



Reply to Attn of: SA-C

September 24, 2008

**TO:** Lyndon B. Johnson Space Center  
Attn: EA3/T. Martin

**FROM:** SA-C/Chairman, Ground Safety Review Panel

**SUBJECT:** Comments on the Phase II Ground Safety Package for the Alpha Magnetic Spectrometer - 02, Flight TBD, Mission STS-TBD

The subject package has been reviewed and the following comments are provided:

1. Page 21 – Can we get a real world perspective of how strong the magnetic field is?
2. Page 22, Figure 4.1.1-2 – Add the 2000G area(s) to the figure.
3. Page 23, Section 4.1.3 – Describe a Cryomagnet quench, and is it a concern at KSC? If so, what are there ground safety implications?
4. Page 27 – Discuss the cryo effects on selected materials; does it become brittle and susceptible to impact?
5. Page 33, paragraph 4 – What material is the small mixing tank made of?
6. Page 38, Section 4.4.2.2, third paragraph – Is the canister in Box C pressurized?
7. Page 58 – Didn't see the cryostats discussed in the HRs from a mechanical perspective; e.g. hoisting points and casters.
8. Page 58, Section 5.1.1.1, second paragraph – It is stated: "The Cryostat is 2.2 m in height and 1.36 m in outer diameter..." The next sentence states: "The Cryostat ... is 1.4 m x 1.4 m x 2.2 m ..." Please clarify.
9. Pages 58, 61, 64, 65 & 71/72, Sections 5.1.1.1, 5.1.2, 5.1.3 & 5.1.8 – It is stated that these items (Cryostat, LHe Master & Transfer Dewars, Liquid Valve Box, Gas Valve Box, VH1 Heat Exchanger) are capable of being hoisted. Will any of these items be hoisted at KSC? For these or any other GSE items that will be hoisted, provide maximum weight data (GSE item full, empty or in between), identify whether lifting points are removable or permanently attached, state rated load/factor of safety of lifting points, and they must comply with Section 4.5.1 "Hoisting and Handling", of KHB 1700.7C.

10. Page 61 Section 5.1.2 – Reference to figures 5.1.3-1 and 5.1.3-2 should be 5.1.2-1 and 5.1.2-2.
11. Page 64 Section 5.1.3 – Reference to figures 5.1.4-1, 5.1.4-2 and 5.1.4-3 should be 5.1.3-1, 5.1.3-2 and 5.1.3-3.
12. Page 70 – The last bullet states the burst disks are 7 bar. The figure shows 8 bar(a). Is that the same?
13. Page 71, Section 5.1.8, sentence 6 – Are the VH1 Heat Exchanger wheels lockable?
14. Page 72, Section 5.1.8, second to last sentence – It is stated that the lifting points have been designed with a safety factor no less than four; however, Section 7.10 states that permanent lifting points on GSE will have an ultimate factor of safety of 5. Please clarify.
15. Page 75, Section 5.1.11 – It is stated that the maximum load capacity of the Support Stands for CGSE Cryogenic and Vent Lines is 150 kg. What is the maximum load that these stands will be required to support?
16. Page 77, Section 5.1.12 – How will the electrical GSE racks be transported/moved at KSC?
17. Page 79 – First bullet – What is the construction of “commercial bottle” and is it covered by the HR?
18. Page 79 – 2<sup>nd</sup> Paragraph/2<sup>nd</sup> Sentence – When will AMS be without power and no personnel access, so as to need the GSE?
19. Page 81 – The TBD for the Warm Helium Gas System GSE will be a Phase II Action Item.
20. Page 84, Section 5.6 – The TBD details for the Star Tracker GSE (including identification of the illumination source that will be used to check the tracker cameras) will be a Phase II Action Item.
21. Page 84, Section 5.7.1 – 1<sup>st</sup> Paragraph, Last Sentence – Quantify “most lifting operations”.
22. Pages 84 & 95, Section 5.7.1 & Section 5.7.3 – Section 5.7.1 states that the PSS has *two* different configurations while at KSC (low and high); however, Section 5.7.3 states that the PLF will lift the PSS into *three* different heights. Please clarify.
23. Pages 84 & 96, Section 5.7.1 & Section 5.7.4 – Section 5.7.4 states that the MPLF will lift the PSS top frame. Please add a description of the PSS top frame to Section 5.7.1.
24. Page 90, Figure 5.7.1-5 – This figure appears to be the same as figure 5.7.1-4.

25. Page 95, Section 5.7.3 – Will the PSS ever be lifted at KSC with the entire AMS-02 payload in it? If so, will the PLF, MPLF or something else be used to lift it? Will the PSS with the entire AMS-02 payload in it ever be moved as one assembly by any other means at KSC?
26. Page 99 – Section 5.9, Last Sentence – Explain what is being sought and from what systems.
27. Page 99 – Section 6.1 – What GSE and how will it arrive? Include a description of the shipping containers.
28. Page 100 – Section 6.3, 11<sup>th</sup> Bullet – Define charging.
29. Page 101 – We think the Pad Clear @ L-80 comes after PLB doors are closed.
30. Page 101 – Contingency return (RLS, TAL, contingency return from orbit) will be discussed at the review.
31. Page 102, Section 7.1 – It is stated that all non-COTS mating will be done dead-faced. What about COTS?
32. Page 102, Section 7.1 – Identify in this section and the electrical HRs, whether the COTS meets UL/an Electric Code, whether it has been modified, and whether it is being used for the purpose it was designed.
33. Page 103 – The requirements for the COPVs, KNPR 8715.3, will be discussed at the review.
34. Page 105, Section 7.6, last paragraph – Explain the purpose of the dump diodes and why they could be a hot touch temperature hazard.
35. Page 105, Section 7.7 – Who will provide the oxygen sensors/monitors?
36. Page 105, Section 7.7, third paragraph – Clarify: “Injury due to prolonged activity close to venting gases may vent will be controlled by requiring...”
37. Page 106 – The 2<sup>nd</sup> Bullet seems to contradict the sentence further down the page about personnel working in the upper bay of the SSPF. Also, second paragraph on page 107 states caution should be taken in upper levels of the CRF.
38. Page 106, last paragraph – It is stated: “While being transported in the canister, flight hardware will be in the transport configuration and will not require nominal venting/evacuation of the helium tank.” On page 107, it is stated: “The evolution of helium gas from either nominal release or by fault conditions...could in theory displace the breathable atmosphere within the canister.” What nominal release will there be in the canister?

39. Page 107 – Explain the sentence at the top of the page “It also stops the vehicle should it be required.”
40. Page 108, Section 7.10 – Add the Support Stands for CGSE Cryogenic and Vent Lines to this section.
41. Page 111 – Section 7.2.2 – When will the list be provided?
42. HR 001 – Delete hazard control 1.1. Use of flammable materials will not be allowed.
43. HR 001/Control 1.2 – Delete “with concurrence from KSC” from the control. Needs to address payload organization assessment of materials used compared to KSC approved lists.
44. HR 001/Control 1.3 – Change GSRP to KSC.
45. HR 001/Control 1.5 – Change “KSC health and safety protocols” to “the Process Waste Questionnaire”.
46. HR 001/Verification 1.2.1 – Add “against KSC-approved lists” to the end of the statement.
47. HR 001/Verification 1.2.2 – Change to “Material Usage Agreements, if necessary”.
48. HR 001/Verifications 1.3.1 & 1.3.2 – Delete these verifications and replace with: “Material Usage Agreement from KSC for all solvents not provided by KSC.”
49. HR 001/Verification 1.5.1 – Change it to “Submission of Process Waste Questionnaire”.
50. HR 001/Control 3.1 – It is stated that AMS-02 GSE electrical circuits are being designed; however, Section 5.8 states that the EGSE for AMS-02 is COTS. Please clarify.
51. HR 001/Control 4.1 – If true, why do we need HR 011/Cause 3 about hot mates?
52. HR 001/Control 5.1 – Does this only apply to electrical connectors?
53. HR 001/Control 6.1 – Are these heaters Flight Hardware or GSE?
54. HR 001/Control 6.1 – What type of monitoring will be used?
55. HR 001/Verification 8.3.1 – How will this be monitored?
56. HR 002/Control 1.3 – Is it meant that non-toxic alternatives will be substituted for toxic materials when possible?
57. HR 002/The TBD GSE Materials List will be a Phase II Action Item. When it is added, reference it on the HR.

58. HR 003/Control 1.1 – Control should also address improper/inadequate insulation design and installation; not just that it is there or not.
59. HR 003/Control 2.1 – Are warnings covered in another HR?
60. HR 004/Verification 1.1.1 – Specify demonstration method.
61. HR 004/Control 2.2 – Specify how the design and operation preclude introduction of overpressure.
62. HR 004/Control 3.2 – We will discuss, in the review, how you can work with Boeing CAPPS & KSC to control KSC hardware.
63. HR 004/Verification 4.1.1 – Add analysis to the verification.
64. HR 004/Verifications 6.2.1, 6.4.1 & 6.5.1 – Add QA verification that pressure relief devices are installed per drawings.
65. HR 004 – Reference the GSE Pressure Systems Components Tables on the HR
66. HR 005/Verification 1.3.1 – Review and approval is by the Project not KSC (GLOBAL – Keep us out of the approval loop)
67. HR 005/Cause 3 Note – Is this a problem?
68. HR 006/Control 2.2 – How will the cryogenic systems be monitored and when?
69. HR 007/Control 2.3 – State how the “Buddy System” will work so that both operators will not suffer from reduced oxygen availability.
70. HR 007/Cause 3 – Will nominal venting occur while in the canister? (See comment# 38)
71. HR 007/Control 3.2 – Should “inspection of atmosphere” be changed to “measurement of atmosphere”?
72. HR 009 – As stated in Section 7.10, address GSE lifting points on this HR. Are all of the lifting points permanently attached?
73. HR 009/Control 2.1 – Add eyebolts that are not permanently attached.
74. HR 010/Verification 1.2.1 – How do DRs prevent incorrect assembly?
75. HR 010/Cause 2 – Add improper installation of PSS top frame.
76. HR 010 – Add the Support Stands for CGSE Cryogenic and Vent Lines to this HR.

77. HR 011/Causes – If three-phase power is used, add mismatch of three-phase power sequencing between AMS-02 electrical equipment and KSC facilities.
78. HR 011/Control 2.3 – Does this include the electrical path from the Cryomagnet to the CAB? (See page 51, section 4.12)
79. HR011/Contol 3.1 – See #51 above.
80. HR 011/Controls 3.1 & 6.2 – Mating of powered connectors requires “scoop-proof” connector design, not just keying.
81. HR 011/Verification 6.2.1 – Will COTS connectors be mated/demated while energized?
82. HR 013/Description – Does the magnetic field pose a hazard to personnel? Will warning signs be required?
83. HR 015/Verification 3.2.1 – Will functional testing of the temperature sensor be performed?
84. HR016/Controls – Move the Use Authorization Approval reference to the safety verification methods section.
85. HR 017/Controls & Verifications for cause 1 – Add personnel training.
86. HR 017/Controls & Verifications for cause 2 – Add tool control plan.
87. HR 017/Add tip-over of electrical GSE racks, and provide tip-over analyses on the racks.

## **GENERAL**

88. Add discussion of Phase III requirements to end of Agenda.
89. Add a Table which identifies the electrical GSE, whether it is COTS, what electric code it meets, whether it requires 3-phase power, and the KSC facilities where it will be used.
90. Will there be a need for scaffolding/access stands/access stairs/ladders? If so, will AMS-02 payload organization provide them or will the use of KSC-provided ones be required?
91. General – When ground processing is performed in the SSPF, personnel must be notified of potential hazards.
  - a. In order to notify personnel Boeing CAPPs SHEA will be required to post signs and possibly issue Safety Bulletins to all employees.
  - b. Boeing CAPPs SHEA would like the payload provider to provide some discussion in the ground safety data package as to the types of signs and the specific wording for these signs that will be posted by Boeing CAPPs SHEA.

- c. This same information should be incorporated into any procedures developed by the payload developer and/or Boeing CAPPS.
- d. For example –
  - i. What potential hazards does the magnet impose on personnel when it is activated?
  - ii. What is the maximum distance that essential and/or non-essential personnel are to be from the magnet when they are performing other tasks in the high bay?
  - iii. What is the maximum distance that personnel will be required to be from the vacuum pumps?
- e. **NOTE:** This issue arose during processing of AMS-01. It is presented now in order to alleviate any issues in the future.

If you have any questions, you may contact Mr. Tom Tinsler at 321-867-3644.



Paul D. Kirkpatrick

cc:

NE-F3/M. Simpson  
 NE-O-C/G. Hamilton  
 NE-O-C/J. Mathis  
 SA-B1/J. King  
 SA-C/M. Smith  
 SA-C1/J. Beach  
 SA-C3/G. Hendricks  
 SA-C3/S. Huet  
 SA-C3/T. Tinsler  
 TA-C2/M. Cardinale  
 UB-E/T. Gill  
 UB-G/S. Bigos  
 UB-I/D. Clark  
 UB-I/S. Patel  
 UB-R/M. Biesack  
 UB-R/J. Keifenheim  
 HQ/OSMA/G. White  
 JSC/EA3/K. Bollweg  
 JSC/EA3/W. W. Guy  
 JSC/EA3/T. Martin  
 JSC/EA3/S. Porter  
 JSC/ESCG/JE-1SA/E. Harvey  
 JSC/ESCG/JE-4EB/M. Fohey

JSC/ESCG/JE-4EB/L. Hill  
 JSC/ESCG/JE-4EB/J. C. Tutt  
 JSC/NC4/D. Moreland  
 JSC/NE141/V. Berend  
 JSC/NE141/G. Dawson  
 JSC/OE/N. Vassberg  
 JSC/OE/S. Wolf  
 Boeing/721S-S210/K. Page  
 Boeing/721S-S215/P. Lintereur  
 Boeing/721S-S243/J. Degano  
 Boeing/721S-S245/J. Balzer  
 Boeing/721S-S280/M. Kinslow  
 USK-291/R. Bond  
 USK-291/D. Kotz