

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL HARDWARE
NUMBER:MB-1SS-E056 -X**

SUBSYSTEM NAME: ECLSS - ISS NITROGEN TRANSFER SYSTEM

REVISION: 0

04/08/97

PART DATA

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:PANEL, DOCKING BASE GN2	V076-643038-001
SRU	:GAUGE, GN2 TRANSFER PRESSURE	ME289-0060-4000

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
DOCKING BASE GN2 PANEL ISS NITROGEN TRANSFER PRESSURE GAUGE**

**QUANTITY OF LIKE ITEMS: 1
ONE**

FUNCTION:
PROVIDES STATUS OF PRESSURE IN NITROGEN TRANSFER LINE DURING RESOURCE TRANSFER BETWEEN THE ORBITER AND SPACE STATION. GAUGE MEASURES PRESSURE BETWEEN 0 AND 4000 PSI AND IS LOCATED ON THE DOCKING BASE GN2 PANEL.

REFERENCE DOCUMENTS: VS28-643001
V076-643036

FAILURE MODES EFFECTS ANALYSIS FMEA - NON-CIL FAILURE MODE

NUMBER: MB-1SS-E056-01

REVISION#: 0 04/08/97

SUBSYSTEM NAME: ECLSS - ISS NITROGEN TRANSFER SYSTEM

LRU: DOCKING BASE GN2 PANEL

CRITICALITY OF THIS

ITEM NAME: GAUGE, ISS NITROGEN TRANSFER PRESSURE

FAILURE MODE: 1R3

FAILURE MODE:

EXTERNAL LEAKAGE (GROSS)

MISSION PHASE:

LO LIFT-OFF
 OO ON-ORBIT
 DO DE-ORBIT

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

CAUSE:

CORROSION, EXCESSIVE VIBRATION, MECHANICAL SHOCK, POROSITY

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN

A) PASS
 B) N/A
 C) PASS

PASS/FAIL RATIONALE:

A)

B)

N/A - REDUNDANCY PROVIDED BY WORKAROUNDS ARE IN STANDBY UNTIL REQUIRED.

C)

METHOD OF FAULT DETECTION:

NONE UNTIL AN INTERNAL LEAKAGE OF THE UPSTREAM MANUAL SHUTOFF VALVE AND MMU SYS 1 ISO VALVE OCCUR, THEN NITROGEN LEAKAGE CAN BE DETECTED THROUGH ORBITER INSTRUMENTATION - REDUCED OR LOSS OF ORBITER GN2 SYSTEM PRESSURE INDICATION. PPO2 DETECTORS WITHIN ORBITER MID DECK COULD ACTIVATED THE CAUTION AND WARNING SYSTEM IF OXYGEN LEVELS WERE REDUCED DUE TO A LONG TERM NITROGEN LEAK. AN INTERNAL LEAK OF N2 THAT WOULD RESULT IN HABITABLE PRESSURE EXCEEDING 15.2 PSIA WOULD SOUND A CLASS II ALARM.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL FAILURE MODE
NUMBER: M8-1SS-E056-01****CORRECTING ACTION: MANUAL****CORRECTING ACTION DESCRIPTION:**

NONE FOR FIRST TWO FAILURES. A FLOW RESTRICTOR (ORIFICE) LOCATED IN THE NITROGEN LINE NEAR THE ORBITER INTERFACE WILL REDUCE THE FLOW RATE OF NITROGEN TO 25 +/-1 LBM/HR, IN THE EVENT AN EXTERNAL NITROGEN LEAK OCCURS AFTER THIRD FAILURE. EVEN AFTER FULL DEPLETION OF THE ORBITER NITROGEN SUPPLY, THE CREW CABIN AREA CONTAINS SUFFICIENT NITROGEN FOR CREW SURVIVAL DURING ABORTED MISSION DE-ORBIT AND LANDING PHASES.

REMARKS/RECOMMENDATIONS:

A SINGLE PATH PROVIDES NITROGEN TO THE ISS FROM THE ORBITER GN2 SYSTEM. NITROGEN LINES AND COMPONENTS DOWNSTREAM OF MMU SYS 1 ISO VALVE ARE NOT PRESSURIZED UNTIL NITROGEN TRANSFER TO ISS TAKES PLACE. ISS GN2 TRANSFER CAN OCCUR DURING SLEEP CYCLES, DURING CREW OR CARGO TRANSFERS BETWEEN ORBITER AND ISS, OR DURING EVA ACTIVITY.

- FAILURE EFFECTS -

(A) SUBSYSTEM:

DURING RESOURCE TRANSFER, NITROGEN SUPPLY IS DIVERTED BEFORE IT REACHES THE SPACE STATION.

(B) INTERFACING SUBSYSTEM(S):

GROSS EXTERNAL LEAKAGE COULD RESULT IN INADEQUATE N2 SUPPLY FOR CREW CABIN AIR MAKEUP, WATER TANKS, AND EXTERNAL AIRLOCK REPRESSURIZATION. POSSIBLE HIGH NITROGEN PRESSURE IN DOCKING BASE AND ISS PMA. HIGH CONCENTRATIONS OF N2 COULD REDUCE THE PERCENT OF OXYGEN BELOW THAT NEEDED FOR HUMAN SURVIVAL.

(C) MISSION:

NO EFFECT UNTIL THE UPSTREAM MANUAL SHUTOFF VALVE AND MMU SYS 1 ISO VALVE INTERNALLY LEAK. THEN INCREASE USE OF N2 COULD RESULT IN EARLY MISSION TERMINATION. LOSS OF MISSION OBJECTIVES ASSOCIATED WITH TRANSFERRING GN2 TO SPACE STATION.

(D) CREW, VEHICLE, AND ELEMENT(S):

INABILITY TO SHUTDOWN LEAKAGE OF N2 WITHIN DOCKING BASE AND PMA DUE TO A FAILURE TO CLOSE UPSTREAM VALVES DURING RESOURCE TRANSFER OR DUE TO AN INTERNAL LEAKAGE CONDITION OF UPSTREAM VALVES DURING NON-RESOURCE TRANSFER OPERATIONS, COULD RESULT IN HIGH LEVELS OF N2 WITHIN THESE AREAS. HIGH CONCENTRATIONS OF N2 COULD POTENTIALLY REDUCE THE PERCENTAGE OF OXYGEN BELOW THAT NEEDED FOR HUMAN SURVIVAL CAUSING CREW ASPHYXIATION. LOSS OF N2 SUPPLY TO ISS COULD IMPACT SPACE STATION

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OPERATIONS. POTENTIAL FOR CREW INJURY OR LOSS DUE TO A HIGH PRESSURE JET FROM AN EXPOSED PIN HOLE LEAK IN THE N2 PRESSURE GAUGE DURING IVA.

(E) FUNCTIONAL CRITICALITY EFFECTS:

FIRST FAILURE (EXTERNAL LEAKAGE OF N2 PRESSURE GAUGE) - GN2 IS DIVERTED AWAY FROM THE SPACE STATION RESULTING IN POTENTIAL IMPACT TO SPACE STATION OPERATIONS.

SECOND FAILURE (DOCKING BASE N2 SHUTOFF VALVE INTERNALLY LEAKS OR FAILS TO CLOSE) - LOSS OF ISOLATION BETWEEN LEAKY GAUGE AND MMU SYS 1 ISO VALVE. NO EFFECT - LOSS OF REDUNDANCY ONLY.

THIRD FAILURE (MMU SYS 1 ISO VALVE INTERNALLY LEAKS OR FAILS TO CLOSE) - INABILITY TO ISOLATE A DOWNSTREAM N2 LEAK USING THIS VALVE. INCREASE USE OF CONSUMABLES WOULD RESULT IN PREMATURE DEPLETION OF ORBITER GN2 TANKS. LOSS OF EVA CAPABILITIES DUE TO INABILITY TO REPRESSURIZE EXTERNAL AIRLOCK RESULTING FROM LACK OF CONSUMABLES. CREW WOULD HAVE TO RELY ON CONSUMABLES REMAINING IN CREW CABIN DURING ORBITER'S RETURN TO EARTH. UNCONTROLLED EXTERNAL LEAKAGE OF NITROGEN WOULD RESULT IN EARLY MISSION TERMINATION. - CRITICALITY 2R3 CONDITION.

DESIGN CRITICALITY (PRIOR TO DOWNGRADE, DESCRIBED IN (F)): 2R3

(F) RATIONALE FOR CRITICALITY DOWNGRADE:

FOURTH FAILURE (EXTERNAL LEAKAGE OF CABIN PRESSURE) - LOSS OF CABIN PRESSURE WITH NO N2 MAKEUP CAPABILITY WOULD RESULT IN LOSS OF CREW AND VEHICLE. - CRITICALITY 1R3 CONDITION.

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: SECONDS

TIME FROM DETECTION TO COMPLETED CORRECTING ACTION: SECONDS

**IS TIME REQUIRED TO IMPLEMENT CORRECTING ACTION LESS THAN TIME TO EFFECT?
YES**

RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:

GIVEN AN INTERNAL LEAKAGE OR FAILURE TO CLOSE CONDITION OF BOTH THE DOCKING BASE N2 SHUTOFF VALVE AND MMU ISOLATION VALVE, CREW WOULD HAVE AMPLE TIME TO UTILIZE ORBITER CREW CABIN CONSUMABLES DURING A MISSION ABORT BEFORE LOSS ON N2 SUPPLY BECAME CATASTROPHIC.

HAZARD REPORT NUMBER(S): ORBI 071, ORBI 404, ORBI 405, ORBI 406

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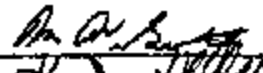
HAZARD(S) DESCRIPTION:

INADEQUATE NITROGEN SUPPLY TO MAINTAIN CABIN PRESSURE (ORBI 071). IVA CREW HAZARDS DUE TO ISS ODS: HIGH PRESSURE LEAK JETS IN GN2 LINES (ORBI 404). EVA CREW HAZARDS DUE TO ISS ODS: HIGH PRESSURE LEAK JETS IN GN2 LINES (ORBI 405). LOSS OF HABITABLE ENVIRONMENT IN THE CREW CABIN/ODS HABITABLE VOLUME DUE TO FLOODING OF VOLUME WITH GASEOUS NITROGEN (ORBI 406).

- APPROVALS -

SS & PAE
DESIGN ENGINEER

: M. W. GUENTHER
: K. J. KELLY

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