PFR-233 Title: IDPU Sep Loop Wiring Exhibits Open Circuit

Assembly : Probe F1	**SubAssembly :** Umbilical Harness	
Component : Probe Extension Cable	**Units Affected:** ☒ 0 0 0 0 0	**Units fixed:** ☒ 0 0 0 0 0
Originator: S. Harris		
Organization: UCB	**Date:** 12/15/2006	
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Failure Occurred During (Check one √)

□ Functional test □ Qualification test ☒ S/C Integration □ Launch operations □ Other (Flight Assy)

Environment when failure occurred:

☒ Ambient	□ Vibration	□ Shock	□ Acoustic
□ Thermal	□ Vacuum	□ Thermal-Vacuum	□ EMI/EMC

Problem Description

Ref: 1. Umbilical Rack #2, SAI #20358

This occurred during Instrument Level LPT, procedure thm_mint_proc_032E, using ref. 1 Umbilical Rack. When IDPU Sep Switches were thrown to enable IDPU Actuator power service, the right hand LED did not light. This LED corresponds to "IDPU Separation Loop 2". This occurrence would indicate that this Sep Loop was not Enabled.

Analyses Performed to Determine Cause

An examination of wiring diagrams and schematics determined that this indication could mean a variety of things, but that in any case it was safe to try to turn on the IDPU Actuator power, and see if it was actually disabled. This was done, and the IDPU Actuator power turned on normally. Standard IDPU actuator tests, as called out in the LPT, were performed normally, with this LED in the OFF state. A partial schematic of the IDPU Sep Loop circuit is shown in Figure 1 for reference.

After powering off the Probe, the Umbilical was disconnected from the Umbilical Drawer, at P1. An ohmmeter was used to determine if the wiring for the IDPU Sep Loop was intact, or whether the problem was isolated in the EGSE. We measured the resistance between pins 13 to 14, looking into the Umbilical, and it measured 2.8Ω, while the resistance between pins 39 to 40 measured OPEN. These latter two lines are, respectively, "IDPU Inhibit Sep Loop 1 RTN" and "IDPU Inhibit Sep Loop 2 RTN". These two lines should both be connected to Probe signal ground on the Array Control Module in the BAU. Therefore the resistance measured between them should be near 0Ω.

We then disconnected the Umbilical at the Probe Extension Cable Connector, P1a, and measured the resistance between pins 32 and 33, looking into the Probe. This resistance measured OPEN. As a check we measured both pins 32 and 33, with respect to pin 34 which is a power ground (DPC Power Rtn). The resistance between 32 to 34 measured 0.4Ω, while the resistance between 33 to 34 measured OPEN. This indicated that pin 33, "IDPU Inhibit Sep Loop2 RTN", is OPEN. The LED did not light because the ground path for the LED current is disconnected.

To further troubleshoot this issue, the Probe was mounted on the Roll-Over Fixture, to make the Probe Extension Cable and Separation Connector accessible. As a first step, the ty wrap that had been removed for the Bolt Cutter installation, a recently performed procedure, was removed again, and the underlying cable bundle was examined for any damage. This inspection yielded immediate results. Please refer to Figure 2. The outer, braided cable jacket had obviously been cut. Further inspection of the wires in the exposed bundle showed that at least one wire had been nicked, with wire strands visible. A quick ohmmeter check verified that this wire was indeed the cause of the OPEN circuit for the signal "IDPU Sep Loop 2 Rtn".

Corrective Action/ Resolution

With the wire bundle exposed and accessible, it was determined that a repair was feasible and desirable. Since the cable bundle doesn't provide enough slack for the wire, to perform a solder splice, a short length of wire was used to make the connection between the two ends of the cut wire, and soldered in accordance with NASA practice. Some detail of the repair is visible in Figure 3.

Prior to making the splice, a thorough visible inspection, of the area was done, using magnification, to verify that no other wires had been damaged. No evidence of other cut wires or nicked wires was found. As further evidence of this fact, it's notable that the cut wire is one wire in a twisted pair. The other wire in the pair was examined thoroughly, and no evidence of damage to this neighboring wire was visible.

After the repair was completed, the braided jacket over the cable bundle was taped closed, and the bundle was secured with a ty wrap. Electrical checks were performed to verify that the repair was intact, and other Umbilical functions were unaffected. These electrical checks are specified in Table 1, using a 78-pin break-out-box on the Probe Extension Cable Connector, P1a. A post repair Bus Functional Test should be completed also, to verify all Umbilical Functions.

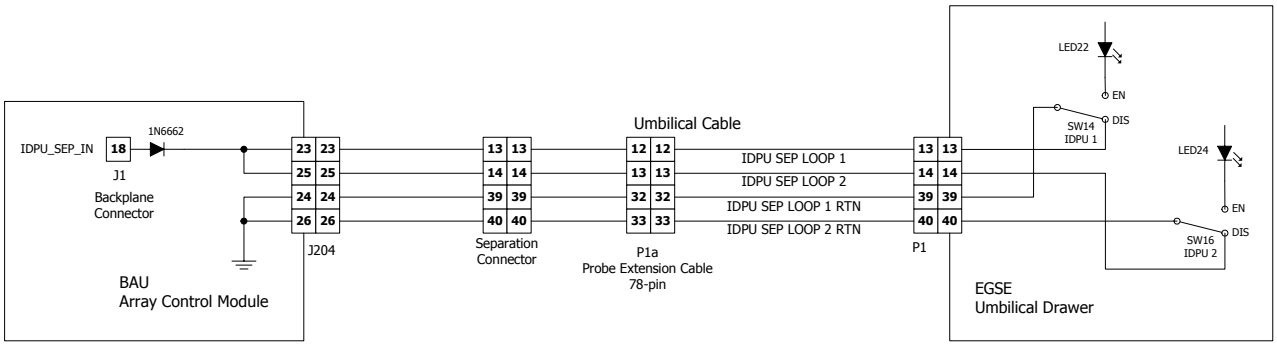

Figure 1: Partial schematic of IDPU Sep Loop circuit

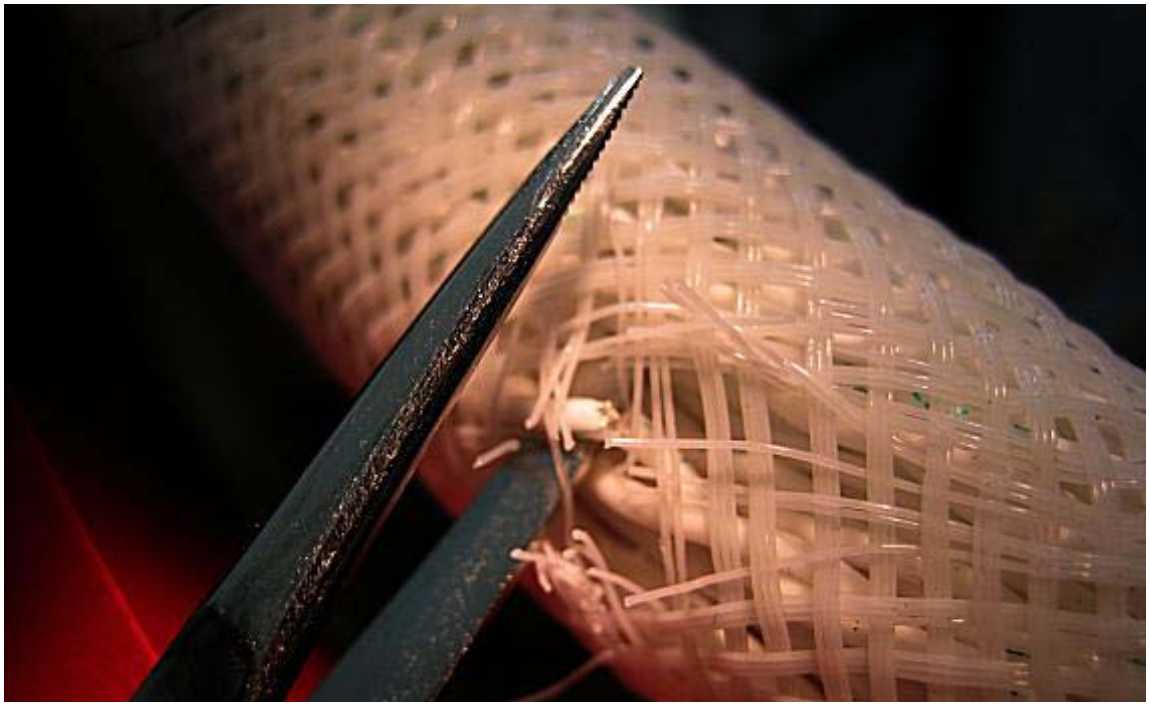

Figure 2: Snapshot of Probe Extension Cable where jacketing was cut, and wire was cut.

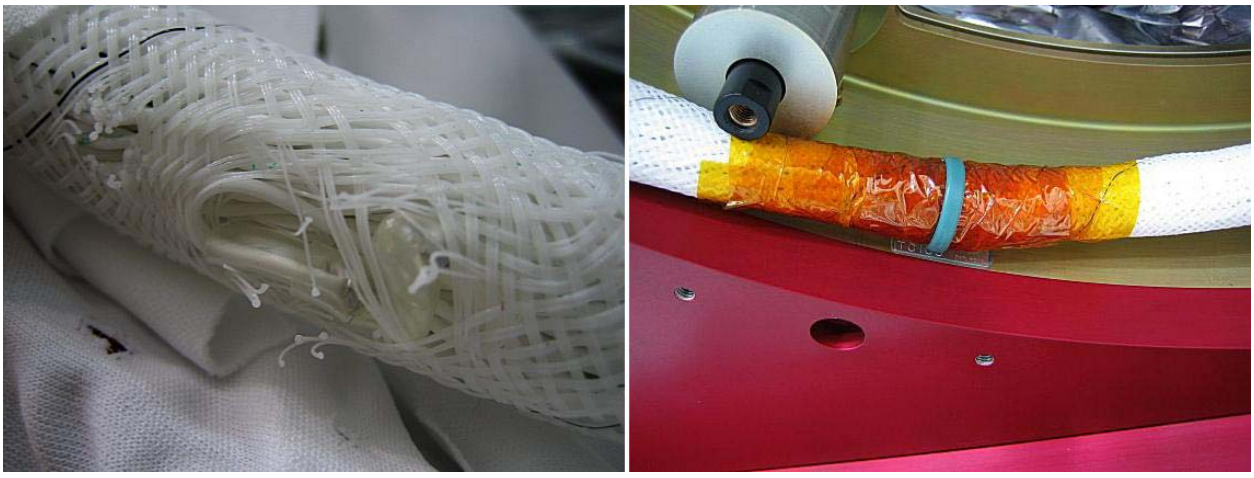

Figure 3: Details of completed repair

Table 1: Post repair electrical checks

Signal Name	J1A Pin	Expected	Measured	Pass/Fail
IDPU_SEP_LOOP_1	12	< 2 ohm	**0.81**	**P**
IDPU_SEP_LOOP_2	13			
IDPU_SEP_LOOP_1_RTN	32	< 2 ohm	**0.69**	**P**
IDPU_SEP_LOOP_2_RTN	33			
IDPU_SEP_LOOP_1_RTN	32	< 2 ohm	**0.71**	**P**
S/C Ground (DPC Pwr Rtn)	34			
IDPU_SEP_LOOP_2_RTN	33	< 2 ohm	**0.69**	**P**
S/C Ground (DPC Pwr Rtn)	34			
IDPU_SEP_LOOP_1	12	> 1 Mohm	**> 50 Mohm**	**P**
IDPU_SEP_LOOP_1_RTN	32			
IDPU_SEP_LOOP_2	13	> 1 Mohm	**> 50 Mohm**	**P**
IDPU_SEP_LOOP_2_RTN	33			
DPC_INPUT_PWR	14	> 1 Mohm	**12.7 Mohm**	**P**
IDPU_SEP_LOOP_2_RTN	33			
BATT_VOLT_MONITOR (BH)	8	24 to 34 V	**31.4 V**	**P**
BATT_VOLT_MONITOR_RTN	28			
BATT_VOLT_MONITOR (PC)	7	24 to 34 V	**31.4 V**	**P**
BATT_VOLT_MONITOR_RTN	27			
BATT_SENSE_P	5	24 to 34 V	**31.4 V**	**P**
BATT_SENSE_N	24			
BATT_CHARGE_DISCHARGE	3	24 to 34 V	**31.4 V**	**P**
BATT_CHARGE_DISCHARGE_RTN	22			
BATT_CHARGE_DISCHARGE	4	24 to 34 V	**31.4 V**	**P**
BATT_CHARGE_DISCHARGE_RTN	23			

Acceptance:
MAM: Ron Jackson_____; MSE: Ellen Taylor_____

PM: Peter Harvey_____; Cognizant Engineer_____

Date of Closure_____