FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 03-1-0516 -X

SUBSYSTEM NAME: MAIN PROPULSION

REVISION: 1 07/27/00

PART DATA

	PART NAME / **VENDOR NAME**	**PART NUMBER** / **VENDOR NUMBER**
LRU	:COUPLING, TEST POINT UNITED SPACE ALLIANCE-NSLD	ME276-0032-0017

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
COUPLING, TEST POINT, GO2/GH2 PRESSURIZATION AIRBORN HALF (0.375 INCH DIAMETER).

VALVE WAS ORIGINALLY DESIGNED AND MANUFACTURED BY LEAR-SEIGLER BUT IS NOW MANUFACTURED BY UNITED SPACE ALLIANCE-NSLD AS AN ALTERNATE PRODUCTION AGENCY.

REFERENCE DESIGNATORS: PD15
PD16

QUANTITY OF LIKE ITEMS: 2
ONE GO2, ONE GH2

FUNCTION:
THE TEST POINT COUPLING IS USED TO MONITOR THE PRESSURE IN THE PRESSURIZATION LINE DURING GROUND TURNAROUND. IN ADDITION, IT IS UTILIZED TO MONITOR ET PRESSURE AFTER ORBITER/ET MATING.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

NUMBER: 03-1-0516-01

REVISION#: 1 07/27/00

SUBSYSTEM NAME: MAIN PROPULSION
LRU: COUPLING, TEST POINT
ITEM NAME: GO2/GH2 TEST POINT COUPLING

CRITICALITY OF THIS FAILURE MODE: 1/1

FAILURE MODE:
RUPTURE/LEAKAGE OF THE COUPLING BODY DURING LOADING, ASCENT.

MISSION PHASE:
PL PRE-LAUNCH
LO LIFT-OFF
DO DE-ORBIT

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

CAUSE:
FATIGUE, MATERIAL DEFECT

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) PRIOR TO T-9 MINUTES.

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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 UNCONTAINED SSME SHUTDOWN DUE TO LOW LH2 NPSP. MASS OF LO2 AND VEHICLE ACCELERATION SHOULD BE SUFFICIENT TO MAINTAIN PROPER ENGINE NPSP, DELAYING UNCONTAINED SSME SHUTDOWN DUE TO LOW LO2 NPSP UNTIL LATE IN POWERED FLIGHT.

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

ALSO RESULTS IN POSSIBLE LOSS OF HELIUM SUPPLY DURING MANIFOLD REPRESSURIZATION CAUSING LOSS OF AFT COMPARTMENT PURGE.

(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:
THE AIRBORNE HALF OF THE TEST POINT COUPLING PROVIDES ACCESS TO THE PRESSURIZATION LINES THROUGH THE GROUND HALF. FOR FLIGHT THE GROUND HALF IS REMOVED AND REPLACED BY A CAP. THE AIRBORNE HALF (HOUSING: 17-7PH CRES) CONTAINS A SPRING (17-7PH CRES) LOADED CLOSED POPPET (303 CRES) WHICH IS MECHANICALLY ACTUATED OPEN UPON INSERTION OF THE GROUND HALF. THE POPPET CONTAINS A KYNAR PRIMARY AND A TEFLON SECONDARY SEAL WHICH SEAT AGAINST A 4 MICRO-INCH SURFACE. THE CAP/HOUSING (CAP: 310 CRES) INTERFACE HAS PRIMARY (KYNAR) AND SECONDARY (TEFLON) SEALS THAT ARE REDUNDANT TO THE POPPET SEALS. THE PRIMARY SEAL IS LOCATED IN THE HOUSING AND SECONDARY SEAL IS IN THE CAP.

THE TEST POINT COUPLING IS DESIGNED FOR 950 PSI OPERATING PRESSURE, 1900 PSI PROOF AND 3800 PSI BURST, AND FOR A LIFE OF 400 ENGAGEMENT/ DISENGAGEMENT CYCLES. STRUCTURAL ANALYSIS INDICATES THAT THE COUPLING HAS A POSITIVE MARGIN OF SAFETY.

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THE TEST POINT COUPLING WAS ALSO USED ON THE APOLLO AND SATURN VEHICLES.

(B) TEST:
ATP

EXAMINATION OF PRODUCT

PROOF PRESSURE (AMBIENT GHE)

MATED (PRESSURIZE AIRBORNE HALF ONLY)
PRESSURE: 1900 PSIG

UNMATED (AIRBORNE HALF)
PRESSURE: 1900 PSIG (POPPET CLOSED, PRESSURE CAP OFF)
PRESSURE: 1900 PSIG (POPPET OPEN, PRESSURE CAP INSTALLED)

LEAKAGE NOT GREATER THAN 1X10-4 SCC/SECOND OF HELIUM

FUNCTIONAL TEST
THREE MATE/UNMATE CYCLES
PRESSURE: 950 PSIG

LEAKAGE

MATED (PRESSURIZE AIRBORNE HALF ONLY)
PRESSURE: 950 PSIG

UNMATED (AIRBORNE HALF)
PRESSURE: 950 PSIG (POPPET CLOSED, PRESSURE CAP OFF)
PRESSURE: 950 PSIG (POPPET OPEN, PRESSURE CAP INSTALLED)

CERTIFICATION

THERMAL CYCLE
3 CYCLES: +100 TO +350 TO +150 TO -100 TO +70 DEG F

VIBRATION

TRANSIENT (PRESSURIZE AIRBORNE HALF ONLY)
PRESSURE: 650 PSIG
SWEEP RATE: 1 OCTAVE/MINUTE

RANDOM (PRESSURIZE AIRBORNE HALF ONLY)
13.3 HOURS IN EACH OF 2 AXES
PRESSURE: 650 PSIG

LEAKAGE

MATED (PRESSURIZE AIRBORNE HALF ONLY)

PRESSURE: 950 PSIG

UNMATED (AIRBORNE HALF)
PRESSURE: 950 PSIG (POPPET CLOSED, PRESSURE CAP OFF)
PRESSURE: 950 PSIG (POPPET OPEN, PRESSURE CAP INSTALLED)

BURST TEST

MATED (PRESSURIZE AIRBORNE HALF ONLY)
PRESSURE: 3800 PSIG

UNMATED (AIRBORNE HALF)
PRESSURE: 3800 PSIG (POPPET CLOSED, PRESSURE CAP OFF)
PRESSURE: 3800 PSIG (POPPET OPEN, PRESSURE CAP INSTALLED)

GROUND TURNAROUND TEST
ANY TURNAROUND CHECKOUT IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:
RECEIVING INSPECTION
ALL RAW MATERIALS ARE VERIFIED FOR MATERIAL AND PROCESS CERTIFICATION, AND VISUALLY INSPECTED.

CONTAMINATION CONTROL
ASSEMBLIES ARE MAINTAINED TO CLEANLINESS LEVEL 100A. CORROSION PROTECTION REQUIREMENTS ARE VERIFIED BY INSPECTION. PROTECTIVE CAPS ARE ALSO EMPLOYED TO PREVENT CONTAMINATION AND DAMAGE TO SEALING SURFACE.

ASSEMBLY/INSTALLATION
DIMENSION AND SURFACE FINISHES ARE VERIFIED BY INSPECTION. ENGAGING TORQUES ARE VERIFIED BY INSPECTION. ASSEMBLIES ARE INSPECTED AND VERIFIED FREE OF TOOL MARKS AND BURRS ON SLOTS AND THREADS.

CRITICAL PROCESSES
THE FOLLOWING CONTROL PROCESSES ARE VERIFIED BY INSPECTION:

DRY FILM LUBRICANT
HEAT TREATMENT
ELECTROPOLISHING
PART PASSIVATION
WELDING

NONDESTRUCTIVE EVALUATION
HELIUM LEAK CHECK IS VERIFIED BY INSPECTION. SAMPLE WELDS ARE SECTIONED AND CHECKED FOR WELD PENETRATION ON A PLAN OF ONE SAMPLE PER 20 WELDS. WELDS ARE VISUALLY EXAMINED AT 20X MAGNIFICATION. MATERIALS ARE VERIFIED FOR OXYGEN COMPATIBILITY PER NHB 8060.1.

TESTING

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ATP IS VERIFIED BY INSPECTION. TEST EQUIPMENT IS VERIFIED CLEANED AND FREE OF CONTAMINATION.

HANDLING/PACKAGING
HANDLING AND PACKAGING 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:
IF THE LH2 NPSP DROPS BELOW THE PRE-FLIGHT ACCEPTED LEVELS (PER FLIGHT RULES), THE CREW WILL MANUALLY THROTTLE THE ENGINES TO KEEP THE NPSP HIGH ENOUGH TO PREVENT LH2 TURBOPUMP CAVITATION.

NO CREW ACTION CAN BE TAKEN FOR THE GO2 SYSTEM.

- 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	: CHARLES EBERHART	:/S/ CHARLES EBERHART
MPS SUBSYSTEM MGR.	: TIM REITH	:/S/ TIM REITH
MOD	: JEFF MUSLER	:/S/ JEFF MUSLER
USA SAM	: MICHAEL SNYDER	:/S/ MICHAEL SNYDER
USA ORBITER ELEMENT	: SUZANNE LITTLE	:/S/ SUZANNE LITTLE
NASA SR&QA	: ERICH BASS	:/S/ ERICH BASS