FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 03-1-0703 -X

SUBSYSTEM NAME: MAIN PROPULSION

REVISION: 1 11/08/00

PART DATA

	PART NAME / **VENDOR NAME**	**PART NUMBER** / **VENDOR NUMBER**
LRU	: SEAL	ME261-0033

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
SEAL, GO2/GH2 HI PRESSURE METALLIC BOSS (K SEAL).

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS:

FUNCTION:
PROVIDES A SEAL BETWEEN TRANSDUCERS/TEST PLUGS AND BOSSES TO PREVENT EXTERNAL LEAKAGE OF PRESSURANT GASES.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

NUMBER: 03-1-0703-01

REVISION#: 1 11/08/2000

SUBSYSTEM NAME: MAIN PROPULSION
LRU: SEAL, GO2/GH2 METALLIC BOSS (K SEAL) **CRITICALITY OF THIS**
ITEM NAME: SEAL, GO2/GH2, METALLIC BOSS (K SEAL) **FAILURE MODE:** 1/1

FAILURE MODE:
RUPTURE/LEAKAGE.

MISSION PHASE:
PL PRE-LAUNCH
LO LIFT-OFF

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

CAUSE:
FATIGUE, MATERIAL DEFECT, DAMAGED SEALING SURFACE

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)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
GO2, GH2 AND/OR GHE LEAKAGE INTO THE AFT COMPARTMENT. POSSIBLE OVERPRESSURIZATION OF THE AFT COMPARTMENT AND FIRE/EXPLOSION HAZARD. GHE LEAKAGE FROM ANTI-ICING PURGE DETECTABLE ON GROUND USING HAZARDOUS GAS DETECTION SYSTEM (HGDS).

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GO2/GH2 FLOW CONTROL VALVES WILL OPEN IN AN ATTEMPT TO MAINTAIN ULLAGE PRESSURE. LOSS OF ET LO2/LH2 ULLAGE PRESSURE WILL RESULT IN VIOLATION OF TANK MINIMUM STRUCTURAL CAPABILITY REQUIREMENTS. POSSIBLE PRE-MECO SSME SHUTDOWN DUE TO LOW LH2 NPSP. MASS OF LO2 AND VEHICLE ACCELERATION SHOULD BE SUFFICIENT TO MAINTAIN PROPER ENGINE NPSP UNTIL LATE IN POWERED FLIGHT.

POSSIBLE LOSS OF ADJACENT CRITICAL COMPONENTS DUE TO IMPINGEMENT OF HIGH PRESSURE GAS.

(B) INTERFACING SUBSYSTEM(S):
SAME AS A.

(C) MISSION:
POSSIBLE LAUNCH SCRUB DUE TO LCC VIOLATION.

(D) CREW, VEHICLE, AND ELEMENT(S):
POSSIBLE LOSS OF CREW/VEHICLE.

(E) FUNCTIONAL CRITICALITY EFFECTS:
NONE.

-DISPOSITION RATIONALE-

(A) DESIGN:
HYDROGEN SEAL:
IN ORDER TO INCREASE THE USEFUL TEMPERATURE RANGE OF THE STANDARD BOSS FITTING, A METALLIC BOSS SEAL (ME261-0033, TYPE III) WAS DEVELOPED. THE SEAL WAS FABRICATED FROM A286 CORROSION RESISTANT STEEL AND IS COATED WITH K-6 NICKEL-LEAD. THE SEAL IS DESIGNED TO BE USED IN MS33649 BOSS PORTS. THE SEAL WAS DESIGNED TO A MINIMUM FACTOR OF SAFETY OF 2.0 PROOF AND 4.0 BURST.

OXYGEN SEAL:
IN ORDER TO INCREASE THE SEALING CAPABILITY IN GO2 APPLICATIONS BOTH HIGH AND LOW TEMPERATURE METALLIC BOSS SEALS (ME261-0033, TYPE II) WERE DEVELOPED. THE SEAL IS FABRICATED FROM A286 CRES AND GOLD PLATED. THE SEAL IS DESIGNED TO BE USED IN MS33649 BOSS PORTS. THE SEAL WAS DESIGNED TO A MINIMUM FACTOR OF SAFETY OF 2.0 PROOF AND 4.0 BURST. ONLY THE GOLD PLATED SEALS (TYPE II & IV) CAN BE USED IN THE GO2 SYSTEM.

THE TYPE IV SEALS ARE NOW USED AS REPLACEMENTS FOR THE TYPE II AND III AND HAVE A THICKER GOLD PLATING (0.0005” VS. 0.0003”) TO AID SEALING FUNCTION.

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EXTERNAL LEAKAGE FROM THE TRANSDUCER/TEST PLUG INTERFACE CAN OCCUR FROM A DAMAGED/DEFECTIVE K-SEAL OR DAMAGE TO THE SEALING SURFACE. THE SEALING SURFACE HAS AN 8 MICRON FINISH AND IS EXAMINED PRIOR TO INSTALLATION OF THE K-SEAL. THE K-SEAL JOINT IS LEAK TESTED AFTER INSTALLATION.

(B) TEST:
ATP

EXAMINATION OF PRODUCT
PER BOEING SPECIFICATION CONTROL DRAWING

COMPATIBILITY TEST (TYPE III ONLY)
GO2 COMPATIBILITY
60 TEST COUPONS (EACH BATCH OF SEALS).
EACH BATCH OF SEALS IDENTIFIED BY LOT TRACEABILITY REQUIREMENTS.

CERTIFICATION

THE SEALS WERE CERTIFIED BY SIMILARITY TO THE K-SEALS USED ON THE SATURN II PROGRAM.

OMRSD
ANY TURNAROUND CHECKOUT IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:
RECEIVING INSPECTION
PARTS ARE VERIFIED TO REQUIREMENTS WITH RESPECT TO MATERIALS, DIMENSIONS, MARKINGS, AND WORKMANSHIP.

CONTAMINATION CONTROL
CLEANLINESS LEVEL OF 100A IS MAINTAINED AND VERIFIED.

ASSEMBLY/INSTALLATION
PRIOR TO JOINT ASSEMBLY, BOSS SEALING SURFACES AND SEAL ARE VISUALLY INSPECTED AND CLEANLINESS IS VERIFIED. SEALS ARE PROOF PRESSURE TESTED AND LEAKED CHECK AFTER INSTALLATION INTO THE VEHICLE.

CRITICAL PROCESSES
K-6 NICKEL-LEAD PLATING IS VERIFIED BY INSPECTION. THE SEAL IS TESTED FOR GO2 COMPATIBILITY PER NHB 8060.1A REQUIREMENTS. GOLD PLATING IS VERIFIED BY INSPECTION.

TESTING
ATP IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING
EACH SEAL IS INDIVIDUALLY WRAPPED IN A FLUOROCARBON FILM AND THEN PLACED IN A POLYURETHANE ENVELOPE AND HEAT SEALED. PACKAGING FOR SHIPMENT IS VERIFIED BY INSPECTION.

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(D) FAILURE HISTORY:
SEVERAL LEAKS HAVE BEEN DETECTED DURING VEHICLE LEAK CHECKS. ALL WERE CORRECTED BY PARTS REPLACEMENT AND/OR RETORQUE.

CURRENT DATA ON TEST FAILURE, FLIGHT FAILURE, UNEXPLAINED ANOMALIES, AND OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE FOUND IN THE PRACA DATABASE.

(E) OPERATIONAL USE:
NO CREW ACTION CAN BE TAKEN.

- APPROVALS -

S&R ENGINEERING	: W.P. MUSTY	:/S/ W.P. MUSTY
S&R ENGINEERING ITM	: P. A. STENGER-NGUYEN	:/S/ P.A. STENGER-NGUYEN
DESIGN ENGINEERING	: EARL HIRAKAWA	:/S/ EARL HIRAKAWA
MPS SUBSYSTEM MGR.	: TIM REITH	:/S/ TIM REITH
MOD	: BILL LANE	:/S/ BILL LANE
USA SAM	: MIKE SNYDER	:/S/ MIKE SNYDER
USA ORBITER ELEMENT	: SUZANNE LITTLE	:/S/ SUZANNE LITTLE
NASA SR&QA	: ERICH BASS	:/S/ ERICH BASS