FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE
NUMBER: 03-3-20010-X

SUBSYSTEM NAME: ORBITAL MANEUVERING SYSTEM (OMS)
REVISION : 6 02/05/91

		PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
SRU	:	GIMBALLED JOINT KETEMA	ME271-0092-0004
SRU	:	GIMBALLED JOINT KETEMA	ME271-0092-0005

PART DATA

■ EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
GIMBALLED JOINT, CROSSFEED

QUANTITY OF LIKE ITEMS: 12

FUNCTION:
A 3 PLY (.008 IN THICK PER PLY) INCONEL 718 LINED BELLOWS EXTERNALLY CONSTRAINED BY AN INCONEL 718 GIMBAL IS USED IN THREE PLACES IN EACH LINE ON THE VEHICLE SIDE AS PART OF THE FLANGED INTERFACE BETWEEN THE PODS AND THE OMS CROSSFEED LINE TO FACILITATE SYSTEM ASSEMBLY AND AFFORD FLEXIBILITY FOR CONNECTION OF ORBITER-MOUNTED CROSSFEED LINES TO THE POD FEEDLINES.

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: 03-3-20010-01

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SUBSYSTEM: ORBITAL MANEUVERING SYSTEM (OMS)

ITEM NAME: GIMBALLED JOINT

CRITICALITY OF THIS FAILURE MODE:1/1

FAILURE MODE:
STRUCTURAL FAILURE, RUPTURE, EXTERNAL LEAKAGE.

MISSION PHASE:
PL PRELAUNCH
LO LIFT-OFF
OO ON-ORBIT
DO DE-ORBIT
LS LANDING SAFING

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 103 DISCOVERY
: 104 ATLANTIS
105 Endeavour

CAUSE:
WELD DEFECT, CORROSION, PROPELLANT BY-PRODUCT EXPOSURE, INSTALLATION DAMAGE, PRESSURE SURGE OR FLIGHT VIBRATION. FAILED CLOSED OF A. C. MOTOR VALVE RELIEF DEVICE.

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:
SUBSYSTEM DEGRADATION - LOSS OF PROPELLANT DURING INTERCONNECT OR CROSSFEED OPERATIONS.

(B) INTERFACING SUBSYSTEM(S):
INABILITY TO USE CROSSFEED LINE (REQUIRED FOR ABORT DUMP), ALSO

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REQUIRED FOR REACTION TO OME FAILURES. CORROSION DAMAGE IN POD/ORBITER AFT COMPARTMENT. INABILITY TO INTERCONNECT TO RCS.

(C) MISSION:
ABORT DECISION.

(D) CREW, VEHICLE, AND ELEMENT(S):
POSSIBLE LOSS OF CREW/VEHICLE IF LEAK RESULTS IN EXCESSIVE PROPELLANT LOSS OR DAMAGE TO TPS/STRUCTURE.

(E) FUNCTIONAL CRITICALITY EFFECTS:

- DISPOSITION RATIONALE -

(A) DESIGN:
DESIGN FACTOR OF SAFETY IS 1.5. LINED MULTIPLY BELLOWS ARE UTILIZED. PROPELLANT COMPATIBLE MATERIALS ARE USED. VIBRATION AND STRESS ANALYSES WERE CONDUCTED TO VERIFY ACCEPTABLE DESIGN. THE INTERNAL LINER ATTENUATES ANY FLOW INDUCED VIBRATION.

(B) TEST:
QUALIFICATION TESTS
ENDURANCE/PRESSURE CYCLING (1200 CYCLES). VIBRATION UNDER SIMULATED MISSION USAGE CONDITIONS. BURST TEST (3600 PSI). QUALIFIED AS PART OF MAIN PROPULSION SYSTEM, VIBRATION, TEMPERATURE, VACUUM, ENGINE FIRING TESTS.

ACCEPTANCE TESTS
EXAMINATION OF PRODUCT, WELD INSPECTIONS, PROOF PRESSURE, LEAKAGE AND FUNCTIONAL TESTS.

GROUND TURNAROUND
V43CB0.160/V42BB0.130 PERFORMS CROSSFEED VALVE RELIEF DEVICE CHECKOUT ON CONTINGENCY.
V43CB0.210 PERFORMS FIRST FLIGHT LEAK CHECKS.
V43CB0.260 TOXIC VAPOR LEAK CHECK OF CROSSFEED LINE 1ST FLIGHT AND CONTINGENCY.
V43CE0.125 STATIC AIR SAMPLE OF ORBITER THE SECOND FLIGHT AND EVERY FLIGHT THEREAFTER.

TO LIMIT CORROSION FROM MINOR PROPELLANT LEAKAGE, PURGE REQUIREMENTS ARE DEFINED IN V05AG0.010 (OLS), V05AG0.020 (OPF), V05AG0.030 (VAB), AND V05AG0.040 (PAD).

MONITORING OF LINE PRESSURES IN FLIGHT FOR EVIDENCE OF LEAKAGE WILL BE POSSIBLE WHEN PRESSURE TRANSDUCER INSTALLATION IN CROSSFEED LINE (MCR

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11110) IS IMPLEMENTED.

(C) INSPECTION:
RECEIVING INSPECTION
MATERIALS AND PROCESSES CERTIFICATIONS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL
CLEANLINESS TO LEVEL 200 FOR MMH AND 200A FOR NTO AND CORROSION PROTECTION PROVISIONS ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
MANUFACTURING, ASSEMBLY AND INSTALLATION PROCEDURES ARE VERIFIED BY INSPECTION. CRITICAL DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION. DIMENSIONAL AND VISUAL INSPECTIONS ARE PERFORMED DURING FABRICATION AND ASSEMBLY.

CRITICAL PROCESSES
INSPECTION VERIFIES THAT WELDS MEET SPECIFICATION.

NONDESTRUCTIVE EVALUATION
PENETRANT AND RADIOGRAPHIC INSPECTION OF WELDS IS VERIFIED BY INSPECTION.

TESTING
TEST EQUIPMENT AND TOOL CALIBRATION ARE VERIFIED BY INSPECTION.
ACCEPTANCE TEST IS VERIFIED BY INSPECTION.

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

(D) FAILURE HISTORY:
NONE.

(E) OPERATIONAL USE:
PROCEDURE IN PLACE FOR VERIFICATION OF CROSSFEED LINE PRESSURE PRIOR TO PERFORMING INTERCONNECT OR NON-CRITICAL CROSSFEED OPERATION IN ORDER TO AVOID POTENTIALLY DAMAGING PRESSURE SURGES. EVIDENCE OF LEAKAGE WOULD RESULT IN ISOLATION OF CROSSFEED LINE AND NEXT PLS ENTRY.

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- APPROVALS -

RELIABILITY ENGINEERING:	J. N. HART	:
DESIGN ENGINEERING	: O. W. CARLSON	:
QUALITY ENGINEERING	: D. J. BUTTNER	: 1/30/91
NASA RELIABILITY	:	: 3/21/91
NASA SUBSYSTEM MANAGER	:	: 3-21-91
NASA QUALITY ASSURANCE	:	: 3-20-91