRU: SSOR (GFE)

CRITICALITY OF THIS

ITEM NAME: SSOR (GFE)

FAILURE MODE: 2/2

FAILURE MODE:

LOSS OF RF OUTPUT, ERRONEOUS OUTPUT (GARBLE OUTPUT)

MISSION PHASE: OO ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

102 COLUMBIA

103 DISCOVERY

104 ATLANTIS

105 ENDEAVOUR

AFTER SPACE COMM MODIFICATION

CAUSE:

CONTAMINATION, VIBRATION, SHOCK, TEMPERATURE CYCLE, EMI

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

CRITICALITY 1R2 DURING INTACT ABORT ONLY (AVIONICS ONLY)? NO

REDUNDANCY SCREEN

A) N/A

B) N/A

C) N/A

PASS/FAIL RATIONALE:

A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

INABILITY TO TRANSMIT/RECEIVE OR INCOMPREHENSIBLE RF NOISE RESULTING IN
LOSS OF UHF VOICE COMMUNICATION LOSS OF RF TRANSMIT/RECEIVE BETWEEN

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE
NUMBER: 05-2B-Z2200M-01**

ORBITER AND EMU'S. LOSS OF VOICE/DATA COMMUNICATION TO/FROM SPACE STATION.

(B) INTERFACING SUBSYSTEM(S):

INABILITY TO TRANSMIT/RECEIVE OR INCOMPREHENSIBLE RF NOISE RESULTING IN LOSS OF UHF VOICE COMMUNICATION. LOSS OF RF TRANSMIT/RECEIVE BETWEEN ORBITER AND EMU'S. LOSS OF VOICE/DATA COMMUNICATION TO/FROM SPACE STATION.

(C) MISSION:

LOSS OF SPACE-TO-SPACE COMMUNICATION. TERMINATE EVA OR STATION RENDEVOUS.

(D) CREW, VEHICLE, AND ELEMENT(S):

NO EFFECT.

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: MINUTES

-DISPOSITION RATIONALE-

(A) DESIGN:

THE SPACE TO SPACE ORBITER RADIO (SSOR) CONSISTS OF TWO INDEPENDENT STRINGS OF RF SUBASSEMBLIES, SIGNAL PROCESSORS, 1553B INTERFACE MODULES, AND MODEMS IN A COMMON ENCLOSURE. THE STRINGS SHARE AUDIO AND ANTENNA INPUTS AND OUTPUTS. THE COMMON OUTPUT TO THE ANTENNA GOES THROUGH ONLY PASSIVE HARDWARE. ALL ACTIVE HARDWARE IS REDUNDANT. AUDIO IS ROUTED FROM A SINGLE CONNECTOR PIN ON THE SSOR TO TWO DIFFERENT SIGNAL PROCESSORS IN THE SSOR. BOTH STRINGS SHARE DC POWER INPUTS FROM MN A AND MN C, BUT THEY HAVE SEPARATE LOGIC FOR CONTROLLING THE DISTRIBUTION OF POWER TO THE HARDWARE, AND LOCKOUT CIRCUITRY PREVENTS BOTH STRINGS FROM BEING POWERED SIMULTANEOUSLY. THE SSOR HAS SEPARATE 1553 DATA INPUTS AND OUTPUTS FOR EACH STRING OF HARDWARE. EACH STRING OF SSOR HARDWARE SUPPORTS TWO FREQUENCIES. IF THERE IS INTERFERENCE ON ONE OF THE FREQUENCIES, COMMUNICATIONS CAN BE SWITCHED TO THE OTHER FREQUENCY.

THE SSOR IS HOUSED IN THE ORIGINAL SHUTTLE GENERAL PURPOSE COMPUTER ENCLOSURES. THE ELECTRICAL DESIGN IS BASED UPON JSC IN-HOUSE ENGINEERING MODEL HARDWARE. LITTON IS MANUFACTURING THE HARDWARE IN ACCORDANCE WITH THE APPROPRIATE NHB 5300.4 STANDARDS.

PASSIVE EEE PARTS ARE SELECTED FROM THE GUIDELINES OF MIL-STD-975. ACTIVE EEE ARE APPROVED BY THE JSC ENGINEERING DIRECTORATE CERTIFIED PARTS APPROVAL PROCESS.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE
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(B) TEST:

THE FOLLOWING TESTS ARE PLANNED FOR THE SSOR.

- (1) CERTIFICATION - ONE TIME QUALIFICATION TEST OF THE QUAL MODEL SSOR. THERMAL CYCLE 5 TIMES FROM 35°F TO 130°F AND BACK TO 35°F, INCLUDING ONE NON-OPERATING EXCURSION TO -65°F. PRESSURE TEST FROM 8 TO 15.23 PSIA WITH ONE NON-OPERATING EXCURSION TO 30 PSIA. ACCELERATION TEST AT +/- 5G IN EACH OF THREE ORTHOGONAL AXES, 5 MINUTES PER AXES. ANALYSIS PERFORMED ON 20G LOAD. SHOCK TESTED WITH 20G PEAK SAWTOOTH AND 11 MSEC DURATION. LANDING VIBRATION ANALYZED. RANDOM VIBRATION TESTED FOR 5 MINUTES ON EACH OF 3 ORTHOGONAL AXES WITH THE SPECTRUM: 20 HZ TO 80 HZ, INCREASING 3 DB/OCT; 80 HZ TO 350 HZ CONSTANT 0.067 G²/HZ; 350 HZ TO 2000 HZ DECREASING 3 DB/OCT. FLIGHT INDUCED VIBRATION TESTS FOR 48 MINUTES ON EACH OF 3 ORTHOGONAL AXES WITH THE SPECTRUM: 20 HZ TO 150 HZ, INCREASING 6 DB/OCT; 150 HZ TO 1000 HZ CONSTANT 0.03 G²/HZ; 1000 HZ TO 2000 HZ DECREASING 6 DB/OCT. TRANSIENT VIBRATION TESTED ON EACH OF 3 ORTHOGONAL AXES WITH AN EXCITATION OF A SWEPT SINEWAVE FROM 5 HZ TO 35 HZ WITH +/- 0.25G PEAK AMPLITUDE AT A ONE OCTAVE/MINUTE SWEEPRATE.
- (2) ACCEPTANCE - ENVIRONMENTAL SCREEN AND COMPLETE ELECTRICAL TEST PERFORMED BY LITTON ON EACH UNIT. THERMAL CYCLE 1.5 TIMES FROM 30°F TO 130°F. VIBRATION TEST 1 MINUTE PER EACH ORTHOGONAL AXIS WITH SPECTRUM: 20 HZ TO 80 HZ, INCREASING 3 DB/OCTAVE; 80 HZ TO 350 HZ CONSTANT 0.040 G²/HZ; 350 HZ TO 2000 HZ DECREASING 3 DB/OCTAVE.
- (3) PREINSTALLATION ACCEPTANCE TEST - ELECTRICAL TEST PERFORMED AT JSC ON EACH UNIT PRIOR TO DELIVERY FOR INSTALLATION IN A VEHICLE.
- (4) GROUND TURNAROUND TEST - EVA COMMUNICATIONS CHECKOUT IS PERFORMED PRIOR TO EACH MISSION THROUGH OMI V1103. PERIODIC TURNAROUND TESTING OF THE SSOR IN THE VEHICLE AT KSC WILL CHECK THE 1553 DATA FLOW, AUDIO INPUT/OUTPUT, POWER OUTPUT, AND SPURIOUS RESPONSE.

(C) INSPECTION:

THE SSOR WILL BE MANUFACTURED IN ACCORDANCE WITH AN APPROVED QUALITY ASSURANCE PLAN USING APPROVED LITTON WORKMANSHIP PROCEDURES. THERE WILL BE INSPECTION OF IN-PROCESS ASSEMBLY AND TESTS AND END-ITEM ACCEPTANCE TESTING. SUBASSEMBLIES WILL BE INSPECTED FOR CONFORMANCE WITH RELEASED DRAWINGS AND THE NHB 5300.4 STANDARDS FOR PARTS PLACEMENT AND SOLDERING. CLEANLINESS IS INSPECTED FOR CONFORMANCE WITH THE VISUALLY CLEAN LEVEL IN SN-C-0005.

(D) FAILURE HISTORY:

THE SSOR IS NEW TO THE SHUTTLE PROGRAM, AND THERE IS NO FAILURE HISTORY AT THIS TIME.

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE

NUMBER: 05-2B-22200M-01

SUBSEQUENT DATA ON TEST FAILURES, FLIGHT FAILURES, UNEXPLAINED ANOMALIES, AND OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE FOUND IN THE PRACA DATABASE.

(E) OPERATIONAL USE:
USE OTHER UHF STRING.

IF UNSUCCESSFUL:
FOR EVA COMM - CREW IS TRAINED TO SAFELY TERMINATE EVA IF MINIMUM REQUIRED COMM IS LOST.

FOR STATION RENDEZVOUS - ALTERNATE COMM LINKS WOULD BE USED IF AVAILABLE (E.G. RELAY VIA GROUND SITE OR A VHF RADIO LIKE USED FOR SHUTTLE MIR.)

- APPROVALS -

PAE MANAGER	: POLLY STENGER-NGUYEN:	<i>Polly Stenger-Nguyen 8/21/98</i>
PRODUCT ASSURANCE ENGR	: VAN D. NGUYEN	<i>Van D. Nguyen 8-20-98</i>
DESIGN ENGINEERING	: D. Y. YOON	<i>D. Y. Yoon 8-20-98</i>
NASA SSMA	: <i>Mike Penney</i>	<i>Mike Penney 8-26-98</i>
NASA SUBSYSTEM MANAGER	: <i>Mark A. Chavez</i>	<i>Mark A. Chavez 8-26-98</i>
NASA MOD	: <i>David B. ...</i>	<i>David B. ... 8-26-98</i>
USA/SAM	: KAREN Blumenthal	<i>Karen Blumenthal 8/26/98</i>

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CRITICALITY 1R2 DURING INTACT ABORT ONLY (AVIONICS ONLY)? NO

REDUNDANCY SCREEN

A) N/A
B) N/A
C) N/A

PASS/FAIL RATIONALE:

A)

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- FAILURE EFFECTS -

(A) SUBSYSTEM:

INABILITY TO TRANSMIT/RECEIVE OR INCOMPREHENSIBLE RF NOISE RESULTING IN LOSS OF UHF VOICE COMMUNICATION. LOSS OF RF TRANSMIT/RECEIVE BETWEEN

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TIME FROM FAILURE TO CRITICAL EFFECT: MINUTES

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(D) FAILURE HISTORY:

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FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE
NUMBER: 05-28-22200M-01

SUBSEQUENT DATA ON TEST FAILURES, FLIGHT FAILURES, UNEXPLAINED ANOMALIES, AND OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE FOUND IN THE PRACA DATABASE.

(E) OPERATIONAL USE:
 USE OTHER UHF STRING.

IF UNSUCCESSFUL:
 FOR EVA COMM - CREW IS TRAINED TO SAFELY TERMINATE EVA IF MINIMUM REQUIRED COMM IS LOST.

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DESIGN ENGINEERING	:	D. Y. YOON	<i>D. Y. Yoon 8-20-98</i>
NASA SSMA	:	<i>Mike Penney</i>	<i>Michael Penney 8-26-98</i>
NASA SUBSYSTEM MANAGER	:	<i>Marc A. Chavez</i>	<i>Marc A. Chavez 8-26-98</i>
NASA MOD	:		<i>Dan K. Binn 8-26-98</i>
USA/SAM	:	KAREN Blumenthal	<i>Karen Blumenthal 8/26/98</i>