PRINT DATE: 06/02/96

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE**
**NUMBER: 05-5-B22-1 -X**

**SUBSYSTEM NAME:** DATA PROCESSING SYSTEM (DPS)
**REVISION:** 3 04/08/96

**PART DATA**

| | **PART NAME** / **VENDOR NAME** | **PART NUMBER** / **VENDOR NUMBER** |
|---|---|---|
| LRU | : KEYBOARD UNIT<br>LOCKHEED | MC615-0007-0104<br>6239700-4 |

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**

**REFERENCE DESIGNATORS:** 35V73A2A1
35V73A2A3
FLIGHT STATION
32V73A12A2A1
AFT STATION

**QUANTITY OF LIKE ITEMS:** 3
1 COMMANDER, 1 PILOT, 1 MISSION STATION

**FUNCTION:**
PRE-MEDS:
PROVIDES DATA SELECTION AND FORMAT CALL UP FOR DISPLAY UNITS (DU) AND FOR ENTRY OF ALPHA NUMERIC DATA AND INSTRUCTIONS INTO THE COMPUTER. PROVIDES MAJOR MODE TRANSITION INTERFACE WITH THE GENERAL PURPOSE COMPUTER (GPC). KEYBOARD INTERFACES WITH THE COMPUTER THROUGH THE DISPLAY ELECTRONICS UNIT (DEU).

MEDS CONFIGURATION:
PROVIDES DATA SELECTION AND FORMAT CALL UP FOR MULTIFUNCTION DISPLAY UNITS (MDU'S) AND FOR ENTRY OF ALPHA NUMERIC DATA AND INSTRUCTIONS INTO THE COMPUTER. PROVIDES MAJOR MODE TRANSITION INTERFACE WITH THE GENERAL PURPOSE COMPUTER (GPC). KEYBOARD INTERFACES WITH THE COMPUTER THROUGH THE INTEGRATED DISPLAY PROCESSORS (IDP'S).

**FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE**
**NUMBER: 05-5-B22-1-01**

**REVISION#:** 4 02/02/98

**SUBSYSTEM NAME:** DATA PROCESSING SYSTEM (DPS)
**LRU:** KEYBOARD UNIT
**ITEM NAME:** KEYBOARD UNIT

**CRITICALITY OF THIS FAILURE MODE:** 1R2

**FAILURE MODE:**
ALL CREDIBLE FAILURE MODE (ERRONEOUS OUTPUT, LOSS OF OUTPUT, KEY HANGS UP IN THE CLOSED POSITION ONLY)

**MISSION PHASE:**

| | |
|---|---|
| PL | PRE-LAUNCH |
| LO | LIFT-OFF |
| OO | ON-ORBIT |
| DO | DE-ORBIT |
| LS | LANDING/SAFING |

**VEHICLE/PAYLOAD/KIT EFFECTIVITY:**

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

**CAUSE:**
STRUCTURAL FAILURE OF SWITCH INTERNAL ASSEMBLY, CONTAMINATION OF SWITCH.

**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:**

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE**
**NUMBER: 05-5-B22-1-01**

PRE-MEDS:
ONE KBU WILL BE LOST. THE DEU/DU WILL RETAIN THE DISPLAY FORMAT PRESENT AT THE TIME OF FAILURE.

MEDS CONFIGURATION:
ONE KBU WILL BE LOST. THE IDP/MDU WILL RETAIN THE DISPLAY FORMAT PRESENT AT THE TIME OF FAILURE.

**(B) INTERFACING SUBSYSTEM(S):**
FIRST FAILURE NO EFFECT. LOSS OF BOTH FORWARD KBU'S PREVENTS DOING OPS 104-105 MANUAL MODE TRANSITION. DURING ENTRY, LOSS OF BOTH FORWARD KBU'S PREVENTS DOING SEVERAL NECESSARY OPS 3XX MANUAL MODE TRANSITIONS.

**(C) MISSION:**
LOSS OF A SINGLE FORWARD KEYBOARD DURING ASCENT OR ON-ORBIT RESULTS IN RETURN TO NEXT PRIMARY LANDING SITE. HOWEVER, ON-ORBIT, IN FLIGHT MAINTENANCE (IFM) WILL BE DONE AT THE KEY LEVEL IF IT IS KNOWN WHICH KEY IS STUCK, OR AT THE KBU LEVEL OTHERWISE. IF IFM RESULTS IN RECOVERY OF KEYBOARD FUNCTION, NOMINAL ENTRY IS POSSIBLE.

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

**(E) FUNCTIONAL CRITICALITY EFFECTS:**
CRITICALITY 1R2 BECAUSE LOSS OF CREW/VEHICLE IS POSSIBLE FOR TWO FAILURES AFTER DEORBIT BURN.

---

**-DISPOSITION RATIONALE-**

---

**(A) DESIGN:**
ILLUMINATED PUSHBUTTON SWITCHES THAT MEET THE REQUIREMENTS OF MIL-S-22885 AND ARE SCREENED TO ORBITER PROJECT PARTS LIST (OPPL). CONSTRUCTION IS THAT OF A RUGGED SIMPLE STRUCTURAL SWITCH WITH NO ELECTRONIC PARTS. DESIGN ALSO INCORPORATES RELIABILITY, MAINTAINABILITY, ENVIRONMENTAL AND TRANSPORTABILITY REQUIREMENTS AND OTHER DESIGN AND CONSTRUCTION PER SPECIFICATION MC615-0007.

**(B) TEST:**

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE**
**NUMBER: 05-5-B2Z-1- 01**

ACCEPTANCE TEST PROCEDURE (TP6239700), WHICH INCLUDES ACCEPTANCE THERMAL TESTS (ATT), ACCEPTANCE VIBRATION TESTS (AVT), EXAMINATION OF PRODUCT, FUNCTIONAL AND PERFORMANCE TEST, INSULATION RESISTANCE TEST, DIELECTRIC STRENGTH TEST AND POWER VARIATION TEST ARE PERFORMED ON EACH UNIT.

QUALIFICATION TESTING INCLUDING POWER, ELECTROMAGNETIC COMPATIBILITY (EMC), CABIN ATMOSPHERE, THERMAL CYCLE, VIBRATION, ACCELERATION, THERMAL VACUUM, LIFE, LIGHTNING AND SHOCK HAVE BEEN PERFORMED.

GROUND TURNAROUND TEST: ALL TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

**(C) INSPECTION:**
RECEIVING INSPECTION:
CERTIFICATES OF COMPLIANCE ARE IN RECEIVING INSPECTION FILES. RECEIVING INSPECTION PERFORMS PHYSICAL ANALYSIS OF MATERIAL.

ASSEMBLY/INSTALLATION:
CRITICAL DIMENSIONS ARE VERIFIED BY INSPECTION AND RECORDED. TORQUE VERIFICATION TOOLS ARE USED BY INSPECTION. INSPECTION OF WIRE HARNESS IS PERFORMED DURING IN-PROCESS AND FINAL INSPECTION.

CRITICAL PROCESSES:
INSPECTION VERIFIES CRIMPING OPERATION/CERTIFICATION. SOLDERING REQUIREMENTS PER NHB5300.4(3A) ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION:
X-RAY INSPECTION OF SWITCH ASSEMBLY IS MADE AT JAY-EL.

TESTING:
ALL ACCEPTANCE TESTS ARE WITNESSED BY DCAS AND LOCKHEED QUALITY CONTROL AND/OR BOEING SOURCE.

HANDLING/PACKAGING:
CHECK IS MADE FOR PROPER CONTAINERS & CLEANLINESS.

**(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 DATABASE

**(E) OPERATIONAL USE:**
THERE ARE NO OPERATIONAL CONSTRAINTS OR SPECIAL CONFIGURATIONS POSSIBLE TO MINIMIZE THE EFFECTS OF THE FIRST FAILURE. AFTER THE FAILURE, AN ALTERNATE KEYBOARD MAY BE USED TO ACCESS THE GPC'S, PER FLIGHT PROCEDURES. THE AFT KEYBOARD CAN BE USED AS BACKUP ONLY DURING ORBIT, OR LOW ACCELERATION PHASES. IF TIME ALLOWS, THE DEU EQUIVALENTS CAN BE UPLINKED FROM THE

PAGE: 6

PRINT DATE: 08/02/98

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE**
**NUMBER: 05-5-B22-1-01**

GROUND TO ESTABLISH GPC INTERFACE. THERE ARE NO ACTIONS POSSIBLE TO PROTECT AGAINST THE NEXT FAILURE. NO SPECIAL CREW TRAINING IS REQUIRED.

**- APPROVALS -**

| | | |
|---|---|---|
| SS&PAE MANAGER | : P. STENGER-NGUYEN | : 8/2/98 |
| SS&PAE | : T. AI | : |
| DESIGN ENGINEERING | : L. TEEBOOM | : 8-2-98 |
| MEDS SYSTEM | : M. B. WARNER | : 8/2/98 |
| MEDS HARDWARE | : R. SITAPARA | : 8/2/98 |
| JSC MOD | : | : |