FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE
NUMBER: 02-3A-U10-*01-X

SUBSYSTEM NAME: SEPARATION MECHANISMS - MECHANICAL
REVISION : Z 01/23/92

	PART NAME / VENDOR NAME	PART NUMBER / VENDOR NUMBER
■ LRU :	DEBRIS CONTAINER, ET UMBIL SEP	V070-565511

PART DATA

■ EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
CONTAINER ASSEMBLY, DEBRIS CONTAINMENT, ET UMBILICAL HOLD DOWN/RELEASE, INCLUDES TWO SPRING-LOADED BLADES TO COVER HOLE WHEN STUD IS RELEASED. REFERENCE 02-3A-U2-01.

■ QUANTITY OF LIKE ITEMS: 6
THREE PER SIDE.

■ FUNCTION:
TWO SPRING-LOADED BLADES PREVENT ESCAPE OF FRANGIBLE NUT, YOKE, BOOSTER, DETONATOR OR PYRO CONNECTOR FRAGMENTS THROUGH UMBILICAL ATTACH BOLT HOLE IN BASE OF DEBRIS CONTAINER AFTER ORBITER/EXTERNAL TANK (ET) SEPARATION. THE TWO SPRING-LOADED BLADES COVER HOLE WHEN STUD SEPARATES FROM ORBITER.

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: 02-3A-U10- 01-01

REVISION# 2 01/23/92 R

SUBSYSTEM: SEPARATION MECHANISMS - MECHANICAL
LRU :DEBRIS CONTAINER, ET UMBIL SEP
ITEM NAME: DEBRIS CONTAINER, ET UMBIL SEP

CRITICALITY OF THIS FAILURE MODE:1/1

■ FAILURE MODE:
SPRING-LOADED BLADES FAIL TO FUNCTION

MISSION PHASE:
LO : LIFT-OFF
DO : DE-ORBIT

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

■ CAUSE:
DEFECTIVE PART/MATERIAL OR MANUFACTURING DEFECT, PHYSICAL BINDING/ JAMMING, CONTAMINATION/FOREIGN OBJECT/DEBRIS, VIBRATION, PYRO SHOCK, LOW TEMPERATURE

■ CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

PASS/FAIL RATIONALE:

■ A)
N/A

■ B)
N/A

■ C)
N/A

- FAILURE EFFECTS -

(A) SUBSYSTEM:
NONE.

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(B) INTERFACING SUBSYSTEM(S):
POSSIBLE INABILITY TO CLOSE OR LATCH ET UMBILICAL CLOSEOUT DOOR IF ESCAPING SEPARATION DEBRIS INTERFERES WITH ET DOOR DRIVE OR LATCHING MECHANISM.

(C) MISSION: SAME AS (D)
POSSIBLE LOSS OF CREW/VEHICLE DUE TO AFT FUSELAGE STRUCTURAL DAMAGE CAUSED BY EXCESSIVE HEAT DURING ENTRY IF AN ET DOOR IS JAMMED OPEN BY ESCAPED DEBRIS.

(D) CREW, VEHICLE, AND ELEMENT(S):
~~SAME AS (C).~~

(E) FUNCTIONAL CRITICALITY EFFECTS:

- DISPOSITION RATIONALE -

■ (A) DESIGN:
THE UMBILICAL DEBRIS CONTAINMENT CONSISTS OF:
1. BLAST CONTAINER (MATERIAL 718 INCONEL) WHICH HOUSES THE FRANGIBLE NUT/STUD ASSEMBLY, THE ELECTRICAL CONNECTORS AND CABLES, THE BLADES AND TORSION SPRINGS TO CLOSE OFF HOLE AS STUD IS EJECTED.
2. THE BLADE MATERIAL IS 718 INCONEL.
3. THE TORSION SPRINGS ARE ELGILOY WIRE.
4. THE SPRING RETAINERS ARE A286 CRES.

■ (B) TEST:
FIFTEEN SINGLE FIRING TESTS WERE PERFORMED AT AMBIENT TEMPERATURE AND TEN SINGLE FIRING TESTS WILL BE PERFORMED AT CRYOGENIC TEMPERATURE DURING THE QUALIFICATION TEST PROGRAM. THESE TESTS WILL CERTIFY THE 25-FLIGHT DESIGN LIFE OF THE DEBRIS/BLAST CONTAINER. ALL TESTS WILL BE CONDUCTED WITH THE UMBILICAL DEBRIS CONTAINER/BLADE VALVE MOUNTED ON THE TEST FIXTURE TO SIMULATE ORBITER INSTALLATION.

TURNAROUND:

OMRSD PARAGRAPH	OMRSD TITLE
V55ARO.040	ET/ORB UMB BLAST CONTAINER TORQUE
V55ARO.050	ET/ORB UMB BLAST CHAMBER TORQUE
V55ARO.090	ORB/ET LH UMB CONTAINERS INSPECTION
V55ARO.100	ORB/ET LH UMB CONTAINERS CAPS INSPECTION
V55ARO.110	ORB/ET LH UMB BLAST CHAMBER INSPECTION
V55ARO.120	ORB/ET RH UMB CONTAINERS INSPECTION
V55ARO.130	ORB/ET RH UMB CONTAINERS COVER INSPECTION
V55ARO.140	ORB/ET RH UMB BLAST CHAMBER INSPECTION
V55ARO.190	FWD, AFT & UMB SEP MECH INSP VERIF

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(C) INSPECTION:
RECEIVING INSPECTION
INCONEL CERTIFICATION VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
MACHINE TOLERANCES ARE PER DRAWING AND ANSI Y14.5 AND ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
PENETRANT INSPECTION IS REQUIRED AND VERIFIED BY INSPECTION.

HANDLING/PACKAGING
PACKAGED AND PROTECTED PER APPLICABLE SPECIFICATION AND VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:
ATTACH BOLTS FOR DEBRIS CONTAINER COVER PLATE WERE BENT/STRETCHED IN QUALIFICATION FIRING TEST SERIES, REF. CAR A07980-010. CORRECTIVE ACTION WAS TO REQUIRE VISUAL INSPECTION AFTER EACH FLIGHT AND REPLACEMENT OF BOLTS AS REQUIRED.

(E) OPERATIONAL USE:
CREW CAN CYCLE THE ET DOOR(S) OPEN/CLOSED IF ESCAPED DEBRIS IMPEDES CLOSING/LATCHING.

- APPROVALS -

RELIABILITY ENGINEERING	D. M. MAYNE	D.M. Mayne
DESIGN ENGINEERING	A. P. YSON	1/29/92
QUALITY MANAGER	R. M. SPURLOCK	
NASA RELIABILITY		2/6/92
NASA SUBSYSTEM MANAGER		2/6/92
NASA QUALITY ASSURANCE		2-5-92