

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE**NUMBER: 03-1-0771 -X****SUBSYSTEM NAME:** MAIN PROPULSION**REVISION:** 1 08/09/00

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
LRU	:BEARING, SPHERICAL, 2" DISC INTERFACE BOEING :	V070-415266-001

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

BEARING, SPHERICAL, GH2 AND GO2 PRESSURIZATION SYSTEM 2 INCH DISCONNECTS,
INTERFACE CLAMPING.

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 2
ONE SET PER GH2/GO2

FUNCTION:

BEARING INTERFACE PROVIDES ALIGNMENT OF THE ET/ORBITER DISCONNECT HALVES
WHEN MATED TO INSURE PROPER DISTRIBUTION OF THE CLAMPING FORCE REQUIRED TO
MAINTAIN DISCONNECT IN MATED CONFIGURATION DURING ASCENT.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

NUMBER: 03-1-0771-01

REVISION#: 1 08/09/00

SUBSYSTEM NAME: MAIN PROPULSION

LRU: BEARING, SPHERICAL, 2" DISC INTERFACE

ITEM NAME: BEARING, SPHERICAL, 2" DISC INTERFACE

CRITICALITY OF THIS

FAILURE MODE: 1/1

FAILURE MODE:

FAILURE TO ALLOW AND MAINTAIN PROPER ALIGNMENT OF PRESSURIZATION DISCONNECT

MISSION PHASE:

PL PRE-LAUNCH

LO LIFT-OFF

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

102 COLUMBIA

103 DISCOVERY

104 ATLANTIS

105 ENDEAVOUR

CAUSE:

PIECE PART STRUCTURAL FAILURE, BINDING

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:

STRUCTURAL FAILURE/BINDING OF THE BEARING DURING ENGINE OPERATION, RESULTS IN MISALIGNMENT OF THE DISCONNECT CAUSING GO2/GH2 LEAKAGE INTO THE ORB/ET UMBILICAL CAVITY. HYDROGEN/OXYGEN ENTERS THE AFT FUSELAGE AND ESCAPES INTO THE ATMOSPHERE. POSSIBLE FIRE/EXPLOSIVE HAZARD BOTH INTERNAL AND EXTERNAL TO THE VEHICLE. POSSIBLE AFT COMPARTMENT OVERPRESSURIZATION.

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DURING ANTI-ICING OPS AND ET HELIUM PREPRESS, GHE LEAKAGE INTO THE AFT COMPARTMENT MAY BE DETECTABLE USING HGDS.

ON THE GROUND, INFRARED CAMERAS, COLOR TV MONITORS, AND PAPER STRIPS MAY DETECT THE PRESENCE OF FIRE.

LOSS OF ET ULLAGE PRESSURE WILL RESULT IN VIOLATION OF TANK MINIMUM STRUCTURAL CAPABILITY REQUIREMENTS. POSSIBLE UNCONTAINED SSME SHUTDOWN. THE GH2 FLOW CONTROL VALVES WILL CYCLE TO HIGH FLOW POSITION IN AN ATTEMPT TO MAINTAIN ET ULLAGE PRESSURE OF THE HYDROGEN TANK.

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

(C) MISSION:
POSSIBLE LAUNCH SCRUB IF DETECTED.

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

(E) FUNCTIONAL CRITICALITY EFFECTS:
1R/2 2 SUCCESS PATHS. TIME FRAME - LOADING.
1) STRUCTURAL FAILURE/BINDING OF THE BEARING CAUSES EXTERNAL LEAKAGE PAST ET/ORB INTERFACE SEAL.
2) LOSS OF HELIUM ANTI-ICING PURGE.

ALLOWS GO2/GH2 FROM THE ET TO LEAK INTO THE ORB/ET UMBILICAL CAVITY CAUSING HYDROGEN/OXYGEN TO ENTER BOTH THE AFT FUSELAGE AND ESCAPE INTO THE ATMOSPHERE. POSSIBLE FIRE/EXPLOSIVE HAZARD BOTH INTERNAL AND EXTERNAL TO THE VEHICLE.

ON THE GROUND, LD54/55 MAY DETECT EXCESSIVE GH2 LEAKAGE. GH2/GO2 LEAKAGE MAY BE DETECTED WITHIN THE AFT COMPARTMENT. INFRARED CAMERAS AND COLOR TV MONITORS MAY DETECT THE PRESENCE OF FIRE.

POSSIBLE LAUNCH SCRUB IF DETECTED.

POSSIBLE LOSS OF CREW/VEHICLE.

-DISPOSITION RATIONALE-

(A) DESIGN:

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THE BEARING CONFIGURATION CONSISTS OF TWO PARTS: THE BEARING, WHICH IS MOUNTED TO THE 2 INCH DISCONNECT MOUNTING FLANGE; AND THE RETAINER, WHICH MAINTAINS THE PRIMARY AND SECONDARY BELLEVILLE WASHERS ALIGNMENT AND LOCATION.. THE BEARING IS MACHINED FROM A286 BAR AND CONTAINS 3 ROSAN INSERTS. THE SPHERICAL SURFACE IS COATED WITH A DRY FILM LUBRICANT. THE RETAINER IS MACHINED FROM A286.

STRUCTURAL FAILURE OR BINDING WOULD PREVENT THE DISCONNECT FROM ALIGNING PROPERLY AND WOULD CAUSE AN UNEVEN DISTRIBUTION OF THE CLAMPING FORCE RESULTING IN GO2 OR GH2 LEAKING PAST THE INTERFACE SEAL.

THE BEARING AND RETAINER ARE DESIGNED TO A YIELD LOAD FACTOR OF SAFETY OF 1.0 AND AN ULTIMATE LOAD FACTOR OF SAFETY OF 1.4. STRUCTURAL ANALYSIS INDICATES POSITIVE MARGINS OF SAFETY FOR ALL CONDITIONS OF OPERATIONS.

(B) TEST:

ATP

EXAMINATION OF PRODUCT

CERTIFICATION

THE BELLEVILLE ASSEMBLY, INCLUDING THE BEARINGS, WERE CERTIFIED WITH THE PRODUCTION LH2 AND LO2 UMBILICAL ASSEMBLIES, EACH CONTAINING INTERFACE LOADING CAPABILITY. THE UMBILICAL ASSEMBLIES WERE SUBJECTED TO THE FOLLOWING SERIES OF ENVIRONMENTAL AND STRUCTURAL TESTS:

UMBILICAL SEPARATION TESTS

28 CYCLES:

AMBIENT AND LO2/LH2 TEMPERATURES (-297 DEG F/-423 DEG F)

MAXIMUM OPERATING PRESSURES: 600 PSIG

EXTERNAL LOAD CONDITIONS

UMBILICAL VIBRATION TESTS (LH2 UMBILICAL ONLY)

RANDOM VIBRATION

4.4 HOURS IN EACH OF THREE AXES

STATIC LOAD TEST

ULTIMATE LOAD TEST

GROUND TURNAROUND TEST

ANY TURNAROUND CHECKOUT IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:

RECEIVING INSPECTION

INCOMING MATERIAL IS VERIFIED FOR MATERIAL AND PROCESS CERTIFICATION.

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CONTAMINATION CONTROL

CORROSION PROTECTION IS VERIFIED BY INSPECTION. GENERALLY CLEAN REQUIREMENT IS VERIFIED.

ASSEMBLY/INSTALLATION

MACHINED PARTS ARE VISUALLY INSPECTED UNDER 10X MAGNIFICATION. RAW MATERIAL SURFACE FINISHED TO 16 RMS AND PARTS SURFACE FINISHED TO 32 RMS ARE VERIFIED BY INSPECTION PER REQUIREMENT.

CRITICAL PROCESSES

DRY FILM LUBRICANT APPLIED ON SPHERICAL SURFACE IS VERIFIED BY INSPECTION. HEAT TREATMENT OF PARTS ARE VERIFIED PER REQUIREMENT.

NONDESTRUCTIVE EVALUATION

MAGNETIC PARTICLE INSPECTION OF PART VERIFIED BY INSPECTION.

TESTING

ATP, INCLUDING MATERIAL TENSILE, HARDNESS, AND STRESS-RUPTURE PROPERTY TESTS, ARE VERIFIED BY INSPECTION.

HANDLING/PACKAGING

HANDLING, PACKAGING, STORAGE, AND SHIPPING REQUIREMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:

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 FOR GO2 LEAK.

WHEN GH2 ULLAGE LEAK IS IDENTIFIED, CREW WILL ENABLE THE SSME LIMIT SHUTDOWN CONTROL AND ABORT TAL OR ACLS.

- 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	: MIKE FISCHER	:/S/ MIKE FISCHER
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