

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE

NUMBER: 05-6BA-2503-IM -X

SUBSYSTEM NAME: EPD&C - LANDING GEAR CONTROL

REVISION: 6

04/09/92

PART DATA

| | PART NAME | PART NUMBER |
|-----|--------------------------|----------------------|
| | VENDOR NAME | VENDOR NUMBER |
| LRU | : FWD MCA-2 | V070-763620 |
| LRU | : FWD MCA-3 | V070-763630 |
| SRU | : RELAY, GENERAL PURPOSE | MC455-0129-0001 |

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

RELAY, GENERAL PURPOSE, LANDING GEAR SENSOR TEST POWER

REFERENCE DESIGNATORS: 82V76A112K32
82V76A113K28

QUANTITY OF LIKE ITEMS: 2
TWO

FUNCTION:

PROVIDES THE MEANS TO SWITCH THE PROXIMITY SWITCH SENSOR ELECTRONIC PACKAGE TO GSE ENERGIZING SOURCE DURING GROUND OPERATIONS TO RAISE AND LOWER THE MAIN GEAR. THE N.C. CONTACTS (DE-ENERGIZED RELAYS) CONDUCTS ORBITER POWER TO THE PROXIMITY SWITCH SENSOR ELECTRONIC PACKAGES FOR FLIGHT OPERATION.

FAILURE MODES EFFECTS ANALYSIS FMEA - CIL FAILURE MODE

NUMBER: 05-6BA-2503-IM- 02

REVISION#: 7 07/01/99

SUBSYSTEM NAME: EPD&C - LANDING GEAR CONTROL

LRU: FWD MCA-2

CRITICALITY OF THIS

ITEM NAME: RELAY, GENERAL PURPOSE

FAILURE MODE: 1R2

FAILURE MODE:

FAILS TO CONDUCT - DE-ENERGIZED STATE

MISSION PHASE: DO DE-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

| | |
|-----|-----------|
| 102 | COLUMBIA |
| 103 | DISCOVERY |
| 104 | ATLANTIS |
| 105 | ENDEAVOUR |

CAUSE:

PIECE PART FAILURE, CONTAMINATION, VIBRATION, MECHANICAL SHOCK, PROCESSING ANOMALY, THERMAL STRESS

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN

| |
|---------|
| A) PASS |
| B) PASS |
| C) PASS |

PASS/FAIL RATIONALE:

A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

FIRST FAILURE - UNABLE TO PROVIDE AC POWER TO ONE OF THE PROXIMITY SWITCH ELECTRONIC PACKAGES

(B) INTERFACING SUBSYSTEM(S):

**FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL FAILURE MODE
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FIRST FAILURE - NO EFFECT

(C) MISSION:
FIRST FAILURE - NO EFFECT

(D) CREW, VEHICLE, AND ELEMENT(S):
FIRST FAILURE - NO EFFECT

(E) FUNCTIONAL CRITICALITY EFFECTS:
THE FOLLOWING ARE THE CRITICAL CHANNELS AND FAILURE EFFECTS ASSOCIATED WITH BOTH PROXIMITY SWITCH ELECTRONIC PACKAGES (NO. 1 AND NO. 2):

PROXIMITY SWITCH ELECTRONIC PACKAGE NO. 1:

CHANNEL 1 : 1R3, PPP
REFERENCE FMEA'S : 05-6BA-2400-IM-1, 05-6BB-2096-IM-3

FIRST FAILURE - 50% OF BRAKING CAPABILITY IS ENABLED.
2ND-3RD FAILURE - ("HYD SYS BRAKE ISOL VALVE" SWITCH AND CHECK VALVE FAIL CLOSED RESULTING IN UNCOMMANDED BRAKE PRESSURE)
POSSIBLE LOSS OF CREW/VEHICLE DUE TO TIRE DAMAGE AT TOUCHDOWN.

CHANNEL 8 :
REFERENCE FMEA'S : 05-6BA-2407-IM-1, 05-6BB-2107-IM-1

CASE 1 : 1R2, PPP
1ST & 2ND FAILURES - (ANTI-SKID SWITCH FAILS FOLLOWED BY THIS CHANNEL FAILS OFF AFTER APPROACH/LANDING INTERFACE)
FLIGHT CONTROL WILL BE AFFECTED SINCE WEIGHT-ON-WHEELS IS ERRONEOUSLY CONFIRMED. TESTING AT AMES LABORATORY HAS FOUND THAT THIS SCENARIO WILL RESULT IN DEGRADATION OF AEROSURFACE CONTROL WHICH MAY RESULT IN LOSS OF CREW/VEHICLE

CASE 2 : 1R3, PPP
FIRST FAILURE - 100% OF BRAKING CAPABILITY IS ENABLED.
2ND-3RD FAILURE - ("HYD SYS BRAKE ISOL VALVE" SWITCH AND CHECK VALVE FAIL CLOSED RESULTING IN UNCOMMANDED BRAKE PRESSURE)
POSSIBLE LOSS OF CREW/VEHICLE DUE TO TIRE DAMAGE AT TOUCHDOWN.

CHANNEL 3, 6 : 1R3, PPP
REFERENCE FMEA'S : 05-6BA-2575-IM-1, 05-6BA-2410-IM-1

FIRST FAILURE - UNABLE TO UNLOCK THE UPLOCK HOOKS VIA ASSOCIATED PIC.

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE**NUMBER: 05-6BA-2503-IM-02**

- SECOND FAILURE - (REDUNDANT PIC) UNABLE TO UNLOCK THE UPLOCK HOOKS VIA PIC
- THIRD FAILURE - (LOSS OF HYDRAULIC SYSTEM NO. 1) POSSIBLE LOSS OF CREW/VEHICLE DUE TO INABILITY TO EXTEND LANDING GEARS.

NOTE: CHANNEL 2 IS USED FOR INDICATION ONLY; CHANNELS 5, 7, 9, AND 10 ARE NOT BEING USED.

LOSS OF OUTPUT OF CHANNEL 4 WOULD RESULT IN FIRING OF THE UNLATCH PYRO ONE SECOND AFTER THE "DOWN" COMMAND IS ISSUED REGARDLESS OF THE STATE OF THE UPLOCK HOOKS (LOCK OR UNLOCK). THIS IS CRITICALITY 3/3 FAILURE.

PROXIMITY SWITCH ELECTRONIC PACKAGE NO. 2:

CHANNEL 1 : 1R3, PPP
REFERENCE FMEA'S : 05-6BA-2400-IM-1, 05-6BB-2096-IM-3

- FIRST FAILURE - 50% OF BRAKING CAPABILITY IS ENABLED.
2ND-3RD FAILURE - ("HYD SYS BRAKE ISOL VALVE" SWITCH AND CHECK VALVE FAIL CLOSED RESULTING IN UNCOMMANDED BRAKE PRESSURE) POSSIBLE LOSS OF CREW/VEHICLE DUE TO TIRE DAMAGE AT TOUCHDOWN.

CHANNEL 3 :
REFERENCE FMEA'S : 05-6BA-2407-IM-1, 05-6BB-2107-IM-1

- CASE 1 : 1R2, PPP
1ST & 2ND FAILURES - (ANTI-SKID SWITCH FAILS FOLLOWED BY THIS CHANNEL FAILS OFF AFTER APPROACH/LANDING INTERFACE) FLIGHT CONTROL WILL BE AFFECTED SINCE WEIGHT-ON-WHEELS IS ERRONEOUSLY CONFIRMED. TESTING AT AMES LABORATORY HAS FOUND THAT THIS SCENARIO WILL RESULT IN DEGRADATION OF AEROSURFACE CONTROL WHICH MAY RESULT IN LOSS OF CREW/VEHICLE.

- CASE 2 : 1R3, PPP
FIRST FAILURE - 100% OF BRAKING CAPABILITY IS ENABLED.
2ND-3RD FAILURE - ("HYD SYS BRAKE ISOL VALVE" SWITCH AND CHECK VALVE FAIL CLOSED RESULTING IN UNCOMMANDED BRAKE PRESSURE) POSSIBLE LOSS OF CREW/VEHICLE DUE TO TIRE DAMAGE AT TOUCHDOWN.

CHANNEL 2, 6 : 1R3, PPP
REFERENCE FMEA'S : 05-6BA-2575-IM-1, 05-6BA-2410-IM-1

- FIRST FAILURE - UNABLE TO UNLOCK THE UPLOCK HOOKS VIA ASSOCIATED PIC.
SECOND FAILURE - (REDUNDANT PIC) UNABLE TO UNLOCK THE UPLOCK HOOKS VIA PIC.
THIRD FAILURE - (LOSS OF HYDRAULIC SYSTEM NO. 1) POSSIBLE LOSS OF CREW/VEHICLE DUE TO INABILITY TO EXTEND LANDING GEARS.

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE
NUMBER: 05-6BA-2503-IM-02

NOTE: CHANNELS 7 AND 8 ARE USED FOR INDICATION ONLY; CHANNELS 5, 9, AND 10 ARE NOT BEING USED.

LOSS OF OUTPUT OF CHANNEL 4 WOULD RESULT IN FIRING OF THE UNLATCH PYRO ONE SECOND AFTER THE "DOWN" COMMAND IS ISSUED REGARDLESS OF THE STATE OF THE UPLOCK HOOKS (LOCK OR UNLOCK). THIS IS CRITICALITY 3/3 FAILURE.

-DISPOSITION RATIONALE-

(A) DESIGN:

REFER TO APPENDIX C, ITEM NO. 2 - GENERAL PURPOSE RELAY

(B) TEST:

REFER TO APPENDIX C, ITEM NO. 2 - GENERAL PURPOSE RELAY

GROUND TURNAROUND TEST

ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:

REFER TO APPENDIX C, ITEM NO. 2 - GENERAL PURPOSE RELAY

(D) FAILURE HISTORY:

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

(E) OPERATIONAL USE:

CORRECTIVE ACTION IN THE EVENT OF A FAILURE IS NONE

- APPROVALS -

EDITORIALLY APPROVED
TECHNICAL APPROVAL

: BNA
: VIA APPROVAL FORM

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: 96-CIL-011_05-6BA(2)