PAGE: 1 PRINT DATE: 09/12/8

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

SUBSYSTEM NAME: SIDE HATCH JETTISON

REVISION : 09/12/88

CLASSIFICATION		NAME	PART NUMBER
LRU	:	HINGE SEVERANCE ASSEMBLY	MC325-0043

QUANTITY OF LIKE ITEMS: 2

DESCRIPTION/FUNCTION:
THE HINGE SEVERANCE ASSEMBLY CONSISTS OF AN OUTER/INNER CHARGE HOLDER WITH ASSOCIATED LINEAR SHAPED CHARGE (LSC). EACH HINGE OF THE SIDE HATCH IS FITTED WITH ONE INNER CHARGE HOLDER (CONTAINING TWO SEPARATE LSC'S) AND TWO OUTER CHARGE HOLDERS EACH CONTAINING A SINGLE LSC.

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FAILURE MODES EFFECTS ANALYSIS (FMEA) NUMBER: P7-2B-CRW5-X

SUMMARY

SUBSYSTEM NAME: SIDE HATCH JETTISON
LRU :HINGE SEVERANCE ASSEMBLY
LRU PART #: MC325-0043
ITEM NAME:HINGE SEVERANCE ASSEMBLY

FMEA NUMBER	ABBREVIATED FAILURE MODE DESCRIPTION	CIL FLG	CRIT	HZ FL
P7-2B-CRW5-01	NO OUTPUT OR FAILS OFF	X	1 1	

FAILURE MODES EFFECTS ANALYSIS (FMEA) NUMBER: F7-2B-CRW5-01

REVISION: 09/12/88

SUBSYSTEM: SIDE HATCH JETTISON
LRU :HINGE SEVERANCE ASSEMBLY CRITICALITY OF THIS
ITEM NAME: HINGE SEVERANCE ASSEMBLY FAILURE MODE:1 1

FAILURE MODE:
LOW/NO OUTPUT FROM OUTER LSC (FAILS TO SEVER)

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:
EXCESSIVE GAP, CONTAMINATION OF PYRO MIX, IMPROPER CORE LOADING. FAILURE OF LSC OR BOOSTER CHARGE TO DETONATE, OVERSTRENGTH MATERIAL.

CRITICALITY 1/1 DURING ANY MISSION PHASE OR ABORT? YES

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

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

PASS/FAIL RATIONALE:
A)

B)

C)

METHOD OF FAULT DETECTION:
NONE.

CORRECTING ACTION: NONE
NO CORRECTIVE ACTION POSSIBLE.

FAILURE MODES EFFECTS ANALYSIS (FMEA) NUMBER: P7-2B-CRW5-01

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF OUTER CUTTING FUNCTION RESULTS IN A FAILURE TO SEVER THE HINGE.

(B) INTERFACING SUBSYSTEM(S):
INABILITY TO JETTISON HATCH DURING CREW EMERGENCY ESCAPE.

(C) MISSION:
NONE

(D) CREW, VEHICLE, AND ELEMENT(S):
A FAILURE OF ANY OUTER CUTTER ASSEMBLY COULD RESULT IN LOSS OF CREW DUE TO INABILITY TO EGRESS FROM THE ORBITER.

Criticality/
Required Fault Tolerance/Achieved Fault Tolerance: 1/1/0 ;

RATIONALE FOR CRITICALITY:
DEVELOPMENTAL TESTS HAVE DEMONSTRATED THAT THE INNER HINGE CUTTER ASSEMBLY IS NOT REDUNDANT TO THE OUTER CUTTER ASSEMBLY. THE CORRECT OPERATION OF THE INNER ASSEMBLY IS EXCEEDINGLY SENSITIVE TO TIME DIFFERENCES IN LSC INITIATION (DEVELOPMENTAL TEST FAILURE WAS DUE TO A DIFFERENCE IN THE MICROSECOND RANGE). IF THE ARRIVAL TIMES OF THE DETONATING SIGNAL TO THE TWO LSC'S IN AN INNER ASSEMBLY ARE NOT WITHIN APPROXIMATELY TWO MICROSECONDS, THE FIRST LSC TO IGNITE RENDERS THE SECOND LSC INOPERABLE.

A SINGLE OUTER CUTTER FAILURE (TRANSFER BOOSTER ASSEMBLY, LSC) COMBINED WITH A CORRESPONDING INOPERABLE INNER LSC WOULD RESULT IN A FAILURE TO SEVER THAT HINGE. ANY DIFFERENCE IN ETS LENGTH AND/OR DETONATING SIGNA VELOCITY (ETS SPECIFICATION ALLOWS FOR A RANGE OF ACCEPTABLE VELOCITIES RESULTS IN A DIFFERENCE IN LSC INITIATION TIME, THUS THE CURRENT HINGE SEVERANCE SYSTEM CANNOT BE CERTIFIED AS REDUNDANT.

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

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NO CORRECTIVE ACTION POSSIBLE.

- DISPOSITION RATIONALE -

(A) DESIGN:
SYSTEM PERFORMS CUTTING FUNCTION WITH NORMAL CORE LOAD. DOES NOT MEET DESIGN REQUIREMENT FOR 85% MARGIN.

(B) TEST:
PRIOR TO STS-26

QUALIFICATION TESTS - RANDOM VIBRATION, THERMAL CYCLE, PRESSURE CYCLE, SHOCK, SALT FOG, NOMINAL FIRINGS (3 AT +10 DEGREES F, 1 AT AMBIENT, 3 AT +125 DEGREES F)

ACCEPTANCE TESTS - EXAMINATION OF PRODUCT, X-RAY, N-RAY, LEAK TEST, EXPLOSIVE CORD CORE LOAD AND SEVERANCE TESTS, ENVIRONMENTAL SEAL TEST. RANDOM SAMPLE FIRING TESTS (QUAL TEST FIRINGS FULFILL REQUIREMENT FOR FIRST LOT).

SYSTEM TEST: ONE (1) INTEGRATED SYSTEM TEST.

LONG TERM
SYSTEM TEST: FIVE ADDITIONAL (5) 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
OPERATIONS VERIFIED BY MIPS ON SHOP TRAVELER.

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

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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:
DEVELOPMENT TEST DEMONSTRATED FAILURE TO CUT HINGE AT 85% EXPLOSIVE LOADING.

(E) OPERATIONAL USE:
ON GROUND, OVERHEAD WINDOW COULD BE UTILIZED AS AN ALTERNATE MEANS OF ESCAPE.

REMARKS:

- APPROVALS -

RELIABILITY ENGINEERING	C. FERRARELLA	C.F. for Ochoa for RGL 9/1/87
DESIGN ENGINEERING	R. YEE	for R.G. Ordon 9/1/87
QUALITY ENGINEERING	E. GUTIERREZ	
NASA RELIABILITY		
NASA DESIGN		
NASA QUALITY ASSURANCE		