Appendix H

Signed Coversheets of Phase III Hazard Reports

(Page Numbering and Document Number reflect original documents on following pages.)

PAYLOAD FLIGHT HAZARD REPORT			a. NO:	AMS-02-F01
b. PAYLOAD	Alpha Magnetic Spectrometer-02 (AMS-02)		c. PHASE:	III
d. SUBSYSTEM:	Structures	e. HAZARD GROUP: Collision, Injury	f. DATE:	January 21, 2011
g. HAZARD TITLE:	Structural Failure of Hardware		i. HAZARD CATEGORY:	CATASTROPHIC X CRITICAL
h. APPLICABLE SAFETY REQUIREMENTS:	NSTS 1700.7B and the ISS Addendum, 200.2, 208.1, 208.2, 208.3			
j. DESCRIPTION OF HAZARD:	Failure of AMS-02 Structures could injure crewmembers or damage the STS, ISS or other payloads. This hazard does not address non-structural pressure systems or sealed/vented container failures.			

k. CAUSES *(list)*

1. Inadequate structural strength for worst-case loads during all mission phases.
2. Improper Material Selection (including Stress Corrosion Cracking)
3. Initiation of propagation of flaws or crack-like defects.
4. Use of counterfeit, substandard or inadequate fasteners.
5. Loosening of safety critical fasteners.
6. Loss of structural integrity of welds.
7. Improper manufacture and/ or assembly.
8. Improper preload or creeping of the Cryomagnet support system straps.
9. Damage to composite structural components during manufacturing, assembly operations, ground handling, and/or ground transportation.
10. Degradation of composite structural components by atomic oxygen.
11. Improper Preload of PAS
12. Reconfiguration of Mechanical Components
13. Failure of Rotating Equipment

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III	21 JAN 2011	Michael K. Lindner 1/21/11

PAYLOAD FLIGHT HAZARD REPORT			a. NO:	AMS-02-F02
b. PAYLOAD	Alpha Magnetic Spectrometer-02 (AMS-02)		c. PHASE:	III
d. SUBSYSTEM:	Materials, AMS-02 DDRS-02	e. HAZARD GROUP: Injury/Illness	f. DATE:	August 4, 2010
g. HAZARD TITLE:	Toxic Material Offgassing		i. HAZARD CATEGORY:	CATASTROPHIC CRITICAL X
h. APPLICABLE SAFETY REQUIREMENTS:	NSTS 1700.7B 209.3			

j. DESCRIPTION OF HAZARD:

Offgas evolution of toxic vapors from materials of construction of hardware used within the Orbiter crew habitable volume can result in injury/illness.

This hazard report covers the AMS-02 provided hardware to be used within the Shuttle Orbiter crew habitable volume during AMS-02 systems check out prior to deployment to the ISS. This hardware consists of interface cables and a RS 422 interface card to be Interfaced with the standard PGSC/NGLS through a USB port.

k. CAUSES

1. Use of hardware/materials of construction which offgas excessive levels of toxic products.

(list)

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III	TRENT MARTIN 8/6/10	Michael R. Shuler 8/6/10

PAYLOAD FLIGHT HAZARD REPORT			a. NO:	AMS-02-F04
b. PAYLOAD	Alpha Magnetic Spectrometer-02 (AMS-02)		c. PHASE:	III
d. SUBSYSTEM:	Pressure Systems	e. HAZARD GROUP: Structural	f. DATE:	August 4, 2010
g. HAZARD TITLE:	Overpressurization of Orbiter Payload Bay		i. HAZARD CATEGORY:	CATASTROPHIC X CRITICAL
h. APPLICABLE SAFETY REQUIREMENTS:	NSTS 1700.7B, 200.1, 200.2, 200.3, 200.4a, 201.3, 202.6, 205, 206, 208.4, 208.4a, 208.4b, 208.4c, 208.4e			
j. DESCRIPTION OF HAZARD:	Nominal or fault venting/release of stored gases (TRD Gas Supply (CO_2, Xe) and the Thermal Control System (Ammonia, CO_2) generates excessive volume/pressure within the Orbiter payload bay during ascent or entry (doors closed) damaging the payload bay doors or aft bulkhead. Damage of these critical structures can result in the loss of Orbiter safe entry capability.			

k. CAUSES

(list)

1. Nominal boil off of cryogenic helium <Deleted>
2. Loss of Vacuum Case thermal isolation <Deleted>
3. Leakage of Warm Helium Gas Supply <Deleted>
4. Leakage of TRD Gas System
5. Leakage of Thermal Control Systems
6. Blockage of Payload Bay Vents with MLI

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III	[signature] TRENT MARTIN 8/4/10	Michael R. [signature] 8/6/10

PAYLOAD FLIGHT HAZARD REPORT			a. NO:	AMS-02-F05
b. PAYLOAD	Alpha Magnetic Spectrometer-02 (AMS-02)		c. PHASE:	III
d. SUBSYSTEM:	Pressurized Systems	e. HAZARD GROUP: Explosion, Contamination	f. DATE:	January 20, 2011
g. HAZARD TITLE:	Rupture of AMS-02 Pressurized Systems: TRD Gas System (Xe & CO_2), Tracker Thermal Control System, Thermal Control Systems		i. HAZARD CATEGORY:	CATASTROPHIC X CRITICAL
h. APPLICABLE SAFETY REQUIREMENTS:	NSTS 1700.7B and ISS Addendum: 200.1, 200.1b, 200.2, 200.3, 200.4a, 201.3, 205, 206, 208.1, 208.2, 208.3, 208.4, 208.4a, 208.4b, 208.4c & 208.4e			
j. DESCRIPTION OF HAZARD:	Rupture/Explosion of the pressurized systems results in significant damage to or loss of the STS, ISS, crewmembers and/or other payloads.			

k. CAUSES *(list)*

1. Inadequate design strength for pressure and other loading environments.
2. Improper material selections and processing.
3. Improper workmanship and/or assembly.
4. Propagation of crack-like defects.
5. Liquefaction/freezing/thawing in lines.
6. Improper filling/over filling of vessel/system.
7. Incorrect commanding of valves.
8. Heater Failure
9. Meteoroid and Orbital Debris (M/OD) impact.
10. Damage to Composite Overwrapped Pressure Vessel

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III	21 JAN 2011	1/21/11

PAYLOAD FLIGHT HAZARD REPORT			a. NO:	AMS-02-F06
b. PAYLOAD	Alpha Magnetic Spectrometer-02 (AMS-02)		c. PHASE:	III
d. SUBSYSTEM:	Pressure Systems, Magnet	e. HAZARD GROUP: Collision	f. DATE:	January 21, 2011
g. HAZARD TITLE:	Excessive Thrust/Overturning Moments		i. HAZARD CATEGORY:	CATASTROPHIC X CRITICAL
h. APPLICABLE SAFETY REQUIREMENTS:	NSTS 1700.7B, ISS Addendum, 200.1b			
j. DESCRIPTION OF HAZARD:	The AMS-02 has the potential due to the presence of stored gases and magnetic fields to generate excessive loads on the vehicles (Orbiter, ISS) or robotic manipulators (SRMS, SSRMS).			

k. CAUSES

(list)

1. Planned/Controlled Venting
2. Inadvertent/Emergency Venting of Gases
3. Gas Loss by the TRD
4. Excessive Magnetic Fields

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III	21 JAN 2011	1/21/11

PAYLOAD FLIGHT HAZARD REPORT			a. NO:	AMS-02-F07
b. PAYLOAD	Alpha Magnetic Spectrometer-02 (AMS-02)		c. PHASE:	III
d. SUBSYSTEM:	Electrical, Radiation	e. HAZARD GROUP: Radiation, Injury/Illness	f. DATE:	January 21, 2011
g. HAZARD TITLE:	Excessive Field Strengths: EMI, Magnetic (DC Field)		i. HAZARD CATEGORY:	CATASTROPHIC X CRITICAL
h. APPLICABLE SAFETY REQUIREMENTS:	NSTS 1700.7B and ISS Addendum, paragraphs 200.2, 212.2			
j. DESCRIPTION OF HAZARD:	The AMS-02 generates energy fields by way of RF and magnetic fields that may have a hazardous effect on Orbiter Systems, ISS systems and equipment (SSRMS, SPDM), Extravehicular Mobility Unit (EMU), Russian Orlan Suit, Simplified Aid for EVA Rescue (SAFER), EVA tools (including the Pistol Grip Tool) and other safety critical subsystems.			

k. CAUSES

1. AMS-02 Generates an Excessive Magnetic Field Strength
2. AMS-02 Radiates an Excessive Electromagnetic Radiation (RF) Field Strength

(list) 3. AMS-02 Changing Magnetic Fields induces currents in proximity systems <Deleted>

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III	[signature] 21 JAN 2011	Michael R. [signature] 1/21/11

PAYLOAD FLIGHT HAZARD REPORT				a. NO:	AMS-02-F08
b. PAYLOAD	Alpha Magnetic Spectrometer-02 (AMS-02)			c. PHASE:	III
d. SUBSYSTEM:	Electrical	e. HAZARD GROUP:	Electric Shock. Injury/Illness	f. DATE:	August 4, 2010
g. HAZARD TITLE:	Electric Shock/Discharge			i. HAZARD CATEGORY:	CATASTROPHIC X CRITICAL
h. APPLICABLE SAFETY REQUIREMENTS:	NSTS 1700.7B and ISS Addendum, paragraph 102.1, 200.1b				
j. DESCRIPTION OF HAZARD:	Incidental contact by an EVA crewmember with the high voltages and currents of the AMS-02 systems (TRD, TOF, ACC, Tracker, RICH, and ECAL could result in damage to the EMU/Orlan and/or physiological effects on the crewmember. Electrical Discharge of high voltage sources through a rarified atmosphere can damage EVA equipment, payload hardware, SSP and ISS systems and injure the EVA Crew. Table of HV Applications Attached				

k. CAUSES

(list)

1. Defective design, component, wire, insulation and/or workmanship
2. Exposed terminals, Connectors, energized conductive surfaces.
3. Coronal Discharge
4. Hazardous Alteration of ISS Plasma Environment

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III	TRENT MARTIN 8/4/10	Michael R. Luna 8/6/10

PAYLOAD FLIGHT HAZARD REPORT			a. NO: AMS-02-F10
b. PAYLOAD	Alpha Magnetic Spectrometer-02 (AMS-02)		c. PHASE: III
d. SUBSYSTEM:	Materials, Thermal Control System	e. HAZARD GROUP: Fire/Flammability	f. DATE: January 21,2011
g. HAZARD TITLE:	Flammable Materials in the Payload Bay		i. HAZARD CATEGORY: CATASTROPHIC X CRITICAL
h. APPLICABLE SAFETY REQUIREMENTS:	NSTS 1700.7B 209.2		
j. DESCRIPTION OF HAZARD:	Use of flammable materials, solid or gaseous, in the Orbiter Payload Bay can present an uncontrolled fire hazard to the Orbiter and other payloads. Note: Shuttle Cabin flammability issues are addressed in STD-AMS-02-F02.		

k. CAUSES

(list)

1. Use of flammable materials in the construction of the AMS-02
2. Use of flammable fluids/gases in the AMS-02 Thermal Control System
3. Ignition of Flammable Cargo Bay Environment (Non-AMS-02 Source Flammable Material)

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III	[signature] 21 JAN 2011	Michael N. [signature] 1/21/11

PAYLOAD FLIGHT HAZARD REPORT				a. NO:	AMS-02-F11
b. PAYLOAD	Alpha Magnetic Spectrometer-02 (AMS-02)			c. PHASE:	III
d. SUBSYSTEM:	Structural, Mechanical	e. HAZARD GROUP:	Impact, Collision	f. DATE:	August 4, 2010
g. HAZARD TITLE:	Mechanism Failure			i. HAZARD CATEGORY:	CATASTROPHIC X CRITICAL X
h. APPLICABLE SAFETY REQUIREMENTS:	NSTS 1700.7B and ISS Addendum, 200.1b, 200.2, 200.3				
j. DESCRIPTION OF HAZARD:	Failure of these mechanisms could place the AMS-02 in conditions that pose a risk of inadequate structural load conditions or damage to vehicle systems. The AMS-02 is complying with ICD requirements for Shuttle and ISS interfaces and is subject to integrated hazard analyses performed by the applicable Programs.				

k. CAUSES *(list)*

1. Inability to Open/Close Orbiter Payload Retention Latch Assembly (PRLA)/ Keel Latch.
2. Inability to Operate the ROEU. (Critical Only)
3. Improper Installation of Grapple Fixtures.
4. Inability to fully capture/release the Payload Attach System, including the UMA.
5. Inadvertent release of Payload Attach System EVA Release Mechanism.
6. Inability to Secure ROEU Support Structure.

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III	[signature] TRENT MARTIN 8/4/10	Michael R. [signature] 8/6/10

PAYLOAD FLIGHT HAZARD REPORT				a. NO:	AMS-02-F12
b. PAYLOAD	Alpha Magnetic Spectrometer-02 (AMS-02)			c. PHASE:	III
d. SUBSYSTEM:	Electrical, Integration	e. HAZARD GROUP:	Injury/Illness, Damage to Hardware	f. DATE:	August 4, 2010
g. HAZARD TITLE:	Mate/Demate of Connectors			i. HAZARD CATEGORY:	CATASTROPHIC X CRITICAL
h. APPLICABLE SAFETY REQUIREMENTS:	NSTS 1700.7B, ISS Addendum: 200.1, 200.1b				
j. DESCRIPTION OF HAZARD:	The mating/demating of connectors associated with the exterior elements of the AMS-02 can result in the damage to integration hardware, payload hardware, the generation of molten debris, electrical shock and loss of system capabilities. The following are the connectors that will be mated/disconnected during the course of the AMS-02 Mission. ROEU, UMA, PVGF, AMS-02 EVA Connector.				

k. CAUSES

1. Mate/Demate with power in connection.
2. Connector mismate.
3. Bent pin shorting

(list)

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III	[illegible] IRENE MARTIN 8/4/10	Michael R. [illegible] 8/6/10

PAYLOAD FLIGHT HAZARD REPORT			a. NO:	AMS-02-F14
b. PAYLOAD	Alpha Magnetic Spectrometer-02 (AMS-02)		c. PHASE:	III
d. SUBSYSTEM:	Mechanical, Thermal, Electrical, Pressurized Systems	e. HAZARD GROUP: Injury/Illness.	f. DATE:	August 4, 2010
g. HAZARD TITLE:	EVA/EVR Hazards		i. HAZARD CATEGORY:	CATASTROPHIC X CRITICAL
h. APPLICABLE SAFETY REQUIREMENTS:	NSTS 1700.7B, ISS Addendum, 200.1b, 200.3, 201.3, 217			

j. DESCRIPTION OF HAZARD:

The failure to design and construct the AMS-02 to be compatible with proximity to EVA translation paths and EVA activities can result in injury or death to the EVA crew. During EVR operations the AMS-02 has to be designed to avoid collision during SSRMS operations.

Note: EVR compatibility with magnetic field covered in AMS-02-F07

k. CAUSES *(list)*

1. Inadequate Access for EVA Tasks
2. Excessive Radiation
3. Sharp Edges/Corners
4. Thermal Extremes
5. Release of residual loads/forces applied
6. Excessive Loads/Effort From EVA Crew
7. Electric Shock/Molten Metal
8. Entrapment of EVA Crew
9. Improper Installation of EBCS
10. Protrusion Outside of PAS Payload Envelope
11. Improper Placement/Installation of Grapple Fixtures

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III	TRENT MARTIN 8/4/10	Michael R. Lunk 8/6/10

PAYLOAD FLIGHT HAZARD REPORT			a. NO:	AMS-02-F16
b. PAYLOAD	Alpha Magnetic Spectrometer-02 (AMS-02)		c. PHASE:	III
d. SUBSYSTEM:	Optics, Materials	e. HAZARD GROUP: Impact/Collision, contamination, Injury/Illness	f. DATE:	August 4, 2010
g. HAZARD TITLE:	Shatterable Material Release		i. HAZARD CATEGORY:	CATASTROPHIC X CRITICAL
h. APPLICABLE SAFETY REQUIREMENTS:	NSTS 1700.7, NSTS 1700.7B ISS Addendum, 200.3, 206, 209, 215			
j. DESCRIPTION OF HAZARD:	The breakage of glass or other frangible material can results in contamination/damage of space suits (EMU, Orlan) or the generation of debris of sufficient size to cause a released mass hazard.			
k. CAUSES *(list)*	1. Release of shatterable materials			

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III	TRENT MARTIN 8/5/10	Michael R. Dunk 8/6/10

PAYLOAD FLIGHT HAZARD REPORT				a. NO:	AMS-02-F17
b. PAYLOAD	Alpha Magnetic Spectrometer-02 (AMS-02)			c. PHASE:	III
d. SUBSYSTEM:	Avionics	e. HAZARD GROUP:	Injury, Damage to critical systems	f. DATE:	January 21, 2011
g. HAZARD TITLE:	Electrical Power Distribution Damage			i. HAZARD CATEGORY:	CATASTROPHIC X CRITICAL
h. APPLICABLE SAFETY REQUIREMENTS:	NSTS 1700.7B and ISS Addendum: 201.3, 207, 213.1				

j. DESCRIPTION OF HAZARD:

Damage to electrical power distribution circuitry can lead to damage to shuttle and ISS wiring, loss of critical circuitry and loss of power source.

k. CAUSES

(list)

1. Short circuit or load failures induce over-current condition in vehicle wiring.
2. Cross strapping of power sources damages vehicle circuitry.

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III	[signature] 21 JAN 2011	Michael R. [signature] 1/21/11

PAYLOAD FLIGHT HAZARD REPORT			a. NO:	AMS-02-F18
b. PAYLOAD	Alpha Magnetic Spectrometer-02 (AMS-02)		c. PHASE:	III
d. SUBSYSTEM:	All	e. HAZARD GROUP: Loss of Orbiter, Loss of ISS	f. DATE:	August 4, 2010
g. HAZARD TITLE:	Rapid Safing/Payload Reconfiguration		i. HAZARD CATEGORY:	CATASTROPHIC X CRITICAL
h. APPLICABLE SAFETY REQUIREMENTS:	NSTS 1700.7B and ISS Addendum, 202.4a, 202.4b, 202.4c (ISS only), 205			

j. DESCRIPTION OF HAZARD:

Operations or configurations of the AMS-02 may impede critical operations of the ISS or Orbiter. These include: Inability to close Orbiter Payload Bay Doors, Reconfiguration to that precludes ISS orbit boost or inability to return at end of life.

The AMS-02 is complying with ICD requirements for Shuttle and ISS interfaces and is subject to integrated hazard analyses performed by the applicable Programs.

k. CAUSES

(list)

1. Preclude closure of Payload Bay Doors/Orbiter Return
2. Configuration precludes ISS Operation such as reboost/EVA
3. AMS-02 Reconfiguration precludes safe return
4. Configuration requirement for planned ISS Service Loss

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III	TREAS MARTIN 8/4/10	Michael R. Luna 8/6/10

PAYLOAD FLIGHT HAZARD REPORT			a. NO:	AMS-02-F20
b. PAYLOAD	Alpha Magnetic Spectrometer-02 (AMS-02)		c. PHASE:	III
d. SUBSYSTEM:	Tracker Alignment System	e. HAZARD GROUP: Injury/Illness	f. DATE:	August 4, 2010
g. HAZARD TITLE:	Crew Exposure to Coherent Light		i. HAZARD CATEGORY:	CATASTROPHIC X CRITICAL
h. APPLICABLE SAFETY REQUIREMENTS:	NSTS 1700.7B and ISS Addendum, 200.1b, 212.3			
j. DESCRIPTION OF HAZARD:	Operation of the Laser for the Tracker Alignment System makes use of coherent light pulses. Should these irradiate the Crew, there is a potential for ocular damage.			
k. CAUSES *(list)*	1. Laser Power Output Exceeds Design Capability 2. Loss of Beam Path Containment and Integrity			

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III	TREVOR MARTIN 8/6/10	Michael R. Clark 8/6/10

FLIGHT PAYLOAD STANDARDIZED HAZARD CONTROL REPORT	A. NUMBER	B. PHASE	C. DATE
	STD- AMS-02-F02	Phase III	August 4, 2010

D. PAYLOAD, DTO, DSO or RME *(Include Part Number(s), if applicable)*	HAZARD TITLE	E. VEHICLE
Alpha Magnetic Spectrometer (AMS-02) Orbiter Interior Elements–See Attached List	STANDARD HAZARDS	Shuttle

F. DESCRIPTION OF HAZARD:	G. HAZARD CONTROLS: *(complies with)*	H. APP.	I. VERIFICATION METHOD, REFERENCE, AND STATUS:
1. Structural Failure *(payloads must comply with the listed requirements for all phases of flight)* *Note: Locker and Soft Stowage items only.*	Designed to meet the standard modular locker stowage requirements of NSTS 21000-IDD-MDK or equivalent IDD _____ .	☒	1.1.1. SVM: Review for compliance with Middeck ICD 1.1.1 STATUS: Closed. ESCG Memorandum ESCG-4295-10-CPAS-MEMO-0002, "DDRS-02 Hazard Controls," dated February 2, 2010
2. Structural Failure of Sealed Containers **Note 1: Only sealed containers made of conventional metal (metal alloy) can use the 1230 form. Sealed containers made of unconventional metals or non-metallic materials shall be documented on Unique Hazard Reports.** **Note 2: The 1230 form is not applicable for "sealed container"(s) employed in levels of containment control of hazardous fluid.**	Sealed containers must meet the criteria of NASA-STD-5003, Para. 4.2.2.4.2.3a, contain a substance which is not a hazard if released, be made of conventional metals (e.g. Al, inconel, monel, steel or titanium), contain less than 14,240 foot-pounds (19,130 Joules) of stored energy due to pressure, and have a maximum delta pressure of 1.5 atm.	☐	N/A. – No Sealed Containers used as structure (No Sealed Containers for any purpose)

APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III	TRENT MARTIN 8/4/10	Michael R. [illegible] 8/20/10

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