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Lyndon B. Johnson Space Center
2101 NASA Road 1
Houston, Texas 77058-3696

TO: NE141/Executive Officer, Payload Safety Review Panel

FROM: NASA Project Manager, Alpha Magnetic Spectrometer-02 (AMS-02)

SUBJECT: Phase I/II/III Flight Safety Data Package (FSDP) for the AMS-02 Multi-Insulation Layer (MLI) Blanket

Enclosed is the final copy of the phase I/II/III FSDP for the AMS-02 MLI Blanket. This safety package overs launch,stowage, and installation.

If you have any further questions regarding this package, please contact Eric Harvey at 281-461-5509.

Phil Mott 6-FEB-2014
Phil Mott Date
JETS AMS-02 Project Manager

10-Feb-2014
Trent Martin Date
NASA AMS-02 Project Manager

Enclosure

Flight Safety Data Package (FSDP) for the Alpha Magnetic Spectrometer-02 (AMS-02) Multi-Layer Insulation (MLI) Blanket

International Space Station Program
Phase I/II/III

ESCG-6100-13-S&EH-DOC-0067
JSC 66528
February 2014

Verify this is the correct version before use

Suitable for Internal NASA and IP Release

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas 77058

NASA - LYNDON B. JOHNSON SPACE CENTER

HOUSTON, TEXAS

Phase I/II/III

Flight Safety Data Package (FSDP) for the Alpha Magnetic Spectrometer-02 (AMS-02) Multi-Layer Insulation (MLI) Blanket

February 2014

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10-Feb-2014

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DOCUMENT CHANGE LOG

Superseded by	Supersedes	Document Number: ESCG-6100-13-S&EH-DOC-0067/ JSC 66528
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Document Title: Flight Safety Data Package (FSDP) for the Alpha Magnetic Spectrometer-02 (AMS-02) Multi-Layer Insulation (MLI) Blanket

Revision/Change Identifier	Date Incorporated	Description	Pages Affected
Eric Harvey	February 2014	Baseline release	All

JSC Form 28 (Dec 95) (MS Word Dec 95) Page 1 of 1

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1 PURPOSE

The purpose of this Flight Safety Data Package (FSDP) is to provide a Phase I/II/III safety assessment of the Alpha Magnetic Spectrometer-02 (AMS-02) Multi-Layer Insulation (MLI) Blanket (SEG39138350-301) and to demonstrate compliance with the International Space Station (ISS) safety requirements found in SSP 51700, *Payload Safety Policy and Requirements for the International Space Station.*

2 SCOPE

The Phase III safety assessment covers the launch, stowage, and contingency installation of the AMS-02 MLI Blanket.

3 BACKGROUND/MISSION SCENARIO

The following sections provide information pertinent to the safety assessment. Section 3.1 provides the background as to why the additional MLI blanket is needed. Section 3.2 outlines the mission scenario.

3.1 BACKGROUND

The Transition Radiation Detector (TRD) Gas Pump has a lower operating/destructive limit of 5°C, which is driven by some of its internal components. There is a requirement that it be turned on before it reaches this lower limit so that it remains warm enough to operate properly. The pump has a 3 year operational life due to the constraints of AMS-02's original superconducting magnet, but AMS wants to extend the life of the pump to 15-20 years so that it can operate for the duration of AMS-02's life on ISS. This requires that the pump not be turned on as frequently as it is now so it can meet this new, extended operational life. Also, running the pump degrades science so AMS would like to only run it during TRD refill operations. Currently, the S-1 Radiator is positioned to allow AMS to remain above the pump's operational temperature, except for short durations during vehicle docking, reboosts, etc., which can be successfully handled by AMS. Due to the aging mechanisms on the ISS, it is possible that the starboard Thermal Radiator Rotary Joint (TRRJ) could fail resulting in afailure angle potentially detrimental to AMS. It could be up to 2 or more months for a repair during which time the TRD pump would run continuously, degrading science and shortening the pump life (and AMS operational life as a result).

3.2 MISSION SCENARIO

In order to maintain the pump above its operational temperature, the project has decided to use an MLI blanket, installed on the port side of AMS, to help insulate it (Figure 3.2-1). This will keep the TRD pump warm enough during those times this portion of AMS experiences the coldest temperatures on orbit, which are when the ISS beta angle is less than -45 degrees, greater than 45 degrees and between -20 and +20 degrees. Once the radiator joint is repaired, the blanket will remain installed on AMS. Analysis has shown that the blanket will not be detrimental to AMS hardware. If for some reason real time data indicates the blanket adversely affects temperatures on AMS, removal of the blanket is an option to prevent damage. NBL runs have shown that EVA removal of the blanket is feasible and acceptable by the crew.

The AMS-02 MLI Blanket is scheduled to launch on ATV-5. Once the launch vehicle docks to the ISS, the blanket will be stowed (either IVA or EVA depending on storage

availability) onboard the station until its Extravehicular Activity (EVA) deployment is deemed necessary.

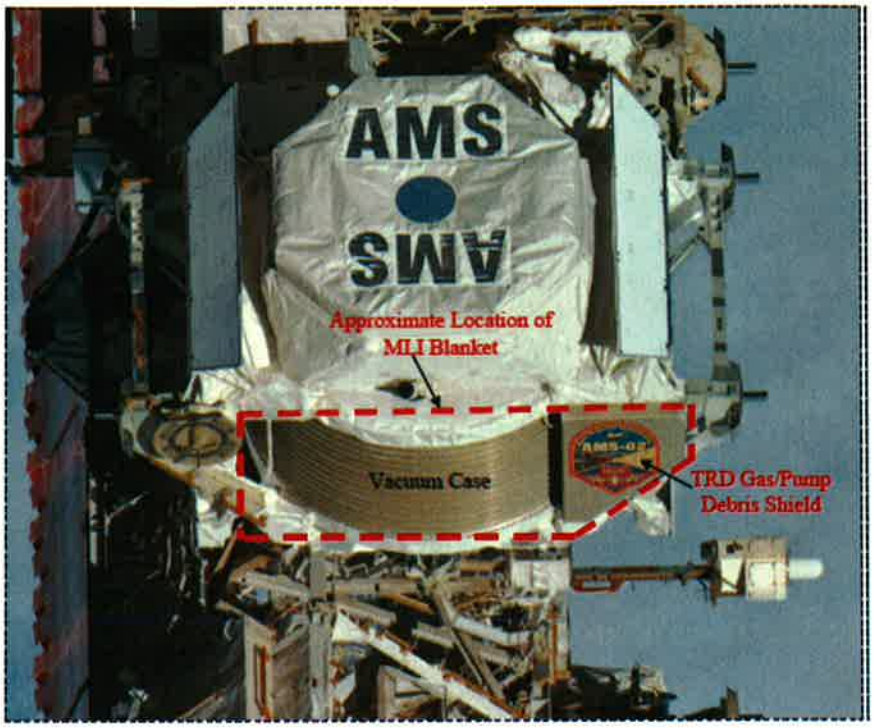

Figure 3.2-1: Approximate Location of the New MLI Blanket

4 PAYLOAD OVERVIEW

The AMS-02 MLI Blanket (Dimensions 139.4 in. x 53.6 in. overall; Figure 4-1) to be flown up will be of similar construction as those already covering other parts of the AMS-02. The layers of the blanket are as follows (in the order from the side that is facing toward space to the layer facing the AMS-02):

- Beta Cloth
- Aluminized Kapton
- 10 layers of Aluminized Mylar (each layer separated by scrim)
- Beta Cloth

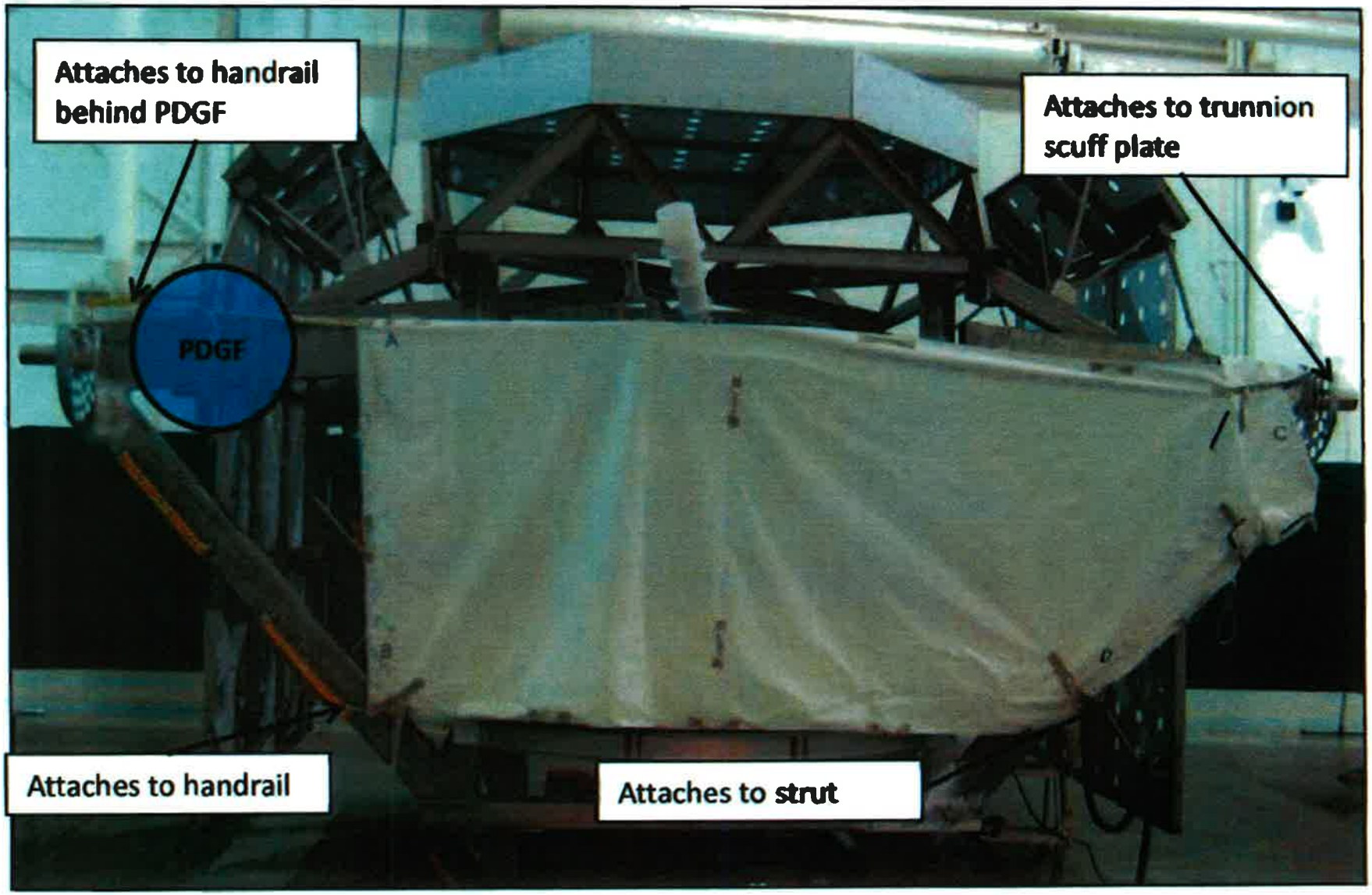

Figure 4-1: Prototype of the AMS-02 MLI Blanket on Neutral Buoyancy Lab (NBL) Mock-Up

One Large Crew Hook (SEG33108084-301), three Large French Hooks (SDG33113537-805), and four Cam Buckles (SED33104182-303) will be used to secure the blanket to the AMS-02. The hooks and cam buckles are certified Government Furnished Equipment (GFE, see Table 4-1) and will be used within their specified limits. The straps attaching the hooks to the blanket are made of 1.25 in. wide beta glass webbing. Straps of the same material have been used in the construction of EVA bags that are used on the ISS. There are also several handling loops on the blanket that allow the crew to more easily maneuver it during deployment on the AMS-02.

Table 4-1: List of AMS-02 MLI Blanket GFE

Part Name	Part Number	GCAR Number
Cam Buckle	SED33104182-303	G6000
Large Crew Hook	SEG33108084-301	G1912A
Large French Hook	SDG33113537-805	G1940B

Two bonding cables (Figure 4-1) will be attached to the blanket to create a class S bond with the AMS-02 superstructure—both on the wake side. Each cable will be insulated and wrapped with glass tape. At the end of each cable is a pip pin (P/N 57591) that will be placed in a previously fayed hole on the port lower trunnion beam (Figure 4-2). The cables and pip pins will be stowed in a pouch built into the blanket to keep them secure. In order to prevent Foreign Object Damage (FOD) due to the unlikely event of pip pin structural failure, both pins will be tethered to the blanket. There is also a small stainless steel retention block that will house the pins after they are inserted into their respective holes (Figures 4-3 through 4-5). The block will capture any FOD from the lower part of the pins in case they fail. The Pip Pin Retention Block is also tethered and grounded to the blanket.

Figure 4-2: Bonding Cable for AMS-02 MLI Blanket

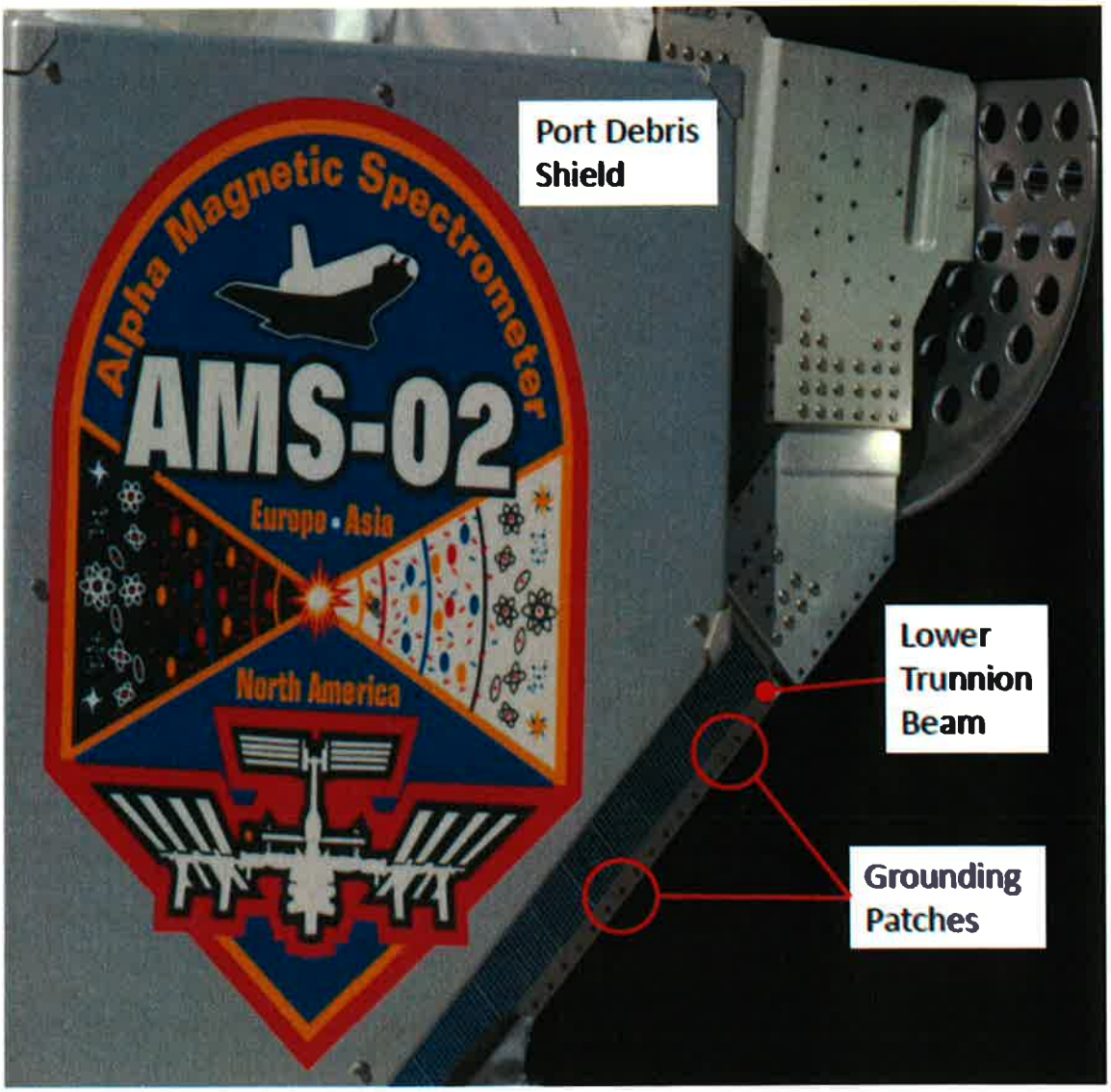

Figure 4-3: Location of Fayed Holes

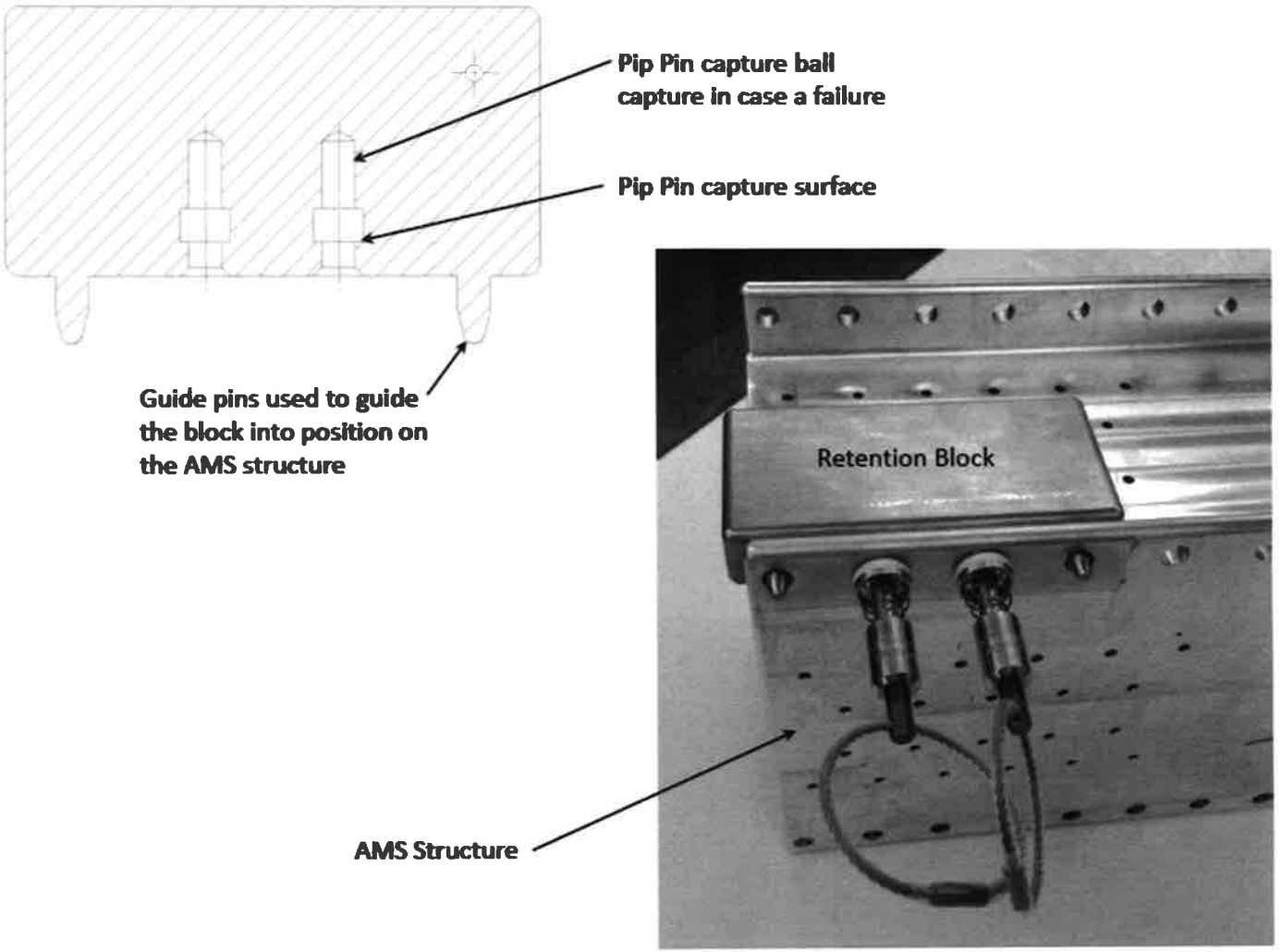

Figure 4-4: Picture of Pip Pin Retention Block with Pip Pins

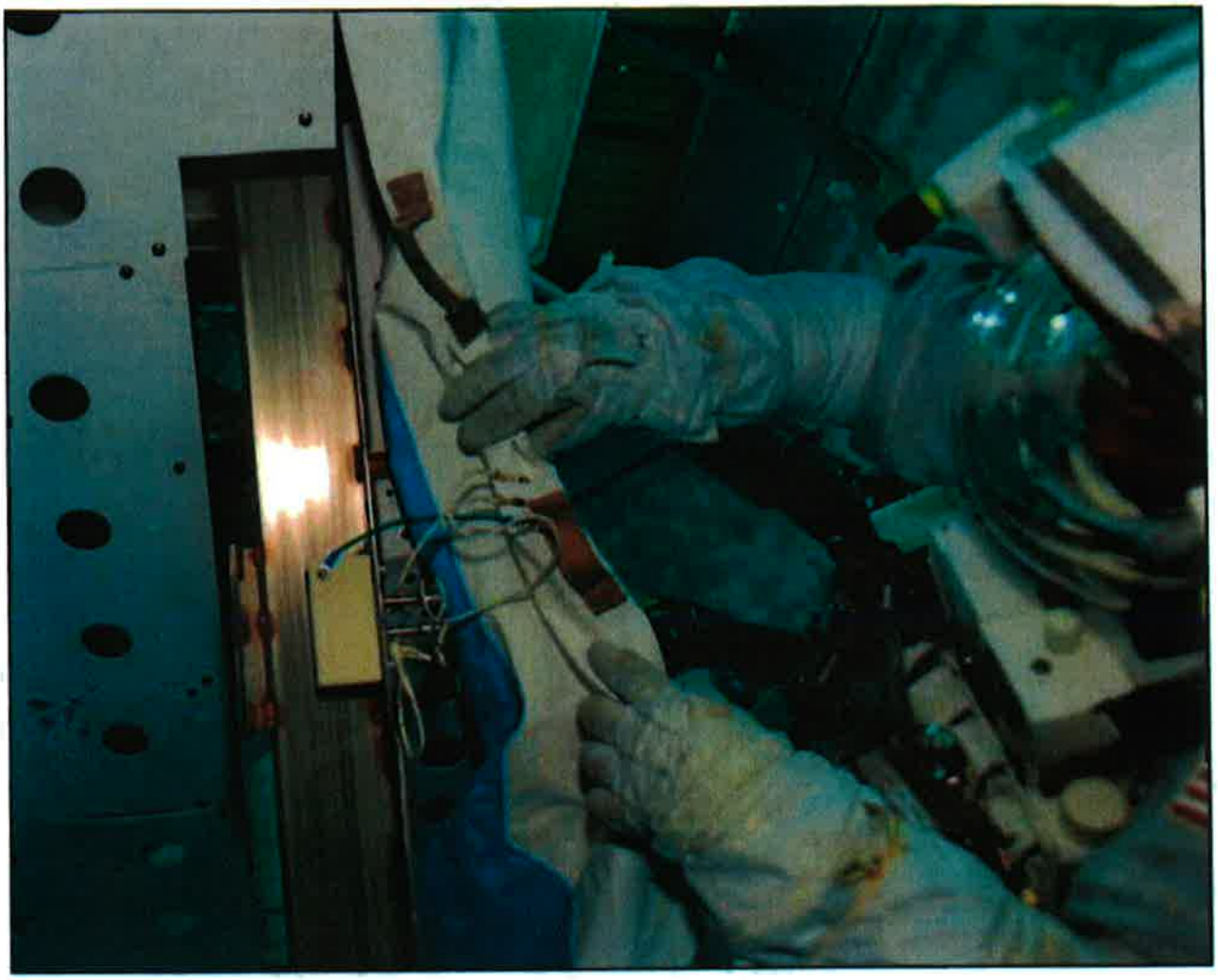

Figure 4-5: Picture of Pip Pin Retention Block Installed During NBL Run

The AMS-02 MLI Blanket will be packed in a Crew Transfer Bag (CTB) for launch and subsequent stowage on ISS. The dimensions of the CTB are 28.5 in. x 16.25 in. x 18.5 in. with a mass of approximately 12 lb (including the packed MLI blanket). There is the possibility that the blanket will be stowed EVA at a predetermined site. The place and configuration are still under discussion.

5 MAINTENANCE HAZARD ASSESSMENT

The maintenance assessment for the AMS-02 MLI Blanket is based on interpretation letter MA2-00-038, *Interpretation of On-Orbit Maintenance.* A general overview of deploying the blanket is provided followed by a safety assessment per the interpretation letter. Any identified hazards are also discussed in section 6.0 of this package.

5.1 GENERAL PROCEDURES

Two EVA crewmen are needed to deploy the AMS-02 MLI Blanket onto the inboard side of AMS. One will be free floating (designated EV1) while the other will be on the Space Station Remote Manipulator System (SSRMS, designated EV2). Prior to the EVA, all high voltage items will be powered off as a precaution.

EV1 will translate to AMS with the blanket tethered to him. He will unstrap two Velcro straps on the blanket so it can be deployed with EV2 holding the blanket during deployment. Strap A will be hooked up to the handrail near the PVGF/trunnion pin (Figures 5-1 and 5-2). EV1 will then translate nadir while unfolding the blanket, attaching the hook on strap B to a handrail (Figure 5-1).

After straps A and B are secured to AMS, EV2 will translate aft on the SSRMS, unfolding the blanket as he moves. When completed, he will hook strap C in a hole on the trunnion scuff plate (Figures 5-1 and 5-3). Then he will wrap strap D (Figures 5-1 and 5-4) around a beam on AMS and attach its hook to a tether point on the strap. After the straps are secured, he will secure the blanket's bonding cables via pip pins and pip pin block (Figure 4-5). The pins will be inserted through two holes that have been previously fayed before launch. Finally, both crewmen will use cam buckles to center the blanket.

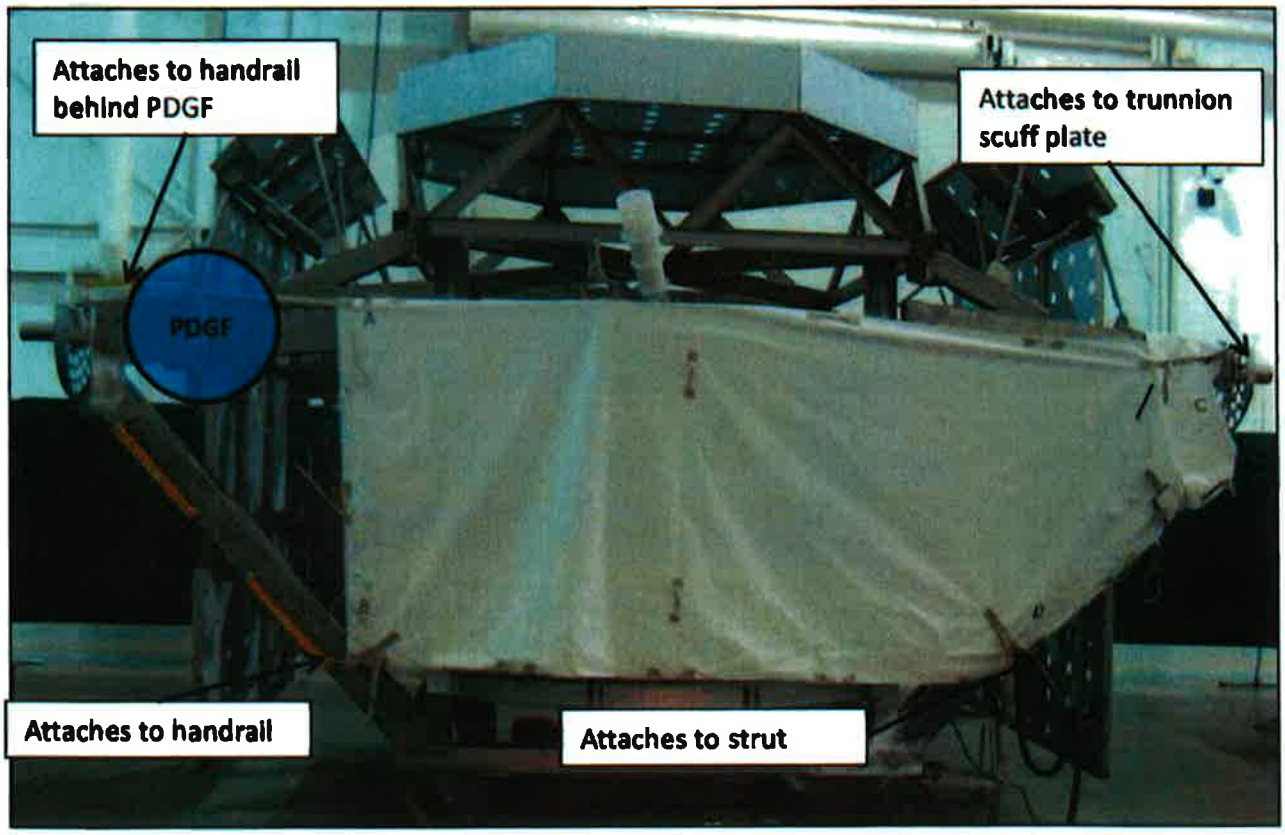

Figure 5-1: Picture Prototype Blanket Showing Strap Locations (Letters Seen on Blanket Corners)

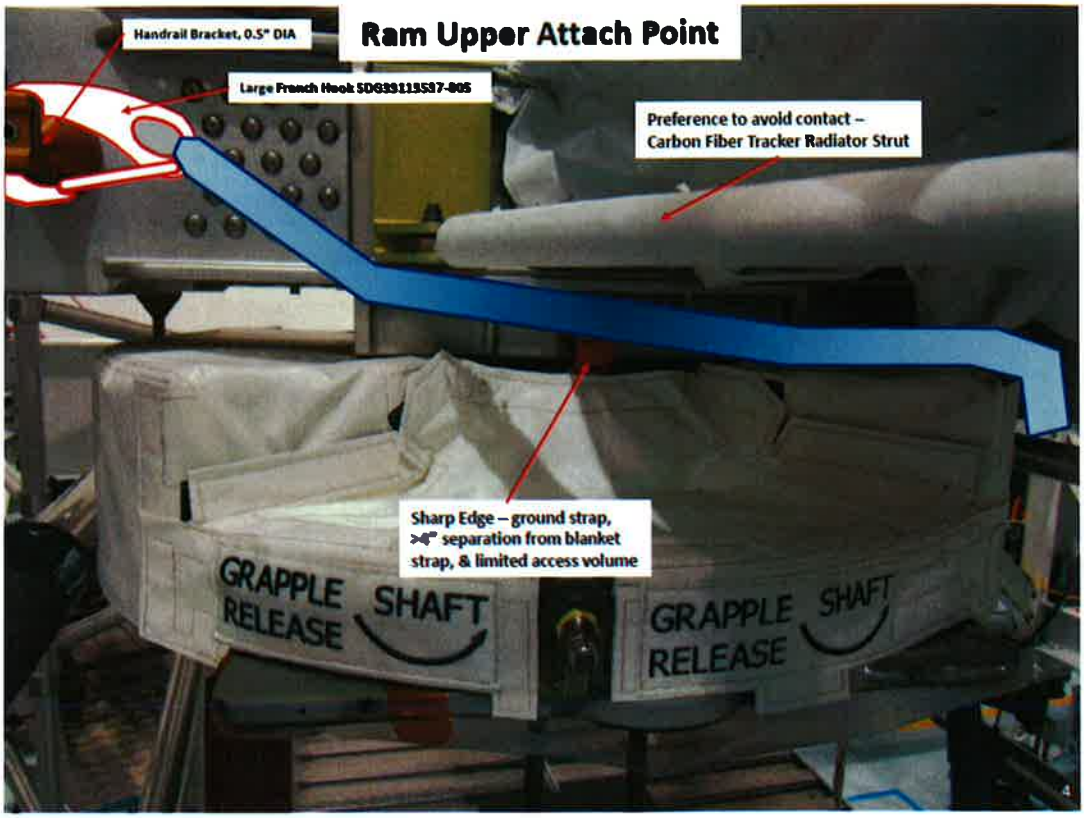

Figure 5-2: Attach Point A

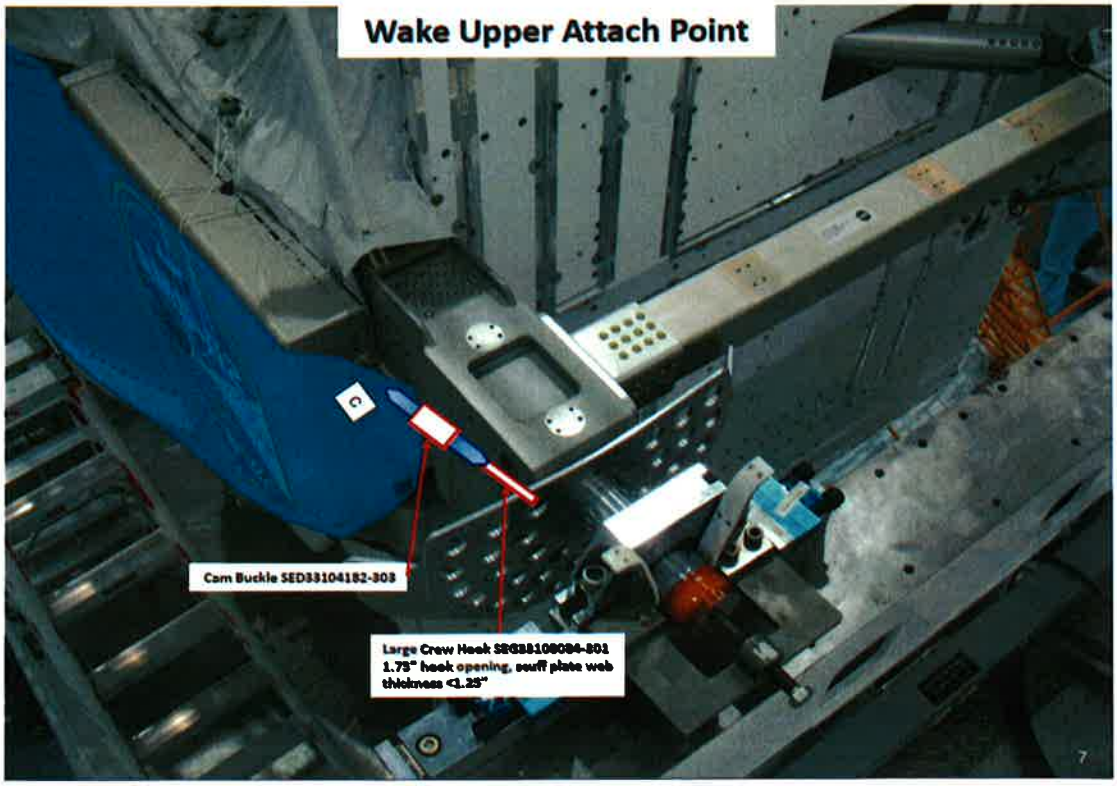

Figure 5-3: Attach Point C

Figure 5-4: Attach Point D (As Seen on NBL Mock-up)

5.2 SAFE ACCESS

Installation of the AMS-02 MLI Blanket does not require the crew to access electrical boxes or other confined spaces that could present an electrical, touch temperature, or sharp edge hazard. The Cam Buckles, Large Crew Hooks, and Large French Hooks have been reviewed and certified for EVA use per the GCARs listed in Table 4-1 and do not present entrapment hazards. EVA crewmen do not have to reach into confined areas of AMS and risk becoming snagged or entrapped while attaching the blanket to AMS. This includes the Star Tracker unit, which has been designated as a No Touch Area (NTA) in OCAD 67862 due to its baffles being sharp edge hazards. EVA crewmen would have to deliberately reach into the Star Tracker to come in contact with the baffle.

Magnetic field strength at the outer surface of the Vacuum Case, likewise, was deemed insufficient to create an entrapment hazard (Refer to hazard report AMS-02-F14, Cause 8). Magnetic fields were assessed to ensure that they would not adversely affect the U.S. EVA suit, the Russian Orlan suit, or robotic operations (Refer to AMS-02-F07, Cause 1).

None of the exposed areas on the wake side of the AMS constitute a touch temperature hazard. Review of on orbit video also revealed no sharp edge hazards as a result of micrometeoroid damage.

One exception to the sharp edge assessment is the grounding strap for the Power and Video Grapple Fixture (PVGF), which is ISS hardware. The edges of the grounding strap measure 0.007 in. thick, which requires them to be rolled or curled to prevent a sharp edge hazard. This was not done, so there is a potential sharp edge hazard for the EVA crewman installing the blanket (NSTS 07700, Vol XIV, Appendix 7, Table II.2-11a requires an edge less than 0.02 in. to be rolled or curled). The control for the sharp edge hazard has been documented in hazard report AMS-BLKT-001, cause 1, control 1.3.

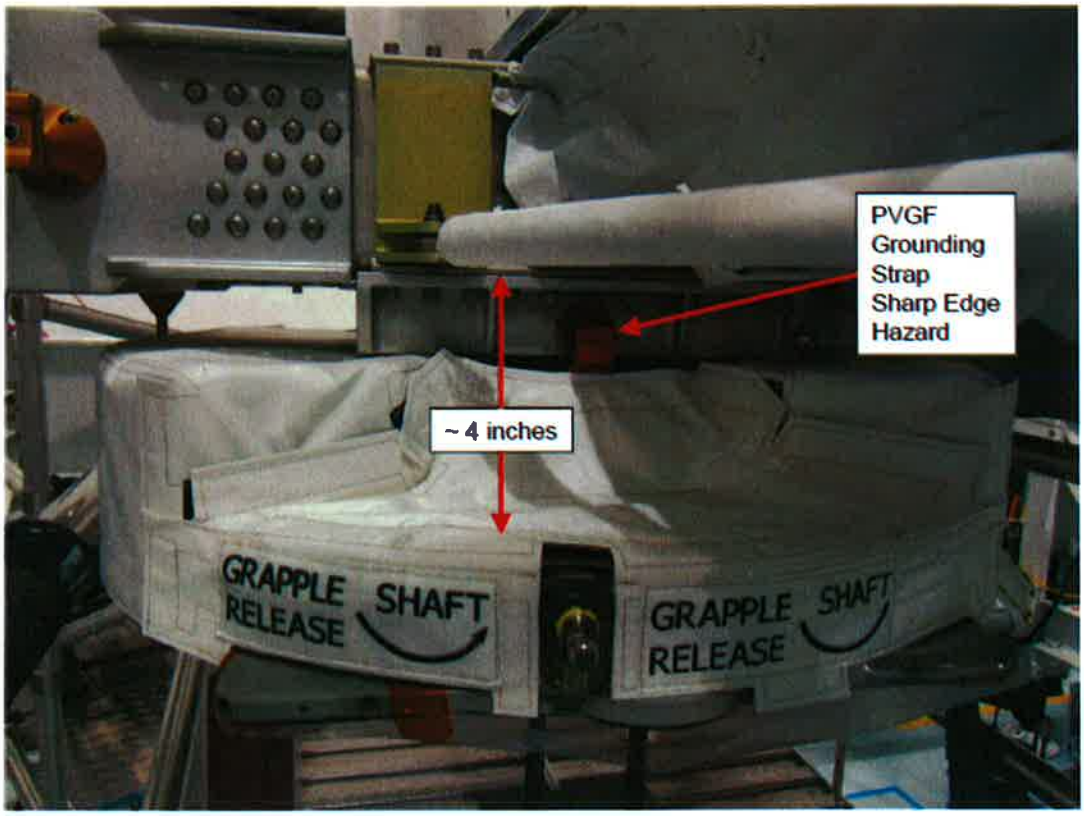

Figure 5.2-1: Location of PVGF Ground Strap with Clearance Between AMS-02 Structure and PVGF

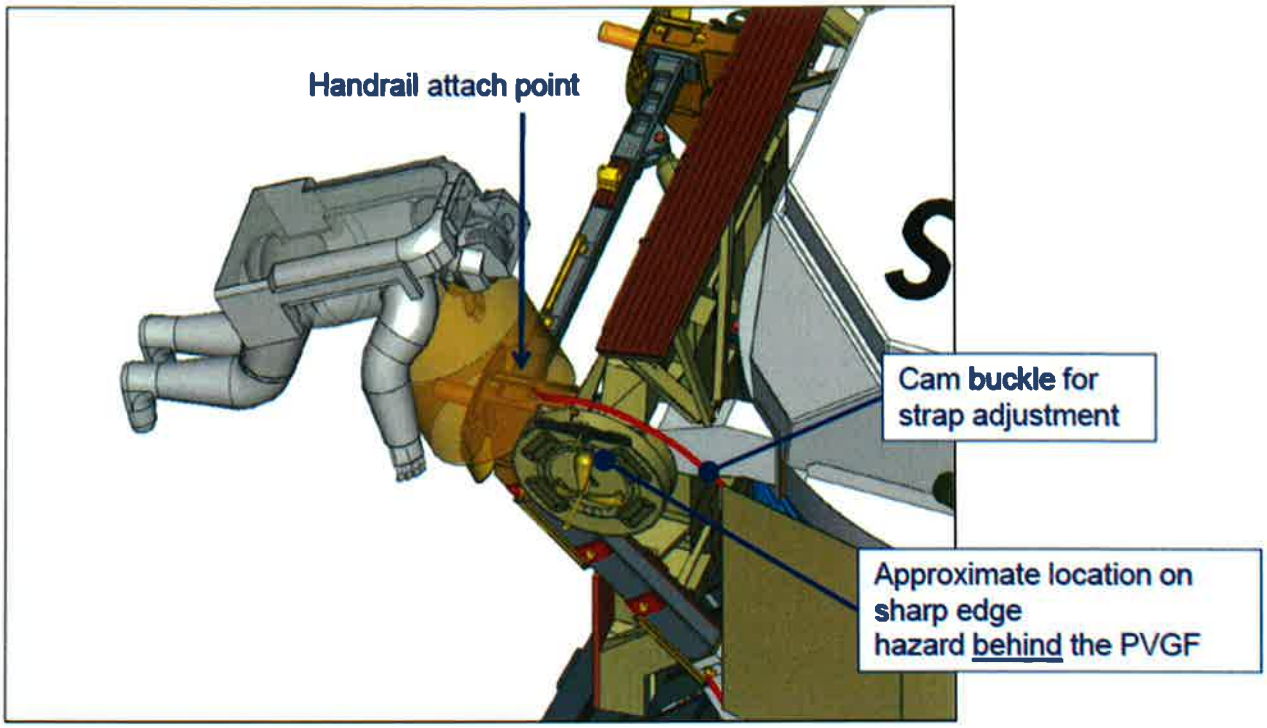

Figure 5.2-2: Position of Hook Attach Point, Strap Cam Buckle, and PVGF Ground Strap

5.3 MODIFICATION OF EXISTING SAFETY FEATURES

Existing safety features on AMS-02 will not be modified before, during, or after EVA operations to attach the blanket. There are no impacts to the baseline AMS-02 hazard reports.

5.4 REVERIFICATION OF SAFETY CRITICAL FEATURES

None of the existing controls on AMS-02 will need to be reverified. The bonding paths on the AMS-02 MLI Blanket will be confirmed by continuity checks conducted on the ground before launch. The ISS crew will need to verify that the blanket's bonding paths have been established while on orbit and document the same by video or still photography.

6 SAFETY DISCUSSION

The safety assessment was conducted using SSP 51700 as the baseline safety requirements document for payloads. The assessment covers the AMS-02 MLI Blanket for launch, IVA stowage, and installation.

6.1 FLAMMABLE MATERIALS

The AMS-02 MLI Blanket is made of A-rated materials selected from the Materials and Processes Technical Information System (MAPTIS) in order to control flammability. The flammable materials hazard is covered in hazard report STD-AMS02-BLKT-Launch, section 1.

6.2 MATERIALS OFFGASSING

The AMS-02 MLI Blanket has undergone an offgassing evaluation per MAPTIS. Offgassing is covered in hazard report STD-AMS02-BLKT, section 2.

6.3 MECHANICAL HAZARDS (SHARP EDGES)

The AMS-02 MLI Blanket will meet the intent of SSP 51700, 3.22.1 for sharp edges in an Intravehicular Activity (IVA) environment. The sharp edge hazard for IVA is covered in hazard report STD-AMS02-BLKT, section 3.

The AMS-02 MLI Blanket will meet the EVA sharp edge requirements found in NSTS 07700, Vol. XIV, App. 7, Table II.2-IIa. The control for the PVGF ground strap has been documented in hazard report AMS-BLKT-001, cause 1, control 1.3.

6.4 TOUCH TEMPERATURE

The AMS-02 MLI Blanket does not contain any heat generating components and cannot exceed high or low IVA touch temperature limits. IVA touch temperature is covered in hazard report STD-AMS02-BLKT, section 4.

The AMS-02 MLI Blanket is constructed of materials that will not violate touch temperature requirements as listed in NSTS 07700, Vol. XIV, II.2.8 (235°F to -118°F up to 0.5 minutes, 145°F to -45°F for greater than 0.5 minutes). The touch temperature hazard cause for EVA is covered in AMS-BLKT-001.

6.5 STRUCTURAL FAILURE

The AMS-02 MLI Blanket will meet the applicable requirements found in SSP 50835 for weight and center of gravity. Structural failure is covered in hazard report STD-AMS02-BLKT, section 15.

After the blanket is attached to AMS, the EVA crewmen will take up the slack on each of the four hook straps by means of cam buckles in order to center it. They will not be imparting significant loads on any of the attachment points. Please refer to ESCG-4005-05-AMS-0039-A *Revised Strength and Stability Assessment of the Alpha Magnetic Spectrometer-02 (AMS-02), Vacuum Case, Payload Attach System (PAS), STS and ISS Integration Hardware and X-Structure Components* for the structural analysis of the Scuff Plate and Trunnion Beam. The EVA handrails being used as attach points (SEG33106347-811 for attach point B, SEG33106347-813 for attach point A) are covered in GCAR G5577A. The blanket itself, along with the GFE used in its design, is designed to handle a crew handling load of 45 lb (Refer to AMS-BLKT-001, Cause 5).

Pip pin failure was a source of concern raised at the AMS-02 MLI Blanket PSRP TIM in January 2013. FOD from a failed pin could cause damage to the ISS and/or result in injury to an EVA crewmen. In order to mitigate this hazard, a stainless steel block was designed to contain parts of the lower pins (including pip pin retention balls). The upper parts of the pins are retained via a tether which is secured to the blanket. This hazard cause is covered in hazard report AMS-BLKT-001.

There was also a concern raised at the TIM that the pip pins were safety critical since they were responsible for creating a bond path for the blanket. This would have required involvement from the Mechanical Systems Working Group (MSWG). In order

to determine fault tolerance, the MSWG asked AMS to talk with the chairman of the Electromagnetic Effects Panel (EMEP). The chairman informed the project, after review of the blanket's design, there is no hazard from electrostatic discharge since the metalized layers of the blanket are completely enclosed by beta cloth. Because of this, the pip pins are not considered safety critical.

6.6 RELEASE OF STORED ENERGY (ELECTROSTATIC DISCHARGE (ESD))

The metalized layers of the AMS-02 MLI Blanket are enclosed in beta cloth which limits the build-up of an electric charge. It also minimizes a discharge that would affect an EVA crewmember and/or hardware. Additionally, the blanket has two bonding cables that are fastened to the AMS-02 superstructure by means of pip pins inserted into previously fayed holes. The ESD hazard cause is covered in AMS-BLKT-001.

6.7 FAILURE OF SAFETY CRITICAL FASTENERS

There is one safety critical fastener on the blanket that attaches the Pip Pin Retention Block to its grounding wire. The fastener will be torqued per its design drawings and have a verifiable secondary locking feature (friction patch) to prevent backout. This hazard cause is covered in hazard report AMS-BLKT-001.

6.8 ENTANGLEMENT/INADVERTANT RELEASE OF HARDWARE

Entanglement/inadvertant release of hardware is controlled through proper packing of the blanket as well as crew procedure inputs that direct the crew to deploy the blanket in a certain manner. A related hazard cause that would cause an inadvertant release of hardware would be incompatibility of blanket materials in the EVA environment. This is controlled through proper material selection for construction of the blanket. This hazard cause is covered in hazard report AMS-BLKT-001.

6.9 MATERIALS INCOMPATIBILITY IN AN EVA ENVRIONMENT

All materials for the AMS-02 MLI Blanket were selected in accordance with the requirements specified in MSFC-HDBK-527/JSC09604 and MSFC-STD.3029A. This hazard cause is covered in hazrd report AMS-BLKT-001.

APPENDIX A: ACRONYM LIST

ACRONYM	DEFINITION
AMS-02	Alpha Magnetic Spectrometer-02
CTB	Crew Transfer Bag
EMEP	Electromagnetic Effects Panel (EMEP)
ESD	Electrostatic Discharge
EVA	Extravehicular Activity
FOD	Foreign Object Damage
FSDP	Flight Safety Data Package
GCAR	Government Certification Approval Request
ICD	Interface Control Document
ISS	International Space Station
IVA	Intravehicular Activity
MAPTIS	Materials and Processes Technical Information System
MLI	Multi-Layer Insulation
MSWG	Mechanical Systems Working Group
NBL	Neutral Buoyancy Lab
NTA	No Touch Area
PO	Payload Organization
PSRP	Payload Safety Review Panel
PVGF	Power and Video Grapple Fixture
SSRMS	Space Station Remote Manipulator System
TRD	Transition Radiation Detector
TRRJ	Thermal Radiator Rotary Joint

APPENDIX B: REFERENCE DOCUMENTS

Number	Title
JSC 65095	Multi-Layer Insulation for the Alpha Magnetic Spectrometer Requirements
MA2-00-038	Interpretation of On-Orbit Maintenance
MSFC-HDBK-527/JSC 09604	Materials Selection List for Space Hardware Systems
MSFC-SPEC-522	Materials Selection List for Space Hardware Systems
NSTS-18798	Interpretations of NSTS/ISS Payload Safety Requirements
NSTS-STD-3000	Man-Systems Integration Standards
SSP 50005	International Space Station Flight Crew Integration Standard
SSP 30245	Space Station Electrical Bonding Requirements
SSP 30599	Safety Review Process, International Space Station Program
SSP 50492	General International Space Station On-Orbit Requirements for Non-pressurized Support Equipment
SSP 50835	ISS Pressurized Volume Hardware Common Interface Requirements/International Space Station
SSP 51700	Payload Safety Policy and Requirements for the International Space Station
SSP 52005	International Space Station Flight Crew Integration Standard

APPENDIX C: HAZARD REPORTS

ISS FLIGHT HARDWARE STANDARDIZED HAZARD REPORT	A. NUMBER STD- AMS02-BLKT	B. PHASE III	C. DATE January 2014
D. HARDWARE NAME *(include part number(s), if applicable)* AMS Blanket Assembly (SEG39138350-301)		E. VEHICLE(S) Flight Undetermined/ISS	

APPROVAL	HARDWARE ORGANIZATION Printed Name, Signature, Date	ISS SAFETY Printed Name, Signature, Date
PHASE I		
PHASE II		
PHASE III	1-30-14 Trent Martin, AMS-02 Project Manager	Anthony C. Sang 2/3/14

Signatures above are effective for all the following pages.

For hardware potentially being handled during EVA use a unique hazard report form to cover contact hazards.

F. HAZARD:	G. HAZARD CONTROLS: *(complies with)*	H. Appl.	I. VERIFICATION METHOD, REFERENCE, AND STATUS: *(If Not Applicable for this hardware, enter N/A)*
1. Materials – Flammability	Payload and System: Meets one or more of the following: a) A-rated materials selected from MAPTIS (Materials and Processes Technical Information System) or applicable International Partner (IP) materials process/segment specification: _____. b) Flammability assessment per JSC 29353, SSP 30233, or applicable IP materials process/segment specification: _____. c) Flammability testing per NASA STD-6001B or applicable IP materials process/segment specification: _____.	☒ ☐ ☐	1a. JSC Materials and Fracture Control Certification documents that the AMS-02 MLI Blanket has been constructed with A-rated materials selected from MAPTIS or applicable IP materials process. Closed, 11/20/13. JSC Materials and Fracture Control Certification MATL-14-03.

ISS FLIGHT HARDWARE STANDARDIZED HAZARD REPORT	A. NUMBER STD- AMS02-BLKT	B. PHASE III	C. DATE January 2014
D. HARDWARE NAME *(Include part number(s), if applicable)* **AMS Blanket Assembly (SEG39138350-301)**		E. VEHICLE(S) Flight Undetermined/ISS	

2. Materials – Offgassing	Payload and System: Meets one or more of the following: a) Offgassing evaluation per: MAPTIS or applicable IP materials process/segment specification: _____. b) Offgassing tests of assembled article per NASA-STD-6001.	☒ ☐	2a. JSC Materials and Fracture Control Certification that the AMS-02 MLI Blanket has successfully undergone an offgassing evaluation. Closed 11/20/13. JSC Materials and Fracture Control Certification MATL-14-03.
3. Mechanical Hazards Causing Injury to IVA Crew (sharp edges, pinch points, etc.)	Payload and System: Meets intent of one or more of the following: a) SSP 51700, 3.22.1 Sharp Edges and Corner Protection b) SSP 50021, 3.3.6.12 Human Engineering Safety or IP segment specification: _____.	☒ ☐	3.a.1 Review of drawings to ensure compliance with SSP 51700, 3.22.1. Closed, 10/21/13. JETS memo, "AMS Blanket Design Verifications", memo number JETS-JE11-13-SAIP-MEMO-0029. 3.a.2 Inspection of final assembly to confirm it meets the intent of SSP 51700, 3.22.1. . Closed 11/13/13. TPS #2A1320041, step 7. TPS was approved on 11/04/13. (Note: EVA mechanical hazards are covered in AMS-BLKT-001) *Note: EVA use requires a unique Hazard Report*

ISS FLIGHT HARDWARE STANDARDIZED HAZARD REPORT	A. NUMBER STD- AMS02-BLKT	B. PHASE III	C. DATE January 2014
D. HARDWARE NAME *(Include part number(s), if applicable)* AMS Blanket Assembly (SEG39138350-301)		E. VEHICLE(S) Flight Undetermined/ISS	

4. Touch Temperature IVA Resulting in Crew Injury	Payload and System: Meet IVA touch temperature requirement SSP 50005, 6.5.3 or IP segment specification: _____. a) For systems with active thermal management: Design contains a single fault tolerant design to not exceed touch temperature limits. b) For systems with no active thermal management: Design is incapable of exceeding touch temperature limits.	☐ ☐	N/A. The AMS-02 MLI Blanket does not contain any heat generating components and cannot exceed high or low IVA touch temperature limits.
5. Shatterable Material releasing 50 micron or larger fragments causing injury to crew	Payload and System: Meets all that apply: a) All shatterable materials are contained such that 50 micron or larger particles are not liberated. b) Optical glass (i.e. lenses, filters, etc.) or other frangible material components of crew cabin hardware are non-stressed (no delta pressure), recessed (such as a camera lens), and supervised by the crew when in use. Items are placed in protected storage or contained when not in use. c) Shatterable materials have passed a vibration test at flight levels/post-test visual inspection.	☐ ☐ ☐	N/A. The AMS-02 MLI Blanket does not have shatterable material. *Note: Include a listing and figure(s) of shatterable material(s) as an attachment.* *Note: EVA use requires a unique Hazard Report*
6. Electromagnetic Radiation (Non-Ionizing) causing injury to crew or interference with ISS systems	Payload and System: Meets all that apply: a) Meets SSP 30237 Space Station Electromagnetic Emission and Susceptibility Requirements b) Meets SSP 30243 Space Station Requirements for Electromagnetic Compatibility c) IP segment specification: _____.	☐ ☐ ☐	*Note: For ionizing radiation or hardware with transmitters use a unique hazard report.* N/A. The AMS-02 Thermal Blanket does not have electromagnetic radiation sources. *Note: Specify all ISS/EMEP (Electromagnetic Effects Panel) approved TIA (Tailoring/Interpretation Agreement) exceedances in verification section.*

ISS FLIGHT HARDWARE STANDARDIZED HAZARD REPORT	A. NUMBER STD- AMS02-BLKT	B. PHASE III	C. DATE January 2014
D. HARDWARE NAME *(Include part number(s), if applicable)* **AMS Blanket Assembly (SEG39138350-301)**		E. VEHICLE(S) Flight Undetermined/ISS	

7. Lasers causing injury to crew	Payload and System: Meets all that apply: a) Classified as as a Class 1 and/or Class 2 laser, as defined in ANSI Z136.1-2007 (as measured at the source). b) The radiant exposure, H, or irradiance, E, at the ISS crewmember's eye or on the crewmember's skin for laser source shall not exceed the maximum permissible exposure (MPE) as defined in ANSI Z136.1-2007. c) In any ocular hazard analysis consideration includes optical magnification equipment on board ISS that could be used to view a laser source or its specular reflection.	☐ ☐ ☐	N/A. The AMS-02 MLI Blanket does not have lasers. *Note: For high intensity incoherent light use a unique hazard report.* *Note: Include the manufacturer laser data sheet(s) as an attachment.* *Note: Lasers operating at class 1M, 2M, 3R, 3B and 4 meeting ANSI Z136.1 -2007 and ANSI Z136.4-2005 shall be documented on a unique hazard report.*
8. Noise Exposure causing hearing damage or crew injury/death from communication interference or inability to detect cautions and alarms	System including integrated equipment meets continuous sound levels (USOS modules) in both SSP 50021, 3.2.6.1 and SSP 50005, 5.4.3.2.3.1 or IP segment specification : _____ Non-Integrated equipment (e.g. GFE, CFE) meet: Continuous sound levels: a) SSP 50021, 3.2.6.2 and SSP 50835 Common IRD 3.12.3.3.1 AND Intermittent sound levels: b) SSP 50835 Common IRD 3.12.3.3.2 Payload compliance is documented in the ICD process.	☐ ☐ ☐	N/A. The AMS-02 MLI Blanket is a payload. *Note: If Alarm Audibility, ICD, or Impulse Noise requirements are not met a unique hazard report is needed. Questions should be directed to the Acoustics Office/SF.*
9. Battery Failure causing crew injury (shock, burn, fire, toxicity hazard)	Payload and System: Battery is non-critical per JSC -20793 Crewed Space Vehicle Battery Safety Requirements or equivalent IP requirement specified in an MoA. Cells/batteries shall be documented on signed form(s) ISS_EP-03.	☐	N/A. The AMS-02 MLI Blanket does not have batteries. ISS_EP-03 Rev B (4/15/2011)--Verify this is the correct version before use.

ISS FLIGHT HARDWARE STANDARDIZED HAZARD REPORT	A. NUMBER STD- AMS02-BLKT	B. PHASE III	C. DATE January 2014
D. HARDWARE NAME *(include part number(s), if applicable)* **AMS Blanket Assembly (SEG39138350-301)**		E. VEHICLE(S) Flight Undetermined/ISS	

10. Capacitors used as energy storage devices	Payload and System: Under standard hazards hardware does not include: a) asymmetric or lithium-based capacitors or b) capacitors with free electrolyte electrolyte Meets both above or a unique Hazard Report and ISS_EP-03 are required.	☐ ☐	N/A. The AMS-02 MLI Blanket does not have capacitors. *Note: If the capacitor meets this criteria, a functional test and visual inspection shall be performed as a verification method.* *Note: Use of tantalum capacitors requires a unique hazard report.*
11. Electrical Power causing crew injury or damage to electrical equipment	Payload and System: Meets all that apply: a) For hardware powered on ISS: Meets station interface circuit protection and wire sizing requirements of SSP 57000, applicable module ICD or IP segment specification : _____, circuit protection requirements of letter TA-92-038, and bonding and grounding requirements per SSP 30240 and SSP 30245.	☐	N/A. The AMS-02 MLI Blanket does not have an electrical system. Bonding requirements for the blanket are covered in hazard report AMS-BLKT-001. *Note: Include circuit protection, wire sizing, bonding and grounding diagrams as an attachment.* *Note: Voltages above 32 volts shall be documented on a unique hazard report.*
12. Mating/Demating Power Connectors causing crew injury due to generation of molten metal or damage to ISS mission- or life-critical electrical equipment	Payload and System: Meets all that apply: a) Meets the low power criteria of letter MA2-99-170 (32V or less, and less than or equal to 3A maximum available upstream current) . AND/OR b) Meets the paragraph 1 criteria of the letter MA2-99-170 (i.e., IVA only, greater than 3A and less than 65A maximum available upstream current and open circuit voltage no greater than 32V). AND c) Meets bonding and grounding requirements per SSP 30240 and SSP 30245.	☐ ☐ ☐	N/A. The AMS-02 MLI Blanket does not have electrical components. Bonding requirements for the blanket are covered in hazard report AMS-BLKT-001. *Note: Include the list of crew mated/demated powered connectors (indicate maximum upstream voltage and current) and upstream inhibits required.* *Note: Include bonding and grounding diagram for mating/demating connectors as an attachment.* *Note: Voltages above 32V, currents greater than 65A, or EVA mate/demate shall be documented on a unique hazard report.*

ISS FLIGHT HARDWARE STANDARDIZED HAZARD REPORT	A. NUMBER STD- AMS02-BLKT	B. PHASE III	C. DATE January 2014
D. HARDWARE NAME *(include part number(s), if applicable)* **AMS Blanket Assembly (SEG39138350-301)**		E. VEHICLE(S) Flight Undetermined/ISS	

13. Rotating Equipment causing crew injury	Payload and System: Rotating equipment meets a) and either b) or c) or IP segment specification: _____. a) Enclosure has obvious containment capabilities. b) Rotating part does not exceed 200 mm (8 inches) in diameter or 8000 revolutions per minute (rpm) speed in all conditions. OR c) Computer Hard Disk Drive structure/enclosure is unmodified and HDDs are industry/safety certified (Example: UL, IEC, CE ratings).	☐ ☐ ☐	N/A. The AMS-02 MLI Blanket does not have rotating equipment. *Note: Include listing of rotating equipment as an attachment.*
14. Interference with Translation Paths	Payload: Design does not impede emergency IVA egress to the remaining adjacent pressurized volumes. System: Hardware designed to comply with IP segment specification or traffic flow and translation paths: a) SSP 50005, 8.7, 8.8 b) SSP 50021, 3.3.6.12.17.1, 3.3.6.12.17.2	☐ ☐ ☐	N/A. The AMS-02 MLI Blanket will be stowed on ISS until it is deployed EVA.
15. Structural Failure *(Item must comply with the listed requirements for all phases of flight))*	Payload and System: Designed to meet the applicable requirements for launch/return as defined in SSP 57008, SSP 50835, or equivalent IDD: _____.	☒	15a. Inspection ensures the AMS-02 MLI Blanket meets weight and CG requirements per SSP 50835. Closed 11/18/13. AMS-02 Memo JETS-JE11-13-SAIP-MEMO-0035, "AMS Blanket Weight and CG Verification" dated 11/15/13. *Note: If structurally mounted a unique hazard report is required.* *Note: Include launch vehicle assessment and/or testing to typical loading events.*

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16. Structural Failure of Sealed Containers	Payload and System: Sealed containers must must be compliant with a) and b) in all cases: a) Be a single, independent container containing a non-hazardous substance. b) Contain less than 19,310 Joules (14,240 foot-pounds) of stored energy due to pressure. *AND* Additionally, one of either c), d) or e) must be met, depending on the MDP and verification method. c) Have a maximum delta pressure of 1.5 atmospheres (22 psia, 1.5 bars). *OR* d) Have an MDP greater than 1.5 atm (22 psia, 1.5 bars), but less than 6.81 atm (100 psia, 6.9 bars) and analysis or test showing minimum safety factor for the design is 2.5 X MDP. *OR* e) Have an MDP greater than 1.5 atm (22 psia, 1.5 bars), but less than 6.81 atm (100 psia, 6.9 bars) and each flight unit pass a proof test to 1.5 X MDP.	☐ ☐ ☐ ☐ ☐	N/A. The AMS-02 MLI Blanket does not have sealed containers. *Note: Include a listing of the sealed container(s) as an attachment.*

ISS FLIGHT HARDWARE STANDARDIZED HAZARD REPORT	A. NUMBER STD- AMS02-BLKT	B. PHASE III	C. DATE January 2014
D. HARDWARE NAME *(include part number(s), if applicable)* **AMS Blanket Assembly (SEG39138350-301)**		E. VEHICLE(S) Flight Undetermined/ISS	

17. Structural Failure of Vented Containers Note: This requirement shall not be applied to external payloads flown by HTV .	Payload and System: Vented enclosures and are not intentionally sealed and will not create a hazard in the event of depressurization or repressurization of the surrounding volume as verified by at least one of the following: a) Contain less than 4,152 Joules (3,063 foot-pounds) of stored energy due to pressure in the event of vent(s) failure (not used for EVA) *Note: Calculation of the stored energy potential can be found in NASA-HDBK-5010, Appendix. G.* b) Vents are sized to maintain a minimum FOS of 1.5 for pressure loads when assessed against depressurization/repressurization rates in SSP 57000, SSP 57008, SSP 50835, or the equivalent ICD/IDD_____. c) Provides an internal volume to effective vent area ratio that results in a differential pressure loading of no greater than 0.7 millibars differential (0.01 psid). *Note: Maximum Effective Vent Ratio (MEVR) for a 0.7 millibar (0.01 psid) pressure differential is defined as:* $MEVR = \left(\frac{\text{Internal Volume } (cm^3)}{\text{Effective Vent Area } (cm^2)} \right) \leq 5080 \text{ cm}$ $MEVR = \left(\frac{Internal\ volume\ (in^3)}{Effective\ vent\ area\ (in^2)} \right) \leq 2000in$	☐ ☐ ☐	N/A. The AMS-02 MLI Blanket does not have vented containers. *Note: Include a listing of the vented container(s) as an attachment.*

PAYLOAD HAZARD REPORT		a. NO: AMS-BLKT-001
b. PAYLOAD: AMS-02 MLI Blanket		c. PHASE: I/II/III
d. SUBSYSTEM: AMS-02 MLI Blanket	e. HAZARD GROUP: EVA/Human Factors	f. DATE: January 2014
g. HAZARD TITLE: EVA Hazards		i. HAZARD CATEGORY ☒ CATASTROPHIC ☐ CRITICAL

h. APPLICABLE SAFETY REQUIREMENTS:
SSP 51700, 3.1.1.2, 3.1.2, 3.18
NSTS 07700, Volume XIV, App. 7
SSP 30245, 3.2.1.3.1, 3.2.1.3.6

j. DESCRIPTION OF HAZARD:
EVA hazards related to the AMS MLI Blanket and its installation could result in injury or death to EVA crewmembers and/or damage to the ISS.

k. HAZARD CAUSES:
1. Mechanical hazards including sharp edges and pinch points

2. EVA touch temperatures

3. Release of stored energy (Electrostatic Discharge (ESD))

4. Foreign Object Damage (FOD) due to pip pin failure and/or safety critical fastener failure

5. Entanglement/entrapment or inadvertant release of hardware

6. Materials incompatibility in an EVA environment

l. HAZARD CONTROLS:
See Attached Pages

m. SAFETY VERIFICATION METHODS:
See Attached Pages

n. STATUS OF VERIFICATION:
See Attached Pages

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III	X [signature] 1-31-14	[signature] 02/03/14

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PAYLOAD HAZARD REPORT CONTINUATION SHEET	a. NO: AMS-BLKT-001
b. PAYLOAD: AMS-02 MLI Blanket	c. PHASE: I/II/III

k. HAZARD CAUSES:

1. Mechanical hazards including sharp edges and pinch points

l. HAZARD CONTROLS:

1.1. The AMS-02 Thermal Blanket will be designed and built to comply with the sharp edge requirements found in NSTS 07700, Vol. XIV, App. 7, Table II.2-IIa.

1.2. The Large Crew Hook, Large French Hooks, and Cam Buckles are certified for EVA and will be used within their specifications. Part and GCAR numbers are as follows:

Part Name	Part Number	GCAR Number
Cam Buckle	SED33104182-303	G6000
Large Crew Hook	SEG33108084-301	G1912A
Large French Hook	SDG33113537-805	G1940B

1.3. The ground strap for the PVGF (ISS program hardware) violates the sharp edge requirements found in NSTS 07700, Vol. XIV, App. 7, Table II.2-IIa. The edge of the ground strap, which measures 0.007 in., was required to be rolled or curled. OCAD AMSBLKT001-1-3 establishes a No Touch Area around the PVGF ground strap.

m. SAFETY VERIFICATION METHODS:

1.1.1. Review of design drawings to ensure the AMS-02 MLI Blanket will be built according to NSTS 07700, Vol. XIV, App. 7, Table II-2-IIa.

1.1.2. Inspection of as-built hardware to ensure the AMS-02 MLI Blanket has been built to design drawings.

1.2.1. Review of design drawings to ensure the AMS-02 MLI Blanket will be built using the above listed GFE.

1.2.2. Inspection of as-built hardware to ensure the AMS-02 MLI Blanket has been built to design drawings.

1.3.1. Approval of OCAD AMSBLKT001-1-3.

n. STATUS OF VERIFICATION:

1.1.1. Closed, 10/21/13. JETS memo, "AMS Blanket Design Verifications", memo number JETS-JE11-13-SAIP-MEMO-0029.

1.1.2. Closed, 11/18/13. JETS memo "AMS Blanket Final Assembly Verification", memo number JETS-JE11-13-SAIP-MEMO-0038.

1.2.1. Closed, 10/21/13. JETS memo, "AMS Blanket Design Verifications", memo number JETS-JE11-13-SAIP-MEMO-0029.

1.2.2.	Closed, 11/18/13. JETS memo "AMS Blanket Final Assembly Verification", memo number JETS-JE11-13-SAIP-MEMO-0038.
1.3.1.	Closed, 01/29/14. Email from Erin Cook, JSC-OCAD-Admin stating that OCAD AMSBLKT001-1-3 (ID number 122568) has been approved.

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PAYLOAD HAZARD REPORT CONTINUATION SHEET	a. NO: AMS-BLKT-001
b. PAYLOAD: AMS-02 MLI Blanket	c. PHASE: I/II/III

k. HAZARD CAUSES:

2. EVA touch temperatures

l. HAZARD CONTROLS:

2.1. The AMS-02 MLI Blanket is constructed of materials that will not violate touch temperature requirements as listed in SSP 57003 (235°F to -180°F up to 0.5 minutes).

m. SAFETY VERIFICATION METHODS:

2.1.1. Thermal analysis for the AMS-02 MLI Blanket will demonstrate compliance with SSP 57003.

n. STATUS OF VERIFICATION:

2.1.1. Closed, 01/29/14, JETS memo JETS-JE33-14-TAED-DOC-0063, "EVA Touch Temperature Analysis for AMS Blanket Assembly"

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PAYLOAD HAZARD REPORT CONTINUATION SHEET	a. NO: AMS-BLKT-001
b. PAYLOAD: AMS-02 MLI Blanket	c. PHASE: I/II/III

k. HAZARD CAUSES:

3. Release of stored energy (Electrostatic Discharge (ESD))

l. HAZARD CONTROLS:

3.1. The AMS-02 MLI Blanket's metalized layers are enclosed in beta cloth, limiting the buildup of a charge as well as minimizing a discharge that would affect an EVA crewmember and/or hardware (Refer to Attachment 1).

3.2. The AMS-02 MLI Blanket has two properly sized, insulated bonding cables with pip pins that will be inserted into two fayed holes in the AMS-02 structure creating an S-type bond (Refer to Attachment 2).

m. SAFETY VERIFICATION METHODS:

3.1.1. Review of design drawings will ensure that the AMS-02 MLI Blanket's metalized layers are enclosed in beta cloth.

3.1.2. Inspection of the as-built hardware will ensure the AMS-02 MLI Blanket has been built according to design drawings.

3.2.1. Review of design drawings will ensure that the AMS-02 MLI Blanket has two properly sized, insulated bonding cables with pip pins.

3.2.2. Inspection of the as-built hardware will ensure the AMS-02 MLI Blanket has been built according to design drawings.

3.2.3. Continuity checks performed on the grounding cables ensure they have been properly installed on the AMS-02 MLI Blanket to prevent ESD. Grounding cable bonds are verified to Class S for the blanket on flight-like AMS-02 hardware.

n. STATUS OF VERIFICATION:

3.1.1.	Closed, 10/21/13. JETS memo, "AMS Blanket Design Verifications", memo number JETS-JE11-13-SAIP-MEMO-0029.
3.1.2.	Closed, 11/18/13. JETS memo "AMS Blanket Final Assembly Verification", memo number JETS-JE11-13-SAIP-MEMO-0038.
3.2.1.	Closed, 10/21/13. JETS memo, "AMS Blanket Design Verifications", memo number JETS-JE11-13-SAIP-MEMO-0029.
3.2.2.	Closed, 11/18/13. JETS memo "AMS Blanket Final Assembly Verification", memo number JETS-JE11-13-SAIP-MEMO-0038.
3.2.3.	Closed, 11/13/13. TPS #2A1320041, steps 2-6. TPS approved on 11/04/13.

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PAYLOAD HAZARD REPORT CONTINUATION SHEET	a. NO: AMS-BLKT-001
b. PAYLOAD: AMS-02 MLI Blanket	c. PHASE: I/II/II

k. HAZARD CAUSES:

4. Foreign Object Damage (FOD) due to pip pin failure and/or safety critical fastener failure

l. HAZARD CONTROLS:

4.1. The pip pins will be enclosed by stainless steel pip pin retention block in order to contain any pieces of the lower part of the pins due to structural failure.

4.2. The pip pins will be connected by tethers to the blanket which will prevent the upper part of the pins from contacting the ISS or EVA crewman.

4.3. The fastener that holds the pip pin retention block to its cable will be torqued according to its design drawing specification (refer to SDG39138350-301) and have a friction patch to prevent back-out. The other end of the cable is riveted to the blanket. (Refer to Attachment 3, at the end of this hazard report, showing location of fastener and rivet.)

4.4. The safety critical fastener is greater than size 8 and, therefore, follows the JSC Fastener Integrity Testing Program (JPR 8730.2).

m. SAFETY VERIFICATION METHODS:

4.1.1. Review of design drawings will confirm pip pin retention block has been included to prevent pip pin fragments from becoming FOD.

4.1.2. Inspection of as-built hardware will confirm the pip pin retention block has been built to design drawings.

4.2.1. Review of design drawings will confirm that each pip pin is connected to a tether.

4.2.2. Inspection of as-built hardware will confirm that each pip pin has been connected to a tether.

4.3.1. Review of design to ensure proven back-off prevention (torque and friction patch).

4.3.2. Inspection of back-off prevention to design drawing ensure proper implementation.

4.4.1. JSC Receiving Inspection and Test Facility (RITF) report.

n. STATUS OF VERIFICATION:

4.1.1. Closed, 10/21/13. JETS memo, "AMS Blanket Design Verifications", memo number JETS-JE11-13-SAIP-MEMO-0029.

4.1.2. Closed, 11/13/13. Leech Industries, Inc. Inspection Report, Job #M244190 dated 08/26/13.

4.2.1.	Closed, 10/21/13. JETS memo, "AMS Blanket Design Verifications", memo number JETS-JE11-13-SAIP-MEMO-0029.
4.2.2.	Closed, 11/18/13. JETS memo "AMS Blanket Pip Pin Tether Verification", memo number JETS-JE11-13-SAIP-MEMO-0036.
4.3.1.	Closed, 10/21/13. JETS memo, "AMS Blanket Design Verifications", memo number JETS-JE11-13-SAIP-MEMO-0029.
4.3.2.	Closed, 11/18/13. JETS memo "AMS Blanket Bolt Back Off Prevention Verification", memo number JETS-JE11-13-SAIP-MEMO-0037.
4.4.1.	Closed, 11/18/13. JSC RITF Material Test Report #060228 date completed

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PAYLOAD HAZARD REPORT CONTINUATION SHEET	a. NO: AMS-BLKT-001
b. PAYLOAD: AMS-02 MLI Blanket	c. PHASE: I/II/III

k. HAZARD CAUSES:

5. Entanglement/entrapment or inadvertant release of hardware

l. HAZARD CONTROLS:

5.1. The AMS MLI Blanket is folded and strapped when launched. It will remain in this configuration until the EVA crewmen must unstrap it for deployment.

5.2. ~~The EVA crewmen will deploy the AMS-02 MLI Blanket according to approved procedures.~~ Deleted per PSRP review on 11/21/13.

5.3. All hooks (with the exception of hook "A" which is used to connect the blanket to an EVA crewman for translation), the pip pins, and the Pip Pin Retention Block are secured in pockets sewn into the blanket to prevent inadvertent release of hardware (Note: Refer to attachment 4, crew consensus report).

5.4. The Large Crew Hook, Large French Hooks, and Cam Buckles are certified for EVA and will be used within their specifications, which is more than adequate to handle the crew handling load of 45 lbf as taken from SSP 57003, Table 3.1.1.2.6-1. Part and GCAR numbers are as follows:

Part Name	Part Number	GCAR Number
Cam Buckle	SED33104182-303	G6000
Large Crew Hook	SEG33108084-301	G1912A
Large French Hook	SDG33113537-805	G1940B

5.5. The stitch design strength of 338 lbs exceeds the crew handling load of 45 lbf as taken from SSP 57003, Table 3.1.1.2.6-1.

5.6. The AMS MLI Blanket will be temporarily stowed EVA next to AMS-02 on its keel. The means of securing the blanket to the truss include the French Hook from side "A" of the blanket and a Russian wire tie wrap. Because of the risk of catastrophic hazard, the MLI Blanket will follow the guidelines for establishing hazard controls in a low risk area per Appendix A of NCR-ISS-193-R4. The guidelines include:

1. **A tie-down plan**- The plan includes using the French hook from side A of the MLI Blanket plus a Russian wire tie wrap. The hook and tie wrap will secure the blanket to the AMS keel.

2. **Verification that on-orbit loads do not exceed the tether's load capability**-As stated in controls 5.4 and 5.5, the hook and stitching for the blanket exceeds the crew handling load of 45 lbf, which is the worst load that the blanket will see on orbit. The Russian tie-wraps have been used on various other EVA hardware to secure it to ISS and will be capable of keeping the blanket on the AMS keel

3. **Perform a safety assessment to ensure no critical hardware could be impacted by the ORU/hardware should it break free and be constrained only by its tethers**-The AMS MLI Blanket is restrained by a French hook and Russian wire tie. It will be installed on a handrail located on the AMS keel. If the wire tie were to fail, there is no safety critical hardware either on AMS or the ISS Truss that can be impacted by the blanket when it restrained only by its hook..

4. **Identify the "Keep Out Zone" to reduce potential for high EVA induced loads**-The AMS MLI Blanket will be temporarily stowed away from EVA translation paths.

m. SAFETY VERIFICATION METHODS:

5.1.1. Review of the AMS-02 MLI Blanket packing configuration to design drawing prior to launch to ensure it is securely folded and strapped to prevent entanglement/entrapment during EVA.

5.1.2 Review of Crew Consensus Report on the AMS-02 MLI Blanket to confirm the crew office has reviewed the packed configuration and that it will not cause a hazard during translation to AMS-02.

5.2.1 Deleted

5.3.1. Review of design drawings will ensure the inclusion of pockets to securely stow hooks, pip pins, and the retention block in the design to prevent inadvertent release of hardware.

5.3.2. Inspection of as-built hardware to design drawings will ensure that pockets have been sewn into the AMS-02 MLI Blanket to secure hooks, pip pins, and the retention block.

5.3.3 Crew consensus report documents that the stowage of the blanket straps (including hooks), pip pins, and the pip pin retention block is acceptable by CB.

5.4.1. GCARs G6000, G1912A, and G1940B document the loads the listed GFE can handle.

5.5.1. A pull test provides data on the failure of the stitch design at 338 lbs during a pull test using the same material layout as the flight article MLI blanket (Beta Cloth, Aluminized Kapton, 10 layers of aluminized Mylar, Beta Cloth).

5.6.1. AMS-02 memo documenting compliance with NCR-ISS-193-R4 Appendix A for a low risk area.

n. STATUS OF VERIFICATION:

5.1.1.	Closed, 11/18/13. JETS memo "AMS Blanket Configuration Review", memo number JETS-JE11-13-SAIP-MEMO-0039.
5.1.2	Closed, 11/25/13. Letter CB-13-025, "Alpha Magnetic Spectrometer (AMS) Blanket and Common Communications Visiting Vehicle (C2V2) Antenna Boom Neutral Buoyancy Laboratory (NBL) Testing Crew Consensus Report.
5.2.1.	Deleted
5.3.1.	Closed, 10/21/13. JETS memo, "AMS Blanket Design Verifications", memo number JETS-JE11-13-SAIP-MEMO-0029.
5.3.2.	Closed, 11/18/13. JETS memo "AMS Blanket Final Assembly Verification", memo number JETS-JE11-13-SAIP-MEMO-0038.
5.3.3.	Closed, 11/25/13. Letter CB-13-025, "Alpha Magnetic Spectrometer (AMS) Blanket and Common Communications Visiting Vehicle (C2V2) Antenna Boom Neutral Buoyancy Laboratory (NBL) Testing Crew Consensus Report.
5.4.1.	Closed, 11/25/13. GCARs G6000, G1912A, and G1940B
5.5.1.	Closed, 01/14/14. JETS memo, "AMS Blanket Pull Test Verification", JETS-JE11-14-SAIP-MEMO-0057.
5.6.1.	Closed, 01/21/14. JETS memo, "AMS Blanket Temp Stow on Keel", JETS –JE11-14-SAIP-MEMO-0058.

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PAYLOAD HAZARD REPORT CONTINUATION SHEET	a. NO: AMS-BLKT-001
b. PAYLOAD: AMS-02 MLI Blanket	c. PHASE: I/II/III

k. HAZARD CAUSES:

6. Materials incompatibility in an EVA environment.

l. HAZARD CONTROLS:

6.1. All materials are selected in accordance with the requirements specified in MSFC-HDBK-527/JSC09604 and MSFC-STD.3029A.

m. SAFETY VERIFICATION METHODS:

6.1.1. JSC Materials and Fracture Control Certification demonstrates compliance with applicable documents.

n. STATUS OF VERIFICATION:

6.1.1. Closed, 11/20/13. JSC Materials and Fracture Control Certification MATL-14-03.

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

Attachment 1 for Control 3.1 and for Grounding Cables Being Placed on Same Side of the AMS-02 Blanket

If understand the blanket design correctly, the metallized layers are all enclosed in beta cloth. This limits the charging of the blanket metallized layers and subsequently, minimizes the potential for discharging those layers to crew or hardware. If the metallized layers are not completely enclosed, then it becomes a critical hazard.

From: Harvey, Eric K [mailto:Eric.Harvey@escg.jacobs.com]
Sent: Thursday, March 28, 2013 3:05 PM
To: Mccollum, Matthew B. (MSFC-ES42); Ross, Stuart B. (JSC-ES)[Jacobs Technology]
Subject: FW: AMS02-SDP-MLI-PhIII-PSRP.docx

Hi Matt and Stuart,

Matt, after talking with Stuart I think we are both trying to figure out how you arrived at your answer to my question below. Is your answer (that ESD in our case is neither critical nor catastrophic) based on the fact that we have adequate controls in place (i.e. the bonding cables) to prevent a hazard or is it because, even without the ground cables, there is no hazard at all?

Given that, I found the following requirement in SSP 30245, Paragraph 3.2.1.3.1 (Class S bond requirement):

> All isolated structural conducting items having an area greater than 100 square centimeters which carry fluids in motion, or otherwise are subject to frictional charging or plasma-induced current flow or charging, shall have a mechanically secure conducting connection to conductive structure. The resistance of the connection shall be less than 1 ohm. See appendix C for exception (EMECB TIA-0012, EMECB TIA-0015, EMECB TIA-0017, EMECB TIA-0018, EMECB TIA-0032, EMECB TIA-0076, EMECB TIA-0078, and EMECB TIA-0099) to this paragraph.

I also looked up paragraph 3.2.1.3.6 (Multilayer Insulation):

> Conductive layers shall be bonded together in at least two locations. The bonding resistance from those locations to structure shall be less than one ohm. See appendix C for exception (EMECB TIA-0120) to this paragraph.

Given that our blanket has overall dimensions of 130 in. x 54 in., it would seem the requirement applies to us. It also seems to imply that due to the size of the blanket ESD is a hazard of some sort. I also remember you asking questions about the material of the blanket, which I am guessing factors into this, too. The question is, if we didn't have the grounding cables in place, do we have a hazard? If so, is it critical or catastrophic?

Eric

Eric K. Harvey
NASA/JSC-ESCG Jacobs
Systems Safety Engineer
Ph: 281-461-3509

From: Ross, Stuart B
Sent: Wednesday, March 27, 2013 5:14 PM
To: Mccollum, Matthew B. (MSFC-ES42); Harvey, Eric K
Cc: Mott, Phillip B
Subject: RE: AMS02-SDP-MLI-PhIII-PSRP.docx

Matt,

We were under the impression that the blanket had enough surface area to build up a large enough charge to be a catastrophic hazard.

Do you have an analysis that shows otherwise?

Thank you,

Stuart

Stuart Ross
JSC/ES5/MSWG Mechanical Systems Safety
ESCG-Jacobs
281-461-5710
Stuart.Ross@escg.jacobs.com

From: Mccollum, Matthew B. (MSFC-ES42) [mailto:matt.mccollum@nasa.gov]
Sent: Wednesday, March 27, 2013 4:14 PM
To: Harvey, Eric K
Cc: Mott, Phillip B; Ross, Stuart B
Subject: RE: AMS02-SDP-MLI-PhIII-PSRP.docx

Neither a critical nor catastrophic hazard.

From: Harvey, Eric K [mailto:Eric.Harvey@escg.jacobs.com]
Sent: Wednesday, March 27, 2013 9:19 AM
To: Mccollum, Matthew B. (MSFC-ES42)
Cc: Mott, Phillip B. (JSC-EA2)[Jacobs Technology]; Ross, Stuart B. (JSC-ES)[Jacobs Technology]
Subject: RE: AMS02-SDP-MLI-PhIII-PSRP.docx

HI Matt,

Are you also saying that it isn't a catastrophic hazard?

Eric

Eric K. Harvey
NASA/JSC-ESCG Jacobs
Systems Safety Engineer
Ph: 281-461-5509

From: Mccollum, Matthew B. (MSFC-ES42) [mailto:matt.mccollum@nasa.gov]
Sent: Tuesday, March 26, 2013 4:35 PM
To: Harvey, Eric K
Subject: RE: AMS02-SDP-MLI-PhIII-PSRP.docx

Eric,

It is not a critical hazard.

Matt

From: Harvey, Eric K [mailto:Eric.Harvey@escg.jacobs.com]
Sent: Tuesday, March 26, 2013 4:24 PM
To: Mccollum, Matthew B. (MSFC-ES42)
Subject: AMS02-SDP-MLI-PhIII-PSRP.docx

Hi Matt,

Here is a copy of the AMS-02 MLI blanket SDP (draft). On page 8, there is a picture that shows you the size of the blanket relative to AMS. There will be two ground straps with pip pins. The pins will be inserted on the same side, creating a ground path between the AMS structure and the blanket.

The MSWG representative at the meeting was wondering if ESD was considered a critical or catastrophic hazard, which is what led me to write you to find out. He needs to know so he can determine fault tolerance for the MSWG.

Thanks for your help, Matt.

Eric

Great – thanks Matt.

Regards,
Tim
Timothy J. Urban
AMS-02 Project Office / Flight Operations Liaison
Work: 281-244-8152
Cell: 713-213-8468

From: Mccollum, Matthew B. (MSFC-ES42)
Sent: Tuesday, January 21, 2014 1:14 PM
To: RAFFOUL, GEORGE (JSC-OA)[THE BOEING COMPANY]; URBAN, TIMOTHY J. (JSC-EA321)[Jacobs Technology, Inc.]
Cc: Martin, Trent D. (JSC-EA321); Bollweg, Kenneth (JSC-EA321); Mott, Phillip B; Fohey, Michael F (Michael.Fohey@jacobs.com); Harvey, Eric K. (JSC-EA2)[Jacobs Technology, Inc.]
Subject: RE: AMS EVA installed thermal blanket grounding approach

George,

I concur.

Matt

From: Raffoul, George W [mailto:George.W.Raffoul@boeing.com]
Sent: Monday, January 20, 2014 5:17 PM
To: URBAN, TIMOTHY J. (JSC-EA321)[Jacobs Technology, Inc.]; Mccollum, Matthew B. (MSFC-ES42)
Cc: Martin, Trent D. (JSC-EA321); Bollweg, Kenneth (JSC-EA321); Mott, Phillip B; Fohey, Michael F (Michael.Fohey@jacobs.com); Harvey, Eric K. (JSC-EA2)[Jacobs Technology, Inc.]
Subject: RE: AMS EVA installed thermal blanket grounding approach

Tim:

I just reviewed today the briefing you presented to the PSRP and dated 11/21/13. My answer to your question regarding "Concurrence with the Design Approach of Using Two Ground Wires on the Same Side of the Blanket" is given below:

The area of the blanket is 48 Square Feet, or 4.46 Square Meters. We have previously approved blankets with areas as large as 10 square meters that are external to the ISS with only 2 jumpers installed. Since the AMS-02 blanket is about half of the 10 square meter area, it means one grounding jumper would be sufficient to drain the electrostatic charge that might build up on it. Therefore, your design of having both grounding jumpers emanate from essentially 2 neighboring points on the same side of the blanket is adequate for static bonding of the blanket.

Matt McCollum, I am sure, will respond if he has a different perspective on this.

Thanks!
George Raffoul
EMEP Panel Co-Chair

281-226-8530 (O)

From: URBAN, TIMOTHY J. (JSC-EA321)[Jacobs Technology, Inc.] [mailto:timothy.j.urban@nasa.gov]
Sent: Thursday, January 09, 2014 10:42 AM
To: EXI-McCollum, Matt
Cc: Martin, Trent D. (JSC-EA321); Bollweg, Kenneth (JSC-EA321); Mott, Phillip B; Fohey, Michael F (Michael.Fohey@jacobs.com); Raffoul, George W; Harvey, Eric K. (JSC-EA2)[Jacobs Technology, Inc.]
Subject: AMS EVA installed thermal blanket grounding approach

Matt,

Over the course of the last year I've spoken with you and Dr. Raffoul several times re: the design approach we've adopted for grounding the AMS EVA installed thermal blanket, which is approximately 48 sq. ft. in size, MLI design with Beta cloth on both sides. Due to concerns from the Payload Safety Review Panel re: the pip pins we're using to attach the ground wires to the faying surface on AMS, both ground wires were moved to the same side of the blanket and use the same faying surface, so that the pin parts could be contained by a retention device, should they fall apart (a concern that was worked by Phil Mott with the mechanism folks of the PSRP).

I have attached the OPS presentation that was made to the PSRP in November, to provide you with the design and installation concepts. The PSRP asked that we ask for your EMEP formal concurrence with the design approach of using two ground wires on the same side of the blanket.

Please let me know if you have any further questions or concerns. I appreciate your time and cooperation.
Regards,
Tim
Timothy J. Urban
AMS-02 Project Office / Flight Operations Liaison
Barrios Technology / JETS, MS JE94
Work: 281-244-8152
Cell: 713-213-8468

Attachment 2 for Control 3.2

No TIA, all approved.

Timothy J. Urban
AMS-02 Project Office / Flight Operations Liaison
Work: 281-244-8152
Cell: 713-213-8468

-----Original Message-----
From: Harvey, Eric K [mailto:Eric.Harvey.ctr@jacobs.com]
Sent: Thursday, December 12, 2013 12:05 PM
To: URBAN, TIMOTHY J. (JSC-EA321)[Jacobs Technology, Inc.]; Mott, Phillip B
Subject: RE: AMS EVA MLI Blanket ground wires

Hi Tim,

Was there ever a TIA written up for this? I don't think there was, but the email below seems to indicate that our set up had to be reviewed by the EME team. Was there ever a determination by them one way or the other.

Eric

Eric K. Harvey
NASA/JSC
JETS Contract (Barrios Technology)
Systems Safety Engineer
Ph: 281-461-5509

-----Original Message-----
From: URBAN, TIMOTHY J. (JSC-EA321)[Jacobs Technology, Inc.] [mailto:timothy.j.urban@nasa.gov]
Sent: Thursday, December 12, 2013 11:58 AM
To: Mott, Phillip B; Harvey, Eric K
Subject: RE: AMS EVA MLI Blanket ground wires

Never mind....

Timothy J. Urban
AMS-02 Project Office / Flight Operations Liaison Barrios Technology, JETS, MS JE94
Work: 281-244-8152
Cell: 713-213-8468

From: Mott, Phillip B [Phillip.Mott@jacobs.com]
Sent: Thursday, December 12, 2013 10:57 AM
To: Harvey, Eric K. (JSC-EA2)[Jacobs Technology, Inc.]; URBAN, TIMOTHY J. (JSC-EA321)[Jacobs Technology, Inc.]
Subject: FW: AMS EVA MLI Blanket ground wires

Just found this one.

Phil Mott
281-461-5712 office
832-654-4505 cell

From: URBAN, TIMOTHY J. (JSC-EA321)[Jacobs Technology] [mailto:timothy.j.urban@nasa.gov]
Sent: Thursday, February 14, 2013 1:35 PM
To: Martin, Trent D. (JSC-EA321); Bollweg, Kenneth (JSC-EA321); Fohey, Michael F; Clark, Craig S; Ju, Hsing R; Mott, Phillip B; Schaefbauer, Mark; Urban, Kase C
Cc: Ziegelaar, Bridget R. (JSC-OZ611); MILEY, ROBERT R. (JSC-OZ)[BOEING]
Subject: AMS EVA MLI Blanket ground wires

I spoke with Dr. George Raffoul (Boeing Electromagnetic Effects [EME] team) re: locating both ground wires on the same side of the blanket.

He says that this meets the grounding requirement. But (and there's always a but) he asked that I prepare a brief presentation detailing the grounding technique / design for the EME team to determine if it needs to go to the panel for processing a TIA (I don't think we'll need a TIA) - no problem preparing the summary presentation.

Mark, Kase - I think this makes the build simpler.

Regards,
Tim
Timothy J. Urban
AMS-02 Project Office / Flight Operations Liaison Barrios Technology Engineering and Science Contract Group, MS JE94
Work: 281-244-8152
Cell: 713-213-8468

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Attachment 3 for Control 4.3

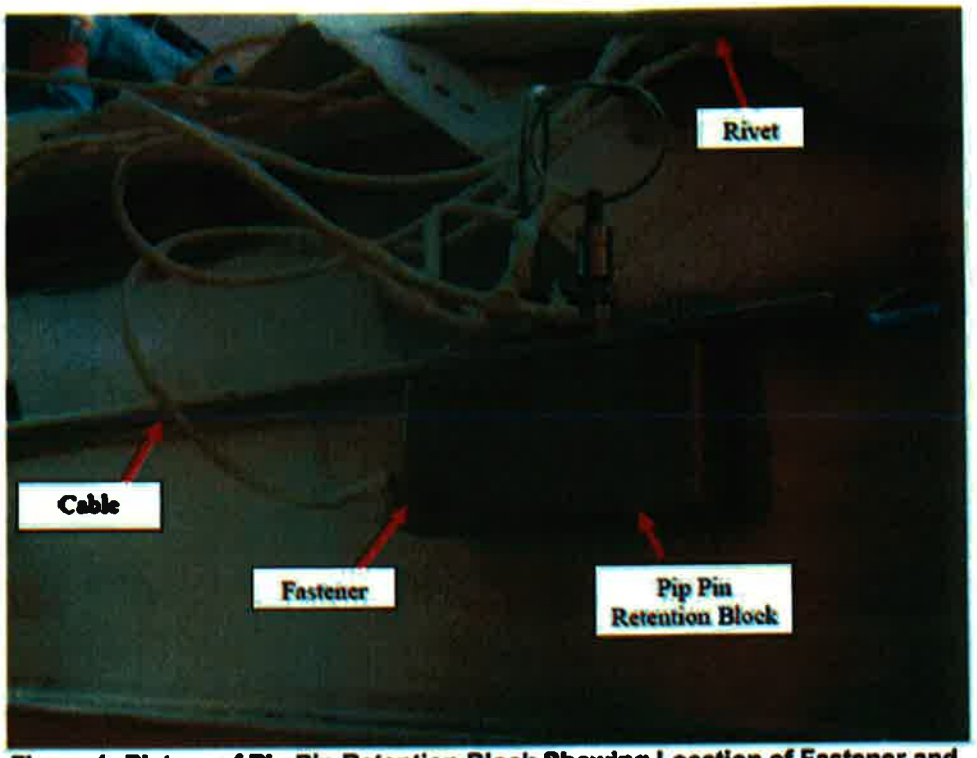

Figure 1: Picture of Pip Pin Retention Block Showing Location of Fastener and Rivet

Attachment 4 for Control 5.3

National Aeronautics and
Space Administration
Lyndon B. Johnson Space Center
2101 NASA Parkway
Houston, Texas 77058-3696

June 17, 2013

Reply to Attn of: CB-13-025

TO: XA/Lead, Extravehicular Activity Flight Management Group

FROM: CB/Chief, Extravehicular Activity Branch

SUBJECT: Alpha Magnetic Spectrometer (AMS) Blanket and Common Communications Visiting Vehicle (C2V2) Antenna Boom Neutral Buoyancy Laboratory (NBL) Testing Crew Consensus Report

Summary: An NBL development test series was performed on May 13 and 14, 2013, to evaluate install of an AMS Thermal blanket and C2V2 Antenna boom operations.

Several tasks were evaluated during this testing series. The evaluation results are documented in the enclosed table. A brief description of the major objectives is given below:

AMS Thermal Blanket – The AMS thermal blanket installs on the in-board face of AMS with straps and buckles built into the blanket which attach to existing structure on AMS. The current plan is to launch the blanket, but only install the blanket if required.

C2V2 Antenna Booms – There are two antenna booms which will be installed on S3 and P3. This test was to evaluate transfer of the longest boom through the joint airlock. A secondary objective was an evaluation of install onto S3 and P3.

The astronaut test subjects participating in the NBL evaluations are listed below:

Andrew J. Feustel	Timothy L. Kopra
Jack D. Fischer	Stanley G. Love

If you have any questions, please contact Daniel C. Burbank, (281) 244-8689 or Oscar S. Koehler at (281) 483-4363.

Sincerely,

Original signed by

Daniel C. Burbank

The following evaluation ratings were used to assess the EVA hardware and tasks in this test:

Category	Description
ACCEPTABLE (A)	Design changes are not required, although recommendations may be included to improve hardware operations.
UNACCEPTABLE 1 (U1)	Design changes are required. Re-testing is not required; however, drawing review and/or shirt-sleeve inspection of flight or high fidelity hardware is required to verify adequacy of design changes.
UNACCEPTABLE 2 (U2)	Design changes are required. Re-testing required to verify adequacy of design changes.
INCONCLUSIVE (I)	No crew consensus can be reached due to inadequate hardware fidelity, inappropriate test conditions or environment, or insufficient number of test subjects used. Re-testing will be required unless specified otherwise.

Acronym List

AMS	Alpha Magnetic Spectrometer
BRT	Body Restraint Tether
CTV2	Common Communication for Visiting Vehicles
EMU	Extravehicular Mobility Unit
EVA	Extra Vehicular Activity
MLI	Multi-Layer Insulation
NBL	Neutral Buoyancy Laboratory
PIP	Push in Place
P3	Port Truss Segment 3
SSRMS	Space Station Remote Manipulator System
S3	Starboard Truss Segment 3
WIF	Worksite Interface
1G	One Gravity

Evaluation Results	Rating*	Recommendations/Comments
* A = Acceptable, UI = Unacceptable but re-testing not needed, UU = Unacceptable and requires re-test, I = Information		
1. AMS Thermal Blanket		
a. Stowing of the AMS blanket for translation was Acceptable.	A	For NBL testing the AMS blanket was folded accordion style such that it would deploy parallel to the AMS long axis. The blanket was then folded over again to create an easily manageable size which could be carried by BRT. Long wire-ties were used to restrain the blanket for translation. The AMS blanket should be launched in this configuration with wire-ties installed. Astronaut Office personnel should be present for final launch configuration folding of the AMS blanket.
b. The integral stowage pockets for the blanket straps, grounding PIP pins and the PIP pin restraint block was Acceptable.	A	Prior to NBL testing the strap stowage pocket at corner C was modified to be a hinged pocket restrained with velcro. This change was based on crew comments provided during 1-G evaluation. The NBL tested configuration for this pocket and all other stowage pockets was acceptable.
b. Installation of the AMS blanket was evaluated with one crewmember free float and the second SSRMS based. This method was found Acceptable. Installation was also evaluated with both crewmembers free float and found Acceptable.	A	Although installation with both crewmembers free float is Acceptable for some cases it may be preferable to use the SSRMS to provide a stable worksite at corner C. The remaining three corners A, B and D can be completed by the free float crewmember. There is not a handrail path from corner A to C or from corner B to D but there is enough adequate structure to provide an acceptable translation path to all worksites. Based on NBL testing and review of flight photos translation along the paths identified in Figure 2 would be Acceptable. Installation of a fairlead using an adjustable tether is recommended prior to translation across this gap.
c. Install of all 4 corner straps (A, B, C and D) was Acceptable.	A	Prior to NBL testing the restraint strap at corner C was modified to the configuration as shown in Figures 4 and 5. This modification was based on crew comments during 1-G evaluation. This modification greatly simplified installation at corner C and was found Acceptable. Installation at corners A, B and D was also found Acceptable with no changes required.
d. Installation of the two grounding PIP pins and the PIP pin retention block (Figures 7, 8, 9, 10 and 11) was Acceptable.	A	Prior to NBL testing the grounding PIP Pins were retained by a MLI tent assembly. The tent assembly was replaced for NBL testing by a much simpler and more EVA friendly retention block. Kudos need to be given to the AMS designers and project for their timely efforts to incorporate crew comments and to provide unique and effective solutions to design problems.
e. Partial installation of the blanket by removal of strap D and tie back was Acceptable.	A	Removal and tie back of corner D was straight forward with no issues.
f. Partial installation of the blanket by removal and tie back of straps D and B was Acceptable.	A	To assist with restraint of the folded blanket and prevent billowing additional wire-ties were installed along the edge between corners A and C.

Evaluation Results	Rating*	Recommendations/Comments
* A = Acceptable, U1 = Unacceptable but re-testing not needed, U2 = Unacceptable and requires re-test, I = Inconclusive		
2. C2V2 Antenna Boom		
a. Transport of the C2V2 P3 Antenna Boom through the Joint airlock is Acceptable.	A	Evaluation was performed using the P3 Antenna Boom configuration as shown in Figure 12. The NBL mockup included a load allevistor as a worst case test configuration. The S3 Antenna Boom is basically the same configuration but with a much shorter length (Figure 13). A future test is planned to evaluate airlock operations with both the S3 and P3 Antenna Booms.
b. Crew translation with the P3 Antenna Boom restrained by BRT was Acceptable.	A	The Boom was positioned parallel to the crewmembers body with the probe near the crewmembers head.
b. Install of the P3 Antenna Boom into P3 WIF 17 was Acceptable.	A	Although Acceptable the length of the P3 Boom handrail should be lengthened to aid crew handling during Boom install. A longer handrail will provide room for the BRT jaws and still leave room for grasping by the EMU glove.
c. Install of the P3 Antenna Boom into the S3 WIF 13 was Inconclusive.	I	At the time of testing a S3 Antenna Boom mockup was not available. Future testing is planned with a S3 boom mockup which is currently in construction. Installation of the P3 antenna at the S3 WIF 13 site was performed to determine if there are any major issues. It does not appear that there will be any issues, but testing with a correct S3 Boom will need to be performed. A longer handrail should be installed in place of the current short handrail on the S3 Boom. A longer handrail will provide room for the BRT jaws and still leave room for grasping by the EMU glove.

Figure 1 - AMS Thermal Blanket Coverage Area

Figure 2 - AMS without Thermal Blankets

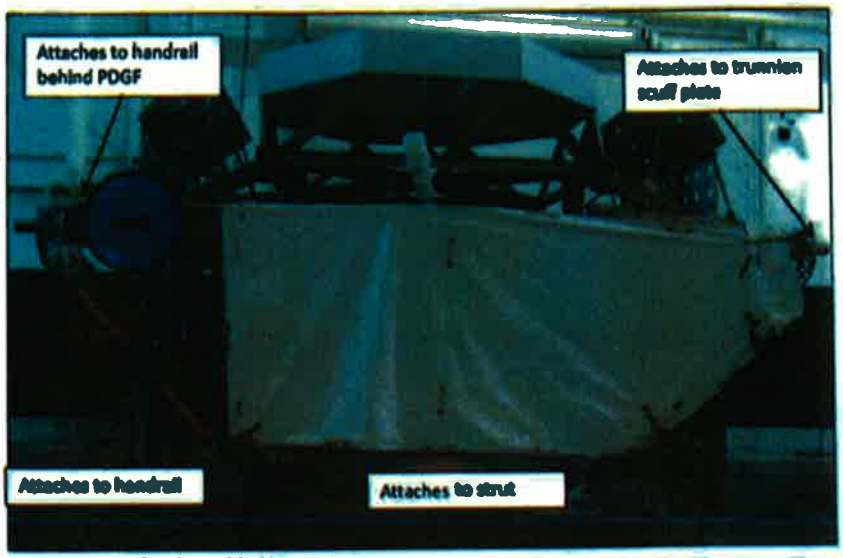

Figure 3 - NBL Mockup with AMS blanket

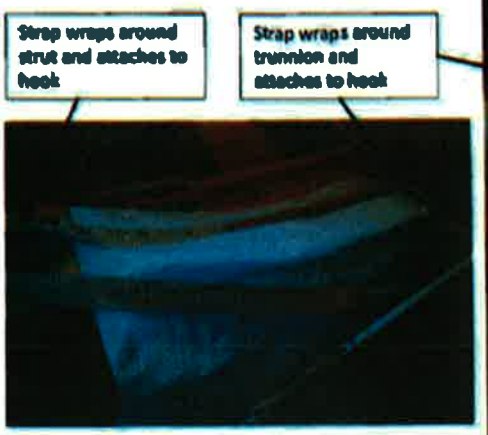

Figure 4 - Corner C top View

Figure 5 - Corner C Scuff Plate Attachment

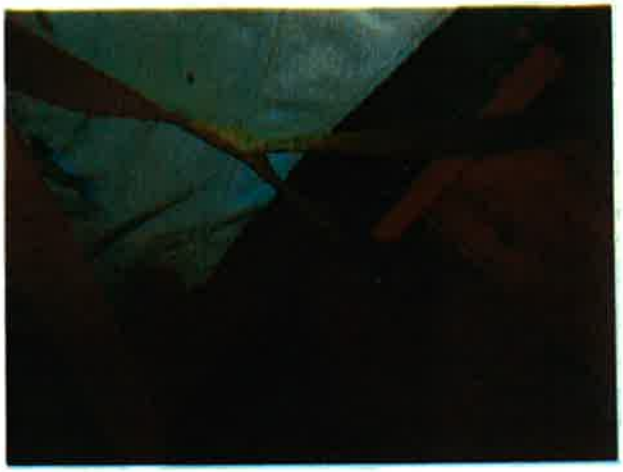

Figure 6 - Corner D Attachment

Figure 7 - Grounding Overview

Figure 8 - Installed Grounding PIP Pins

Figure 9 - PIP Pin Retention Block

Figure 10 - PIP Pin Retention Block Stowage

Figure 11 - PIP Pin Retention Block Installed

APPENDIX D: SAFETY CERTIFICATE

FLIGHT SAFETY CERTIFICATE

I. Certificate Number – *Unique alpha-numeric identifier provided by the Cargo Item Provider.* ATV-5/NASA/TR1OF2/AMSBLKT-1

II. Cargo Item Provider – *The Cargo Item Provider is either the IP which owns the cargo or is the IP sponsoring the cargo on behalf of its nationals which own the hardware.*

☒ NASA ☐ FSA ☐ ESA ☐ JAXA ☐ CSA

III. Cargo Identification – *Official nomenclature and part number of the cargo item.*

Cargo Item Name *(Use an attachment for more items)*	Part Number / Configuration Item No.
AMS Blanket Assembly	SEG39136360-301

IV. Transportation Safety Requirements – *The check marks below define the transportation vehicle(s) which will be used for the upload/download of the cargo item(s) together with the Process and Technical Safety Requirements which have been made applicable to the subject cargo item(s).*

Transport Vehicle	Process Requirements	Launch Requirements	☐Return ☐Disposal Req.
		Category: ☒1 ☐2	Category: ☐1 ☐2
☐ Dragon ☐ Cygnus	☐ SSP 30599	☐ SSP 51700*	☐ Choose a Document*
☐ Progress ☐ Soyuz	☐ SSP 50146 ☐ Other:	☐ П32928-103	☐ П32928-103
☐ HTV	☐ JSX-20099418 ☐ JSX-20099598	☐ JMR-0028	☐ Choose a Document
☒ ATV	☒ ESA-ATV-PR-13830	☒ ESA-ATV-1700.7b	Not Applicable

V. Operations/Stowage Safety Requirements – *The check marks below define the foreseen on-orbit operational/stowage location and the Process and Technical Safety Requirements which have been made applicable to the subject cargo item(s).*

ISS Segment	Process Requirements	Stowage Requirements	Operations Requirements
		Category: ☒1 ☐2	Category: 1 ☒2
☒ NASA ☐ JAXA ☐ ESA ☐ FSA	☒ SSP 30599 ☐ Other:	☒ SSP 51700 ☐ Choose Additional Document ☐ Choose Additional Document ☐ Choose Additional Document	☒ SSP 51700 ☐ Choose Additional Document ☐ Choose Additional Document ☐ Choose Additional Document

VI. Signatures

Cargo Item Provider Certification/Safety Panel Approval – *By the provision of the signatures below, the Cargo Item Provider (hardware owner) certifies that all necessary safety analyses have been performed in accordance with the above-identified applicable safety requirements, and the associated verifications have been completed or transferred to a Verification Tracking Log. The Safety Panel and/or authorized IP Safety Organization has reviewed and approved the safety assessment.*

Title	Name	Signature and Date
☒ Project Manager EA3, AMS-02	Trent Martin	1.23.14
☐ Choose a title		
☒ Choose a title SRP/PSRP Chair	Anthony C Sang	2/3/14

ISS Segment Owner Concurrence – *For Category 2 hardware, by the provision of the signature below, the Segment Owner Safety Organization is providing its concurrence with the operation and/or stowage of the hardware for that segment.*

Title	Name	Signature and Date

Transport Vehicle Owner Approval – *For Category 2 hardware transported on another IP's vehicle, the applicable Safety Panel or IP Safety Organization has reviewed and approved the safety assessment for transportation.*

Title	Name	Signature and Date

1 of 2

ISS_OS_906 (Initial Release June/2012)
Previous Editions Are Obsolete. Verify correct version.

FLIGHT SAFETY CERTIFICATE

I. Certificate Number – Unique alpha-numeric identifier provided by the Cargo Item Provider.	ATV-5/NASA/TR1OP1/AMSBLKT-1

VII. Baseline Safety Documentation – *Provide a reference number, title and date of the baseline safety document which provides the results of the IP safety analysis for the cargo item(s) being provided. If additional lines are needed, use a continuation page.*

Document Reference Number	Document Title	Date
ESCG-6100-13-S&EH-DOC-0067	Phase I/II/III Flight Safety Data Package (FSDP) for the AMS-02 Multi-Insulation Layer (MLI) Blanket	July 2013

VIII. Cargo Item(s) Description – *Provide a brief description of the cargo item(s) being provided. The description should include as a minimum 1) Functional Description (how it works), 2) Materials of construction, 3) Definition of the transportation configuration, 4) Definition of the stowage configuration (if different from the transportation configuration), 5) Permanent magnet data (if applicable, including quantity and strength of magnets), 6) Hazardous Material summary (BSL, THL ratings, ionizing radiation source data, etc.), 7) Definition of the Safe Design Life (Experiments only), and 8) Definition of the Safe Operation Life (Experiments only).*

Function/How it works:

The AMS-02 MLI Blanket will eventually be used to help insulate the inboard side of the AMS-02, including the TRD pump.

Construction/Materials:

The AMS-02 MLI Blanket is made of Beta Cloth, Aluminized Kapton, and Aluminized Mylar. Attached to the blanket are one Large Crew Hook (SEG33108084-301, GCAR G1912A), three Large French Hooks (SDG33113537-605, GCAR G1940B), four Cam Buckles (SED33104182-303, GCAR G6000), and two bonding cables with pip pins. The Crew Hooks, French Hooks and Cam Buckles are prevously certified Government Furnished Equipment (GFE).

Transportation Configuration:

The AMS-02 MLI Blanket will be soft-stowed in a Crew Transfer Bag (CTB) for launch.

Stowage Configuration:

The AMS-02 MLI Blanket will be soft-stowed aboard the ISS in a CTB until it is cleared for deployment on the AMS-02.

Mass/Dimensions:

15.0lb (56.8 kg)/130.0 in. (330.2 cm) x 54.0 in. (137.2 cm) (unfolded); 16.0 in. (40.6 cm) x 12.5 in. (31.8 cm) x 5.0 in. (12.7 cm) (folded)

Permanent Magnet Data (If applicable):

There are no permanent magnets in the AMS-02 MLI Blanket.

Hazardous Material Summary (Biological/Toxicology ratings, ionizing radiation sources, etc., if applicable):

There are no hazardous materials in the AMS-02 MLI Blanket.

Safe Design Life (Experiments only):**

End of ISS life.

Safe Operational Life (Experiments only):**
End of ISS life.

* Per "Environmental Compatibility" requirements as noted within SSP 50021, section 3.3.6.1.8 and/or SSP 51700, section 3.1.3, hardware transported on Dragon or Cygnus shall be assessed to applicable environmental conditions as noted within the current revision of SSP 50835, "ISS Pressurized Volume Hardware Common Interface Requirements Document."

** See form instructions (ISS_OE_906A) for additional information on determining safe Design/Operational life.

ISS_OE_906 (Initial Release June/2012)
Previous Editions Are Obsolete. Verify correct version.