FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL HARDWARE
NUMBER:M5-6MR-0007 -X

SUBSYSTEM NAME: ORBITER DOCKING SYSTEM

REVISION: 2 03/27/98

PART DATA

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:MPCA-1	VO70-764400
LRU	:MPCA-2	VO70-764430
SRU	:FUSE	MC451-0018-1000

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
FUSE, SUB-MINIATURE, 10 AMP - PANEL MAIN A AND PANEL MAIN B CONTROL CIRCUIT.

REFERENCE DESIGNATORS:
40V76A25F30
40V76A25F31
40V76A26F30
40V76A26F31

QUANTITY OF LIKE ITEMS: 4
FOUR

FUNCTION:
PROVIDE DISTRIBUTION AND CIRCUIT PROTECTION FOR THE PNL MN A AND THE PNL MN B ODS DOCKING SYSTEM POWER CIRCUITS. THESE CIRCUITS PROVIDE POWER TO THE PMA 2/3 HOOK MOTORS, VESTIBULE DEPRESSURIZATION VALVES, PMA 2/3 GROUP 1 & 2 SYSTEM A/B PASSIVE HOOKS CONTROL, AND THE TRUSS DOCKING LIGHTS FUNCTIONS.

REFERENCE DOCUMENTS:
1) VS70-953103, INTEGRATED SCHEMATIC - 53A, MAIN A/MAIN B SYSTEM POWER AND APDS LOGIC BUSES

FAILURE MODES EFFECTS ANALYSIS FMEA -- NON-CIL FAILURE MODE
NUMBER: M5-6MR-0007-01

REVISION#: 2 03/27/98

SUBSYSTEM NAME: ORBITER DOCKING SYSTEM
LRU: MPCA-1, 2
ITEM NAME: FUSE

CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
FAILS OPEN

MISSION PHASE: OO ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 105 ENDEAVOUR

CAUSE:
A) STRUCTURAL FAILURE, B) CONTAMINATION, C) VIBRATION, D) MECHANICAL SHOCK, E) PROCESSING ANOMALY, F) THERMAL STRESS

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

REDUNDANCY SCREEN
A) PASS
B) N/A
C) PASS

PASS/FAIL RATIONALE:
A)

B)
SCREEN "B" IS "N/A" BECAUSE AT LEAST TWO REMAINING PATHS ARE READILY DETECTABLE IN FLIGHT.

C)

METHOD OF FAULT DETECTION:
FIRST FAILURE IS NOT DETECTABLE. LOSS OF BOTH FUSES CAN BE DETECTED BY VISUALLY INSPECTING THE PANEL MAIN A AND B POWER INDICATORS.

CORRECTING ACTION: MANUAL

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CORRECTING ACTION DESCRIPTION:
STATUS OF THE PANEL MAIN A AND B BUSES IS VERIFIED ON THE A6A3 CONTROL PANEL BY INDICATORS DS1 AND DS2. CREW COULD ATTEMPT TO RECYCLE BLEED VALVE CLOSED.

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF ONE PARALLEL FUSE. DEGRADATION OF PANEL MAIN BUS A OR B PROTECTION REDUNDANCY.

(B) INTERFACING SUBSYSTEM(S):
FIRST FAILURE - NO EFFECT

(C) MISSION:
FIRST FAILURE - NO EFFECT

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

(E) FUNCTIONAL CRITICALITY EFFECTS:
CASE 1: (1R3, PPP SCENARIO)
POSSIBLE LOSS OF CREW/VEHICLE AFTER FIVE FAILURES:

1) ONE OF THE TWO PARALLEL 10 AMP FUSES OPENS - LOSS OF REDUNDANCY TO THE POWER FEED TO THE PANEL MAIN BUS (A OR B).
2) CANNOT CLOSE 6 HOOKS (1 GROUP) ON THE ORBITER SIDE OF THE INTERFACE DURING DOCKING (I.E. HOOK CABLE BREAKS FOR 1 HOOK GROUP) REQUIRING THE USE OF THE CORRESPONDING STANDBY REDUNDANT PMA 2/3 SIDE HOOKS) IN ORDER TO DOCK.
3) AFTER DOCKING, THE SECOND 10 AMP FUSE POWERING PANEL MAIN BUS A FAILS OPEN. THIS RESULTS IN LOSS OF ABILITY TO ENERGIZE ONE OF THE TWO PMA 2/3 SIDE HOOK MOTORS FOR OPENING THE HOOKS FOR UNDOCKING. REDUNDANT MOTOR IS POWERED BY PANEL MAIN BUS B AND IS AVAILABLE TO OPEN THE HOOKS.
4) LOSS OF PANEL MAIN BUS B (POWER CONTACTOR K5 FAILS OPEN) CAUSES LOSS OF ALL POWER TO THE ACTIVE HOOK MOTORS IN PMA 2/3 RESULTING IN LOSS OF ABILITY TO UNDOCK NOMINALLY.
5) PYROTECHNIC SEPARATION ATTEMPTED FOR UNDOCKING. ONE PYROBOLT FAILS TO INITIATE RESULTING IN LOSS OF CAPABILITY TO IMPLEMENT PYROTECHNIC SEPARATION - LOSS OF UNDOCKING CAPABILITY.

CASE 2: (2R3, PPP SCENARIO)
POSSIBLE LOSS OF MISSION AFTER THREE FAILURES:

1) ONE OF THE TWO PARALLEL 10 AMP FUSES OPENS - LOSS OF REDUNDANCY TO THE POWER FEED TO THE PANEL MAIN BUS (A OR B).

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2) AFTER DOCKING, THE SECOND 10 AMP FUSE POWERING PANEL MAIN BUS A FAILS OPEN. THIS RESULTS IN LOSS OF POWER TO ONE OF THE TWO VENT VALVES RESULTING IN THE LOSS OF REDUNDANCY TO PERFORM VESTIBULE PURGING.
3) LOSS OF PANEL MAIN BUS B (POWER CONTACTOR K5 FAILS OPEN) CAUSES LOSS OF POWER TO THE REDUNDANT VENT VALVE RESULTING IN LOSS OF ABILITY TO PURGE THE VESTIBULE OF POSSIBLE CONTAMINANTS (I.E. RESIDUAL HYDRAZINE DURING MANEUVERING) PRIOR TO OPENING THE UPPER HATCH.

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: MINUTES

TIME FROM DETECTION TO COMPLETED CORRECTING ACTION: MINUTES

IS TIME REQUIRED TO IMPLEMENT CORRECTING ACTION LESS THAN TIME TO EFFECT?
YES

RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:
CASE 1:
ALTHOUGH THE CRITICALITY REMAINS UNCHANGED AFTER WORKAROUNDS CONSIDERATION (ALLOWED PER CR S050107W), THEY ARE PROVIDING ADDITIONAL FAULT TOLERANCE TO THE SYSTEM.

AFTER THE FIFTH FAILURE, THE CREW WOULD PERFORM EVA TO REMOVE THE 96 BOLTS FROM THE DOCKING BASE TO CIRCUMVENT THE WORST CASE "DESIGN CRITICALITY" EFFECT. IF UNABLE TO PERFORM EVA (SIXTH) FAILURE) POSSIBLE LOSS OF CREW/VEHICLE DUE TO LOSS OF ALL UNDOCKING CAPABILITY.

HAZARD REPORT NUMBER(S): DM20HA04(F)

HAZARD(S) DESCRIPTION:
INABILITY TO SAFELY SEPARATE THE ORBITER FROM A MATED ELEMENT

- APPROVALS -

SS&PAE	: T. K. KIMURA	T K Kimura 4-3-98
DESIGN ENGINEERING	: C. J. ARROYO	C J Arroyo 4/6/98