Failure Modes and Effects Analysis/Critical Items List

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Title: Risk Assessment Executive Summary Report (RAESR) for the USA SAFER

Item Name: Inertial Reference Unit (IRU) Qty: 1 FMEA Number: US-SFR-290

Item Part Number: LN-200 ORU Name: SAFER

Subsystem Name: Avionics ORU Part Number: SED33105900-311

Function: Provides angular rate sensing capability to SAFER avionics.

Item Type Designator: C PG/IP Identifier: N/A

Reference Designator/Find No.: N/A Drawing Number: SED33105904

Logistics Control Number: N/A

End Item Name: SAFER

End Item Capability: Six degrees of freedom through 24 thrusters, each rated at 0.8 ± 0.08 lbs. force in vacuum.

End Item Function: Provides emergency EVA self-rescue for separated crewmember.

ISS Zone: EVA Shuttle Zone: EVA

Criticality

Critical Item: Yes: No: X Criticality Category: 1R 1R/3

Success Success Paths Remaining:

Paths:

Failure (Mode, Cause, Detection, Corrective Action)

Failure Mode: IRU sends incorrect angular rate data to CEA processor.

Failure Mode Code:

Failure Cause: EEE part failure, short/open circuit, contamination, software error, radiation event, EMI.

Failure Detection:

Flight: IVA – IVA checkout.

EVA – SAFER does not perform automatic attitude hold function. LCD displays "Rate Sensor Fail" message.

AAH light is not illuminated.

Ground: Functional Test.

Time To Detect Quantity: 10 Time To Detect Units: Seconds

Correcting Action: IVA – If the IVA checkout detects a failure, the backup SAFER (if available) will be used.

EVA – 1) Crewmember assumes manual control. Attempt to manually stop rotation.

2) Crew training may allow recovery from unwanted rotational rates.

3) Cycling power may allow recovery.

Remarks: The avionics software disables AAH when data from the IRU is incomplete or detected to be corrupted. During

the IVA checkout, if software does not receive data from the IRU, a "Rate Check" message is displayed until the display proceed switch is toggled in either direction. After toggling the display proceed switch, a "Fail: Rate XXX"

message is displayed.

Failure Effect Phase: EVA Operations Affected Stage(S): EVA Operations

Failure Effect

On ORU/Assembly:

<u>First/Second Failure:</u> Inadvertent EVA crewmember separation.

Third (this) Failure: Software de-activates AAH.

On Subsystem/Next Assembly: SAFER software identifies bad data has been sent from IRU.

On End Item/Segment: SAFER does not automatically stop rotation rates. Possible loss of mission objectives if

SAFER required for EVA.

On Crew/ISS: Possible loss of crewmember. Possible damage to EMU/Orbiter/ISS.

Time To Effect Quantity: 1

Time To Effect Units: Minutes

Redundancy Screen

ISS (Shuttle)

Checkout Pre-Launch (A): Pass Checkout On-Orbit (B): N/A

Detection Flight Crew: Pass Or Detection Ground Crew: Fail

Loss Of Redundancy

From A Single Cause (C): Pass