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PRINT DATE: 02/06/92

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE
 NUMBER: P2-1G-URG1 X

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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 CUTTER IRVIN/ROBERTS RESEARCH	MC621-0076-0011 812003

 PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

QUANTITY OF LIKE ITEMS: 2
 TWO

FUNCTION:

THE CUTTER ASSEMBLY IS A SMALL CYLINDRICAL PYROTECHNIC DEVICE MOUNTED ALONG WITH THE REEFING LINE AT THE CANOPY SKIRT. A HOLE IN THE CUTTER BODY ACCOMMODATES THE REEFING LINE. A LANYARD OPERATED FIRING PIN IS USED TO INITIATE THE PYRO TIME-DELAY TRAIN. AFTER THE TRAIN HAS BURNED FOR THE REQUIRED TIME, IT IGNITES A POWDER CHARGE WHICH DRIVES A CUTTING BLADE AGAINST THE ANVIL AND SEVERS THE REEFING LINE.

TWO REEFING LINE CUTTERS ARE USED TO SEVER THE SINGLE REEFING LINE; IF ONE CUTTER FAILS, THE OTHER (REDUNDANT) CUTTER WOULD SEVER THE LINE. THE TIME BETWEEN SEAR PIN EXTRACTION AND LINE SEVERANCE (TIME DELAY) IS 3.0 TO 4.8 SECONDS.

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

REVISION# 2 02/06/92

CRITICALITY OF THIS
FAILURE MODE:3/3.

- FAILURE MODE:
REEFING LINE CUTTER ACTIVATES PREMATURELY.

MISSION PHASE:

PL PRELAUNCH
DO DE-ORBIT

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

- CAUSE:
MECHANICAL FAILURE, HANDLING/PACKING ERROR, TIME DELAY IMPROPER OPERATION

- 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 IN ONE STAGE.
- (B) INTERFACING SUBSYSTEM(S):
NO EFFECT

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■ (C) MISSION:
SEE (D)

■ (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:

- DISPOSITION RATIONALE -

■ (A) DESIGN:
THE TWO REEFING LINE CUTTERS ARE INSTALLED IN POCKETS 180 DEGREES APART
ON THE DRAG CHUTE SKIRT BAND AND EACH IS ACTUATED BY A LANYARD ATTACHED
TO A SUSPENSION LINE. PULL FORCE TO RELEASE THE CUTTER SEAR PIN IS 15
TO 55 LB. THE CUTTERS ARE INSTALLED IN THE DRAG CHUTE PACK IN
ACCORDANCE WITH APPROVED PROCEDURES TO PRECLUDE PREMATURE ACTIVATION,
AND ARE ENVIRONMENTALLY PROTECTED WITHIN THE PACK. THE TIME DELAY
COMPOUND IS BETWEEN THE PRIMER CAP AND BLADE PROPELLANT. SIMILAR
CUTTERS WERE USED IN THE PARACHUTES OF THE APOLLO EARTH LANDING SYSTEM.

■ (B) TEST:
QUALIFICATION TEST: 36 REEFING LINE CUTTERS WERE SUBJECTED TO THERMAL
CYCLE TESTS BETWEEN -120 F AND +100 F WITH A FINAL 10 MINUTES AT +135 F.
TEN UNITS WERE FIRED AT AMBIENT TEMPERATURE, 10 UNITS AT LOW (-85 F)
TEMPERATURE, TEN UNITS AT HIGH (+135 F) TEMPERATURE. ONE marginally
LOADED UNIT, ONE STRUCTURAL MARGIN UNIT AND ONE LOCKED SHUT UNIT WERE
FIRED. THREE UNITS WERE FIRED AFTER AN 8-FOOT DROP TEST.

ACCEPTANCE TEST: EACH CUTTER WILL BE SUBJECTED TO EXAMINATION OF
PRODUCT, LEAKAGE TEST, X-RAY AND N-RAY INSPECTION, AND WEIGHT CHECK.
TEN PERCENT OF UNITS OR 10 UNITS MINIMUM IN EACH LOT WILL BE FIRED IN
LOT ACCEPTANCE TEST.

■ (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.

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ASSEMBLY/INSTALLATION

PARTS ARE X-RAYED AND N-RAYED TO VERIFY CORRECT ASSEMBLY AND PRESENCE OF ALL DETAIL PARTS AND EXPLOSIVES. VISUAL INSPECTION, IDENTIFICATION PERFORMED, AND PARTS PROTECTION VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

X-RAYS AND N-RAYS ARE REVIEWED BY VENDOR, OCAS, NASA QUALITY, AND ENGINEERING.

CRITICAL PROCESSES

SELECTED MANUFACTURING/ASSEMBLY STEPS ARE IDENTIFIED BY NASA QUALITY ASSURANCE AND VERIFIED BY GOVERNMENT INSPECTION AS MANDATORY INSPECTION POINTS (MIPS). ALL MANUFACTURING PROCESSES, SUCH AS WELDING, PLATING, HEAT TREATING, PASSIVATION, AND ANODIZING ARE VERIFIED BY INSPECTION.

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
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