PAYLOAD HAZARD REPORT		a. NO: GHR-AMS02-011
b. PAYLOAD: Alpha Magnetic Spectrometer-02 (AMS-02) GSE		c. PHASE: II
d. SUBSYSTEM: Electrical Systems	e. HAZARD GROUP: Electrical	f. DATE: May 2008
g. HAZARD TITLE: Electric Discharge/Shock		i. HAZARD CATEGORY ☒ CATASTROPHIC ☐ CRITICAL

h. APPLICABLE SAFETY REQUIREMENTS:

KHB 1700.7, 4.3.2 Electrical

j. DESCRIPTION OF HAZARD

Damage occurs to AMS, AMS GSE, facilities, or injury to personnel due to electrical events triggered by electrical shorting or unwanted electrical contract. (>30 V_{rms} and 50 VDC)

k. HAZARD CAUSES:

1. Over voltage/over current.
2. Contact with high voltage sources.
3. Mis-mating of powered connectors.
4. Water leakage.
5. AMS-02 payload or electrical GSE conductive external parts or surfaces that are not at ground potential.
6. Personnel short an energized AMS-02 payload or GSE electrical circuit during connector mating/demating.
7. Mismatch of three-phase power sequencing between AMS-02 electrical equipment and KSC facilities.

l. HAZARD CONTROLS:

(See continuation sheet)

m. SAFETY VERIFICATION METHODS:

(See continuation sheet)

n. STATUS OF VERIFICATION:

(See continuation sheet)

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II	TRENT MARTIN 10/3/08	10/3/08
PHASE III		

JSC Form 542B (Rev November 22, 1999) (MS Word September 1997)

PAYLOAD HAZARD REPORT CONTINUATION SHEET	a. NO: GHR-AMS02-011
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k. HAZARD CAUSES:

1. Over voltage/over current.

l. HAZARD CONTROLS:

1.1. System is protected by circuit protection devices.

1.2 System designed per AMS approved electrical codes (Chinese Electrical Code, international, or NEC equivalent code).

m. SAFETY VERIFICATION METHODS:

1.1.1 Electrical systems schematics review and approval by AMS to ensure proper fusing.

1.1.2 Review and approval of facility GFCI.

1.1.3 Review and approval of AMS and AMS CGSE electrical systems/schematics to ensure proper GFCI/over voltage protection.

1.2.1 Review and approval of AMS and AMS CGSE electrical schematics. (For Flight EPDC, see AMS-02-F017, AMS-02-F08 and AMS-02-F12).

1.2.2 Review of COTS hardware for UL or equivalent qualification.

n. STATUS OF VERIFICATION:

1.1.1	Open
1.1.2	Open
1.1.3	Open
1.2.1.	Open
1.2.2	Open

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k. HAZARD CAUSES:

2. Contact with high voltage/current sources.

l. HAZARD CONTROLS:

2.1 Socket connectors on power (source) side of GSE.

2.2 High voltage sources on GSE are labeled if accessible.

2.3 High voltage sources on flight hardware and GSE are inaccessible during nominal operations..

2.4 Lockout-tagout procedures during maintenance operations involving power supplies.

m. SAFETY VERIFICATION METHODS:

2.1.1 Inspection of GSE socket connectors/schematics.

2.2.1 QA inspection of warning labels to verify that they are appropriately sized and located.

2.3.1 QA inspection of hardware ensuring high voltage locations are inaccessible.

2.4.1 Review of operational procedures showing lockout-tagout of power supplies for AMS GSE to ensure no power to AMS GSE prior to maintenance operations.

n. STATUS OF VERIFICATION:

2.1.1.	Open
2.2.1.	Open
2.3.1.	Open
2.4.1.	Open

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k. HAZARD CAUSES:

3. Mis-mating of power connectors.

l. HAZARD CONTROLS:

3.1 Connector keying to preclude mis-mating

m. SAFETY VERIFICATION METHODS:

3.1.1 Review and approval of electrical schematics.

3.1.2 QA inspection of as-built hardware (particularly the electrical connectors).

n. STATUS OF VERIFICATION:

3.1.1 Open
3.1.2 Open

PAYLOAD HAZARD REPORT CONTINUATION SHEET	a. NO: GHR-AMS02-011
b. PAYLOAD: Alpha Magnetic Spectrometer-02 (AMS-02) GSE	c. Phase II

k. HAZARD CAUSES:

4. Water leakage.

l. HAZARD CONTROLS:

4.1 Follow vacuum pump cooling system assembly procedures to preclude water leakage.

m. SAFETY VERIFICATION METHODS:

4.1.1 Review of AMS-02 vacuum pump assembly procedures and QA inspections of as-built hardware to approved drawings.

n. STATUS OF VERIFICATION:

4.1.1 Open

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k. HAZARD CAUSES:

5. AMS-02 payload or electrical GSE conductive external parts or surfaces that are not at ground potential.

l. HAZARD CONTROLS:

5.1 Proper grounding and bonding between AMS-02 hardware and KSC facilities will be used. The design, construction and installation of the AMS-02 payload and electrical GSE will assure that all conductive external parts and surfaces are at ground potential at all times.

5.2 AMS-02 non-COTS GSE power cords will have a non-current carrying ground conductor.

m. SAFETY VERIFICATION METHODS:

5.1.1 Grounding and bonding verification tests will be performed on the AMS-02 payload, electrical GSE and the interfacing between AMS-02 equipment and KSC facilities.

5.2.1 QA inspections/verification tests of the AMS-02 hardware.

n. STATUS OF VERIFICATION:

5.1.1. Open
5.2.1. Open

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k. HAZARD CAUSES:

6. Personnel short an energized AMS-02 payload or GSE electrical circuit after connector mating/demating.

l. HAZARD CONTROLS:

6.1 No blind mating will be allowed.

6.2 Plug design will preclude inadvertently reversing a connection.

m. SAFETY VERIFICATION METHODS:

6.1.1 Review of AMS-02 procedures to ensure there is a warning to not perform blind mating.
6.2.1 Review of design for non-COTS connectors.

n. STATUS OF VERIFICATION:

6.1.1 Open
6.2.1 Open

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k. HAZARD CAUSES:

7. Mismatch of three-phase power sequencing between AMS-02 electrical equipment and KSC facilities.

l. HAZARD CONTROLS:

7.1 Phasing of interface will be checked for proper phasing prior to mating per procedure.

m. SAFETY VERIFICATION METHODS:

7.1.1 Review of procedures.

n. STATUS OF VERIFICATION:

7.1.1 Open

ECTRICAL EQUIPMENT MATRIX

ial	Electrical Code	3-Phase Yes/No	KSC Facilities	Batteries Yes/No Commercial/Custom	Functions	Quantity	Comment
	UL	No	No	No	Oscilloscope	1	
	UL	No	No	No	Oscilloscope	1	
	N/A	N/A	No	Yes, Commercial	Multimeters	5	
	UL	No	No	No	Fan for main radiator cooling	8	
	UL	No	No	No	Fan for Zenith radiator cooling	4	
	CE/GS	No	No	No	Fan for PDS and CAB cooling	3	
	CE	No	No	No	AST LED	1	
	CE	No	No	No	GPS simulator	1	
	CE	No	No	No	GPS Attenuator	1	
	CE	No	No	No	GPS simulator transmitter	1	
	UL	No	No	No	Personal computer (POC/GSC)	2	
	UL	No	No	No	Personal computer (POC)	2	
	UL	No	No	No	Personal computer (GSC)	4	
	UL	No	No	No	DC power supply (120V)	4	
	UL	No	No	No	Gigabit network switch	1	
	UL	No	No	No	10/1000 network switch	1	
	UL	No	No	No	LCD Monitors	2	
	UL	No	No	No	Remote reboot power outlets	2	
		No	No	No	EEPCAN interface, 5V	2	
		No	No	No	RS422-USB interface (DDRS)	2	

	UL	No	No	No	Personal computer (POC/GSC)	4	
	UL	No	No	No	Personal computer (POC)	2	
	UL	No	No	No	Gigabit network switch	1	
	UL	No	No	No	10/1000 network switch	1	
	UL	No	No	No	LCD Monitors	13	
	UL	No	No	No	Personal computer (SOC)	2	
	UL	No	No	No	Disk server (POC)	1	
	UL	No	No	Yes, Commercial	UPS for disk server	1	
	UL	No	No	No	Network printer	1	
	CE	YES	No	No	Main Vacuum Pump	2	One is spare. 400V 3Ph.5--50Hz, 73kVA, 105A
	CE	No	No	No	PVVV Vacuum Pump	1	Intermittent use.
	CE	No	No	No	He leak detector	1	
	CE	Yes	No	No	Chiller for PCR??	1	3phase, 50Hz, 400V
	UL	No	No	Yes, Commercial	UPS for CGSE	2	
	UNK	No	No	Yes, Commercial	UPS for CGSE	2	May need to be replaced, not suitable for PCR.
	CE	No	No	Yes, Commercial	Industrial PC for CGSE	3	
	CE	No	No	Yes, Commercial	Industrial PC Display	3	240V?
	CE	No	No	Yes, Commercial	Industrial PC for CGSE	1	
	UL	No	No	No	PLC crates for CGSE	10	
	UL	No	No	No	Temperature Indicator	1	various models

	CE	No	No	No	Alarm MUX?	1	
	CCC	No	No	No	Ethernet hub	1	
	CE	No	No	No	Liquid He level probe	1	240V
	UNK	No	No	No	"Complex Vacuum Meter"	1	Hopefully not needed.
	UL	No	No	No	110-220V transformer	3	or use KSC?
		No	No	No	EEPCAN interface, 5V	2	
	UL	No	No	No	CGSE Monitoring & Control	~30	various models
	UL	No	No	No	CGSE Monitoring & Control	~20	
	UL	No	No	Yes, Commercial	Laptop computer	40	
	UL	No	No	No	Network printer	1	