

PAYLOAD HAZARD REPORT		a. NO: GHR-AMS02-001
b. PAYLOAD: Alpha Magnetic Spectrometer-02 (AMS-02) GSE		c. PHASE: III
d. SUBSYSTEM: Materials, Rotating Equipment, Electrical	e. HAZARD GROUP: Fire	f. DATE: August 2010
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"> 1. Improper use of flammable materials. 2. Exposure of flammable materials to ignition sources. 3. AMS-02 GSE electrical circuits overheat due to overloads or short circuits. 4. Mating/demating of energized AMS-02 electrical circuits causes arcing. 5. Mismatching of AMS-02 connectors. 6. Runaway AMS-02 heaters. 7. Damaged hardware causes fire. 9. Static buildup from GSE power equipment. (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		
PHASE DIII	<i>T. W. TRENTMANN</i> 8/16/10	<i>[Signature]</i> 8/25/10

PAYLOAD HAZARD REPORT CONTINUATION SHEET	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 KSC approved list or 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 properly stowed in the flight hardware.	
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 (MSDSs) that will be submitted for all material/solvents/chemicals not provided by NASA/KSC.	
1.1.2 Review of AMS-02 design 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 AMS-02 materials 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. MSDSs will be submitted for all materials not on the NASA/KSC approved lists.	
1.4.1 Review of containment in flight hardware to ensure proper containment of flammable gases.	
1.5.1 Approval of the Process Waste Questionnaire.	
n. STATUS OF VERIFICATION:	
1.1.1 Closed 11/25/09. ESCG-4470-09-TEAN-DOC-0121, <i>AMS-02 Heat Pipes and Loop Heat Pipes Fluid Fill Quantities</i> , 09/09/09; Form P-4562-E, <i>Praxair Material Safety Data Sheet</i> , Ammonia, Anhydrous; <i>Lenox Material Safety Data Sheet</i> , Propylene.	
1.1.2 Closed 11/25/09. E-mail from Chris Tutt to Tom Tinsler, PSE of GSRP, Paul Kirkpatrick, GSRP Chair, and Joe Delai, STS-134/ULF6 Mission Manager entitled "Flammable Materials on AMS-02", 11/23/09.	
1.2.1 Closed to SVTL.	
1.2.2 Closed to SVTL.	
1.3.1 Closed 11/09/09. AMS-02 will not bring any of their own solvents to KSC.	
1.3.2 Closed 11/09/09. AMS-02 will not bring any of their own solvents to KSC.	
1.4.1 Closed 11/09/09. All flammable materials associated with AMS-02 will be sealed in heat pipes and loop heat pipes, which are located on the flight hardware. Pressure tables from FSDP for Wake and Ram Radiator Heat Pipes and Tracker Radiator Heat Pipes and E-mail from Mike Cardinale date 02/16/2010/.	
1.5.1 Closed to SVTL.	

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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 of design for proper containment of flammable materials.. 2.3.1 Review of flight hardware and GSE design drawings for proper controls/shielding.	
n. STATUS OF VERIFICATION: 2.1.1. Closed to SVTL. 2.2.1 Closed to SVTL. . 2.3.1 Closed to SVTL.	

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k. HAZARD CAUSES: 3. AMS-02 GSE electrical circuits overheat due to overloads or short circuits.	
1. 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 Closed to SVTL.	

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

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<p>k. HAZARD CAUSES</p> <p>5. Mismatching of AMS-02 connectors. (Note: AMS will not make any blind mates)</p>	
<p>l. HAZARD CONTROLS</p> <p>5.1 AMS-02 connectors carrying electrical power will be selected which make it physically impossible to mismatch.</p> <p>5.2 For those connectors that cannot conform to Control 5.1, procedures will be put into place to prevent mismatching.</p> <p>5.3 Warning labels indicating not to mismatch will be placed on connectors that cannot conform to Control 5.1.</p>	
<p>m. SAFETY VERIFICATION METHODS</p> <p>5.1.1 Review of AMS-02 drawings.</p> <p>5.1.2 QA inspections of as-built hardware to approved drawings.</p> <p>5.2.1 Review of procedures to ensure there are warnings to preclude mismatching.</p> <p>5.3.1 Review of affected connectors to ensure label placement.</p>	
<p>n. STATUS OF VERIFICATION:</p> <p>5.1.1 Closed 12/22/09. ESCG-4390-08-SP-MEMO-0022, <i>Mate/Demate of Connectors</i>, 06/11/08. This closes the verification for all flight related electrical connectors.</p> <p>5.1.2 Closed to SVTL.</p> <p>5.2.1 Closed to SVTL</p> <p>5.3.1 Closed to SVTL.</p>	

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k. HAZARD CAUSES: 6. Runaway AMS-02 heaters.	
l. HAZARD CONTROLS: 6.1 The AMS-02 heater circuits will be monitored via computer and kept below a potential ignition temperature. 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. 6.3.1 Review of AMS-02 heater parameters.	
n. STATUS OF VERIFICATION: 6.1.1 Closed to SVTL. 6.3.1 Closed to SVTL.. AMSTR-NLR-TN-043, Issue 4.0, <i>AMS Tracker Thermal Control Subsystem TTCS Heater Specifications</i> , 08/2009.	

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<p>k. HAZARD CAUSES:</p> <p>7. Damaged hardware causes fire.</p>	
<p>l. HAZARD CONTROLS:</p> <p>7.1 Components will be selected to ensure design lifetime will exceed operational lifetime.</p>	
<p>m. SAFETY VERIFICATION METHODS:</p> <p>7.1.1 Review of component specifications to ensure design lifetime exceeds operational lifetime.</p>	
<p>n. STATUS OF VERIFICATION:</p> <p>7.1.1 Closed to SVTL.</p>	

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k. HAZARD CAUSES: 9. Static buildup from GSE power equipment.	
l. HAZARD CONTROLS: 9.1 Bond and ground GSE power equipment to ensure there is no static buildup per KSC bonding/grounding requirements.	
m. SAFETY VERIFICATION METHODS: 9.1.1 Review of GSE electrical schematics for proper bonding/grounding.	
n. STATUS OF VERIFICATION: 9.1.1. Closed to SVTL.	