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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:	<p>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.</p> <p>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.</p>		
k. CAUSES	<p>(list)</p> <ol style="list-style-type: none"> 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	<i>[Signature]</i> TREAT MARTIN 8/4/10	<i>[Signature]</i> Michael R. Luke 8/16/10	

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I. HAZARD CONTROL (CONTROL), m. SAFETY VERIFICATION METHODS (SVM), n. STATUS OF VERIFICATIONS (STATUS)			OPS CONTROL
1. CAUSE: Preclude closure of Payload Bay Doors/Orbiter Return			
1.1 CONTROL: The AMS-02 design does not contain any mechanisms or structures that protrude through the Orbiter payload bay door dynamic envelope. Payload bay doors can be closed without physical constraint imposed by the AMS-02.			
1.1.1 SVM: Review of AMS-02 Design.			
1.1.2 SVM: Analysis of Dynamic Envelop intrusions.			
1.1.1 STATUS: Closed. AMS-02 outer mold line model reviewed and all close clearance points identified through the process described in NSTS 37329 Appendix Q, Rev E, September 2006.			
1.1.2 STATUS: Closed. DCLA analysis documented in ESCG-4460-09-LODY-MEMO-0272, "Design Coupled Loads Analysis for the Alpha Magnetic Spectrometer-02 (AMS-02)," dated September 1, 2009. Email from AMS-02 Project Engineer C. Lauritzen, March 8 2010, summarizes clearance assessment performed as part of the DCLA showed no intrusions into Orbiter Payload Bay Door Dynamic Envelope.			
1.2 CONTROL: The AMS-02 design does not require a specific configuration of AMS-02 systems (including ROEU connection) to safely return to the ground.			
1.2.1 SVM: Review of Design.			
1.2.1 STATUS: Closed. Memo ESCG-4390-06-SP-MEMO-0004 dated 06 March 2006 from AMS-02 Chief Engineer Chris Tutt. ESCG Memorandum ESCG-4295-ADV SY-MEMO-0019, "Rapid Safing Operations," dated July 15, 2010.			
1.3 CONTROL: The AMS-02 does not need any special thermal conditioning of composite structures or other systems to allow for safe return.			
1.3.1 SVM: Thermal Analysis to confirm thermal condition of structure under worst case conditions.			
1.3.2 SVM: Structural Analysis to confirm adequate margin for thermal extremes of composite structures/systems.			
1.3.1 STATUS: Closed. ESCG Memorandum ESCG-4175-09-REENTES-MEMO-0032, "Review of Stress Analysis of AMS-02 Composites," dated June 4, 2009. ESCG Memorandum ESCG-4295-ADV SY-MEMO-0019, "Rapid Safing Operations," dated July 15, 2010.			
1.3.2 STATUS: Closed. ESCG Memorandum ESCG-4175-09-REENTES-MEMO-0032, "Review of Stress			

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Analysis of AMS-02 Composites,” dated June 4, 2009. ESCG Memorandum ESCG-4295-ADV SY-MEMO-0019, “Rapid Safing Operations,” dated July 15, 2010.			
1.4 <SKIPPED NUMBER>			
<p>1.5 CONTROL: The AMS-02 is safe to return only with all four PRLAs and the Active Keel (latch) Assembly closed.</p> <p>1.5.1 SVM: Structural Analysis to verify safe return with 4 of 4 PRLA and Keel Latch.</p> <p>1.5.2 SVM: Formal acceptance of procedure requirement by MOD through and OCAD(OCAD 67910).</p> <p>1.5.1 STATUS: Closed. ESCG-4005-05-AMS-0039, “Strength and Stability Assessment of the Alpha Magnetic Spectrometer-02 (AMS-02) Unique Support Structure (USS-02), Vacuum Case, Payload Attach System (PAS), and STS and ISS Integration Hardware,” August 12, 2009</p> <p>1.5.2 STATUS: Closed. Acceptance of OCAD transmitted by email from JSC-OCAD-Admin@mail.nasa.gov on June 3, 2010</p>		S	
NOTE: The AMS-02 is capable of clearing the payload bay by RMS and SSRMS operations or be resecured within the PRLAs and be safe for return within the required 1 hour and 35 minute time allotted per MA2-96-190 for a rapid undocking of the Orbiter from the ISS and return to Earth. ISS –STR-907 for rapid safing.			
2.0 CAUSE: Configuration precludes ISS Operation such as reboost/EVA			
<p>2.1 CONTROL: The AMS-02 does not reconfigure its elements in such a manner that reduces the structural strength of the AMS-02 to handle worst-case ISS loads. (NOTE: The ability to sustain ISS/Orbiter loads safely is addressed AMS-02-F01)</p> <p>2.1.1 SVM: Review of design.</p> <p>2.1.2 SVM: AMS-02 Structural Analysis.</p> <p>2.1.1 STATUS: Closed. ESCG MEMO ESCG4390-07-SP-MEMO-0019, “AMS-02 On-Orbit Configuration Changes”, November 12, 2007</p> <p>2.1.2 STATUS: Closed. ESCG-4005-05-AMS-0039, “Strength and Stability Assessment of the Alpha Magnetic Spectrometer-02 (AMS-02) Unique Support Structure (USS-02), Vacuum Case, Payload Attach System (PAS), and STS and ISS Integration Hardware,” August 12, 2009</p>			
2.2 CONTROL: The AMS-02 persistent magnetic field does not preclude translation of EVA crew, SPDM or MSBS down			

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<p>the truss past the AMS-02. EVA/EVR upon the AMS-02 itself are not impeded by the constant field of the AMS-02 magnet.</p> <p>2.2.1 SVM: Review of design</p> <p>2.2.2 SVM: <Deleted></p> <p>2.2.3 SVM: Magnetic Field Measurement and Analysis</p> <p>2.2.1 STATUS: Closed. MAGIK Action Item 1808 demonstrating EVR capabilities and free path past AMS-02 along the MT rail with Cryomagnet (six times stronger field). Approved EMEP TIA 1133 dated May 14, 2010 addresses EVR compatibility.</p> <p>2.2.2 STATUS: <Deleted></p> <p>2.2.3 STATUS: Closed. ESCG Memorandum ESCG-4295-10-ADV SY-MEMO-0013, "AMS Permanent Magnet Magnetic Field Correlation," dated July 6, 2010</p>			
<p>2.3 CONTROL: The AMS-02 design allows for the installation of the AMS-02 either in the Orbiter Payload Bay or upon a PAS site on the ISS Truss without specific reconfiguration of the AMS-02 hardware or avionics.</p> <p>2.3.1 SVM: Review of Design.</p> <p>2.3.2 SVM: Physical interface confirmation with Shuttle</p> <p>2.3.3 SVM: Fit Check of hardware (ISS).</p> <p>2.3.1 STATUS: Closed. ESCG Memorandums (3) indicate AMS-02 Compliance with ICD Interfaces without reconfigurations being required. ESCG-4390-06-SP-MEMO-0006, "USS-02 Trunnion Interfaces," dated March 13, 2006, ESCG-4390-06-SP-MEMO-0001, "Mechanical Design of the Payload Attach System (PAS)," dated January 8, 2006, ESCG-4175-09-REENTES-MEMO-0019, "Review of AMS-02 ROEU Bracket Design," dated April 24, 2009</p> <p>2.3.2 STATUS: Closed to SVTL.</p> <p>2.3.3 STATUS: Closed. Memo ESCG-4390-05-SP-MEMO-0012, "Functional Testing of the Payload Attach System" dated 28 December 2005, from AMS-02 Chief Engineer Chris Tutt.</p>			
3. CAUSE: AMS-02 Reconfiguration precludes safe return			
3.1 CONTROL: The AMS-02 does not alter its configuration to preclude return at any time during the mission for an abort			

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return by the Orbiter			
3.1.1 SVM: Review of Design			
3.1.1 STATUS: Closed. ESCG Memorandum ESCG-4175-09-REENTES-MEMO-0022, "AMS-02 Potential Abort Landing Configurations," dated April 28, 2009			
3.2 CONTROL: The AMS-02 Pressure systems do not require pressure stabilization of any pressurized tanks or components.			
3.2.1 SVM: Review of Design.			
3.2.2 SVM: Structural Verification Plan.			
3.2.1 STATUS: Closed. ESCG Memorandum ESCG-4175-09-REENTES-MEMO-0022, "AMS-02 Potential Abort Landing Configurations," dated April 28, 2009			
3.2.2 STATUS: Closed. JSC 28792, Revision E, "Alpha Magnetic Spectrometer – 02 Structural Verification Plan for the Space Transportation System and the International Space Station," dated September 2006.			
3.3 CONTROL: <Deleted>			
3.4 CONTROL: <Deleted>			
4 CAUSE: Configuration requirement for planned ISS Service Loss			
4.1 CONTROL: The AMS-02 does not require any configuration changes to support planned Loss of Services to ensure a safe configuration or condition of the AMS-02 hardware. The AMS-02 is designed to support planned and unexpected loss of ISS Services without causing a hazard to the ISS, the crew or other payloads.			
4.1.1 SVM: Review of Design			
4.1.1 STATUS: Closed. ESCG Memo ESCG-4390-07-SP-MEMO-0011, "Effect of Loss of Station Services on AMS-02", dated 21 September, 2007.			
Notes:			

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ACRONYMS

AMS-02 – Alpha Magnetic Spectrometer	PAS – Payload Attach Site, Payload Attach System
DCLA – Design Coupled Loads Analysis	ROEU – Remotely Operated Electrical Umbilical
EVA – Extravehicular Activity	