

PAYLOAD HAZARD REPORT		a. NO: GHR-AMS02-001
b. PAYLOAD: Alpha Magnetic Spectrometer-02 (AMS-02) GSE		c. PHASE: II
d. SUBSYSTEM: Materials, Rotating Equipment, Electrical	e. HAZARD GROUP: Fire	f. DATE: May 2008
g. HAZARD TITLE: Fire hazard due to flammable materials and/or equipment failure.		i. HAZARD CATEGORY <input checked="" type="checkbox"/> CATASTROPHIC <input type="checkbox"/> CRITICAL
h. APPLICABLE SAFETY REQUIREMENTS: KHB 1700.7C, Sections: 4.3.2 Electrical; 4.3.9 GSE Materials		
j. DESCRIPTION OF HAZARD: AMS-02 GSE flammable materials (including solvents, chemicals etc), and/or ignition sources could cause a fire.  (For Materials of Flight Hardware, see AMS-02-F10)		
k. HAZARD CAUSES:  <ol style="list-style-type: none"> <li>1. Improper use of flammable materials.</li> <li>2. Exposure of flammable materials to ignition sources.</li> <li>3. AMS-02 GSE electrical circuits overheat due to overloads or short circuits.</li> <li>4. Mating/demating of energized AMS-02 electrical circuits causes arcing.</li> <li>5. Mismatching of AMS-02 connectors.</li> <li>6. Runaway AMS-02 heaters.</li> <li>7. Damaged Hardware causes fire.</li> <li>8. Mechanical failure of rotating equipment.</li> <li>9. Static buildup from rotating equipment.</li> </ol> (Note-Contact with liquefied air as an ignition source is addressed under GHR-AMS02-003, Liquefaction of Atmospheric Gases)		
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	<i>Trent Martinez</i> 10/3/08	<i>Richard Hall</i> 10/3/08
PHASE III		

<b>PAYLOAD HAZARD REPORT CONTINUATION SHEET</b>		a. NO: GHR AMS02--001
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k. HAZARD CAUSES: 1. Improper use of flammable materials.		
l. HAZARD CONTROLS: 1.1 Use of flammable AMS-02 GSE materials will be avoided wherever possible in all payload processing areas. A list of any flammable materials used will be submitted to the Customer Integration Manager (CIM). 1.2 All plastic films, adhesive tape and foams will be used per MUA based on material rating, application, and quantity used. 1.3 KSC-provided cleaning solvents will be used when possible. Cleaning solvents and adhesives not provided by KSC will be submitted to KSC for review and approval (Including application quantities, amount, and storage methods). 1.4 Flammable liquids and gases will be stored in properly sealed containers and in a hazardous materials storage cabinet as required or will be vented outside of KSC facilities in a controlled manner. 1.5 Potentially hazardous byproducts (dirty rags, dirty used solvents etc) will be disposed of in accordance with KSC health and safety protocols. (Note: Includes disposal of toxic and flammable materials.)		
m. SAFETY VERIFICATION METHODS: 1.1.1 Review of AMS-02 flight and GSE materials lists including Material Safety Data Sheets (MSDS's) that will be submitted for all material/solvents/chemicals not provided by NASA/KSC. 1.1.2 Review of AMS-02 procedures for location of materials usage. 1.2.1 Review of AMS-02 flight and GSE materials lists against KSC-approved lists. 1.2.2 Review of AMS02materials usage agreements. 1.3.1 Material usage agreement from KSC for all solvents not provided by KSC. 1.3.2 Review of AMS-02 flight and GSE solvents and adhesives for location of materials usage. Material Safety Data Sheets (MSDS's) will be submitted for all materials not on the NASA/KSC approved lists. 1.4.1 Review of design of sealed containers with flammable liquids to verify positive margins against rupture or leakage. 1.4.2 Review of containment venting to ensure that flammable gases are not allowed to accumulate. 1.5.1 Approval of the Process Waste Questionnaire.		
n. STATUS OF VERIFICATION: 1.1.1 Open 1.1.2 Open 1.2.1 Open 1.2.2 Open 1.3.1 Open 1.3.2 Open 1.4.1 Open 1.4.2 Open 1.5.1 Open		

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k. HAZARD CAUSES:		
2. Exposure of flammable materials to ignition sources.		
1. HAZARD CONTROLS:		
2.1 Label all ignition sources that can't be eliminated which are found on flight hardware and GSE.		
2.2 Prohibit use of flammable material near ignition sources.		
2.3 Proper control/shielding of ignition sources on flight hardware and GSE.		
m. SAFETY VERIFICATION METHODS:		
2.1.1 Inspect flight hardware and GSE for proper identification of potential ignition sources and correct warning labels.		
2.2.1 Review proper use of flammable material per Material Safety Data Sheets (MSDS).		
2.3.1 Review of flight hardware and GSE design drawings for proper controls/shielding.		
n. STATUS OF VERIFICATION:		
2.1.1. Open		
2.2.1 Open		
2.3.1 Open		

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k. HAZARD CAUSES: 3. AMS-02 GSE electrical circuits overheat due to overloads or short circuits.			
l. HAZARD CONTROLS: 3.1 AMS-02 GSE electrical circuits are selected (COTS) or designed (custom) using proper wire sizes and overload protection devices (such as fuses and circuit breakers) to prevent overheating.  (Note: All ground cabling will be built to the same/equivalent rating as the flight hardware)			
m. SAFETY VERIFICATION METHODS: 3.1.1 Review of AMS-02 electrical GSE to verify it meets the requirements of KHB 1700.7C, Section 4.3.2 (Electrical) and the National Electric Code (NEC), National Fire Protection Association, 70 (NFPA 70), or equivalent.			
n. STATUS OF VERIFICATION: 3.1.1 Open			

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k. HAZARD CAUSES: 4. Mating/demating of energized AMS-02 electrical circuits causes arcing.			
l. HAZARD CONTROLS: 4.1 All mating/demating of connectors will be performed on de-energized electrical circuits.			
m. SAFETY VERIFICATION METHODS: 4.1.1. Review of AMS-02 mating/demating procedures			
n. STATUS OF VERIFICATION: 4.1.1. Open			

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c. Phase II

k. HAZARD CAUSES:

5. Mismatching of AMS-02 connectors.

l. HAZARD CONTROLS:

5.1 AMS-02 connectors carrying electrical power will be selected which make it physically impossible to mismatch.

m. SAFETY VERIFICATION METHODS:

5.1.1 Review of AMS-02 drawings.

5.1.2 QA inspections of as-built hardware to approved drawings.

n. STATUS OF VERIFICATION:

5.1.1 Open

5.1.2 Open

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k. HAZARD CAUSES: 6. Runaway AMS-02 heaters.	
I. HAZARD CONTROLS: 6.1 The AMS-02 heater circuits will be monitored via computer and kept below a potential ignition temperature. 6.2 Heating tape on the fill-gas K-bottles is set to 40C (TRD Gas System). 6.3 Heaters on flight hardware are controlled by thermostats.	
m. SAFETY VERIFICATION METHODS: 6.1.1 Review of AMS-02 procedures to verify monitoring of heater circuit temperatures. 6.2.1 Review of AMS-02 procedures to verify K-bottle heater tape controller is set to 40C. 6.3.1 Review of AMS-02 heater parameters.	
n. STATUS OF VERIFICATION: 6.1.1. Open 6.2.1. Open	

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k. HAZARD CAUSES:

7. Damaged hardware causes fire.

l. HAZARD CONTROLS:

7.1 Components will be selected to ensure design lifetime will exceed operational lifetime.

7.2 Components will be selected to ensure that they can withstand the thermal cycling associated with the AMS-02 Cryogenic Systems.

m. SAFETY VERIFICATION METHODS:

7.1.1 Review of component specifications to ensure design lifetime exceeds operational lifetime.

7.2.1 Review of component specifications to ensure they can withstand thermal cycling.

n. STATUS OF VERIFICATION:

7.1.1 Open

7.2.1 Open

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k. HAZARD CAUSES: 8. Mechanical failure of rotating equipment		
l. HAZARD CONTROLS: 8.1 Proper selection of components to minimize heat buildup. 8.2 Proper lubrication of rotating equipment to minimize heat buildup. 8.3 Adequate cooling of rotating equipment (i.e. vacuum pumps) to ensure rotating equipment won't heat up beyond design parameters. Large vacuum (Roots) pumps are equipped with autoshutoff sensors for over temperature conditions.		
m. SAFETY VERIFICATION METHODS: 8.1.1 Review of design drawings to ensure proper components are being used 8.2.1 Review preventative maintenance schedule to ensure rotating parts are being lubricated. 8.3.1 Monitoring of rotating via computer equipment cooling system. 8.3.2 Review of manufacturer's specifications for autoshutoff feature.		
n. STATUS OF VERIFICATION: 8.1.1 Open 8.2.1 Open 8.3.1 Open		

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k. HAZARD CAUSES:

9. Static buildup from rotating equipment.

l. HAZARD CONTROLS:

9.1 Bond and ground rotating equipment to ensure there is no static buildup.

m. SAFETY VERIFICATION METHODS:

9.1.1 Review of GSE electrical schematics for proper bonding/grounding.

n. STATUS OF VERIFICATION:

9.1.1. Open