FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE
NUMBER: M2-1G-DRG5-X

SUBSYSTEM NAME: LANDING DECELERATION - DRAG PARACHUTE
REVISION : 1 02/11/92

	PART NAME / VENDOR NAME	PART NUMBER / VENDOR NUMBER
LRU :	CLOSEOUT DOOR, CHUTE COMPARTMT	V070-524151-001

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
THE ALUMINUM ALLOY INTEGRALLY MACHINED DOOR, 22.91 IN. BY 18.29 IN., HAS A BREAKAWAY HINGE AT THE RIGHT SIDE AND IS RETAINED BY TWO SHEAR PINS AT THE LEFT SIDE. A MORTAR IMPACT PLATE IS INSTALLED ADJACENT TO THE SHEAR PINS. APPROXIMATE WEIGHT OF THE DOOR WITH TPS INSTALLED IS 13.6 LB.

QUANTITY OF LIKE ITEMS: 1
ONE

FUNCTION:
THE CLOSEOUT DOOR SEALS THE DRAG CHUTE COMPARTMENT DURING ASCENT, ORBITAL OPERATIONS, ENTRY AND APPROACH. WHEN THE PILOT CHUTE MORTAR IS FIRED, THE PILOT CHUTE PACK IMPACTS THE STRIKER PLATE, BREAKS THE SHEAR PINS AND ROTATES THE DOOR ABOUT THE HINGE LINE UNTIL SEPARATION OCCURS 0.025 SECONDS AFTER CARTRIDGE INITIATION. AN O-RING SEAL BETWEEN THE DOOR AND DOOR FRAME PREVENTS AIR OR GAS INFILTRATION INTO THE COMPARTMENT.

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FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: M2-1G-ORG5-01

REVISION# 1 02/11/92 R

SUBSYSTEM: LANDING DECELERATION - DRAG PARACHUTE
LRU :CLOSEOUT DOOR, CHUTE COMPARTMT
ITEM NAME: CLOSEOUT DOOR, CHUTE COMPARTMT

CRITICALITY OF THIS FAILURE MODE:1/1

■ FAILURE MODE:
OPENS PREMATURELY

MISSION PHASE:
LO LIFT-OFF
OO ON-ORBIT

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

■ CAUSE:
DOOR SHEAR PIN OR HINGE FAILURE, PRESSURE/VENT FAILURE, LAUNCH ENVIRONMENT, MANUFACTURING OR MATERIAL DEFECT, IMPROPER INSTALLATION

■ CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

PASS/FAIL RATIONALE:
■ A)

■ B)

■ C)

■ MASTER MEAS. LIST NUMBERS: V51T0914A
: V51T0915A

- FAILURE EFFECTS -

■ (A) SUBSYSTEM:
DOOR SEPARATES FROM VEHICLE. POSSIBLE INGESTION OF HAZARDOUS GAS DURING ASCENT OR ENTRY. PROBABLE DAMAGE TO CHUTE FABRIC. POSSIBLE AUTO-IGNITION OF MORTAR CARTRIDGE AND DEPLOYMENT OF PILOT CHUTE AND DRAG

CHUTE DURING LIFT-OFF PHASE.

- (B) INTERFACING SUBSYSTEM(S):
POSSIBLE HAZARDOUS GAS INGESTION INTO AFT FUSELAGE. LOSS OF ADDITIONAL BRAKING CAPABILITY. POSSIBLE DAMAGE TO SSME #1 LH2 CIRCULATION LINES BY CONTACT WITH DOOR OR KEVLAR RISERS. NORMAL BRAKING CAPABILITIES REMAIN.

- (C) MISSION:
SEE (B) AND (D)

- (D) CREW, VEHICLE, AND ELEMENT(S):
LOSS OF THERMAL PROTECTION COULD RESULT IN ORBITER STRUCTURAL DAMAGE FROM HIGH TEMPERATURES DURING LIFT OFF OR ENTRY. POSSIBLE LOSS OF SSME #1, CREW AND VEHICLE.

- (E) FUNCTIONAL CRITICALITY EFFECTS:

- DISPOSITION RATIONALE -

- (A) DESIGN:
DOOR IS INTEGRALLY MACHINED ALUMINUM ALLOY PANEL WITH INTEGRAL HINGES AND SHEAR PIN LUGS. DOOR IS USED FOR ONE FLIGHT ONLY. DOOR IS DESIGNED TO WITHSTAND BURST DIFFERENTIAL PRESSURE OF 1.36 PSI. MINIMUM STRENGTH OF SHEAR PINS IS 969 LB TOTAL (4 SHEAR FACES). DOOR IS DESIGNED TO A SAFETY FACTOR OF 1.4 WITH POSITIVE MARGINS ON ALL ELEMENTS.

NOMINAL MISSION OPERATIONS POSITION ENGINE NOZZLE OUTSIDE OF ENVELOPE IN WHICH CONTACT BY DOOR OR RISER COULD OCCUR. HOWEVER, RANGE OF ENGINE GIMBALLING INCLUDES AN EXTREME POSITION SUCH THAT THEORETICAL CONTACT IS POSSIBLE.

- (B) TEST:
QUALIFICATION TEST:
SEVEN NEW DOORS WERE SUBJECTED TO QUALIFICATION TESTS. ONE DOOR WAS SUBJECTED TO RANDOM VIBRATION FOR 6.64 MINUTES IN EACH OF THREE ORTHOGONAL AXES, EQUIVALENT TO TEN MISSIONS WITH SCATTER FACTOR OF FOUR (40 MISSIONS). POSITIVE (BURST) PRESSURE OF 1.36 PSID WAS APPLIED DURING SIMULATED ASCENT VIBRATION. ADDITIONALLY, THIS DOOR WAS SUBJECTED TO THERMAL CYCLING BETWEEN -120 F AND +100 F AND DOOR SEAL AIR INFILTRATION TEST AT AMBIENT, HIGH (+300 F) AND LOW (-100 F) TEMPERATURES, TO VERIFY AIR INFILTRATION SEAL CAPABILITY.

ACCEPTANCE TEST:
EACH DOOR IS VISUALLY EXAMINED AND WEIGHED; ALSO, DOOR SEAL LEAK TEST IS PERFORMED AND STATIC DOOR RELEASE ANGLE IS VERIFIED. LOT ACCEPTANCE

TESTS OF DOOR SHEAR PINS ARE PERFORMED TO VERIFY SINGLE SHEAR VALUE OF 255 TO 305 LB.

■ (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.

ASSEMBLY/INSTALLATION
VISUAL INSPECTION, IDENTIFICATION PERFORMED, AND PARTS PROTECTION VERIFIED BY INSPECTION.

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, AND ANODIZING ARE VERIFIED BY INSPECTION.

HANDLING/PACKAGING
STORAGE ENVIRONMENTS ARE MONITORED AND VERIFIED BY INSPECTION.

ACCEPTANCE
ROCKWELL INSPECTION WITNESSES ACCEPTANCE TESTING.

■ (D) FAILURE HISTORY:
IM NO. A07813-000 RECORDED A QUALIFICATION VIBRATION TEST FAILURE OF THE TWO SHEAR PINS RETAINING THE DOOR. CORRECTIVE ACTION WAS TO ELIMINATE SHEAR PIN FREE PLAY, ADD TWO RUBBER CUSHIONS, REVISE VIBRATION TEST LEVELS AND REPEAT THE QUALIFICATION VIBRATION TEST.

■ (E) OPERATIONAL USE:
NO WORKAROUND FEASIBLE.

- APPROVALS -

RELIABILITY ENGINEERING	D. M. MAYNE	D.M. Mayne
DESIGN ENGINEERING	C. LOWRY	
QUALITY MANAGER	O. J. BUTTNER	2/25/92
NASA RELIABILITY		2/25/92
NASA SUBSYSTEM MANAGER		2/25/92
NASA QUALITY ASSURANCE		2-25-92