CRITICAL ITEMS LIST

CIL NUMBER: OIU-CIL-0001 **ORIGINATOR:** R. V. Abshier **PROJECT:** Shuttle

PART NAME: ORBITER INTERFACE UNIT
PART NUMBER: SED39126900-301
LRU/ORU PART NAME: ORBITER INTERFACE UNIT
LRU/ORU PART NUMBER: SED39126900-301
DRAWING NUMBER: SED39126900
LOCATION: SHUTTLE AFD/PANEL - L11
EFFECTIVITY/AFFECT STAGE: OV-103, OV-104, OV-105/ STS-91, ALL ORBITER BASED ISS ASSEMBLY AND UTILIZATION FLIGHTS

QUANTITY: 2
SYSTEM: N/A
SUBSYSTEM: N/A

CRITICALITY CATEGORY 1RC/2

INTACT ABORT MODE CRITICALITY: N/A

FMEA REFERENCE: OIU-FMEA-0001

FMEA/CIL IDENTIFICATION NUMBER: JSC No. 27273

FUNCTION: The OIU (Orbiter Interface Unit) provides MIL-STD-1553B routing between Orbiter and ISS for commands to the ISS and telemetry from the ISS.

FAILURE MODE: Loss of OIU Output

CAUSE:

1) Loss of Input Power - Each OIU is powered from separate power buses. However, the power to both OIU's is passed through a single connector located on a Standard Switch Panel (SSP) in the Aft Flight Deck (AFD). Therefore, the connector is a single failure point (SFP).
2) Loss of Command Path - The command path is defined as the path between Orbiter services (e.g. Payload Signal Processor (PSP)) and the OIU, or the path between the OIU and ISS (MIL-STD-1553B buses).
3) Loss of Telemetry Path - The telemetry path is defined as the path between the OIU and Orbiter services (e.g. Payload Data Interleaver (PDI)), or the path between the ISS and the OIU (MIL-STD-1553B buses).
4) OIU Internal Fault - Hardware component failure.

-FAILURE EFFECTS-

END ITEM:

First Failure: None, other OIU fully functional..

Second Failure: Loss of command capability to complete critical assembly operations and loss of critical system monitoring resulting in possible loss of ISS or loss of mission.

SUBSYSTEM:

First Failure: No effect, other OIU fully functional.

Second Failure: Loss of command capability to complete critical assembly operations and loss of critical system monitoring resulting in possible loss of ISS or loss of mission.

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SUBSYSTEM: N/A

FAILURE EFFECTS (CONTD.)

MISSION:
First Failure: No effect, other OIU fully functional.
Second Failure: Loss of command & telemetry via Orbiter may result in loss of mission.

CREW/VEHICLE :
Possible loss of vehicles (Shuttle and/or ISS), loss of crew if all redundancy is lost.

SUCCESS PATHS: 2
SUCCESS PATH REMAINING AFTER FIRST FAILURE: 1

END ITEM EFFECTIVITY: STS-91, ISS BUILD 2A AND SUBS

MISSION PHASES: Assembly and On-orbit

TIME TO EFFECT: Minutes
TIME TO DETECT Minutes
TIME TO CORRECT: Minutes
WORKAROUNDS: Power up and configure second OIU per Crew Procedures No. TBS.

REDUNDANCY SCREENS: Check All that Fail

A	B	C	
☐		☐	1. C/O PRELAUNCH:
	☐	☐	2. C/O ON ORBIT:
	☐	☐	3. DETECTION FLIGHT CREW:
☐		☐	4. DETECTION GROUND CREW:
☐	☐	☒	5. LOSS OF REDUNDANCY FROM SINGLE CAUSE:

A - *Redundant hardware item capable of checkout during normal ground turnaround*
B - *Loss of redundant hardware item is readily detectable during flight*
C - *Loss of all redundant hardware items cannot be the result of a single credible cause*

Redundancy Screen C was failed because of the common power connector at the Standard Switch Panel. A failure of this connector could result in the inability to apply power to either OIU.

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HAZARD INFORMATION:

HAZARD: Yes

HAZARD ORGANIZATION CODE: TBS

HAZARD NUMBER: See JSC 26868, Hazard Report No. S-OIU-1007

REMARKS:

Prior to S-Band activation, commands can be passed through MCC Moscow (Unlike Redundancy). However, this path was groundruled out of this analysis because Russian coverage is limited to Russian Ground Sites. Afterwards, commands can be passed through MCC-H (Unlike Redundancy) using TDRSS. Coverage is between 92 % using 2 TDRSS satellites and ~100% using 3 TDRSS satellites.

-RATIONALE FOR ACCEPTABILITY-

(A) DESIGN:

1) There are two OIUs providing standby redundancy, and each are redundantly powered from separate buses through a common switch. As noted in the FMEA, the switch is a single failure point (SFP). However, this type of switch is used extensively (approximately 900 occurrences in the 4 Orbiters). The switch is certified for criticality 1 operations. There is no appreciable failure rate experienced for this model of switch.
2) The OIU is designed and built using Mil-Standard parts (MIL-STD 975) and the JSC approved parts list (JSC 09604).

(B) TEST/ANALYSIS:

Each OIU is subjected to extensive hardware and software testing as set forth in JSC 27350 "OIU Certification Plan". The OIU is evaluated for off nominal and marginal conditions during SAIL testing. Reference TPS No.'s 809720041, 809720049, 809720050, 809720051, 809720052, 809720053, 809720054, 809720055, 809720064, 809720065, 809720066, 809720073, 809720074, 809720075, 809720076, 809720077, 809720078, 809720081, & 809720085. The OIU is certified to be functional for the environments it will be exposed to. Reference TPS No's 809720025, 809720030, 809720035, 809720036, & 809720082. The OIU is evaluated for proper interface functionality at the ISS Software Verification Facility (SVF). Interfaces to the Russian elements are also evaluated at both the SVF and in Russia.

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RATIONALE FOR ACCEPTABILITY (CONTD.)

(C) **INSPECTION:** The proper function of both OIUs are verified during "Orbiter Turnaround" checkout (Reference ORMSD activities per RCN No. SS13034DM and SS13114).

(D) **FAILURE HISTORY:** No documented failures at this time.

(E) **OPERATIONAL USE:**
The crew will receive training on the required crew procedures for the OIU. The crew procedures will be contained in Crew Procedures No. TBD. The OIU will require crew action to restore functionality upon first failure.

(F) **MAINTAINABILITY:**
There are no on-orbit maintainability requirements or in-flight maintenance (IFM) requirements for the OIU.

PREPARED BY: R. V. Abshier **REVISION:**

DATE: 11/09/96 **WAIVER NUMBER**

APPROVED BY: R. V. Abshier

DATE: 7/17/97