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FAILURE MODES EFFECTS ANALYSIS (FMEA) NUMBER: P7-2B-CRW-X

SUBSYSTEM NAME: SIDE HATCH JETTISON

REVISION : 09/12/88

CLASSIFICATION		NAME	PART NUMBER
LRU	:	COLLAR SEVERANCE ASSEMBLY	V070-553410
SRU	:	EXPANDING TUBE ASSEMBLY	MC325-0040

QUANTITY OF LIKE ITEMS: 1

DESCRIPTION/FUNCTION:
LOWER/UPPER EXPANDING TUBE ASSEMBLY. THE COLLAR SEVERANCE SYSTEM IS MADE UP OF 70 FRANGIBLE BOLTS, AN UPPER HALF COLLAR ASSEMBLY AND A LOWER HALF COLLAR ASSEMBLY. EACH SEMI-CIRCULAR (HALF) ASSEMBLY CONSISTS OF TWO REDUNDANT EXPANDING TUBE ASSEMBLIES (XTA) AND ONE INITIATION BLOCK. EACH XTA IS INDIVIDUALLY CAPABLE OF SEVERING THE FRANGIBLE BOLTS OF A SEMI-CIRCULAR ASSEMBLY; THAT IS, ONLY ONE XTA FROM THE UPPER ASSEMBLY AND ONE FROM THE LOWER ASSEMBLY IS NECESSARY TO SEVER THE FRANGIBLE BOLTS IN THE ENTIRE COLLAR SEVERANCE SYSTEM ENSURING SEPARATION OF THE COLLAR FROM THE ORBITER DURING CREW EMERGENCY ESCAPE.

REFERENCE DOCUMENTS: V070-553417

FAILURE MODES EFFECTS ANALYSIS (FMEA) NUMBER: P7-2B-CRW-X

SUMMARY

SUBSYSTEM NAME: SIDE HATCH JETTISON
LRU :COLLAR SEVERANCE ASSEMBLY
LRU PART #: V070-553410
ITEM NAME:EXPANDING TUBE ASSEMBLY

FMEA NUMBER	ABBREVIATED FAILURE MODE DESCRIPTION	CIL FLG	CRIT	HI FL
P7-2B-CRW-01	NO OUTPUT OR FAILS OFF	X	1R2	

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FAILURE MODES EFFECTS ANALYSIS (FMEA) NUMBER: P7-2B-CRW-01

REVISION: 09/12/88

SUBSYSTEM: SIDE HATCH JETTISON
LRU :COLLAR SEVERANCE ASSEMBLY CRITICALITY OF THIS
ITEM NAME: EXPANDING TUBE ASSEMBLY FAILURE MODE: 1R2

FAILURE MODE:
LOW OR NO EXPANSION

MISSION PHASE:
RTLS RETURN TO LAUNCH SITE
TAL TRANS ATLANTIC ABORT
AOA ABORT ONCE AROUND
DO DE-ORBIT
LS LANDING SEQUENCE

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

CAUSE:
PYRO MIX CONTAMINATION, INCORRECT LOADING, OVERSTRENGTH TUBE, EXCESSIVE GAP.

CRITICALITY 1/1 DURING ANY MISSION PHASE OR ABORT? NO

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

PASS/FAIL RATIONALE:
A)
NOT APPLICABLE TO PYRO/MECHANICAL SYSTEM.

B)
NOT APPLICABLE TO PYRO/MECHANICAL SYSTEM.

C)
A PROXIMITY OF ETS LINES OR T-HANDLE FAILURE ALLOWS POSSIBLE LOSS OF AL REDUNDANCY DUE TO A SINGLE EVENT.

METHOD OF FAULT DETECTION:
NONE.

CORRECTING ACTION: NONE
NO CORRECTIVE ACTION POSSIBLE.

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FAILURE MODES EFFECTS ANALYSIS (FMEA) NUMBER: P7-2B-CRW-01

- FAILURE EFFECTS -

(A) SUBSYSTEM:
THE FAILURE OF ONE LOWER AND/OR ONE UPPER EXPANDING TUBE HAS NO EFFECT OTHER THAN LOSS OF REDUNDANCY.

(B) INTERFACING SUBSYSTEM(S):
TWO LOWER EXPANDING TUBE FAILURES OR TWO UPPER EXPANDING TUBE FAILURES RESULTS IN A FAILURE TO FRACTURE ALL FRANGIBLE BOLTS AND THUS A FAILURE TO EFFECT SEPARATION OF THE COLLAR FROM THE ORBITER.

(C) MISSION:
NONE

(D) CREW, VEHICLE, AND ELEMENT(S):
PROBABLE LOSS OF CREW DUE TO INABILITY TO ESCAPE THROUGH SIDE HATCH.

Criticality/
Required Fault Tolerance/Achieved Fault Tolerance: 1R/1/1

RATIONALE FOR CRITICALITY:
REDUNDANT XTA AVAILABLE TO PERFORM FUNCTION.

TIME FROM FAILURE TO CRITICAL EFFECT: IMMEDIATE

TIME FROM FAILURE OCCURRENCE TO DETECTION: IMMEDIATE

TIME FROM DETECTION TO COMPLETED CORRECTIVE ACTION: N/A

TIME REQUIRED TO IMPLEMENT CORRECTIVE ACTION LESS THAN TIME TO EFFECT? N/A
NO CORRECTIVE ACTION POSSIBLE.

- DISPOSITION RATIONALE -

(A) DESIGN:
REDUNDANT PYRO SYSTEM. NO SINGLE FAILURE PER COLLAR ASSEMBLY CAN RENDER SYSTEM INOPERATIVE; EACH INDIVIDUAL XTA FOR EACH COLLAR ASSEMBLY WILL PERFORM FUNCTION WITH 85% CHARGE.

(B) TEST:
PRIOR TO STS-26

QUAL TEST: RANDOM VIBRATION, THERMAL CYCLE, PRESSURE CYCLE, SHOCK, SALT

FAILURE MODES EFFECTS ANALYSIS (FMEA) NUMBER: P7-2B-CRW-01

FOG, X-RAY, N-RAY, MARGIN DEMONSTRATION FIRING WITH SINGLE XTA LOADED AT 85% AT 10 DEGREES F, FIRINGS OF NOMINAL LOAD ASSEMBLY (3 AT +10 DEGREES F, 2 AT AMBIENT, 3 AT +125 DEGREES F).

ACCEPTANCE TEST: EXAMINATION OF PRODUCT, X-RAY, N-RAY, LEAK TEST, EXPLOSIVE CORD CORE LOAD AN DETONATION VELOCITY TESTS. RANDOM SAMPLE FIRING TESTS (QUAL TEST FIRINGS FULFILL REQUIREMENT FOR FIRST LOT).

SYSTEM TEST: ONE (1) INTEGRATED SYSTEM TEST (COLLAR, HINGE, THRUSTERS).

LONG TERM
SYSTEM TEST: FIVE (5) ADDITIONAL INTEGRATED SYSTEM TESTS.

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

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

ASSEMBLY/INSTALLATION
OPERATION VERIFIED BY MIPS ON SHOP TRAVELLER.

NONDESTRUCTIVE EVALUATION
PARTS ARE X-RAYED AND N-RAYED TO VERIFY CORRECT ASSEMBLY AND PRESENCE OF ALL DETAIL PARTS AND EXPLOSIVES. X-RAYS AND N-RAYS ARE REVIEWED BY VENDOR, DCAS, NASA QUALITY AND ENGINEERING. ALL CRITICAL DIMENSIONS ARE INSPECTED.

TEST
ATP IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES
CRITICAL PROCESSES SUCH AS WELDING, PLATING, HEAT TREATING, PASSIVATION AND ANODIZING ARE VERIFIED BY INSPECTION.

STORAGE
STORAGE ENVIRONMENT VERIFIED BY INSPECTION.

HANDLING AND PACKAGING
HANDLING AND PACKAGING IS VERIFIED BY INSPECTION PER THE REQUIREMENTS OF APPLICABLE SPECIFICATIONS.

(D) FAILURE HISTORY:
NO HISTORY OF FAILURE.

(E) OPERATIONAL USE:

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NONE.

REMARKS:
THE REDUNDANCY IS SUCH THAT A FAILURE OF ONE UPPER AND ONE LOWER DETONATING CORD WILL NOT RESULT IN A SYSTEM FAILURE.

- APPROVALS -

RELIABILITY ENGINEERING	C. FERRARELLA	
DESIGN ENGINEERING	R. YEE	
QUALITY ENGINEERING	E. GUTIERREZ	
NASA RELIABILITY		4-27-98
NASA DESIGN		4-27-98
NASA QUALITY ASSURANCE		