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PRINT DATE: 09/12/88

FAILURE MODES EFFECTS ANALYSIS (FMEA) NUMBER: P7-2B-CRW7-X

SUBSYSTEM NAME: SIDE HATCH JETTISON

REVISION : 09/12/88

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CLASSIFICATION                      NAME                      PART NUMBER  
LRU                      :              THRUSTER ASSEMBLY                      MC325-0041-0001

QUANTITY OF LIKE ITEMS: 3

DESCRIPTION/FUNCTION:

EACH THRUSTER ASSEMBLY CONSISTS OF A THRUSTER HOUSING, PISTON HEAD, AN INTERNAL PISTON SUBASSEMBLY AND THE THRUSTER HOUSING END CAP. UPON IGNITION OF THE GAS CARTRIDGE ASSEMBLY, THE GAS GENERATED PRESSURIZES THE REGION BEHIND THE THRUSTER PISTON HEAD CAUSING THE SHEAR PIN TO FAIL AND THE PISTON HEAD TO MOVE FORWARD. THIS ACTION ESTABLISHES THE REQUIRED STROKE/PRESSURE CHARACTERISTICS FOR SIDE HATCH JETTISON. AT 8.0 INCHES OF STROKE, THE PISTON HEAD MOTION IS STOPPED BY THE END CAP SHOULDER. AT THIS POINT THE PISTON SUBASSEMBLY IS FREE TO BE JETTISONED WITH THE SIDE HATCH.

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SUMMARY

SUBSYSTEM NAME: SIDE MATCH JETTISON  
LRU :THRUSTER ASSEMBLY  
LRU PART #: MC325-0041-0001  
ITEM NAME:THRUSTER ASSEMBLY

FMEA NUMBER	ABBREVIATED FAILURE MODE DESCRIPTION	CIL FLG	CRIT	RZ FL
P7-2B-CRW7-01	NO OUTPUT OR FAILS OFF	X	1 1	

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FAILURE MODES EFFECTS ANALYSIS (FMEA) NUMBER: P7-2B-CRW7-01

SUBSYSTEM: SIDE HATCH JETTISON  
LRU : THRUSTER ASSEMBLY  
ITEM NAME: THRUSTER ASSEMBLY

REVISION: 09/12/88

CRITICALITY OF THIS  
FAILURE MODE: 1 1

FAILURE MODE:  
LOW/NO OUTPUT

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:  
LEAKAGE, STRUCTURAL FAILURE, BINDING

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.

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- FAILURE EFFECTS -

(A) SUBSYSTEM:

LOSS OF IMPULSE FROM ONE THRUSTER ASSEMBLY.

(B) INTERFACING SUBSYSTEM(S):

REDUCED HATCH VELOCITY. UNPREDICTABLE HATCH TRAJECTORY. WORST CASE  
COULD PREVENT HATCH OPENING.

(C) MISSION:

NONE

(D) CREW, VEHICLE, AND ELEMENT(S):

LOSS OF ONE THRUSTER ASSEMBLY AFFECTS THE TRAJECTORY OF THE JETTISONED  
HATCH RESULTING IN A POSSIBLE COLLISION WITH THE ORBITER. ERRATIC  
ORBITER DYNAMICS COULD RESULT IN LOSS OF CREW.

Criticality/

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

RATIONALE FOR CRITICALITY:

SINGLE FAILURE RESULTS IN LOSS OF CREW.

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:

DESIGN CAPABLE OF FUNCTIONING UNDER WORST CASE CONDITIONS: CASE ONE - 1  
THRUSTERS EACH WITH 2 CARTRIDGES AT 115% AND ONE THRUSTER WITH ONE INERT  
CARTRIDGE AND ONE CARTRIDGE AT 85%; CASE TWO - 3 THRUSTERS EACH WITH TWO  
85% CARTRIDGES.

(B) TEST:

PRIOR TO STS-26

QUALIFICATION TEST: NONE.

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ACCEPTANCE TEST: TENSILE TEST THREE (3) COUPONS FROM HOUSING HEAT LOT, HOUSING PROOF PRESSURE TEST, SHEAR PIN STRENGTH TEST (100% OF LOT), X-RAY, N-RAY, LEAK TEST.

SYSTEM TEST: ONE (1) INTEGRATED SYSTEM TEST (NOTE: SYSTEM TEST USES THREE (3) THRUSTERS AT 100%).

**LONG TERM**

QUALIFICATION TEST: HUMIDITY, SHOCK, RANDOM VIBRATION, TEMPERATURE CYCLING, PRESSURE CYCLING, X-RAY, N-RAY, SINGLE THRUSTER FIRINGS (2 AT +35 DEGREES F, 2 AT AMBIENT, 2 AT +120 DEGREES F), LOCK SHUT FIRING, THREE THRUSTER FIRINGS (FUNCTIONAL MARGIN, STRUCTURAL MARGIN, REDUNDANCY VERIFICATION).

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**

OPERATIONS VERIFIED BY MIP'S 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**

ATI

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.

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(D) FAILURE HISTORY:  
NO FAILURE HISTORY.

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

REMARKS:

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- APPROVALS -  
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RELIABILITY ENGINEERING: C. FERRARELLA  
DESIGN ENGINEERING : R. YEE  
QUALITY ENGINEERING : E. GUTIERREZ  
NASA RELIABILITY :  
NASA DESIGN :  
NASA QUALITY ASSURANCE :

*C. Ferrarella* 9/12/88  
*R. Yee* 9/12/88  
*E. Gutierrez*  
*Thomas J. Brown* 9-27-88  
*...*