

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL HARDWARE
NUMBER:M5-6MR-0040 -X

SUBSYSTEM NAME: ORBITER DOCKING SYSTEM

REVISION: 0 03/27/98

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
ASSY	:DOCKING BASE	VO76-000003
LRU	:FLOODLIGHT	VB28-704063-001

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
 FLOODLIGHT, TUNGSTEN HALOGEN, 135 WATT - ODS FORWARD AND AFT TRUSS DOCKING LIGHTS

REFERENCE DESIGNATORS: 40V73A170
 40V73A171

QUANTITY OF LIKE ITEMS: 2
 (TWO)

FUNCTION:
 AFT/FORWARD TRUSS DOCKING LIGHTS. USED FOR GENERAL LIGHTING.

REFERENCE DOCUMENTS: 1) VS70-953103, INTEGRATED SCHEMATIC DIAGRAM - 53AE, DOCKING LIGHTS

FAILURE MODES EFFECTS ANALYSIS FMEA - NON-CIL FAILURE MODE

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SUBSYSTEM NAME: ORBITER DOCKING SYSTEM

LRU: N/A

ITEM NAME: FLOODLIGHT

CRITICALITY OF THIS
FAILURE MODE: 1R3

FAILURE MODE:

SHORT (+28VDC TO CHASSIS GROUND)

MISSION PHASE: OO ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 105 ENDEAVOUR

CAUSE:

A) PIECE PART 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) PASS
 C) PASS

PASS/FAIL RATIONALE:

A)

B)

C)

METHOD OF FAULT DETECTION:

VISUAL CUE - PARTIAL LIGHT

MASTER MEAS. LIST NUMBERS: NONE

CORRECTING ACTION: NONE

CORRECTING ACTION DESCRIPTION:

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NONE

- FAILURE EFFECTS -

(A) SUBSYSTEM:

ONE FORWARD OR AFT TRUSS DOCKING LIGHT FAILS OFF.

(B) INTERFACING SUBSYSTEM(S):

FIXTURE SHORTS +28VDC TO CHASSIS GROUND AND CAUSES THE OPENING OF THE TWO UPSTREAM 10 AMP FUSES POWERING THE AFFECTED PANEL MAIN BUS (MAIN BUS A OR B). THIS CAUSES LOSS OF POWER TO THE CONNECTED PMA 2/3 HOOKS MOTORS AND THE DOCKING BASE VENT VALVE (LOSS OF REDUNDANCY IN DRIVING THE PMA 2/3 HOOKS AND CONTROLLING THE VENT VALVES).

(C) MISSION:

NO EFFECT - FIRST FAILURE

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

NO EFFECT - FIRST FAILURE

(E) FUNCTIONAL CRITICALITY EFFECTS:

CASE 1: (1R3, PPP SCENARIO)

POSSIBLE LOSS OF CREW/VEHICLE AFTER FOUR FAILURES:

- 1) 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.
- 2) AFTER DOCKING, TRUSS LIGHT FIXTURE SHORTS +28VDC TO CHASSIS GROUND AND OPENS THE TWO UPSTREAM 10 AMP FUSES POWERING PANEL MAIN BUS A. 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.
- 3) 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.
- 4) 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 TWO FAILURES:

- 1) AFTER DOCKING, TRUSS LIGHT FIXTURE SHORTS +28VDC TO CHASSIS GROUND AND OPENS THE TWO UPSTREAM 10 AMP FUSES POWERING PANEL MAIN BUS A. THIS

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RESULTS IN LOSS OF POWER TO ONE OF THE TWO VENT VALVES RESULTING IN THE LOSS OF REDUNDANCY TO PERFORM VESTIBULE PURGING.

- 2) 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.

DESIGN CRITICALITY (PRIOR TO DOWNGRADE, DESCRIBED IN (F)):

(F) RATIONALE FOR CRITICALITY DOWNGRADE:

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 FOURTH 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 (FIFTH) FAILURE) POSSIBLE LOSS OF CREW/VEHICLE DUE TO LOSS OF ALL UNDOCKING CAPABILITY.

- 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:

IN ORDER TO USE THE PMA 2/3 SIDE HOOKS SINCE THEY ARE STANDBY REDUNDANT, THERE MUST BE A PRE-EXISTING CONDITION THAT THE ASSOCIATED ORBITER SIDE HOOKS ARE INOPERATIVE. IF IT IS NECESSARY THAT THE PMA 2/3 HOOKS BE USED, TWO SEPARATE DRIVE MOTORS ARE AVAILABLE AND ARE POWERED FROM DIFFERENT PANEL MAIN BUSES FOR OPENING THE HOOKS FOR UNDOCKING.

HAZARD REPORT NUMBER(S): DM20HA04(F)

HAZARD(S) DESCRIPTION:

INABILITY TO SAFELY SEPARATE THE ORBITER FROM A MATED ELEMENT

- APPROVALS -

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SS&PAE
DESIGN ENGINEERING

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J. K. Kimura 4-3-98
Ch C 4/3/98