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PRINT DATE: 02/06/92

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE

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SUBSYSTEM NAME: LANDING DECELERATION - DRAG PARACHUTE

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	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
■ LRU :	MAIN DRAG PARACHUTE ASSEMBLY IRVIN	MC621-0076-0001 812000
■ SRU :	REEFING LINE	MC621-0076-0012

PART DATA

- EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:  
THE SINGLE REEFING LINE IN THE DRAG CHUTE AT THE BASE OF THE DRAG CHUTE CANOPY IS A KEVLAR CORD WITH A BREAKING STRENGTH OF 6500 LB. THE REEFING LINE HAS A SINGLE SPLICE.
- QUANTITY OF LIKE ITEMS: 1  
ONE
- FUNCTION:  
WHEN THE DRAG CHUTE FIRST INFLATES, THE REEFING LINE AT THE BASE OF THE CANOPY RESTRICTS INFLATION TO 40 PERCENT OF DRAG AREA (APPROXIMATELY 63 PERCENT OF FULL DIAMETER). AFTER A TIME DELAY OF 3.0 TO 4.8 SECONDS, THE REEFING LINE IS CUT BY TWO CUTTERS, ALLOWING FULL INFLATION OF THE DRAG CHUTE CANOPY. MAXIMUM OPERATIONAL LOAD IN THE REEFING LINE IS 1786 LB.

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SUBSYSTEM: LANDING DECELERATION - DRAG PARACHUTE  
LRU :MAIN DRAG PARACHUTE ASSEMBLY  
ITEM NAME: REEFING LINE

CRITICALITY OF THIS  
FAILURE MODE:3/3

FAILURE MODE:  
BROKEN, PREMATURELY SEVERED

MISSION PHASE:  
PL PRELAUNCH  
OO DE-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA  
: 103 DISCOVERY  
: 104 ATLANTIS  
: 105 ENDEAVOUR

CAUSE:  
EXCESSIVE LOAD, PACKING ERROR, MANUFACTURING DEFECT, DEFECTIVE SPLICE

CRITICALITY 1/1 DURING INTACT ABORT ONLY? YES

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

PASS/FAIL RATIONALE:

- A)
- B)
- C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:  
DRAG CHUTE INFLATES TO FULL DIAMETER AT LINE STRETCH, RESULTING IN  
INCREASED PEAK DRAG LOAD.

(B) INTERFACING SUBSYSTEM(S):  
NO EFFECT

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■ (C) MISSION:  
NONE

■ (D) CREW, VEHICLE, AND ELEMENT(S):  
NONE IN NORMAL MISSION. POSSIBLE LOSS OF CREW/VEHICLE DURING INTACT ABORT IN SOME OFF-NOMINAL CHUTE DEPLOYMENTS, I.E., HIGH SPEED/MAIN GEAR TOUCHDOWN. THE LARGE PITCH-UP MAY DEGRADE HANDLING QUALITIES TO THE EXTENT OF LOSS OF CONTROL.

■ (E) FUNCTIONAL CRITICALITY EFFECTS:

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- DISPOSITION RATIONALE -  
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■ (A) DESIGN:  
THE REEFING LINE IS A SPLICED KEVLAR CORD THREADED THROUGH RINGS AROUND THE INSIDE OF THE DRAG CHUTE CANOPY SKIRT. THE LINE CONSTRICTS THE CHUTE DIAMETER IN THE FIRST STAGE (REEFED) CONDITION TO REDUCE PEAK LOADS. MAXIMUM LOAD IN THE REEFING LINE IS 1786 LB. AT FIRST STAGE INFLATION. BREAKING STRENGTH IS 6500 LB. HANDLING PROCEDURES MINIMIZE POSSIBILITY OF INADVERTENTLY SEVERING THE REEFING LINE WHILE PACKING THE DRAG CHUTE.

■ (B) TEST:  
QUALIFICATION OF THE DRAG CHUTE, INCLUDING THE REEFING LINE, IS BY ANALYSIS BASED ON SEAM AND JOINT TESTS. DRAG CHUTE REEFING CHARACTERISTICS ARE CERTIFIED BY ANALYSIS.

DEPLOYMENT TEST DATA WAS OBTAINED FROM DRAG CHUTE DEPLOYMENT TESTS USING A B-52 AIRCRAFT. DRAG CHUTE WAS PACKED EIGHT TIMES FOR B-52 TESTS WHICH DEMONSTRATED NO TENDENCY TOWARD PACKING ERRORS THAT COULD RESULT IN PREMATURELY SEVERED REEFING LINE.

ACCEPTANCE TEST: DRAG CHUTE ACCEPTANCE TESTS INCLUDE EXAMINATION OF PRODUCT AND VERIFICATION OF PACKING PROCEDURE.

■ (C) INSPECTION:  
RECEIVING INSPECTION  
RAW MATERIAL IS VERIFIED BY INSPECTION TO ASSURE SPECIFIED SHUTTLE REQUIREMENTS ARE SATISFIED.

CONTAMINATION CONTROL  
CONTAMINATION CONTROL AND CORROSION PROTECTION PROCESSES ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

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VISUAL INSPECTION, IDENTIFICATION PERFORMED, AND PARTS PROTECTION VERIFIED BY INSPECTION.

CRITICAL PROCESSES  
SELECTED MANUFACTURING/ASSEMBLY STEPS ARE IDENTIFIED BY NASA QUALITY ASSURANCE AND VERIFIED BY GOVERNMENT INSPECTION AS MANDATORY INSPECTION POINTS (MIPS).

HANDLING/PACKAGING  
STORAGE ENVIRONMENTS ARE MONITORED AND VERIFIED BY INSPECTION.

ACCEPTANCE  
ROCKWELL SOURCE INSPECTION WITNESSES ACCEPTANCE TESTING.

■ (D) FAILURE HISTORY:  
NONE TO DATE

■ (E) OPERATIONAL USE:  
NONE

- APPROVALS -

RELIABILITY ENGINEERING: D. M. MAYNE  
DESIGN ENGINEERING : C. LOWRY  
QUALITY MANAGER : O. J. BUTTNER  
NASA RELIABILITY :  
NASA SUBSYSTEM MANAGER :  
NASA QUALITY ASSURANCE :

*D.M. Mayne*  
*C. Lowry*  
*O.J. Buttner 2/2/92*  
*Raytheon 2/25/92*  
*3-25-92*