PRINT DATE: 04/11/98

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL HARDWARE
NUMBER:M5-6SS-0926 -X

SUBSYSTEM NAME: ISS DOCKING SYSTEM

REVISION: 0 02/27/98

PART DATA

	PART NAME / **VENDOR NAME**	**PART NUMBER** / **VENDOR NUMBER**
ASSY	:EXTERNAL AIRLOCK	V628-000003
LRU	:TEMPERATURE SENSOR	ME449-0160-0005

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
TEMPERATURE SENSOR, 0-160 DEG F - EXTERNAL AIRLOCK STRUCTURE UPPER (ZONES 1 AND 2) AND LOWER (ZONE 3)

REFERENCE DESIGNATORS: 84V64MT21
84V64MT22
84V64MT23

QUANTITY OF LIKE ITEMS: 3
(THREE)

FUNCTION:
A TEMPERATURE SENSOR IS PROVIDED AT TWO LOCATIONS ON THE EXTERNAL AIRLOCK STRUCTURE ADJACENT TO THE HEATER AND SPACED 180 DEGREES APART (ZONES 1 AND 2). A TEMPERATURE SENSOR IS ALSO LOCATED AT THE LOWER PART OF THE EXTERNAL AIRLOCK NEAR THE KEEL PIN (ZONE 3). THESE SENSORS PROVIDE STATUS OF TEMPERATURE OF THE UPPER AND LOWER PARTS OF THE EXTERNAL AIRLOCK STRUCTURE. THESE MEASUREMENTS ARE MONITORED BY THE CREW AND ARE DOWNLINKED TO GROUND PERSONNEL.

REFERENCE DOCUMENTS: VS70-640109, SCHEMATIC DIAGRAM - AIRLOCK ENVIRONMENTAL CONTROL SUBSYSTEM

FAILURE MODES EFFECTS ANALYSIS FMEA – NON-CIL FAILURE MODE
NUMBER: M5-6SS-0926-01

REVISION#: 0 02/27/98

SUBSYSTEM NAME: ISS DOCKING SYSTEM
LRU: N/A
ITEM NAME: TEMPERATURE SENSOR

CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
ERRONEOUS OUTPUT

MISSION PHASE: OO ON-ORBIT

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

CAUSE:
A) PIECE PART STRUCTURAL FAILURE, B) CONTAMINATION, C) VIBRATION, D) MECHANICAL SHOCK, E) PROCESSING ANOMALY, F) THERMAL STRESS

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

CRITICALITY 1R2 DURING INTACT ABORT ONLY (AVIONICS ONLY)? NO

REDUNDANCY SCREEN
A) PASS
B) PASS
C) PASS

PASS/FAIL RATIONALE:
A)

B)

C)

MASTER MEAS. LIST NUMBERS:
V64T0135A
V64T0136A
V64T0137A

- FAILURE EFFECTS -

(A) SUBSYSTEM:
ERRONEOUS TEMPERATURE READING

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(B) INTERFACING SUBSYSTEM(S):
FIRST FAILURE - NO EFFECT. CONTROL AND OVER TEMPERATURE THERMOSTAT WILL CONTROL THE TEMPERATURE OF THE KEEL AREA STRUCTURE.

(C) MISSION:
FIRST FAILURE - NO EFFECT

(D) CREW, VEHICLE, AND ELEMENT(S):
FIRST FAILURE - NO EFFECT

(E) FUNCTIONAL CRITICALITY EFFECTS:
CASE 1:
POSSIBLE LOSS OF CREW/VEHICLE AFTER FOUR FAILURES:
1) ERRONEOUS OUTPUT OF ZONE 1 OR 2 (KEEL) TEMPERATURE SENSOR INDICATING LOWER THAN ACTUAL TEMPERATURE WHICH MAY NOT TRIGGER THE FDA ALARM IF THE HEATER ZONE TEMPERATURE RISES ABOVE 113 DEG. F (UPPER FDA LIMIT).
2) ASSOCIATED CONTROL THERMOSTAT FAILS CLOSED - LOSS OF ABILITY TO CONTROL THE HEATERS BETWEEN THE SET POINT TEMPERATURES (55 TO 75 DEG. F).
3) ASSOCIATED OVER TEMPERATURE THERMOSTAT FAILS CLOSED - LOSS OF ABILITY TO AUTOMATICALLY DE-ENERGIZE CIRCUIT WHEN UPPER SET TEMPERATURE IS REACHED. AFFECTED HEATERS FAIL ON.
4) LOSS OF ABILITY OF GROUND PERSONNEL TO RECEIVE DOWNLINKED TEMPERATURE MEASUREMENT DATA - LOSS OF ABILITY TO DETECT HEATER SYSTEM FAILURES AND INFORM CREW TO PERFORM CORRECTIVE ACTION. POSSIBLE INJURY TO CREW DUE TO BURNS WHEN CONTACTING HOT STRUCTURE.

CASE 2: (WHEN DOCKED TO ISS)
POSSIBLE LOSS OF CREW/VEHICLE AFTER FOUR FAILURES:
1) ERRONEOUS OUTPUT OF ZONE 3 (KEEL) TEMPERATURE SENSOR INDICATING LOWER THAN ACTUAL TEMPERATURE WHICH MAY NOT TRIGGER THE FDA ALARM IF THE HEATER ZONE TEMPERATURE RISES ABOVE 113 DEG. F (UPPER FDA LIMIT).
2) ZONE 3 CONTROL THERMOSTAT FAILS CLOSED - LOSS OF ABILITY TO CONTROL THE HEATERS BETWEEN THE SET POINT TEMPERATURES (55 TO 75 DEG. F).
3) ASSOCIATED ZONE 3 (KEEL) OVER TEMPERATURE THERMOSTAT FAILS CLOSED - LOSS OF ABILITY TO AUTOMATICALLY DE-ENERGIZE CIRCUIT WHEN UPPER SET TEMPERATURE IS REACHED. AFFECTED HEATERS FAIL ON.
4) LOSS OF ABILITY OF GROUND PERSONNEL TO RECEIVE DOWNLINKED TEMPERATURE MEASUREMENT DATA - LOSS OF ABILITY TO DETECT HEATER SYSTEM FAILURES AND INFORM CREW TO PERFORM CORRECTIVE ACTION. POSSIBLE LOSS OF RUSSIAN AVIONICS ON PALLET DUE TO EXCEEDANCE OF THE UPPER CERTIFICATION TEMPERATURE LIMIT (122 DEG. F MAXIMUM DURING OPERATION) RESULTING IN LOSS OF NOMINAL UNDOCKING CAPABILITY.

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

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(F) RATIONALE FOR CRITICALITY DOWNGRADE:
ALTHOUGH THE CRITICALITY REMAINS UNCHANGED AFTER WORKAROUNDS CONSIDERATION (ALLOWED PER CR S050107W), THEY ARE PROVIDING ADDITIONAL FAULT TOLERANCE TO THE SYSTEM.

CASE 2:
AFTER THE FOURTH FAILURE, THE CREW WOULD PERFORM IFM TO DRIVE THE HOOK MOTORS. IF THE IFM IS NOT SUCCESSFUL (FIFTH FAILURE), THE CREW WOULD PERFORM EVA TO REMOVE 96 BOLTS FROM THE DOCKING BASE TO CIRCUMVENT THE WORST CASE "DESIGN CRITICALITY" EFFECT. IF UNABLE TO PERFORM EVA (SIXTH FAILURE), POSSIBLE LOSS OF CREW/VEHICLE DUE TO LOSS OF ALL UNDOCKING CAPABILITY.

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: HOURS

TIME FROM DETECTION TO COMPLETED CORRECTING ACTION: HOURS

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

RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:
ERRONEOUS OUTPUT (ERRATIC TEMPERATURE SIGNATURE) WILL BE READILY DETECTED BY GROUND PERSONNEL. CREW WILL BE ABLE TO DE-ENERGIZE THE HEATER CIRCUITS BY OPENING THE CIRCUIT BREAKERS.

HAZARD REPORT NUMBER(S): CASE 1: ORBI 404 (STATUS - OPEN), CASE 2:ORBI 401

HAZARD(S) DESCRIPTION:
CASE 1: IVA CREW HAZARDS DUE TO ISS ODS (CAUSE D - HOT SPOTS).
CASE 2: INABILITY TO SAFELY SEPARATE ORITER FROM A MATED ELEMENT.

- APPROVALS -

SS&PAE	: T. K. KIMURA	: J. Kimura 4-13-98
DESIGN ENGINEERING	: C. J. ARROYO	: